

JANSONS INSTITUTE OF TECHNOLOGY

(Autonomous)

Accredited by NAAC 'A Grade' and ISO 9001: 2015 Certified Institution
Approved by AICTE and Affiliated to Anna University
Coimbatore – 641 659, Tamil Nadu, India.



B.E. – CIVIL ENGINEERING

Curriculum and Syllabi

(Regulations 2024)



Jansons Institute of Technology

(Autonomous)

Regulations 2024

Choice Based Credit System

B.E. Civil Engineering

Curriculum and Syllabi for Semesters I to VIII

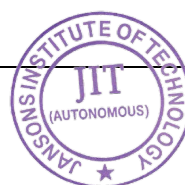
Programme Educational Objectives (PEOs)

Graduates of the Programme will

PE01	Gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations
PE02	Become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.
PE03	Become entrepreneurs and develop processes and technologies to meet desired infrastructure needs of society and formulate solutions that are technically sound, Economically feasible, and socially acceptable.
PE04	Perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.
PE05	Function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering

Program Outcomes (POs)

PO01	Engineering knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO02	Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
PO03	Design/development of solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
PO04	Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
PE05	Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
PO06	The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

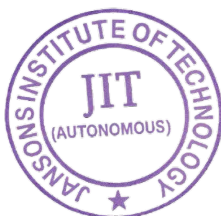


PO07	Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
PO08	Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO09	Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

Program Specific Outcomes (PSOs)

On successful completion of the degree programme, the graduates shall exhibit,

PS01	Knowledge of Civil Engineering discipline: Demonstrate in-depth knowledge of Civil Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge
PS02	Critical analysis of Civil Engineering problems and innovation: Critically analyze complex Civil Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.
PS03	Conceptualization and evaluation of engineering solutions to Civil Engineering: Issues Conceptualize and solve Civil Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio-cultural factors



SUMMARY

S.No.	Subject Area	CREDITS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1.	HSMC	4	3							7
2.	BSC	12	7	4	3					26
3.	ESC	6	3	4						16
4.	PCC		5	13	21	17	15			68
5.	PEC					6	6	6		18
6.	OEC						3	6		9
7.	EEC	2	3	2	1	2		5	7	21
	Total	24	21	23	25	25	24	17	7	166
8.	Mandatory Course (Non-credit)				✓	✓	✓			

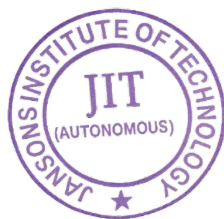


Mandatory Induction Programme

Sl. No	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	Induction Programme							

Semester - I

Sl. No	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1	U24HS1101	Professional English - I	HS	3	0	0	3	3
2	U24MA2101	Matrices and Calculus	BS	3	1	0	4	4
3	U24PH2101	Engineering Physics	BS	3	0	0	3	3
4	U24CY2101	Engineering Chemistry	BS	3	0	0	3	3
5	U24GE3003	Engineering Graphics	ES	2	2	0	4	4
5	U24GE1101	தமிழர்மரபு /Heritage of Tamils	HS	1	0	0	1	1
Practical Courses								
7	U24GE3004	Engineering Practices Laboratory	ES	0	0	4	4	2
8	U24GE2101	Physics and Chemistry Laboratory	BS	0	0	4	4	2
9	U24GE7101	English Laboratory	EE	0	0	2	2	1
10	U24GE7102	Design Thinking for Innovation	EE	0	0	2	2	1
Total				15	3	12	30	24



Semester – II

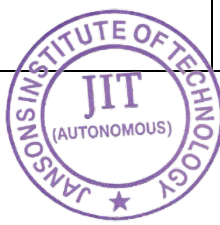
Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1	U24HS1201	Professional English - II	HS	2	0	0	2	2
2	U24MA2202	Transforms and Partial Differential Equations	BS	3	1	0	4	4
3	U24PH2202	Physics for Civil Engineering	BS	3	0	0	3	3
4	U24ME3201	Engineering Mechanics	PC	3	0	0	3	3
6	U24GE1201	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	1
Theory cum Laboratory courses								
7	U24GE3201	Python Programming	ES	2	0	2	4	3
Practical Courses								
8	U24CE4201	Computer Aided Drafting and Drawing Laboratory	PC	0	0	4	4	2
9	U24GE7201	Communication Laboratory	EE	0	0	4	4	2
10	U24GE7202	Fundamentals of Entrepreneurship and Startup	EE	0	0	2	2	1
11		Foreign Language ^	EE	0	0	2	2	0 [#]
Total				14	1	12	27	21

^Japanese / German

[#]The grades earned by the students will be recorded in the marksheet, however the same shall not be considered for the computation of CGPA

FOREIGN LANGUAGES OFFERED

S.No.	Course code	Course title	Category	Periods per week			Total contact periods
				L	T	P	
1	U24GE7203	Deutsch - I	EE	0	0	2	2
2	U24GE7204	Japanese - I	EE	0	0	2	2



Semester – III

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1	U24MA2201	Statistics and Numerical Methods	BS	3	1	0	4	4
2	U24CE4301	Fluid Mechanics	PC	3	0	0	3	3
3	U24CE4302	Construction Materials and Practices	PC	3	0	0	3	3
4	U24CE4303	Surveying and Geomatics	PC	3	0	0	3	3
5	U24CE4304	Engineering Geology	PC	2	0	0	2	2
	U24GE1101	*தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	1
Theory cum Laboratory courses								
6	U24EC3306	Basic Electrical, Electronics and Instrumentation Engineering	ES	3	0	2	5	4
Practical Courses								
7	U24CE4305	Surveying Laboratory	PC	0	0	2	4	2
8	U24GE7301	Professional Development	EE	0	0	2	2	1
9	U24GE7302	Product development / Process design	EE	0	0	2	2	1
Total				17	1	8	28	23

***For Lateral Entry students only**



Semester – IV

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1	U24CE4401	Strength of Materials	PC	3	1	0	4	4
2	U24CE4402	Concrete Technology	PC	3	0	0	3	3
3	U24CY2401	Environmental Sciences, Climate Change and Sustainability	BS	3	0	0	3	3
	U24GE1201	*தமிழரும்த் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	1
Theory cum Laboratory courses								
4	U24CE4403	Hydraulics Engineering	PC	3	0	2	5	4
5	U24CE4404	Geotechnical Engineering I	PC	3	0	2	5	4
6	U24CE4405	Environmental Engineering	PC	3	0	2	5	4
Practical Courses								
7	U24CE4406	Materials Testing Laboratory	PC	0	0	2	4	2
8	U24CE4407	Technical Seminar	EE	0	0	2	2	1
Total				19	1	10	32	26

***For Lateral Entry students only**

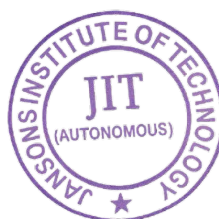


Semester – V

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1	U24CE4501	Design of Reinforced Concrete Structural Elements	PC	3	1	0	4	4
2	U24CE4502	Design of Steel Structural Elements	PC	3	1	0	4	4
3	U24CE4503	Geotechnical Engineering II	PC	3	0	0	3	3
4		Professional Elective I	PE	3	0	0	3	3
5		Professional Elective II	PE	3	0	0	3	3
6		Mandatory Course-I**	MC	3	0	0	3	Non-credit course
Theory cum Laboratory courses								
7	U24CE4504	Transportation Engineering	PC	3	0	2	5	4
Practical Courses								
8	U24CE4505	Computer Aided Structural Design and Detailing	PC	0	0	4	4	2
9	U24CE4506	Internship (4weeks) ***	EE	0	0	0	0	2
Total				21	2	6	29	25

*** 4 weeks internship during summer vacation

** Student to choose from the given list of Mandatory courses



-Semester – VI

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1	U24CE4601	Structural Analysis	PC	3	1	0	4	4
2	U24CE4602	Estimation, Costing, and Valuation Engineering	PC	3	0	0	3	3
3	U24CE4603	Prestressed Concrete Structures	PC	3	0	0	3	3
4	U24GE1601	Professional Ethics	PC	3	0	0	3	3
5		Professional Elective III	PE	3	0	0	3	3
6		Professional Elective IV	PE	3	0	0	3	3
7		Open Elective I	OE	3	0	0	3	3
8		Mandatory Course-II**	MC	3	0	0	3	Non-credit course
Practical Courses								
9	U24CE4603	Digital Construction	PC	0	0	4	4	2
Total				24	1	7	32	24

**** Student to choose from the given list of Mandatory courses**



Semester – VII

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Theory Courses								
1		Professional Elective V	PE	3	0	0	3	3
2		Professional Elective VI	PE	3	0	0	3	3
3		Open Elective II	OE	3	0	0	3	3
4		Open Elective III	OE	3	0	0	3	3
Practical Courses								
5	U24CE7701	Design Project	EE	0	0	6	6	3
6	U24CE7702	Internship (4 weeks) **	EE	0	0	0	0	2
Total				12	0	6	18	17

**** 4 weeks internship during summer vacation**

Semester – VIII

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
Practical Courses								
1	U24CE7801	Project Work/ Internship/ Apprenticeship	EE	0	0	14	14	7
Total				0	0	14	14	7

TOTAL CREDITS : 166

MANDATORY COURSES

S.No.	Course code	Course title	Category	Periods per week			Total contact periods
				L	T	P	
1	U24GE8501	Introduction to Women and Gender Studies	MC	3	0	0	3
2	U24HS8501	Elements of Literature	MC	3	0	0	3
3	U24HS8502	Film Appreciation	MC	3	0	0	3
4	U24CY8501	Disaster Risk Reduction and Management	MC	3	0	0	3
5	U24GE8502	Well-Being With Traditional Practices- Yoga, Ayurveda, And Siddha	MC	3	0	0	3
6	U24GE8503	History of Science and Technology in India	MC	3	0	0	3
7	U24GE8504	Political and Economic Thought for a Humane Society	MC	3	0	0	3
8	U24GE8505	State, Nation Building and Politics in India	MC	3	0	0	3
9	U24GE8506	Industrial Safety	MC	3	0	0	3
10	U24MA8501	Exploring Vedic Mathematics	MC	3	0	0	3
11	U24MA8502	Fundamentals of Astrology	MC	3	0	0	3

***Mandatory Courses are offered as Non-Credit Courses**

FOREIGN LANGUAGES

S.No.	Course code	Course title	Category	Periods per week			Total contact periods
				L	T	P	
1	U24GE7203	Deutsch - I	EE	0	0	2	2
2	U24GE7204	Japanese - I	EE	0	0	2	2

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I (Structures)	VERTICAL II (Construction techniques and Practices)	VERTICAL III (Geotechnical)	VERTICAL IV (Transportation infrastructure)	VERTICAL V (Environment)	VERTICAL VI (Water Resources)	VERTICAL VII (Geo- Informatics)
Introduction to Finite Element Analysis	Formwork Engineering	Geo- Environmental Engineering	Railways, Airports and Harbours Engineering	Climate Change Adaptation and Mitigation	Water Quality and Management	Total Station and GPS Surveying
Prefabricated Structures	Construction Equipment and Automation	Ground Improvement Techniques	Traffic Engineering and Management	Air and Noise Pollution Control Engineering	Hydrology and Water Resources Engineering	Geospatial Remote Sensing Concepts
Steel Concrete Composite Structures	Advanced Construction Techniques	Soil Dynamics and Machine Foundations	Urban Planning and Development	Industrial Wastewater Management	Watershed Conservation and Management	Satellite Image Processing
Structural Health Monitoring	Construction Engineering & Management	Earthquake Resistant Structures	Smart cities & intelligent Transportation Systems	Solid and Hazardous Waste Management	Integrated Water Resources Management	Cartography and GIS
Pre-Engineered Buildings	Sustainable and Green Construction	Tunnelling Engineering	Pavement Engineering	Environment, Health and Safety Policy and Legislations	Rainwater Harvesting	Photogrammetry
Tall buildings	Construction Project Planning Systems	Pile Foundation	Transportation planning Process	Environmental and Social Impact Assessment	Environment and Irrigation Engineering and Drawing	Hydrographic Surveying

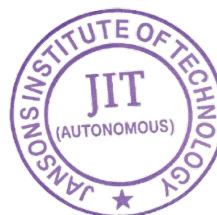


PROFESSIONAL ELECTIVE COURSES: VERTICALS**VERTICAL I: STRUCTURES**

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5A01	Introduction to Finite Element Analysis	PE	3	0	0	3	3
2	U24CE5A02	Prefabricated Structures	PE	3	0	0	3	3
3	U24CE5A03	Steel Concrete Composite Structures	PE	3	0	0	3	3
4	U24CE5A04	Structural Health Monitoring	PE	3	0	0	3	3
5	U24CE5A05	Pre-Engineered Buildings	PE	3	0	0	3	3
6	U24CE5A06	Tall buildings	PE	3	0	0	3	3

VERTICAL II: CONSTRUCTION TECHNIQUES AND PRACTICES

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5B01	Formwork Engineering	PE	3	0	0	3	3
2	U24CE5B02	Construction Equipment and Automation	PE	3	0	0	3	3
3	U24CE5B03	Advanced Construction Techniques	PE	3	0	0	3	3
4	U24CE5B04	Construction Engineering and Management	PE	3	0	0	3	3
5	U24CE5B05	Sustainable and Green Construction	PE	3	0	0	3	3
6	U24CE5B06	Construction Project Planning Systems	PE	3	0	0	3	3

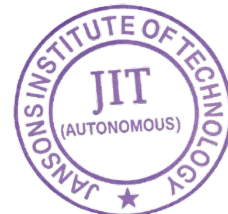


VERTICAL III: GEOTECHNICAL

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5C01	Geo-Environmental Engineering	PE	3	0	0	3	3
2	U24CE5C02	Ground Improvement Techniques	PE	3	0	0	3	3
3	U24CE5C03	Soil Dynamics and Machine Foundations	PE	3	0	0	3	3
4	U24CE5C04	Earthquake Resistant Structures	PE	3	0	0	3	3
5	U24CE5C05	Tunnelling Engineering	PE	3	0	0	3	3
6	U24CE5C06	Pile Foundation	PE	3	0	0	3	3

VERTICAL IV: TRANSPORTATION INFRASTRUCTURE

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5D01	Railways, Airports and Harbours Engineering	PE	3	0	0	3	3
2	U24CE5D02	Traffic Engineering and Management	PE	3	0	0	3	3
3	U24CE5D03	Urban Planning and Development	PE	3	0	0	3	3
4	U24CE5D04	Smart Cities and Intelligent Transportation Systems	PE	3	0	0	3	3
5	U24CE5D05	Pavement Engineering	PE	3	0	0	3	3
6	U24CE5D06	Transportation Planning Process	PE	3	0	0	3	3

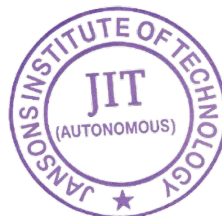


VERTICAL V: ENVIRONMENT

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5E01	Climate Change Adaptation and Mitigation	PE	3	0	0	3	3
2	U24CE5E02	Air and Noise Pollution Control Engineering	PE	3	0	0	3	3
3	U24CE5E03	Industrial Wastewater Management	PE	3	0	0	3	3
4	U24CE5E04	Solid and Hazardous Waste Management	PE	3	0	0	3	3
5	U24CE5E05	Environment, Health and Safety Policy and Legislations	PE	3	0	0	3	3
6	U24CE5E06	Environmental and Social Impact Assessment	PE	3	0	0	3	3

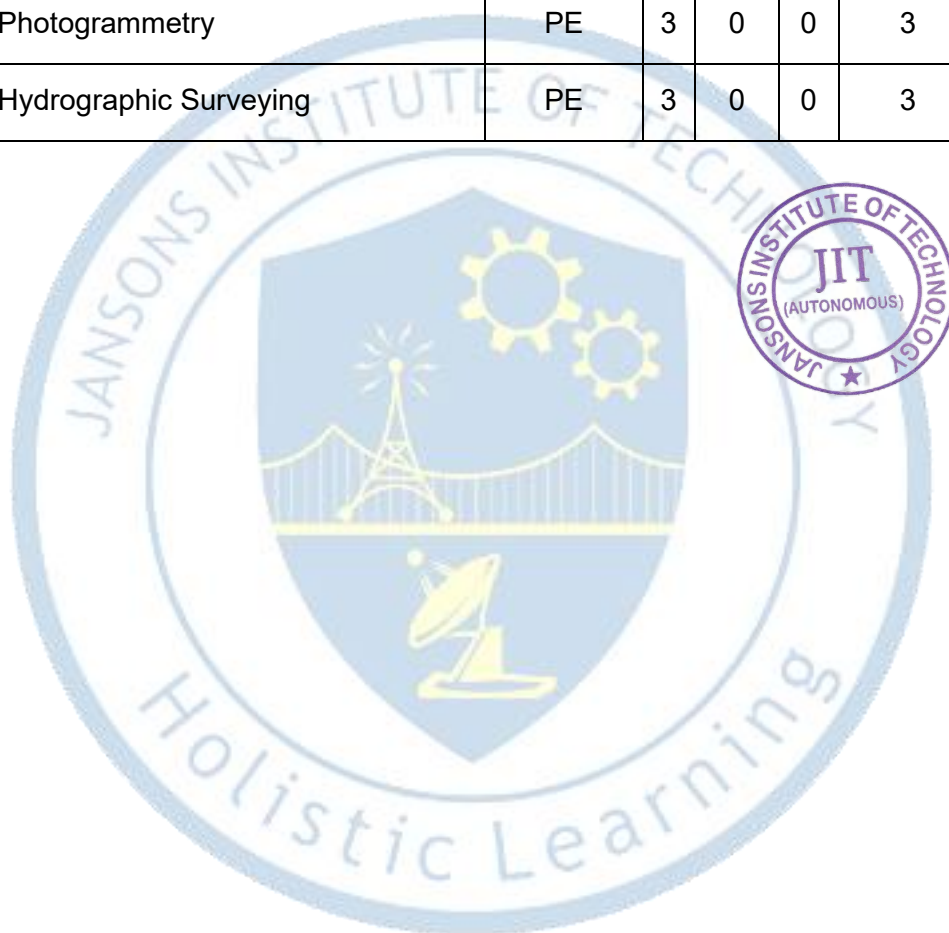
VERTICAL VI: WATER RESOURCES

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5F01	Water Quality and Management	PE	3	0	0	3	3
2	U24CE5F02	Hydrology and Water Resources Engineering	PE	3	0	0	3	3
3	U24CE5F03	Watershed Conservation and Management	PE	3	0	0	3	3
4	U24CE5F04	Integrated Water Resources Management	PE	3	0	0	3	3
5	U24CE5F05	Rainwater Harvesting	PE	3	0	0	3	3
6	U24CE5F06	Environment and Irrigation Engineering and Drawing	PE	2	0	2	4	3



VERTICAL VII: GEO- INFORMATICS

Sl. No	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CE5G01	Total Station and GPS Surveying	PE	3	0	0	3	3
2	U24CE5G02	Geospatial Remote Sensing Concepts	PE	3	0	0	3	3
3	U24CE5G03	Satellite Image Processing	PE	3	0	0	3	3
4	U24CE5G04	Cartography and GIS	PE	3	0	0	3	3
5	U24CE5G05	Photogrammetry	PE	3	0	0	3	3
6	U24CE5G06	Hydrographic Surveying	PE	3	0	0	3	3

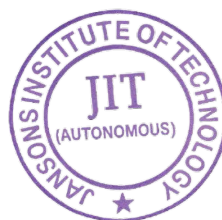


OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

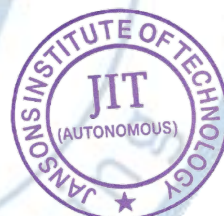
OPEN ELECTIVE

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1.	U24AD6602	Artificial Intelligence and Machine Learning Fundamentals	OE	3	0	0	3	3
2.	U24AD6603	Augmented Reality /Virtual Reality Technology	OE	3	0	0	3	3
3.	U24AD6604	Applications of AI in Civil Engineering	OE	3	0	0	3	3
4.	U24CY6603	Renewable Energy Technologies	OE	3	0	0	3	3
5.	U24ME6604	Quality Engineering	OE	3	0	0	3	3
6.	U24ME5A03	3D Additive Manufacturing	OE	3	0	0	3	3
7.	U24EC6602	Drone Technologies	OE	3	0	0	3	3
8.	U24EC6605	IoT Concepts and Applications	OE	2	0	2	4	3
9.	U24GE6601	Intellectual Property Rights	OE	3	0	0	3	3
10.	U24CY6601	Universal Human Values	OE	3	0	0	3	3
11.	U24GE6604	Community Engagement and Social Responsibility	OE	3	0	0	3	3
12.	U24EC6606	Sixth Generation Wireless Technology	OE	3	0	0	3	3
13.	U24EC6607	High Speed Wireless Communication Networks	OE	3	0	0	3	3
14.	U24EC6603	Wearable Technology	OE	3	0	0	3	3
15.	U24MA6604	Resource Management Techniques	OE	3	0	0	3	3
16.	U24MA6602	Operations Research	OE	3	0	0	3	3
17.	U24GE6602	IT in Agriculture System	OE	3	0	0	3	3
18.	U24PH6602	Nano Technology	OE	3	0	0	3	3
19.	U24GE6606	Project Report Writing	OE	3	0	0	3	3
20.	U24ME6601	Entrepreneurship Development	OE	3	0	0	3	3



Verticals for Minor Degree (In addition to all the verticals of other programmes)

I	II	III	IV	V
Fintech and BlockChain	Entrepreneurship	Public Administration	Business Data Analytics	Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building & Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity & Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis



Holistic Learning

Vertical – I :Fintech And BlockChain

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CB5V01	Financial Management	PE	3	0	0	3	3
2	U24CB5V02	Fundamentals of Investment	PE	3	0	0	3	3
3	U24CB5V03	Banking, Financial Services and Insurance	PE	3	0	0	3	3
4	U24CB5V04	Introduction to Blockchain and its Applications	PE	3	0	0	3	3
5	U24CB5V05	Fintech Personal Finance and Payments	PE	3	0	0	3	3
6	U24CB5V06	Fintech	PE	3	0	0	3	3

Vertical – II : Entrepreneurship

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CB5W01	Foundations of Entrepreneurship	PE	3	0	0	3	3
2	U24CB5W02	Team Building & Leadership Management for Business	PE	3	0	0	3	3
3	U24CB5W03	Creativity & Innovation in Entrepreneurship	PE	3	0	0	3	3
4	U24CB5W04	Principles of Marketing Management for Business	PE	3	0	0	3	3
5	U24CB5W05	Human Resource Management for Entrepreneurs	PE	3	0	0	3	3
6	U24CB5W06	Financing New Business Ventures	PE	3	0	0	3	3

Vertical – III : Public Administration

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24GE5X01	Principles of Public Administration	PE	3	0	0	3	3
2	U24GE5X02	Constitution of India	PE	3	0	0	3	3
3	U24GE5X03	Public Personnel Administration	PE	3	0	0	3	3
4	U24GE5X04	Administrative Theories	PE	3	0	0	3	3
5	U24GE5X05	Indian Administrative System	PE	3	0	0	3	3
6	U24GE5X06	Public Policy Administration	PE	3	0	0	3	3

Vertical – IV : Business Data Analytics

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24CB5Y01	Statistics for Management	PE	3	0	0	3	3
2	U24CB5Y02	Data mining for Business Intelligence	PE	3	0	0	3	3
3	U24CB5Y03	Human Resource Analytics	PE	3	0	0	3	3
4	U24CB5Y04	Marketing and Social Media Web Analytics	PE	3	0	0	3	3
5	U24CB5Y05	Operation and Supply Chain Analytics	PE	3	0	0	3	3
6	U24CB5Y06	Financial Analytics	PE	3	0	0	3	3



Vertical– V: Environment and Sustainability

Sl. No.	Course Code	Course Title	Category	Periods per Week			Contact Hours	Credits
				L	T	P		
1	U24GE5Z01	Sustainable infrastructure Development	PE	3	0	0	3	3
2	U24GE5Z02	Sustainable Agriculture and Environmental Management	PE	3	0	0	3	3
3	U24GE5Z03	Sustainable Bio Materials	PE	3	0	0	3	3
4	U24GE5Z04	Materials for Energy Sustainability	PE	3	0	0	3	3
5	U24GE5Z05	Green Technology	PE	3	0	0	3	3
6	U24GE5Z06	Environmental Quality Monitoring and Analysis	PE	3	0	0	3	3



1. Student Induction Programme - Purpose & Concept

This is a 3-week long induction programme for the UG students entering the institution, right at the start. Purpose of the Student Induction Programme is to help new students adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self-exploration.

The term induction is a well-planned event to educate the new entrants about the environment in a particular institution, and connect them with the people in it. The Student Induction Programme engages with the new students as soon as they come into the institution; regular classes start only after that.

The time during the Induction Programme is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. These are included under Proficiency Modules. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

2. Daily Activity

The following are the activities under the induction programme in which the student would be fully engaged throughout the day for the entire duration of the programme.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. There would be games in the evening or at other suitable times according to the local climate. These would help develop team work besides health.

2.2 Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts like painting, music, dance, pottery, sculpture etc. The student would pursue it every day for the duration of the programme. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Mentoring and Universal Human Values

Mentoring and connecting the students with faculty members is the most important part of student induction. Mentoring takes place in the context and setting of Universal Human Values. It gets the student to explore oneself and experience the joy of learning, prepares one to stand up to peer pressure and make decisions with courage, be aware of relationships and be sensitive to others, understand the role of money in life and experience the feeling of prosperity.

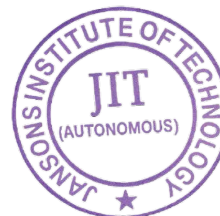
Students are educated in Universal human Values in 3 modules. First module comprises Basic Aspirations and Self-Management and the second module includes Harmony in the Family and Health. The last module preaches Harmony in the Society and Nature. It is best taught through group discussions and real-life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each.

2.4 Introduction to Sustainable Development Goals (SDG)

Students are encouraged to gain knowledge in accepting the need for Sustainable Development Goals. The students are enlightened on the SDGs which give a comprehensive framework of goals and targets with which students understand the complexity of the actions we must take to achieve development that is sustainable across social, environmental, economic aspects and over time.

3. Other Activity

Below activities are not there on a daily basis, but are conducted for 3-4 days.



3.1 Familiarization with College, Department/Branch

The incoming students will be told about the credit and grading system, and about the examinations. They would be informed about how study in college differs from study in school. They shall be taken on a tour of the college and shown important points such as the library, canteen, laboratories, workshops and other facilities.

They would be shown their respective department, and told what it means to get into the branch or department. Students would be described about what role the technology related to their department plays in society and after graduation what role the student would play in society as an engineer in that branch. A lecture by an alumnus of the department would be carried out which would be very helpful in this regard. The above activity would be done right in the first two days, and then over the afternoons thereafter, as appropriate.

3.2 Department Specific Activities

Activities such as games, quizzes, social interactions, small experiments, design thinking etc., that are relevant to the particular branch of Engineering are introduced to kindle interest in building things in that particular field. For example, CSE, CSBS and AI&DS students would be given activities that kindle computational thinking and ECE students would be introduced to build simple circuits as an extension of their knowledge in science and so on.

3.3 Literary Activity

Literary activity would encompass reading a book, writing a summary, debating, enacting a play etc.

3.4 Proficiency Modules

The induction programme period is used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These activities are run like crash courses, so that when normal courses start after the induction programme, the student would have overcome the lacunas substantially. The problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

3.5 Lectures & Workshops by Eminent People

Lectures by eminent people would be organized, once a week. It would give the students, exposure to people who are eminent, in industry or engineering, in social service, or in public life. Alumni would be invited as well. Motivational lectures about life, meditation, etc. would be organized.

3.6 Visits in Local Area

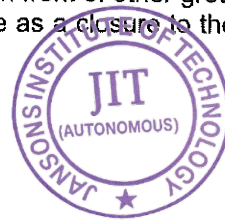
A couple of visits to the local landmarks including will be organized which would familiarize the students with the area together with bonding with each other, like in a picnic. Visits would also be organized to a hospital, orphanage or a village. These would expose them to people in suffering or to different lifestyles. This might also sensitize them to engineering needs in these areas.

3.7 Extra-Curricular Activities in College

The new students shall be introduced to the extra-curricular activities at the college/university. They would be shown the facilities and informed about activities related to different clubs etc. Selected senior students will be involved in leading these activities by giving presentations, under faculty supervision.

3.8 Feedback and Report on the Programme

Students would be asked to give their mid-programme feedback. They should write their opinions about the programme at the end of the first week or so. The feedback would be used to make any mid-course correction, if any. At the end of the programme, each group (of 20 students) would be asked to prepare a single report on their experiences of the programme. On the second last day, each group should present their report in front of other groups. Immediately after their presentation, they should submit their written report. This will also serve as a closure to the programme. Finally, online anonymous feedback would be collected at the end of the programme.



U24HS1101	PROFESSIONAL ENGLISH I	L	T	P	C
		3	0	0	3
Course Objectives:	To improve the basic grammar, lexical, communicative competence of learners and develop learners' ability to use language in professional context.				
Unit - I	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION				9
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).					
Unit - II	NARRATION AND SUMMATION				9
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.					
Unit - III	DESCRIPTION OF A PROCESS / PRODUCT				9
Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).					
Unit – IV	CLASSIFICATION AND RECOMMENDATIONS				9
Reading – Newspaper articles; Journal reports and Nonverbal Communication (tables, pie charts etc). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from nonverbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.					
Unit - V	EXPRESSION				9
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Relate appropriate words in a technical context.	K2
CO2	Interpret the fundamentals of basic grammatical structures.	K2
CO3	Infer the denotative and connotative meanings in professional context.	K2
CO4	Explain the information presented in tables, charts and other graphical representations.	K2
CO5	Outline editorials, narrations, and essays on various topics	K2

Knowledge Level: K1 - Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 - Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference Books

1	Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2	A Course Book on Technical English by Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3	English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN: 0070264244.
4	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5	Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.



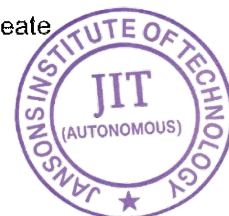
U24MA2101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4
Course Objectives:	Integrate matrix algebra, calculus, and multivariable functions to address engineering challenges adeptly. Emphasize practical applications of integration techniques and multiple integrals. Equip students with indispensable mathematical proficiencies vital for engineering analysis.				
Unit - I	MATRICES				9+3
Types of matrices – System of equations – Characteristic equation – Eigenvalues and Eigenvectors of real matrices – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications: Stretching of an elastic membrane.					
Unit - II	DIFFERENTIAL CALCULUS				9+3
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications: Maxima and Minima of functions of one variable.					
Unit - III	FUNCTIONS OF SEVERAL VARIABLES				9+3
Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.					
Unit – IV	INTEGRAL CALCULUS				9+3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centre of mass.					
Unit - V	MULTIPLE INTEGRALS				9+3
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double integrals – Applications: Moments and centre of mass, moment of inertia					
Total Periods:					60

Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Apply the matrix algebra methods for solving real time problems.	K3
CO2	Utilize the differential calculus tools to solve engineering problems.	K3
CO3	Apply the differential calculus ideas in functions of several variables.	K3
CO4	Choose the different methods of integration for solving engineering problems.	K3
CO5	Make use of the multiple integrals in solving real-world issues such as areas and volumes.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
3	James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.

Reference Books

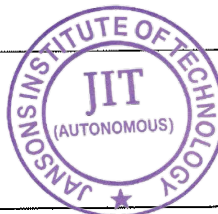
1	Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
2	Bali. N., Goyal. M. and Watkins. C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3	Jain. R. K. and Iyengar. S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 5th Edition, 2016.
4	Narayanan.S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5	Ramana. B. V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6	Srimantha Pal and Bhunia. S.C, "Engineering Mathematics", Oxford University Press, 2015.
7	Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.



U24PH2101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3
Course Objectives:	To enhance and apply the fundamental knowledge of Properties of matter, laser, optical fibre, thermal physics, Quantum physics, Optics and Ultrasonics and its applications relevant to various streams of Engineering and Technology.				
Unit - I	PROPERTIES OF MATTER	7			
Interatomic Forces & Intermolecular Forces - Solid - Elasticity – Stress & strain diagram and its uses – types of stress & strain - Hooke's Law - Young's modulus, Bulk modulus, modulus of rigidity, Poisson's Ratio, Relation between the Three Moduli of Elasticity– factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple – torsion pendulum: theory and experiment – bending of beams – bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment – I-shaped girders.					
Unit - II	LASER AND FIBRE OPTICS	9			
Theory of laser - characteristics – Spontaneous and stimulated emission - Einstein 's A and B coefficients - derivation – resonant cavity, optical amplification (qualitative) – population inversion - CO2 laser, Nd-YAG laser, semiconductor laser – Basic applications of lasers in industry - 3D profiling, laser drilling and laser welding. Principle, numerical aperture and acceptance angle – types of optical fibres (material, refractive index, mode) – losses associated with optical fibres –Fibre optic communication system (Block diagram) - fibre optic sensors: pressure and displacement- Endoscope					
Unit - III	THERMAL PHYSICS	9			
Transfer of heat energy (conduction, convection and radiation) – thermal expansion of solids and liquids – expansion joints – bimetallic strips – thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity – Forbe's method: thermal conductivity of good conductor and Lee's disc method: thermal conductivity of bad conductor : theory and experiment – conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers (qualitative) - refrigerators, ovens and solar water heaters.					
Unit – IV	QUANTUM PHYSICS	11			
Wave particle duality – electron diffraction – Heisenberg's uncertainty principle - wave function and its operators, physical significance of wave function – Schrödinger's wave equation – time independent and time dependent equations – particle in a infinite potential well: 1D, 2D and 3D Boxes – Normalization, probabilities, Expectation values, Eigen values and Eigen functions - tunnelling (qualitative) – Scanning Tunnelling Microscope (STM) - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig -Penney model and origin of energy bands.					
Unit - V	OPTICS AND ULTRASONICS	9			
Optics: Reflection and refraction of light waves - total internal reflection - interference – Michelson Interferometer: construction and working to determine thickness of the thin transparent material - Theory of air wedge and experiment: determination of the thickness of thin wire. Ultrasonics: Production of ultrasonics by Magnetostriction and Piezoelectric method – Acoustic grating: Wavelength of ultrasonic waves – Non-destructive testing – Pulse echo system through transmission and reflection modes – Medical applications – Sonogram.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can



COs	Statements	K-Level
CO1	Explain the basics of properties of matter and its applications.	K2
CO2	Apply the knowledge of laser and fibre optics principle in various fields.	K3
CO3	Illustrate the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers.	K2

COs	Statements	K-Level
CO4	Explain the importance of quantum theory and its applications in tunnelling microscopes.	K2
CO5	Apply the concepts of optics in material property and ultrasonics in medical field.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	1	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	1	-	-	-	-	-	1	-	-	-
CO	3	2	1	-	-	1	-	-	-	-	-	1	1	-	-

Correlation levels 1, 2 and 3 are as defined below:

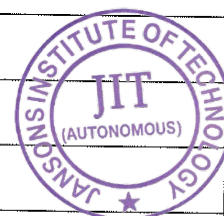
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Bhattacharya, D.K. & Poonam, T. —Engineering Physics. Oxford University Press, 2015
2	Gaur, R.K. & Gupta, S.L. —Engineering Physics. Dhanpat Rai Publishers, 2012
3	Pandey, B.K. & Chaturvedi, S. —Engineering Physics. Cengage Learning India, 2012
4	Arumugam M. Engineering Physics. Anuradha publishers, 2010
5	Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
6	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
7	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill, 2017.

Reference Books

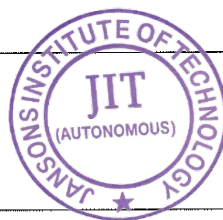
1	Halliday, D., Resnick, R. & Walker, J. —Principles of Physics. Wiley, 2015.
2	Serway, R.A. & Jewett, J.W. —Physics for Scientists and Engineers. Cengage Learning, 2010.
3	Tipler, P.A. & Mosca, G. —Physics for Scientists and Engineers with Modern Physics.
4	W.H.Freeman, 2007.4. Mani P. Engineering Physics I. Dhanam Publications, 2011.
5	Marikani A. Engineering Physics - PHI Learning Pvt., India, 2009.
6	K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.



U24CY2101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3
Course Objectives:	To understand water quality parameters in water treatment and corrosion prevention methods, outline the phases and significance of alloys, summarize fuels and combustion properties, explore the uses of energy storage devices, and impart knowledge in nanomaterial preparation methods.				
Unit - I	WATER TECHNOLOGY				9
Sources and impurities, Water quality parameters: Definition and significance of color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Boiler troubles: Scale and Sludge, Boiler Corrosion, Caustic Embrittlement, Priming & Foaming. Treatment of Boiler Feed water: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion Exchange Demineralization and Zeolite process. Desalination of brackish water: Reverse Osmosis (RO)- Applications of RO in domestic and industrial purposes.					
Unit - II	CORROSION AND ITS CONTROL				9
Corrosion: Introduction - Mechanism of Corrosion - Chemical corrosion, Electrochemical corrosion - Differential Aeration corrosion - Pilling Bedworth rule - Factors influencing corrosion. Corrosion control- Cathodic Protection - Sacrificial Anodic Protection method - Impressed Current Cathodic Protection - Use of Inhibitors. Protective coatings - Metallic coatings - Anodic and Cathodic coatings - Methods of application of Metal coatings. Organic coatings - Paints, Varnishes, Emulsion paints, Special paints - Luminescent paint, Heat - resistant paint, Fire - retardant paint, Water repellent paint, Antifouling paint.					
Unit - III	ALLOYS AND PHASE RULE				9
Alloys: Introduction- Definition- properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – Heat treatment of steel. Phase rule: Introduction, definition of terms with examples, One component system -water system - Reduced phase rule - Thermal analysis and Cooling curves - Two Component System - Lead-Silver system – Pattinson's process.					
Unit – IV	FUELS, COMBUSTION AND ENERGY STORAGE DEVICES				9
Fuels and Combustion: Classification of fuels-Calorific value, units of heat, Gross and Net calorific values, problems on Calorific values. Coal- ranking of coal-Properties of coal- Carbonization-Manufacture of Metallurgical coke -Otto Hoffmann's by-product oven method. Petroleum-Refining of crude oil, Manufacture of Synthetic petrol (Bergius process), Knocking-Octane number and Cetane number. Energy storage devices: Types of batteries - Primary battery - dry cell, Secondary battery - Lead acid battery and Lithium-ion battery; Electric vehicles - working principle; Fuel cells: H ₂ -O ₂ fuel cell, Microbial Fuel Cell (MFC).					
Unit - V	NANOCHEMISTRY				9
Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – Nanoparticle, Nanoclusters, Nanorods, Nanowire and Nanotube. Preparation of nanomaterials: Sol-gel, Solvothermal, Laser ablation, Chemical Vapour Deposition (CVD), Electrochemical deposition and Electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can



COs	Statements	K-Level
CO1	Apply suitable methodologies for water treatment using water quality parameters.	K3
CO2	Outline the different types of corrosion processes and preventive methods.	K2
CO3	Explain the relationship between phases and the selection of alloy materials.	K2

COs	Statements	K-Level
CO4	Interpret the knowledge of fuels in combustion technology and various energy storage devices.	K2
CO5	Infer the basic concepts of nanotechnology and the synthesis of nanomaterials.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	2	2	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	2	2	-	-	-	-	2	-	-	-
CO3	3	2	-	-	-	1	2	-	-	-	-	1	-	-	-
CO4	3	2	-	-	-	2	2	-	-	-	-	2	-	-	-
CO5	3	2	-	-	-	2	2	-	-	-	-	1	-	-	-
CO	3	2	-	-	-	2	2	-	-	-	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

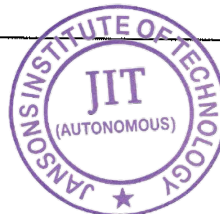
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.
2	Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3	S.S. Dara, "A Textbook of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018.
4	O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

Reference Books

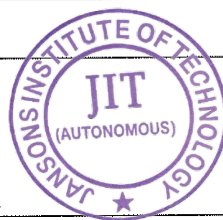
1	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IM Series in Metallurgy and Materials Science, 2018.
2	T. Pradeep, "Nano: The Essentials: Understanding Nanoscience and Nanotechnology", (2008) Tata McGraw-Hill Publishing Company Limited, New Delhi.
3	B.R.Puri, L.R.Sharma, M.S.Pathania., "Principles of Physical Chemistry", Vishal Publishing Company, 2008.
4	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.



U24GE3003	ENGINEERING GRAPHICS	L	T	P	C
		2	2	0	4
Course Objectives:	The main learning objective of this course is to prepare the students to acquaint the knowledge on Drawing Standards, projections of points, straight lines, plane surfaces, orthographic projection of solids, section of solids, development of lateral surfaces, isometric and perspective projections of simple solids, engineering curves and freehand sketch of simple objects.				
CONCEPTS AND CONVENTIONS					
Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.					
Unit - I	PROJECTION OF POINTS, LINES AND PLANE SURFACE				12
Orthographic projection – principles - Principal planes - First angle projection - projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.					
Unit - II	PROJECTION OF SOLIDS				12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Practicing three-dimensional modeling of simple objects by CAD Software.					
Unit - III	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES				12
Sectioning of solids like prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three-dimensional modeling of simple objects by CAD Software.					
Unit – IV	ISOMETRIC AND PERSPECTIVE PROJECTIONS				12
Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three-dimensional modeling of isometric projection of simple objects by CAD Software.					
Unit - V	PLANE CURVES AND FREEHAND SKETCHING				12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three-Dimensional objects — Layout of views - Freehand sketching of multiple views from pictorial views of objects.					
Total Periods:					60

Course Outcomes

On completion of the course, the student can



COs	Statements	K-Level
CO1	Interpret orthographic projections of points, lines and plane surfaces.	K2
CO2	Illustrate the projection of solids placed in first quadrant	K2
CO3	Show the projections of sectioned solids and development of surfaces.	K2
CO4	Show the projections of isometric and perspective sections of simple solids.	K2

COs	Statements	K-Level
CO5	Interpret conic curves, involutes, cycloids and perform freehand sketching	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

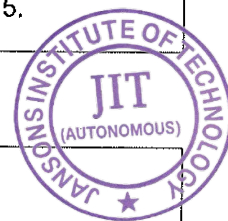
1	Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
2	Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2018.

Reference Books

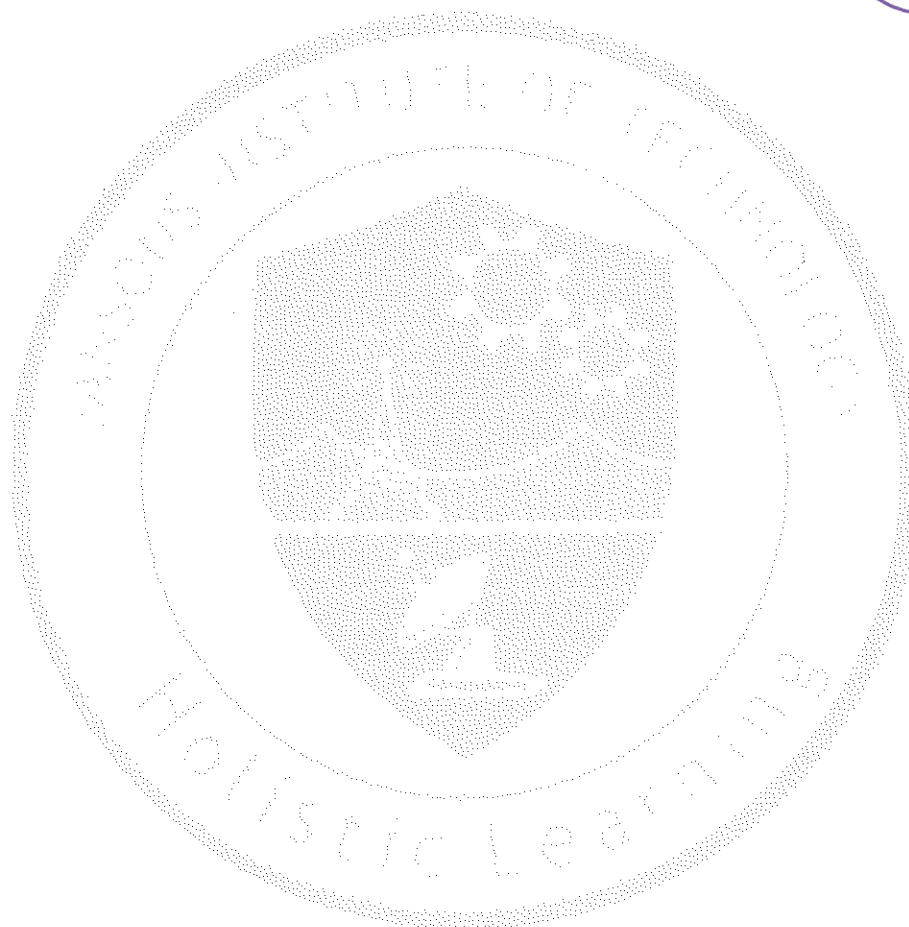
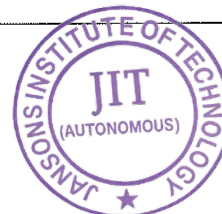
1	Bhrott N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53 Edition, 2019.
2	Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2 nd Edition, 2019.
3	Gopalakrishna K.R., "Engineering Drawing" (Vol. I & II combined), Subhas Publications, Bangalore, 27 th Edition, 2017.
4	Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
5	Parthasarathy N. S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
6	Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 5 th Edition, 2015.

Publication of Bureau of Indian Standards

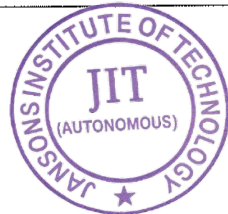
1	IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
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2	IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3	IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4	IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5	IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.



U24GE1101	தமிழர் மரபு	L	T	P	C
		1	0	0	1
Course Objectives:	இந்த பாடத்திட்டத்தில், மாணவர்களுக்கு தமிழர்களின் செழுமையான கலாச்சாரம் மற்றும் பாரம்பரியம் பற்றிய நுண்ணறிவை வழங்கவும், தமிழகத்தில் நடைமுறையில் உள்ள கட்டிடக்கலை அற்புதங்களை உருவாக்குவதற்கான பொறியியல் நுட்பங்கள் குறித்த விரிவான தகவல்களை மாணவர்களுக்கு வழங்கவும் மற்றும் மாணவர்களை தமிழர் மரபின் வேர்களுடன் இணைக்கவும், பாராட்டவும், பாதுகாக்கவும் உதவுகிறது				
Unit - I	மொழி மற்றும் இலக்கியம்				3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழக காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.					
Unit - II	மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை				3
நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.					
Unit - III	நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுக்கள்				3
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுக்கள்.					
Unit - IV	தமிழர்களின் திணைக் கோட்பாடுகள்				3
தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்க கால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.					
Unit - V	இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு				3
இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுய மரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுக்கள், கையெழுத்துப்படிகள் - தமிழ்ப்புத்தகங்களின் அச்ச வரலாறு.					
Total Periods:					15



Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	தமிழ் இலக்கியத்தில் உள்ள மனித விழுமியங்களையும் உரிமைகளையும் புரிந்து கொள்ளலாம்.	K2
CO2	தமிழக மக்கள் கடைப்பிடிக்கும் கலை மற்றும் கலாச்சாரத்தை அறிந்து கொள்ளலாம்.	K2
CO3	தமிழ்நாட்டு மக்கள் பயிற்சி செய்யும் பல்வேறு விளையாட்டுகளையும் நடனங்களையும் புரிந்து கொள்ளலாம்.	K2
CO4	சங்க இலக்கியம் மற்றும் அரசர்களின் வீரம் பற்றிய கருத்துக்களை அறிந்து கொள்ளலாம்.	K2
CO5	சுதந்திரப் போராட்ட வீரர்களின் வாழ்க்கை வரலாற்றை, வேத மூலிகைகள் மற்றும் வாழ்க்கையின் வளர்ச்சிகளை அறிந்து கொள்ளலாம்.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

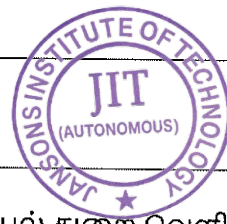
	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO2	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight
2. Moderate
3. Substantial (High)

Text Books

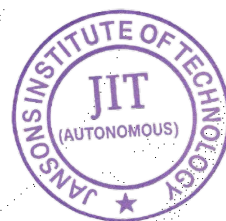
1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர். இல. சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4	பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)



5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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Reference Books

1	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
2	Historical Heritage of the Tamils (Dr. S. V. Subramanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
3	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
4	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, and Educational Services Corporation, Tamil Nadu)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
6	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
7	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.



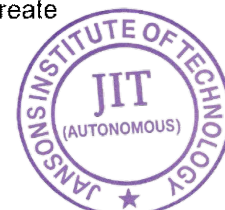
U24GE1101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1
Course Objectives:	This course enables the students to provide an insight to the students into the rich culture and heritage of the state, to provide the students detailed information on the engineering techniques to construct architectural marvels practiced in Tamil Nadu and also to make the students connect with their roots, appreciate, and preserve it.				
Unit - I	LANGUAGE AND LITERATURE	3			
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.					
Unit - II	HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE	3			
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.					
Unit - III	FOLK AND MARTIAL ARTS	3			
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.					
Unit – IV	THINAI CONCEPT OF TAMILS	3			
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature- Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.					
Unit - V	CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE	3			
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.					
Total Periods:					15

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Understand the human values and rights in Tamil literature.	K2
CO2	Classify the art and culture being practiced by people of Tamil Nadu.	K2
CO3	Outline the various games and dance practices by people of Tamil Nadu.	K2
CO4	Explain the concepts of Sangam Literature and the bravery of Kings	K2
CO5	Summarise the life history of freedom fighters, Vedic herbs and developments in life	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO2	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

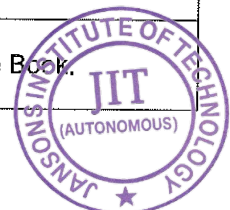
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர். இல. சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருதை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
4	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

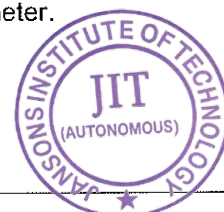
Reference Books

1	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
2	Historical Heritage of the Tamils (Dr. S. V. Subramanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
3	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
4	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, and Educational Services Corporation, Tamil Nadu)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
6	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
7	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.



U24GE3004	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives:	To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.				

Exp. No	Title
GROUP – A (CIVIL & MECHANICAL)	
I - CIVIL ENGINEERING PRACTICE	
1	PLUMBING WORK: a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household. b) Preparing plumbing line sketches. c) Laying pipe connection to the suction side of a pump d) Laying pipe connection to the delivery side of a pump. e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.
2	WOOD WORK: a) Sawing, b) Planning and c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint. Wood Work Study: a) Studying joints in door panels and wooden furniture b) Studying common industrial trusses using models
II - MECHANICAL ENGINEERING PRACTICE	
1	WELDING WORK: a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding b) Practicing gas welding and Basics
2	MACHINING WORK: a) Turning Operation b) Drilling Operation c) Tapping Operation
3	ASSEMBLY WORK: a) Assembling a centrifugal pump b) Assembling a household mixer c) Assembling an air conditioner
4	SHEET METAL WORK: a) Making of a square tray b) Making of a funnel
5	FOUNDRY WORK: a) Demonstrating basic foundry operations.
Total Periods :	
30	
GROUP B (ELECTRICAL & ELECTRONICS)	
III - ELECTRICAL ENGINEERING PRACTICE	
1	a) Residential house wiring using switches, fuse, indicator, lamp and energy meter. b) Fluorescent lamp wiring. c) Stair case wiring d) Measurement of energy using single phase energy meter. e) Measurement of resistance to earth of electrical equipment. f) Study of Iron Box wiring and assembly



Exp. No	Title
IV - ELECTRONICS ENGINEERING PRACTICE	
1	a) Study of Electronic components and equipments – Resistor colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO. b) Study of logic gates AND, OR, EX-OR and NOT. c) Generation of Clock Signal. d) Soldering simple electronic circuits and checking continuity. e) Study the elements of smart phone.
Total Periods: 30	

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Demonstrate various carpentry joints and plumbing connections.	K2
CO2	Identify welding tools, equipment and perform welding joints.	K2
CO3	Demonstrate simple machining process and sheet metal work.	K2
CO4	Demonstrate basic home electrical works, appliances and measure the electrical quantities.	K2
CO5	Infer the electronic components, logic gates, soldering and test simple electronic circuits.	K2

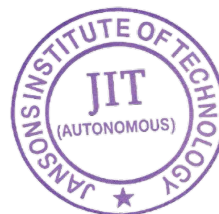
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	2	1	-	-	-	-	-	-	2	-	-	2	1	-	-
CO2	2	1	-	-	-	-	-	-	2	-	-	2	1	-	-
CO3	2	1	-	-	-	-	-	-	2	-	-	2	1	-	-
CO4	2	1	-	-	-	-	-	-	2	-	-	2	1	-	-
CO5	2	1	-	-	-	-	-	-	2	-	-	2	1	-	-
CO	2	1	-	-	-	-	-	-	2	-	-	2	1	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



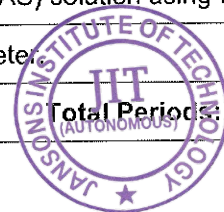
U24GE2101	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives:	To make students understand and apply the basic concepts of properties of matter, light, sound, thermal properties, semiconductor physics and fibre optics by carrying out experiments. To inculcate experimental skills to test the water and to familiarize with the electro analytical techniques applied for quantitative analysis.				

PHYSICS LABORATORY

Exp. No	Title (Any seven experiments)	
1	Torsional pendulum - Determination of rigidity modulus of wire.	
2	Non-uniform bending - Determination of Young's modulus of the beam.	
3	Uniform bending – Determination of Young's modulus of the beam.	
4	Laser- Determination of the wavelength of the laser using grating.	
5	Air wedge - Determination of thickness of a thin sheet/wire.	
6	Optical fibre -Determination of Numerical Aperture and acceptance angle.	
7	Ultrasonic Interferometer - Determination of velocity of ultrasonic waves in liquids.	
8	Determination of thermal conductivity of a bad conductor – Lee's Disc method.	
9	Determination of wavelength of mercury spectrum – spectrometer grating.	
10	Determination of band gap of a semiconductor.	
11	Determination of Numerical Aperture and acceptance angle - Optical fibre.	
Total Periods:		30

CHEMISTRY LABORATORY

CHEMISTRY LABORATORY		
Exp. No	Title (Any seven experiments)	
1	Determination of Total, Temporary & Permanent Hardness of Water by EDTA method.	
2	Determination of Chloride Content of water sample by Argentometric method.	
3	Determination of types and amount of Alkalinity in water sample.	
4	Preparation of Na_2CO_3 as a primary standard and Estimation of Acidity of a water sample using the primary standard solution.	
5	Determination of Dissolved Oxygen (DO) content of water sample by Winkler's method.	
6	Determination of strength and amount of the given Hydrochloric Acid by pH metric applications.	
7	Determination of strength and amount of acids in a Mixture of Acids using Conductivity meter.	
8	Conductometric titration of Barium Chloride against Sodium Sulphate (Precipitation Titration).	
9	Estimation of Ferrous ion present in Ferrous Ammonium Sulphate (FAS) solution using Potentiometer.	
10	Estimation of Iron content of the water sample using Spectrophotometer.	
Total Periods:		30



Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Extend the principles of elasticity and optics properties in engineering applications.	K2
CO2	Demonstrate the principles of sound in ultrasonic interferometer.	K2
CO3	Explain the thermal properties in engineering applications.	K2
CO4	Apply the knowledge of water quality parameters in water treatment through volumetric analysis.	K2
CO5	Interpret the amount of metal ions present in the solutions through Instrumental analysis.	K2
CO6	Infer the quantity of substances present in the solution by Electro Analytical Techniques.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	2	-	-	2	-	-	-
CO2	3	2	-	-	-	-	-	-	2	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	2	-	-	1	-	-	-
CO4	3	2	-	-	-	-	2	-	2	-	-	2	-	-	-
CO5	3	2	-	-	-	-	2	-	2	-	-	1	-	-	-
CO6	3	2	-	-	-	-	2	-	2	-	-	1	-	-	-
CO	3	2	-	-	-	-	2	-	2	-	-	1	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

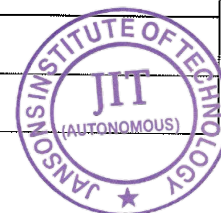
1. Slight 2. Moderate 3. Substantial (High)

Text Books

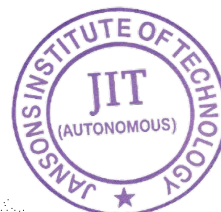
1	Physics Laboratory Manual / Record, Department of Physics.
2	Bhattacharya D K and Poonam Tandon, "Engineering Physics", 2nd Edition, Oxford University Press, Chennai, 2017
3	Marikani A, "Engineering Physics", 3rd edition, PHI publishers, Chennai, 2021.
4	Dr V.Veeraiyan, Dr L .Devaraj Stephan, "Chemistry Lab Manual "2021.
5	Engineering Chemistry Laboratory Manual / Record, Department of Chemistry.

Reference Books

1	Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", 2nd Edition, Pearson India Education Services Private Limited, Chennai, 2018
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2	Avadhanulu M N, Kshirsagar P G, Arun Murthy TVS, "A Text book of Engineering Physics", 2nd Edition, S Chand Publishing, New delhi, 2018.
3	Thyagaran K, Ajoy Ghatak, "Lasers - Fundamentals and Applications", 2nd Edition, Laxmi Publications Pvt Limited, New Delhi, 2019.
4	J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, "Vogel's Textbook of Quantitative Chemical Analysis" (2009).
5	Daniel C. Harris, "Quantitative Chemical Analysis" 2015.



U24GE7101	ENGLISH LABORATORY	L	T	P	C
		0	0	2	1
Course Objectives:	To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.				

Exp. No	Title	
1	Telephone communication	
2	Self-Introduction	
3	Summarising a documentary	
4	Mini Presentation	
5	Product Description	
6	Picture Comprehension	
7	Ted Talks Report	
8	Travelogue	
9	Debates and Discussions	
10	Just a Minute	
Total Periods:		30

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Relate the fundamentals of communication.	K2
CO2	Explain different points of view in a discussion on various topics	K2
CO3	Illustrate products and processes based on their purpose	K2
CO4	Explain fluently and accurately in formal and informal communicative contexts	K2
CO5	Interpret their opinions effectively in both formal and informal discussions	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

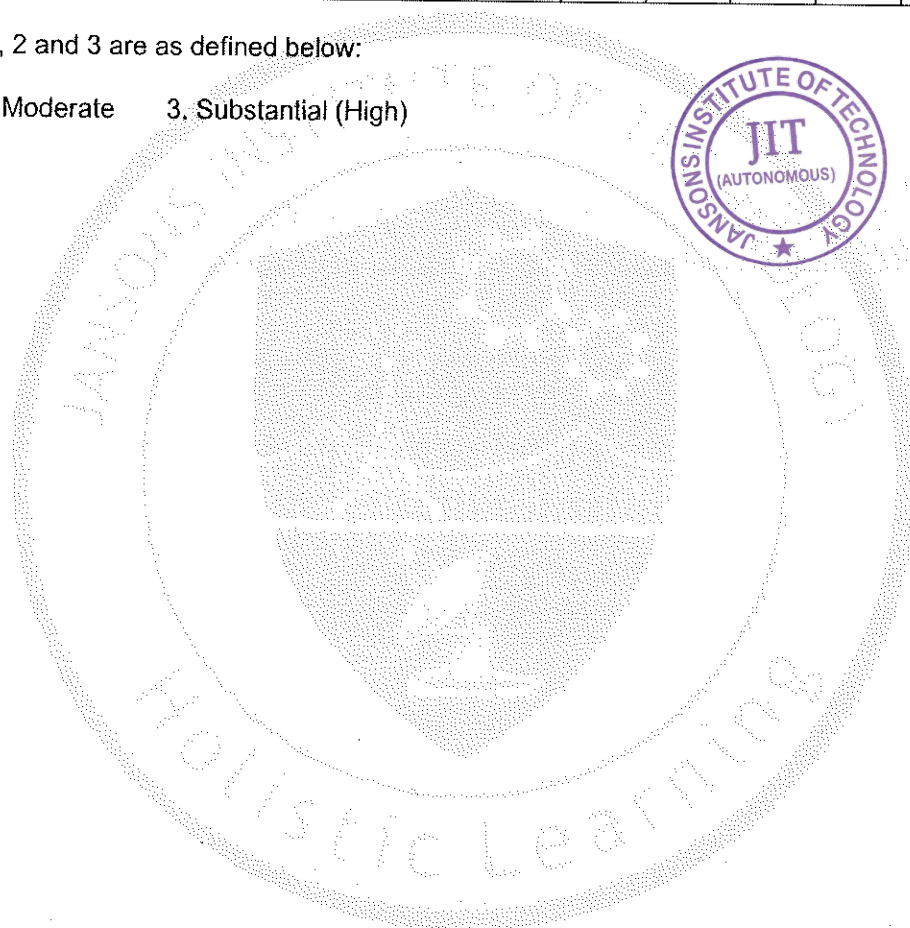
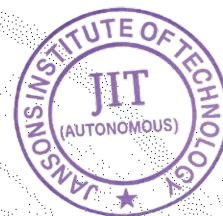


CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



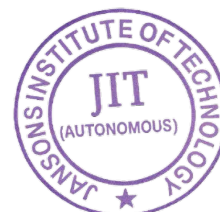
U24GE7102	DESIGN THINKING FOR INNOVATION	L	T	P	C
		0	0	2	1
Course Objectives:	To understand innovation, stages involved in design thinking and use the different idea generation techniques in Design Thinking.				
Unit - I	HISTORY OF MODERN DESIGN				4
Introduction to Engineering design, History of Modern design: Early innovations- industrialization, Global Innovation Index- Design Thinking and Innovation.					
Unit - II	DESIGN THINKING APPROACHES				6
Design thinking as a systematic approach to innovation, Three lenses of Design thinking, design challenges, product development-Case studies.					
Unit - III	STAGES OF DESIGN THINKING				6
Introduction – Empathize- Define- Ideate- Prototype- Test- Examples, constraints in design- Case studies.					
Unit – IV	IDEA GENERATION TECHNIQUES				6
Introduction -Creative Thinking-Idea Generation Techniques- brain storming, visual thinking, Mind Mapping- SCAMPER, Story boarding, Questioning Assumptions, Reverse Thinking- Case studies.					
Unit - V	DESIGN THINKING AND INNOVATION				8
Innovation, User Values and Behaviours-experimental mindset strategies for creativity, teams for innovation, design alternatives, decision making for new design. Concept Poster: Organize all information about an innovation concept to identify critical questions for prototyping. Project: Apply tools to your innovation problem or the provided scenario.					
Total Periods:					30

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain early innovations in modern design history	K2
CO2	Classify design thinking approaches and applications.	K2
CO3	Illustrate stages and constraints of design thinking	K2
CO4	Interpret various idea generation techniques and applications	K2
CO5	Demonstrate innovation concepts and creative strategies with suitable techniques	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	2	1	-	-	-	1	-	-	2	2	-	2	-	-	-
CO3	2	1	-	-	-	1	2	-	2	2	-	2	-	-	-
CO4	2	1	-	-	-	1	-	-	2	2	-	2	-	-	-
CO5	2	1	-	-	-	1	2	-	2	2	-	2	-	-	-
CO	2	1	-	-	-	1	2	-	2	2	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

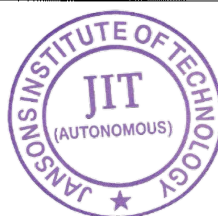
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.
2	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4	Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Reference Books

1	"Design Thinking - A Primer"By Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras.
2	Design Thinking: A User-Centred Approach to Innovation. (2023). Dr. Harjinthar Singh, Dr. Khairul Anuar Abdul Wahid: Marc & Zed PUBLISHING.
3	"Design Thinking - A Primer"By Prof. Ashwin Mahalingam, Prof. Bala Ramadurai, IIT Madras. Swayan NPTEL course.
4	Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.
5	Handbook of Design Thinking: Tips & Tools for how to design thinking by Christian Mueller Roterberg, Kindle Direct Publishing.



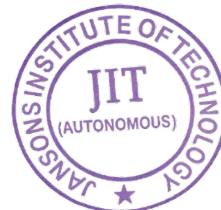
U24HS1201		PROFESSIONAL ENGLISH II		L	T	P	C
				2	0	0	2
Course Objectives:		To improve the basic grammar with reading, writing and analytical thinking skills in comprehending documents through professional context which demonstrate an understanding of job application, interviews for internship and placements.					
Unit - I		MAKING COMPARISONS				6	
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases.							
Unit - II		EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING				6	
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds							
Unit - III		BUSINESS COMMUNICATION				6	
Technical Synonyms and Antonyms, Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).							
Unit – IV		REPORTING OF EVENTS AND RESEARCH				6	
Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions							
Unit - V		THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY				6	
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.							
Total Periods:						30	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Compare the ideas in technical context.	K2
CO2	Interpret the cause and effects in events, industrial processes through writing and speaking skills.	K2
CO3	Relate problems for feasible solutions and communicate it in professional format.	K2
CO4	Explain logical ideas and opinions in technical context.	K2
CO5	Outline professional resume for internships and jobs in an effective manner.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

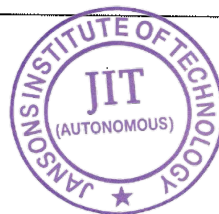
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2	English for Science & Technology Cambridge University Press 2021.
3	Authored by Dr.Veena Selvam, Dr.Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr.KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference Books

1	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3	Learning to Communicate – Dr.V. Chellammal. Allied Publishers, New Delhi, 2003
4	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5	Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.



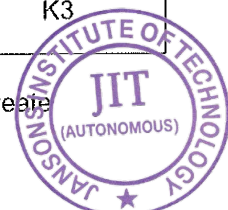
U24MA2202	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4
Course Objectives:	Introduce essential PDE concepts and Fourier series analysis for engineering, exploring heat flow solutions and diverse scenarios, while also incorporating Z transform for discrete time systems.				
Unit - I	PARTIAL DIFFERENTIAL EQUATIONS				9+3
Formation of partial differential equations – Classification of linear and nonlinear partial differential equations - Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.					
Unit - II	FOURIER SERIES				9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval's identity – Complex form of the Fourier series – Harmonic analysis.					
Unit - III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS				9+3
Classification of PDE – Method of separation of variables - Fourier series solutions of one-dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Cartesian coordinates only).					
Unit – IV	FOURIER TRANSFORMS				9+3
Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's Identity.					
Unit - V	Z - TRANSFORMS AND DIFFERENCE EQUATIONS				9+3
Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms.					
Total Periods:					60

Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Identify the various methods to solve the given partial differential equations.	K3
CO2	Construct the functions as a Fourier series.	K3
CO3	Apply the Fourier series techniques to solve the one-dimensional, two-dimensional heat flow problems and one-dimensional wave equations.	K3
CO4	Solve the physical engineering challenges by using Fourier transforms techniques.	K3
CO5	Make use of the Z- transform techniques to solve the ordinary difference equations.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

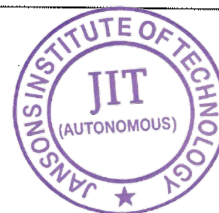
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2018.
2	Kreyszig E, "Advanced Engineering Mathematics", 10th Edition, John Wiley, New Delhi, India, 2018.

Reference Books

1	Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers", SPIE Press, 1999.
2	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2021.
3	James. G., "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education, New Delhi, 2016.
4	Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G, "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
6	Wyllie. R.C. and Barrett. L.C., "Advanced Engineering Mathematics ", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

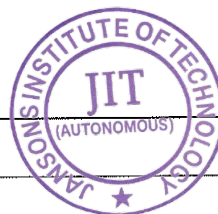


U24PH2202	PHYSICS FOR CIVIL ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To make the students understand the basics of heat transfer, thermal performance of building and various thermal applications, the ventilation and air conditioning of buildings, sound insulation and lighting designs, the processing and applications of new engineering materials, codal provisions and byelaws in civil engineering.				
Unit - I	THERMAL APPLICATIONS				7
Principles of heat transfer, steady state of heat flow, conduction through compound media-series and parallel-conductivity of rubber tube and powder materials - heat transfer through fenestrations, thermal insulation and its benefits - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, climate and design of solar radiation, shading devices - central heating.					
Unit - II	VENTILATION AND REFRIGERATION				9
Requirements and principles of natural ventilation - Ventilation measurements: Air flow measure, Air volume, Air velocity, carbon-di-oxide measurement - design for natural ventilation - Window type air conditioner - packaged air conditioner: construction and working - chilled water plant: construction and working - fan coil systems: construction and working - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by air conditioner (AC) Systems.					
Unit - III	VIBRATIONS, ACOUSTICS AND LIGHTING DESIGNS				11
Vibrations: Theory of free vibrations, Damped vibrations and three cases of damping, Theory of forced vibrations. Resonance. Acoustics: Introduction to Acoustics, Types of Acoustics, Reverberation time, Sabine's formula (derivation) and measurement of absorption coefficient. Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation- impact of noise in multi-storeyed buildings. Lighting Designs: Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.					
Unit – IV	NEW ENGINEERING MATERIALS				10
Composites - Definition and Classification - Fibre reinforced plastics (FRP): manufacturing, properties and applications - fibre reinforced metals (FRM): manufacturing, properties and applications - Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of Ni-Ti alloy applications - advantages and disadvantages of SMA - Ceramics - Classification - Crystalline - Non-Crystalline - Bonded ceramics, Manufacturing methods - Slip casting – Properties and applications.					
Unit - V	CODAL PROVISIONS & BYE LAWS				8
Historical context and development of civil engineering codes - Role of codes in ensuring safety, reliability, and efficiency – Importance and Difference between codal provisions and byelaws - Zoning and building byelaws- Examples of major international and national codes - Detailed study of various types of codes and standards, Structural codes, Environmental codes, Safety codes, Materials codes - Case Studies - Risk management and mitigation. Promoting sustainable development and environmental protection-Advances in sustainable and green building codes -Emerging trends and future directions in engineering standards.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Explain the thermal applications in various fields.	K2
CO2	Apply the ventilation and refrigeration principles in real-time use.	K3
CO3	Select the various concepts of acoustics and lighting designs in buildings.	K3



CO	Statements	K-Level
CO4	Summarize new engineering materials and devices.	K2
CO5	Interpret the importance of codal provisions and bylaws in Civil Engineering.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	2	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	2	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO5	3	2	-	-	-	1	-	1	-	-	-	1	2	-	-
CO	3	2	-	-	-	1	-	1	-	-	-	1	2	1	-

Correlation levels 1, 2 and 3 are as defined below:

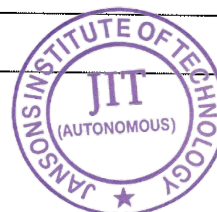
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Marko Pinteric, Building Physics, Springer 2017.
2	D.S.Mathur, Elements of Properties of Matter. S Chand & Company, 2010.
3	Hugo Hens, Building Physics: Heat, Air and Moisture, Wiley, 2017.
4	Building Materials and Construction, S.K. Duggal, New Age International Publishers, 2017.
5	A History of Building Codes G.C. Herman, International Code Council, 2019.
6	Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications Pvt Ltd.

Reference Books

1	W.R.Stevens. Building Physics: Lighting. Pergamon Press, 2013.
2	Hugo Hens, Applied Building Physics, Wiley, 2016.
3	K.G.Budinski and M.K.Budinski. Engineering Materials: Properties and Selection. Pearson Education, 2016.
4	Peter A. Claisse, Civil Engineering Materials, Elsevier, 2016.
5	Patrick L. Abbott, Natural Disasters, McGraw-Hill, 2017.



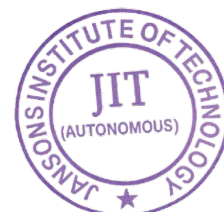
U24ME3201	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3
Course Objectives:	Students can understand about concept of equilibrium of particles, principles of equilibrium of rigid bodies, moment of area, mass moment of inertia, various types and laws of frictions and dynamic forces applied in rigid bodies.				
Unit - I	STATICS OF PARTICLES				9
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.					
Unit - II	EQUILIBRIUM OF RIGID BODIES				9
Principle of Transmissibility, Equivalent Forces, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two Dimensions - Reactions at Supports and Connections.					
Unit - III	GEOMETRY DEPENDENT PROPERTIES				9
Centroids and centre of gravity – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem.					
Unit – IV	FRICTION				9
The laws of dry friction, Coefficients of Friction, Angles of Friction, Wheel Friction, Rolling Resistance, Ladder friction.					
Unit - V	DYNAMICS OF PARTICLES				9
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion - Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamental concepts in determining the effect of forces on a particle.	K2
CO2	Outline the effect of forces in a rigid body.	K2
CO3	Interpret the geometry dependent properties of solids and sections.	K2
CO4	Explain the concepts and laws of dry friction	K2
CO5	Infer the principles of kinetics involved in dynamic conditions.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	2	2	1	-
CO4	2	2	-	-	-	-	-	-	-	-	-	2	2	1	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	2	1	-
CO	3	2	-	-	-	-	-	-	-	-	-	2	2	1	-

Correlation levels 1, 2 and 3 are as defined below:

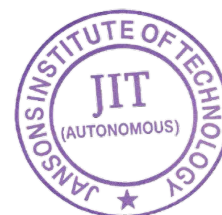
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education., 12th Edition, 2019.
2	Vela Murali, "Engineering Mechanics-Statics and Dynamics", Oxford University Press, 2018

Reference Books

1	Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
2	Hibbeler, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 14th edition, Prentice Hall, 2020.
3	Irving H. Shames, Krishna Mohana Rao G, Engineering Mechanics – Statics and Dynamics, 4th Edition, Pearson Education Asia Pvt. Ltd., 2014.
4	Bolton J N, Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 9th edition, Wiley student edition, 2020.
5	Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, 5th Edition, McGraw Hill Higher Education, 2013.

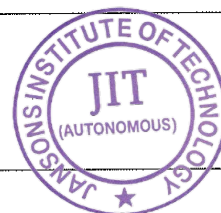


U24GE1201	தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1
Course Objectives:	இந்த பாடத்திட்டத்தில், மக்களின் வாழ்க்கைமுறையில் பொருட்களை உருவாக்கும் கலை மற்றும் மேம்பாடுகளை புரிந்து கொள்ளவும், கட்டிடங்கள் கட்டும் பல்வேறு முறைகளை புரிந்து கொள்ளவும், தமிழர்கள் கட்டிடக்கலையில் பயன்படுத்தப்படும் நுட்பங்களை புரிந்து கொள்ளவும், நவீன தொழில்நுட்பத்துடன் தமிழின் கருத்துக்களை புரிந்து கொள்ளவும் பயன்படுத்தவும் உதவுகிறது.				
Unit - I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்				3
சங்க காலத்தில் நெசவுத்தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.					
Unit - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில் நுட்பம்				3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும், நடுகல் லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் -சோழர் காலத்து பெருங்கோவில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல் , மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந் தோ - சாரோசெனிக் கட்டிடக் கலை.					
Unit - III	உற்பத்தித் தொழில் நுட்பம்				3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல் மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும் புத்துண்டுகள் - தொல் லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.					
Unit - IV	வேளாண்மை மற்றும் நீர்ப்பாசனத்தொழில்நுட்பம்				3
அணை, ஏரி, குளங் கள் , மதகு - சோழர் காலக் குழுவித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன் வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.					
Unit - V	அறிவியல் தமிழ் மற்றும் கணித் தமிழ்				3
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு செய் தல் - தமிழ் மென் பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல் விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம் .					
Total Periods:					15

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	தமிழர்களின் வாழ்க்கை வரலாற்றில் படிப்படியான முன்னேற்றத்தை அறிந்து கொள்ளலாம்.	K2



COs	Statements	K-Level
CO2	கடந்த காலத்தின் தாக்கத்தை நிகழ்காலத்துடன் சேர்த்து வீடுகள் மற்றும் கட்டிடங்களை கட்டலாம்.	K2
CO3	தொழில்நுட்பத்தின் உதவியுடன் குறிப்பிடத்தக்க விஷயங்களை உருவாக்க கற்றுக்கொள்ளலாம்.	K2
CO4	கடல்களின் அளவீடுகளைக் கண்டறிய பண்டைய திறன்களைப் பயன்படுத்தலாம்.	K2
CO5	தமிழின் கருத்துக்களை நவீன தொழில்நுட்பத்துடன் பயன்படுத்தலாம்.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO2	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

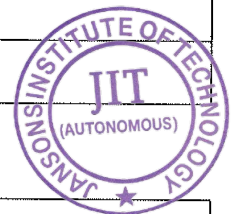
1. Slight 2. Moderate 3. Substantial (High)

Text Books

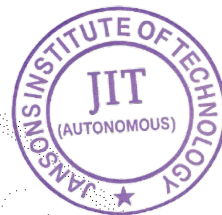
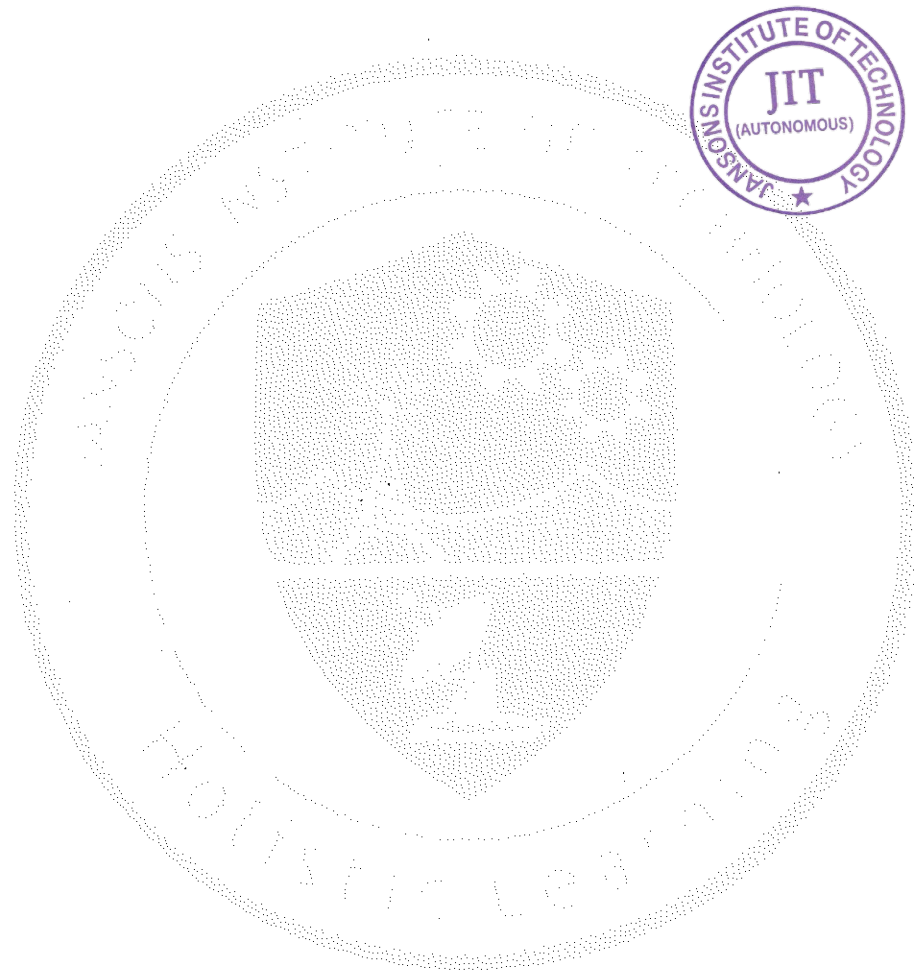
1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர். இல. சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு),
4	பொருறை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

Reference Books

1	Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
2	Historical Heritage of the Tamils (Dr. S. V. Subramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).



3	The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
4	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
6	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
7	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.



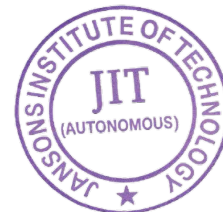
U24GE1201	TAMILS AND TECHNOLOGY		L	T	P	C
			1	0	0	1
Course Objectives:	This course enables the students to understand the art of making things and developments in the lifestyle of people, understand the various methods of constructing buildings, understand the techniques being used in Architecture by Tamils and also understand and apply the concepts of Tamil with modern technology.					
Unit - I	WEAVING AND CERAMIC TECHNOLOGY					3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.						
Unit - II	DESIGN AND CONSTRUCTION TECHNOLOGY					3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.						
Unit - III	MANUFACTURING TECHNOLOGY					3
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.						
Unit – IV	AGRICULTURE AND IRRIGATION TECHNOLOGY					3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoempu of Chola Period, Animal Husbandry Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.						
Unit - V	SCIENTIFIC TAMIL & TAMIL COMPUTING					3
Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.						
Total Periods:						15

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Understand the gradual improvement in the life history of Tamils.	K2
CO2	Interpret the concepts of the design & construction technology in Sangam age.	K2
CO3	Explain the manufacturing technology in the Sangam age.	K2
CO4	Summarise the ancient skills to find out the measurements of oceans.	K2
CO5	Outline the concepts of Tamil with modern technology.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO2	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO3	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-
CO	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

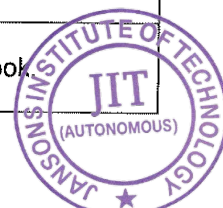
1. Slight 2. Moderate 3. Substantial (High)

Text Books

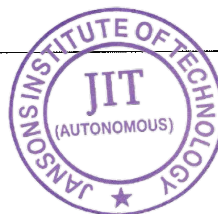
1	தமிழக வரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2	கணினித் தமிழ் – முனைவர். இல. சுந்தரம். (விகடன் பிரசுரம்).
3	கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4	பொருளை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
4	Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

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2	Historical Heritage of the Tamils (Dr. S. V. Subramanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
3	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
4	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, and Educational Services Corporation, Tamil Nadu)
5	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
6	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).
7	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book



U24GE3201	PYTHON PROGRAMMING				L	T	P	C
					2	0	2	3
Course Objectives:		To understand the basics of algorithmic problem solving and solve problems using python conditionals, loops and functions. To gain knowledge about the concepts of data structures - lists, tuples, dictionaries to represent complex data and input/output with files in python.						
Unit - I		COMPUTATIONAL THINKING AND PROBLEM SOLVING						12
Introduction – Translators - Compilation and Interpretation - Language Processors - Computer Software –Types of Software – Application Software Packages - Software Development Steps - Fundamentals of Computing – Identification of Computational Problems – Algorithms - Building Blocks of Algorithms - Notation - Algorithmic Problem Solving - Strategies for Developing Algorithms.								
Suggested Activities:								
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.								
Unit - II		DATA TYPES, EXPRESSIONS, STATEMENTS						12
Introduction to Python – History & Versions - Importance of Python – Applications - Comparison of Python with C and Java - Installing Python in Windows & Ubuntu - Structure of a Python Program - Standard libraries in Python - Executing Python programs - Python Interpreter and Interactive Mode, Types of Errors – Keywords - Values and Types- Variable Names and Keywords - Type Conversion - Operators and Operands - Precedence of Operators - Expressions – Statements.								
Suggested Activities:								
1. Install and configure Python IDE								
2. Python programming using simple statements and expressions								
Unit - III		CONTROL FLOW, FUNCTIONS, STRINGS						12
Conditionals Statements – Boolean Values and Operators – Conditional: if – Alternative: if-else - Chained Conditional: if-elif-else - Iteration Statements – state – while – for – break – continue -pass - Fruitful Functions: Return Values, Parameters, Local and Global Scope, Function Call, Function Composition, Recursion; Strings: String Slices, Immutability, String Functions and Methods, String Module - Programs using Decision Making, Loops, Functions and Strings.								
Suggested Activities:								
1. Scientific problems using Conditionals and Iterative loops.								
2. Implementing programs using Functions.								
3. Implementing programs using Strings.								
Unit – IV		LISTS, TUPLES, DICTIONARIES						12
Lists: List Operations - List Slices - List Methods and Functions - List Loop, Mutability – Aliasing - Cloning Lists - List Parameters; Tuples: Tuples Operations - Methods and Functions - Tuple Assignment - Tuple as Return Value; Dictionaries: Operations - Methods and Functions - Programs using Lists, Tuples and Dictionaries.								
Suggested Activities:								
1. Implementing real-time/technical applications using Lists, Tuples.								
2. Implementing real-time/technical applications using Sets, Dictionaries.								
Unit - V		FILES, MODULES, PACKAGES						12
Files and Exception: File Types – Text Files – Binary Files - Reading and Writing files - Format Operator - Command Line Arguments - Errors and Exceptions - Handling Exceptions, Modules and Packages.								
Suggested Activities:								
1. Implementing real-time/technical applications using File & Exception handling.								
2. Implementing programs using modules & packages.								
3. Exploring Pygame tool and developing a game activity using Pygame like bouncing ball, car race etc.								
Total Periods:								60



Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Outline the algorithmic solutions to solve the simple computational problems.	K2
CO2	Infer and execute simple python programs.	K2
CO3	Explain the simple python program using functions, conditionals and looping.	K2
CO4	Interpret the compound data using python lists, tuples and dictionaries.	K2
CO5	Extend the usage of read and write data from/to files in python programs.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	2	-	-	-	-	-	-	-	1	-	-	1	1	-	-
CO2	2	-	-	-	-	-	-	-	1	-	-	1	1	-	-
CO3	2	1	-	-	-	-	-	-	1	-	-	1	1	-	-
CO4	2	1	-	-	-	-	-	-	1	-	-	1	1	-	-
CO5	2	1	-	-	-	-	-	-	1	-	-	1	1	-	-
CO	2	1	-	-	-	-	-	-	1	-	-	1	1	-	-

Correlation levels 1, 2 and 3 are as defined below:

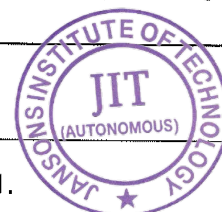
1. Slight 2. Moderate 3. Substantial (High)

Text Books

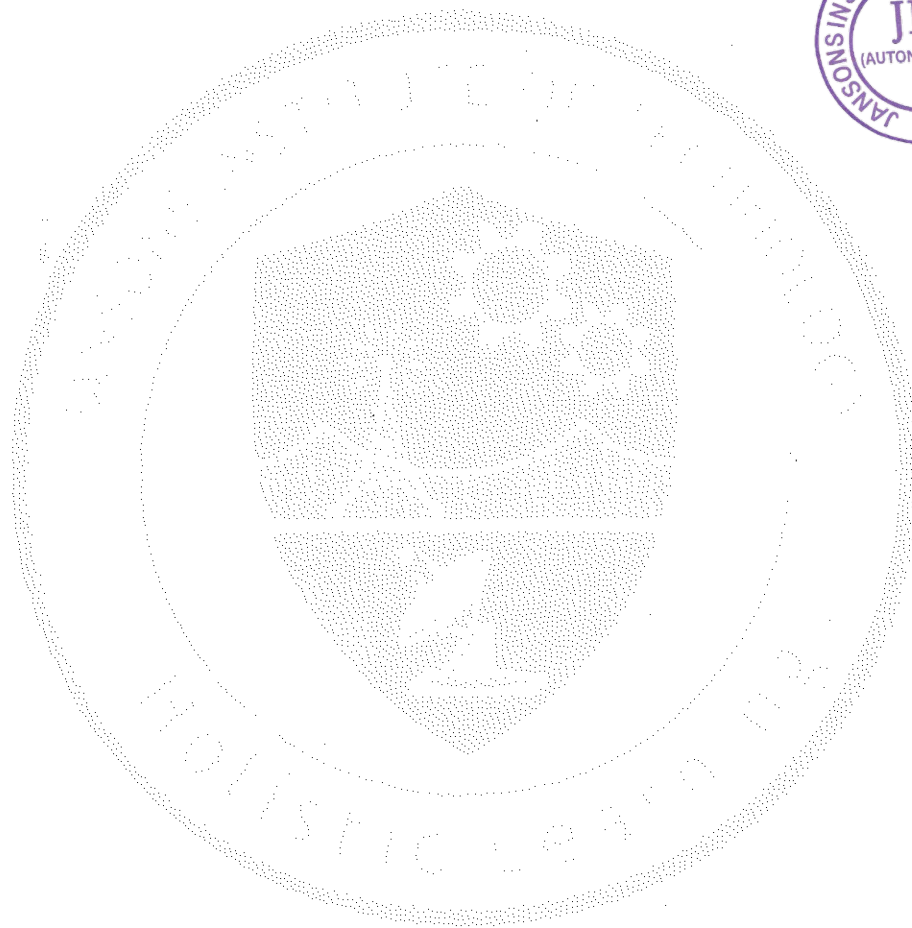
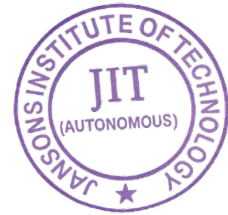
1	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2	John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
3	David Amos, Dan Bader, Joanna Jablonski, Fletcher Heisler, "Python Basics: A Practical Introduction to Python 3", 4th Edition, 2020.
4	Udayan Das, Aubrey Lawson, Chris Mayfield, Narges Norouzi, "Introduction to Python Programming", OpenStax, Rice University, Texas, 2024.

Reference Books

1	Arockia Mary P, Problem Solving and Python Programming, Shanlax Publications, 2021.
2	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.



3	Dr. Krishna Kumar Mohbey, Dr. Brijesh Bakariya, "An Introduction to Python Programming: A Practical Approach", BPB Publications, 2021
4	https://www.python.org/
5	https://realpython.com/python-modules-packages/
6	https://learnpython.com/blog/python-modules-packages-libraries-frameworks/
7	https://www.upgrad.com/tutorials/software-engineering/python-tutorial/module-and-package-in-python/



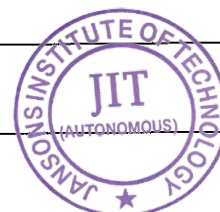
U24CE4201	COMPUTER AIDED DRAFTING & DRAWING LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives:	To enable the students to plan the building as per National building code extensive building components, distinct sign conventions and symbols, and diverse viewpoints of a structure with planning and drawing principles for both residential and public buildings.				

Exp. No	Title	
1	To draw the conventional signs and symbols used in civil engineering drawings.	
2	To draw the developed plan, elevation, section and site plan of a given line diagram for residential buildings.	
3	To draw the components of buildings like doors.	
4	To draw the components of buildings like windows.	
5	To draw the various types of brick bonds	
6	To draw the elevation of roof structures like king post truss.	
7	To draw the queen post truss.	
8	To draw the different types of roofs like couple, collar and pitched roof.	
9	To draw the foundation details for the buildings.	
10	To draw the plan and elevation of different types of staircases.	
11	To draw the elevation and section of ledged and battens door.	
12	To draw the developed plan, elevation, section and site plan of public buildings	
Total Periods:		60

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Plan buildings as per NBC regulations and building laws.	K3
CO2	Identify the various joinery details and brick bonds.	K3
CO3	Choose the different types of trusses and roof components.	K3



COs	Statements	K - Level
CO4	Model the multiple types of footings, staircase and steel connection details.	K3
CO5	Develop the plan, elevation, and various sectional views of simple residential and public buildings.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

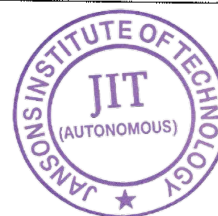
	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	3	2	-	-	-	-	2	2	-	1	2	3	-	-
CO2	3	3	2	-	-	-	-	2	2	-	1	2	3	-	-
CO3	3	3	2	-	-	-	-	2	2	-	1	2	3	-	-
CO4	3	3	2	-	-	-	-	2	2	-	1	2	3	-	-
CO5	3	3	2	-	-	-	-	2	2	-	1	2	3	-	-
CO	3	3	2	-	-	-	-	2	2	-	1	2	3	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Building Planning and Drawing, M N Gangarde, S P Deshpande, Nirali Prakashan Publisher, 2020.
2	Planning, Designing and scheduling, Girescharan Singh & Jagadish Singh, Standard Publishers, 2020.
3	Building Planning and Drawing, January 2019, 9th edition by Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publishing House Pvt. Ltd,
4	Building Planning and Drawing by S.S. Bhavikatti, Dreamtech Press India Pvt. Ltd, 2019.



U24GE7201	COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives:	To encourage group discussion, effective presentation skills to analyse concepts that are relevant to the context and able to communicate effectively through formal and informal writing.				

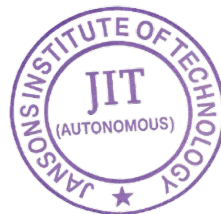
Exp. No	Title	
1	Speaking Skill.	
2	Role Play.	
3	Email Writing.	
4	Group Discussion.	
5	Dialogue writing.	
6	Paragraph Writing.	
7	Formal / Semi – Formal letters	
8	Writing Instructions	
9	Short Article Writing	
10	Writing Recommendations	
Total Periods:		60

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Relate speaking skills effectively in formal and semi formal context.	K2
CO2	Infer concepts with problems from various perspectives for suitable solutions.	K2
CO3	Interpret the writing skills with technical format.	K2
CO4	Explain the content with the correct format to convey information with clarity.	K2
CO5	Relate recommendations for effective execution of tasks.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

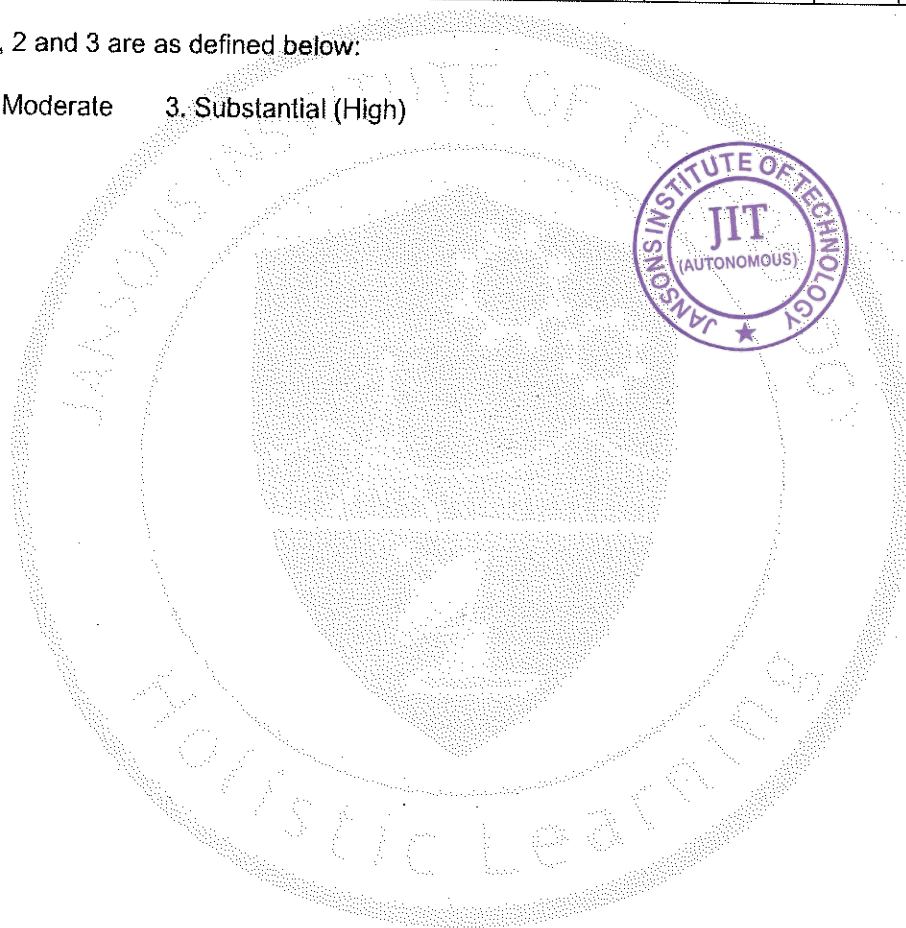


CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-
CO	-	-	-	-	-	-	-	-	3	3	-	3	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



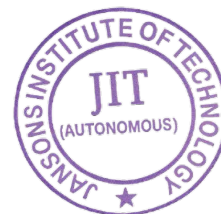
U24GE7202	FUNDAMENTALS OF ENTREPRENEURSHIP AND STARTUP	L	T	P	C
		0	0	2	1
Course Objectives:	To familiarize Entrepreneurship and Startups, understand and formulate the Problem Canva, Business model Canva and relate the incubation support with respect to startups.				
Unit - I	FUNDAMENTALS OF ENTREPRENEURSHIP				4
Meaning and importance of Entrepreneurship- Types of entrepreneurial skills – Entrepreneurship in different sectors- Role of entrepreneurship development programmes (EDP).					
Unit - II	FUNDAMENTALS OF STARTUP				6
Introduction- Features of Startup- Understanding problems and Customer Persona- Problem statement Canva- Empathy map and Value Proposition- Prototyping- Presentation on Problem canva.					
Unit - III	BUSINESS PLAN AND PITCHING				6
Market Analysis- Business Model Canva- Go to Market Strategy- Cost Analysis and Revenue streams- Presentation on Business model Canva.					
Unit – IV	INCUBATION SUPPORT TO STARTUPS				6
Commercialisation- Meaning and Definition of Incubation support-Functions of pre incubation and Incubation centres- Registration process.					
Unit - V	CASE STUDIES ON STARTUP				8
How to Pitch a startup- Pitch deck – Case studies of Successful startups in India- Failure analysis of Startups Pitch deck presentation.					
Total Periods:					30

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the types of entrepreneurial skills	K2
CO2	Summarize the problem statement Canva for the identified problem	K2
CO3	Extend a business plan with market analysis and financial projection	K2
CO4	Explain commercialisation and incubation support for startups	K2
CO5	Demonstrate a pitch deck for startup with insights from the case studies	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	1	-	-	-	-	1	-	-	2	2	-	2	-	-	-
CO3	-	-	-	-	-	1	-	-	2	2	1	2	-	-	-
CO4	1	-	-	-	-	1	-	2	-	-	-	2	-	-	-
CO5	-	-	-	-	-	1	-	2	2	3	-	2	-	-	-
CO	1	-	-	-	-	1	-	2	2	2	1	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

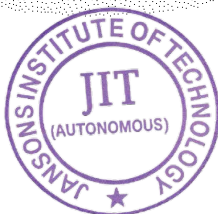
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	"Entrepreneurship: Theory, Process, and Practice" Authors: Donald F. Kuratko, Richard M. Hodgetts, and Justin G. Longenecker, Publisher: Cengage Learning Year of Publication: 2021.
2	"Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers".
3	Alexander Osterwalder and Yves Pigneur Publisher: Wiley Year of Publication: 2010.
4	Rashmi Bansal, Connect the Dots, Westland and Tranquebar Press, 2012.

Reference Books

1	"Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries, Publisher: Currency, Year of Publication: 2011.
2	"The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything" Author: Guy Kawasaki, Publisher: Portfolio, Year of Publication: 2015.



U24GE7203		Deutsch - I		L	T	P	C
				0	0	2	1
Course Objectives:		In this course equip the students with foundational proficiency in the German language by developing their basic grammar, vocabulary, pronunciation, and conversational skills, enabling them to communicate effectively in everyday, workplace, travel, and social contexts.					
Unit - I	INTRODUCTION TO GERMAN SOUNDS AND BASIC WORDS					9	
Die Satzmelodie - Das Alphabet - Die Laute sch [S] und sp [Sp] - Diphthonge: ei [ai] - Begrüßen - Sich und andere vorstellen - Buchstabieren - Zählen							
Unit - II	FAMILY					9	
Angaben zur Person: Name, Alter, Familie - Länder - Städte - Berufe - Sprachen - Hobbys - Zahlen Personalpronomen und Verben im Präsens - Personalpronomen - Aussagesätze - Fragesätze - Bestimmter Artikel - Possessivartikel							
Unit - III	FIRST CONVERSATION AT WORKPLACE					9	
Gespräche mit Kollegen - Die Büroeinrichtung und die Abteilungen beschreiben - Nach Preisen fragen - Über Freizeitaktivitäten sprechen - Nomengruppe im Nominativ: bestimmter und unbestimmter Artikel - Possessivartikel - Pronomen - Verben im Präsens - Modalverb: können - Negation - Lokale Präpositionen: aus, in, bei, nach							
Unit – IV	TRAVEL					9	
Ein Hotelzimmer reservieren - Sich im Hotel anmelden - Probleme im Hotelzimmer benennen - Sich in einer Stadt orientieren - Informationen über Museen erfragen (Öffnungszeiten/Eintrittspreise) - Nomengruppe im Akkusativ - Komposita - Verben im Präsens - Verben mit Akkusativ - Modalverb: möchte(n) - Temporale und lokale Präpositionen							
Unit - V	FOOD AND DRINK					9	
Essen und Trinken bestellen - Nahrungsmittel einkaufen - Einfache Rezepte lesen Informationen über Essgewohnheiten geben und erfragen - Nomengruppe im Akkusativ - Plural der Nomen - Modalverb: mögen - Präteritum von sein und haben - Personalpronomen im Akkusativ							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	STATEMENTS	K-Level
CO1	Explain basic German sounds, alphabet patterns, pronunciation rules, and commonly used introductory expressions in everyday communication.	K2
CO2	Describe personal information, family details, professions, and hobbies using appropriate personal pronouns, articles, and present tense verb forms.	K2



COs	STATEMENTS	K-Level
CO3	Interpret and respond to simple workplace conversations using correct grammatical structures such as modal verbs, negation, and prepositions	K2
CO4	Explain travel-related interactions including hotel reservations, city navigation, and museum inquiries using appropriate accusative forms and modal verbs	K2
CO5	Discuss food and drink preferences, ordering processes, and basic shopping conversations using plural forms, accusative pronouns, and simple past forms of <i>sein</i> and <i>haben</i> .	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	1	-	2	3	-	2	-	-	1
CO2	-	-	-	-	-	1	-	2	3	-	2	-	-	1
CO3	-	-	-	-	-	2	-	3	3	1	2	1	1	2
CO4	-	-	-	-	-	2	-	2	3	1	2	-	1	2
CO5	-	-	-	-	-	1	-	2	3	-	2	-	1	1
CO	-	-	-	-	-	1	-	3	3	0	2	-	1	1

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Text Books:

1	Dengler, Stefanie, et al. <i>Netzwerk A1: Kursbuch</i> . Ernst Klett Sprachen, 2017.
2	Funk, Hermann, et al. <i>Menschen A1: Kursbuch</i> . Hueber Verlag, 2012.
3	Funk, Hermann, et al. <i>Menschen A1: Arbeitsbuch</i> . Hueber Verlag, 2012.
4	Koithan, Ute, et al. <i>Aspekte neu A1 Plus</i> . Klett Sprachen, 2016.

Reference Books:

1	Dreyer, Hilke, and Richard Schmitt. <i>Lehr- und Übungsbuch der deutschen Grammatik</i> . Hueber Verlag, 2015.
2	Reimann, Monika. <i>Grundstufen-Grammatik für Deutsch als Fremdsprache</i> . Hueber Verlag, 2010.
3	Lemcke, Christiane, et al. <i>Berliner Platz 1 NEU</i> . Langenscheidt, 2016.
4	Hall, Karin, and Barbara Scheiner. <i>Übungsgrammatik für die Grundstufe</i> . Hueber Verlag, 2014.
5	Di Donato, Robert, et al. <i>Deutsch Na Klar! An Introductory German Course</i> . McGraw-Hill Education, 2014.



U24GE7204		JAPANESE - I		L	T	P	C
				0	0	2	1
Course Objectives:		To develop foundational proficiency in the Japanese language by enabling students to understand the Japanese writing system (Hiragana, Katakana, and basic Kanji), acquire essential grammar and vocabulary, and communicate effectively in everyday, workplace, travel, and social situations.					
Unit - I	INTRODUCTION TO JAPANESE					9	
Japanese written system - Japanese sounds - Hiragana (あ、い、う、え、お...) -Hiragana variations - Katakana - Katakana variations							
Unit - II	MYSELF					9	
Countries - Languages - Occupations - Self-introduction - Family - People - Numbers - My family - wa...desu - mo particle- to particle - ni particle - no particle.							
Unit - III	FIRST CONVERSATION AT WORKPLACE					9	
Food - Drinks - 7 Kanji - Food for lunch - Eating places - ga suki desu - sukijanai - o particle - de particle - My breakfast - My lunch							
Unit – IV	TRAVEL					9	
Home - Furniture - 4 kanjis - Places to visit nearby - Rooms - Things in the room - ni + ga + arimasu - ni + ga + imasu - general counter - My home - My room							
Unit - V	FOOD AND DRINK					9	
Daily routines - Time - 10 kanjis - Free-time activities - Places - Calendar - telling time - ni particle - kara... made... - time expression - ii adjective							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	STATEMENTS	K-Level
CO1	Explain the Japanese writing system including Hiragana, Katakana, basic Kanji, and fundamental pronunciation patterns.	K2
CO2	Describe personal information, family details, occupations, and nationalities using basic Japanese sentence structures and particles (wa, mo, to, ni, no).	K2
CO3	Interpret and respond to simple workplace and daily-life conversations related to food, preferences, and common expressions using appropriate particles (ga, o, de).	K2
CO4	Explain travel-related and home-based conversations using sentence patterns such as <i>ni + ga + arimasu/imasu</i> and basic counters.	K2
CO5	Discuss daily routines, time expressions, free-time activities, and calendar-related conversations using correct particles and adjective forms.	K2

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	1	-	2	3	-	2	-	-	1
CO2	-	-	-	-	-	1	-	2	3	-	2	-	-	1
CO3	-	-	-	-	-	2	-	3	3	1	2	1	1	2
CO4	-	-	-	-	-	2	-	2	3	1	2	-	1	2
CO5	-	-	-	-	-	1	-	2	3	-	2	-	1	1
CO	-	-	-	-	-	1	-	3	3	0	2	-	1	1

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Text Books:

1	Banno, Eri, et al. <i>Genki I: An Integrated Course in Elementary Japanese</i> . 3rd ed., The Japan Times Publishing, 2020.
2	The Japan Foundation. <i>Marugoto: Japanese Language and Culture Starter A1 – Katsudoo (Coursebook for Communicative Language Activities)</i> . Sanshusha Publishing, 2014.
3	The Japan Foundation. <i>Marugoto: Japanese Language and Culture Starter A1 – Rikai (Coursebook for Communicative Language Competences)</i> . Sanshusha Publishing, 2014.
4	Tohsaku, Yookoso! Yasu-Hiko. <i>Yookoso! An Invitation to Contemporary Japanese, Book 1</i> . 3rd ed., McGraw-Hill Education, 2014.
5	Nakama, Yukiko Abe Hatasa, et al. <i>Nakama 1: Japanese Communication, Culture, Context</i> . 3rd ed., Cengage Learning, 2017.

Reference Books:

1	Makino, Seiichi, and Michio Tsutsui. <i>A Dictionary of Basic Japanese Grammar</i> . The Japan Times Publishing, 1989.
2	Hadamitzky, Wolfgang, and Mark Spahn. <i>Japanese Kanji and Kana: A Complete Guide to the Japanese Writing System</i> . Tuttle Publishing, 2011.
3	Miura, Akira. <i>Essential Japanese Grammar: A Comprehensive Guide to Contemporary Usage</i> . Tuttle Publishing, 1998.
4	Henshall, Kenneth G. <i>A Guide to Remembering Japanese Characters</i> . Tuttle Publishing, 2015.
5	Sasaki, Isami, et al. <i>Minna no Nihongo I: Main Textbook</i> . 2nd ed., 3A Corporation, 2012.

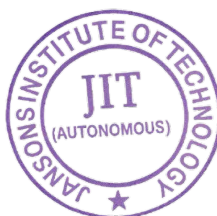


U24MA2201	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4
Course Objectives:	Introduce statistical and numerical methods for engineering problem-solving, crucial for real-world applications, covering hypothesis testing, equation solving, interpolation, and numerical treatment of differential equations.				
Unit - I	TESTING OF HYPOTHESIS				9+3
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test fr goodness of fit – Independence of attributes.					
Unit - II	DESIGN OF EXPERIMENTS				9+3
One way and two-way classifications - Completely randomized design – Randomized block design – Latin square design - 2 ² factorial design.					
Unit - III	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS				9+3
Solution of algebraic and transcendental equations - Fixed point iteration method – Bisection method - Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi’s method for symmetric matrices.					
Unit – IV	INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION				9+3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single integrations using Trapezoidal rule, Simpson’s 1/3 rule, Simpson’s 3/8 rule and Croute’s method.					
Unit - V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS				9+3
Single step methods: Taylor’s series method - Euler’s method - Modified Euler’s method – Fourth order Runge-Kutta method for solving first order differential equations - Multi step methods: Milne’s and Adams - Bash forth predictor corrector methods for solving first order differential equations.					
Total Periods:					60

On completion of the course, the student can

CO	Statements	K-Level
CO1	Identify the types of testing of hypothesis for small and large samples in real life problems.	K3
CO2	Apply the basic concepts of design of experiments.	K3
CO3	Apply the concepts of numerical techniques for solving transcendental equations, eigenvalues and eigenvectors of matrices.	K3
CO4	Utilize the various numerical techniques such as interpolations, differentiation and integrations in solving engineering problems.	K3
CO5	Solve the ordinary differential equations with initial conditions using various single-step and multi-step numerical techniques	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



Course Outcomes

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	1	-	-	-
CO	3	2	-	-	-	-	-	-	-	-	1	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

Reference Books

1	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis", Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
6	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.



U24CE4301	FLUID MECHANICS	L	T	P	C
		3	0	0	3
Course Objectives:	Introduce fluid properties and static behaviour, then apply control volume analysis to flow measurement, pipe flow, and forces on bends, emphasizing boundary layer theory.				
Unit - I	BASIC CONCEPTS OF FLUID FLOW & FLUIDS PROPERTIES	9			
Distinction between a fluid and a solid, Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation with temperature, Newton's law of viscosity, Vapor pressure, boiling point, cavitation, Surface tension, capillarity, Bulk modulus of elasticity, compressibility.					
Unit - II	FLUID STATICS AND PRESSURE MEASUREMENT	9			
Fluid Pressure: Pascal's Law, pressure variation with temperature, density, and altitude, Pressure measuring devices: Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers, Pressure Gauges, Hydrostatic pressure and force: Horizontal, vertical, and inclined surfaces, Buoyancy and stability of floating bodies.					
Unit - III	FLUID KINEMATICS AND FLOW CLASSIFICATION	9			
Fundamental dimensions, Classification of fluid flow: Steady/unsteady, uniform/non-uniform, Laminar/turbulent, rotational/irrotational, compressible/incompressible, ideal/real, One, two, and three-dimensional flows, Streamline, path line, streak line, stream tube, Stream function, velocity potential function, Continuity equation in Cartesian coordinates.					
Unit – IV	FLUID DYNAMICS AND FLOW MEASUREMENT	9			
Surface and body forces, Equations of motion: Euler's equation, Bernoulli's equation – derivation and energy principle Applications: Venturimeter, Orifice meter, Pitot tube, Momentum principle; Forces exerted by fluid flow on pipe bends, Vortex flow,Free and Forced.					
Unit - V	DIMENSIONAL ANALYSIS AND PIPE FLOW	9			
Dimensional Analysis and Dynamic Similitude Reynolds Number, Froude Number, Mach Number, Weber Number, Euler Number Buckingham's π -Theorem Velocity distribution in pipes Laminar and turbulent flow characteristics.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

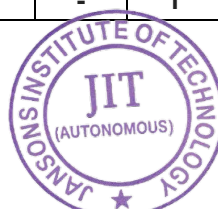
COs	Statements	K-Level
CO1	Explain the fundamental properties of fluids and their significance in engineering applications.	K2
CO2	Analyse fluid statics principles to find pressure distribution, hydrostatic forces, and buoyancy.	K4
CO3	Illustrate different types of fluid flow and their mathematical representation using continuity equations	K3
CO4	Apply Bernoulli's and momentum principles to solve engineering problems related to fluid flow measurement and forces on pipe bends	K4
CO5	Summarize dimensional analysis techniques and flow characteristics in laminar and turbulent pipe flow.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	-	-	-	-	-	1	-	-	1	3	2	2
CO2	3	3	2	-	-	-	-	1	-	-	1	3	2	2
CO3	3	3	2	-	-	-	-	1	-	-	1	3	2	2
CO4	3	3	2	-	-	-	-	1	-	-	1	3	2	2
CO5	3	3	2	-	-	-	-	1	-	-	1	3	2	2
CO	3	3	2	-	-	-	-	1	-	-	1	3	2	2

Correlation levels 1, 2 and 3 are as defined below:



1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, 22nd Revised Edition, 2022.
2	R. K. Rajput, Fluid Mechanics and Hydraulic Machines, S. Chand & Company Ltd., New Delhi, Revised Edition, 2022.
3	R. K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, 11th Revised Edition, 2021.
4	A. K. Jain, Fluid Mechanics, Khanna Publishers, New Delhi, 13th Revised Edition, 2022.

Reference Books

1	S. K. Som, Gautam Biswas and S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 3rd Edition, 2021.
2	B. S. Pani, Fluid Mechanics: A Concise Introduction, PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2019.
3	N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press (India) Pvt. Ltd., Hyderabad, 4th Edition, 2021.
4	Yunus A. Çengel and John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw Hill Education, 5th Edition, 2022.
5	Robert W. Fox, Alan T. McDonald and Philip J. Pritchard, Fox and McDonald's Introduction to Fluid Mechanics, Wiley India Pvt. Ltd., 10th Edition, 2020.

Codes / Manuals

1	IS 9137:1978 (Reaffirmed), Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Pumps – Hydraulic Performance Tests, Bureau of Indian Standards (BIS), New Delhi.
2	IS 5120:1977 (Reaffirmed), Technical Requirements for Rotodynamic Special Purpose Pumps, Bureau of Indian Standards (BIS), New Delhi.
3	CPHEEO, Manual on Water Supply and Treatment, Ministry of Housing and Urban Affairs, Government of India, 3rd Edition, 2019.
4	Central Water Commission (CWC), Hydraulic Data Book, Government of India, Latest Edition.

Web-links

1. https://onlinecourses.nptel.ac.in/noc24_me40/preview



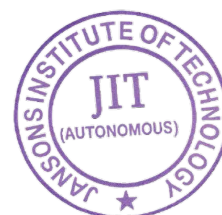
U24CE4302		CONSTRUCTION MATERIALS AND PRACTICES			L	T	P	C
					3	0	0	3
Course Objectives:		The students will learn about the various construction materials, the techniques and testing procedures that are commonly used in civil engineering construction						
Unit - I	BASICS CONSTRUCTION MATERIALS						9	
Stone as building material – Criteria for selection – Tests on stones – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks Sustainable bricks, geopolymer bricks – Compressive strength – Water Absorption – Efflorescence – Lime – Preparation of lime mortar – Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete)								
Unit - II	ADVANCED CONSTRUCTIONS MATERIALS						9	
Concrete hollow blocks – Lightweight concrete blocks., self-healing concrete blocks-Timber – Market forms – Plywood – Veneer – False ceiling materials – Steel – Mechanical treatment – Aluminum – Uses – Market forms – Glass – Ceramics – Refractories – Composite Materials – Types and applications – FRP – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement. Transparent wood, carbon fiber composites, smart glass-Aerothon blocks-Porotherm blocks.								
Unit - III	CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS						9	
Types of Foundations – Shallow and Deep Foundations – Stone Masonry – Brick Masonry – Plastering and Pointing – Cavity Walls – Diaphragm Walls – Formwork – Centering and Shuttering – Shoring – Scaffolding – Underpinning – Roofing – Flooring – Joints in concrete – Contraction/Construction/Expansion joints – Fire Protection – Thermal Insulation – Ventilation and Air conditioning – Acoustics and Sound Insulation – Damp Proofing. 3D printed buildings, aerogel insulation, passive cooling techniques.								
Unit – IV	CONSTRUCTION EQUIPMENTS						9	
Overview of Construction Equipment – Earthmoving Equipment –Hauling & Lifting Equipment – Material Handling Equipment – Concrete Equipment – Compaction & Paving Equipment – Tunneling & Foundation Equipment – Automation & Technological Advancements – Equipment Safety & Maintenance								
Unit - V	CONSTRUCTION PLANNING						9	
Introduction to construction planning – Scheduling for activities – Critical path method (CPM) and PERT network modelling and time analysis –Building Information Modelling-Project Management Softwares.								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Summarize the properties and applications of various construction materials.	K2
CO2	Illustrate the properties and applications of modern and traditional construction materials.	K2
CO3	Explain advanced construction techniques and service requirements to enhance building performance.	K2
CO4	Utilize appropriate construction equipment for efficient site operations.	K2
CO5	Interpret modern planning and scheduling tools for effective project management.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO–PO–PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	1	-	-	3	-	-	-	-	3	2	1	1
CO2	3	2	1	-	-	3	-	-	-	-	3	2	1	1
CO3	3	2	1	-	-	3	-	-	-	-	3	2	1	1
CO4	3	2	1	-	-	3	-	-	-	-	3	2	1	1
CO5	3	2	1	-	-	3	-	-	-	-	3	2	1	1
CO	3	2	1	-	-	3	-	-	-	-	3	2	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

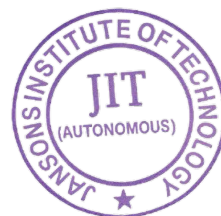
1	P. C. Varghese, Building Materials, PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2023.
2	S. P. Arora and S. P. Bindra, Building Construction, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 6th Revised Edition, 2021.
3	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi, 12th Revised Edition, 2022.
4	S. K. Sharma and G. C. Sushil Kumar, Building Construction, S. Chand & Company Ltd., New Delhi, 2021.

Reference Books

1	P. C. Varghese, Building Construction, PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2022.
2	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi, 12th Revised Edition, 2022.
3	Robert L. Peurifoy, Clifford J. Schexnayder, Aviad Shapira and Robert Schmitt, Construction Planning, Equipment and Methods, McGraw Hill Education, 9th Edition, 2018.
4	L. S. Srinath, PERT and CPM: Principles and Applications, Affiliated East-West Press Pvt. Ltd., New Delhi, Reprint Edition, 2021.
5	Michael S. Mamlouk and John P. Zaniewski, Materials for Civil and Construction Engineers, Pearson Education, 5th Edition, 2022.
6	Roy Chudley and Roger Greeno, Building Construction Handbook, Routledge, 13th Edition, 2024.

Web-links

1. https://onlinecourses.nptel.ac.in/noc24_ce06/preview



U24CE4303		SURVEYING AND GEOMATICS		L	T	P	C
				3	0	0	3
Course Objectives:		At the end of the course the student will possess knowledge about survey field techniques & Geomatics					
Unit - I	FUNDAMENTALS OF CONVENTIONAL SURVEYING					9	
Principles, Linear, angular and graphical methods, Survey stations, Survey lines, ranging, bearing of survey lines, Levelling, Compass Surveying.							
Unit - II	THEODOLITE SURVEYING					9	
Principles of levelling, booking and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes. Horizontal and vertical angle measurements, Temporary and permanent adjustments, Heights and distances, Tacheometric surveying, Stadia Tacheometry, Trigonometric levelling, Single Plane method, Double Plane method.							
Unit - III	CONTROL SURVEYING AND ADJUSTMENT					9	
Horizontal and vertical control, Methods, Triangulation, Traversing, Gale's table, Trilateration, Concepts of measurements and errors, Error propagation and Linearization, Adjustment methods, Least square methods, Angles, lengths and levelling network.							
Unit - IV	MODERN SURVEYING					9	
Total Station, Digital Theodolite, EDM, Electronic field book, Advantages, Parts and accessories, Working principle, Observables, Errors, COGO functions, Field procedure and applications. GPS: Advantages, System components, Signal structure, Selective availability and anti-spoofing receiver components and antenna, Planning and data acquisition, Data processing, Errors in GPS, Field procedure and applications, LIDAR Surveying.							
Unit - V	PHOTOGRAMMETRY SURVEYING & REMOTE SENSING					9	
Basics of Photogrammetry-Aerial Photography-Photographic Scale & Measurements -Overview of Surveying-Ground Control for Photogrammetry -Digital Elevation Models (DEMs)-Sensors & Platforms-Applications of Remote Sensing.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply fundamental surveying techniques and find measurement errors.	K3
CO2	Make Use of theodolite and tacheometer for precise angle and distance measurements.	K3
CO3	Implement control surveying and error adjustment techniques.	K3
CO4	Utilize modern instruments like Total Station and GPS for accurate data collection.	K3
CO5	Summarize aerial and remote sensing data for mapping and terrain interpretation.	K2

Knowledge Level: K1- Remember, K2- Understand, K3-Apply, K4-Analyze, K5- Evaluate, K6-Create

CO, PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	-	-	-	1	-	-	-	-	2	3	2	1
CO2	2	1	-	-	-	1	-	-	-	-	2	3	2	1
CO3	2	1	-	-	-	1	-	-	-	-	2	3	2	1
CO4	2	1	-	-	-	1	-	-	-	-	2	3	2	1
CO5	2	1	-	-	-	1	-	-	-	-	2	3	2	1
CO	2	1	-	-	-	1	-	-	-	-	2	3	2	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Surveying, Volume I & II, Laxmi Publications (P) Ltd., New Delhi, 18th Revised Edition, 2022.
2	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts I & II, Pune Vidyarthi Griha Prakashan, Pune, 31st Revised Edition, 2021.
3	R. Subramanian, Surveying and Levelling, Oxford University Press, New Delhi, 3rd Edition, 2021.

Reference Books

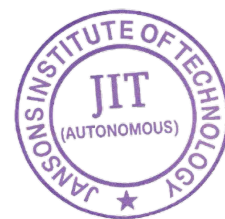
1	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts I & II, Pune Vidyarthi Griha Prakashan, Pune, 31st Revised Edition, 2021.
2	David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, Volume II, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 7th Edition (Indian Reprint), 2019.
3	Manoj K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros., Roorkee, 2nd Revised Edition, 2018.
4	K. R. Arora, Surveying, Volume I & II, Standard Publishers Distributors, New Delhi, 17th Revised Edition, 2021.
5	C. Venkatramaiah, Textbook of Surveying, Universities Press (India) Pvt. Ltd., Hyderabad, 3rd Edition, 2019.
6	M. Anji Reddy, Remote Sensing and Geographical Information Systems, BS Publications, Hyderabad, 4th Edition, 2018.

CODES / MANUALS

1	Bureau of Indian Standards (BIS), IS 1742:1983 (Reaffirmed), Code of Practice for Building Surveys, New Delhi.
2	Survey of India, National Map Policy and Survey Manual, Government of India, Latest Edition.
3	National Spatial Data Infrastructure (NSDI), Standards and Guidelines for Geospatial Data, Government of India, Latest Version.
4	Bureau of Indian Standards (BIS), IS 1491 (Parts 1 & 2), Glossary of Terms Relating to Surveying and Levelling, New Delhi.

Web,links

1. <https://nptel.ac.in/courses/105107122>



U24CE4304		ENGINEERING GEOLOGY				L	T	P	C
						2	0	0	2
Course Objectives:		To familiarize the role and importance of geology in civil engineering, surface and subsurface investigations.							
Unit - I	PHYSICAL GEOLOGY AND GEOMORPHOLOGY							6	
Significance of Geology in Civil Engineering; Internal structure of the Earth; Weathering: types, engineering classification of weathered rocks and relevance to Civil Engineering Geological landforms and their importance in Civil Engineering; Plate tectonics, Groundwater: origin, movement and role of groundwater									
Unit - II	MINERALOGY AND PETROLOGY							6	
Physical and Chemical properties of common rock forming minerals: Quartz family, Feldspar family, Mica, Calcite, Gypsum and Clay minerals and their significance. Formation of Igneous, Metamorphic and Sedimentary rocks; Engineering properties of rocks: field and laboratory tests.									
Unit - III	STRUCTURAL GEOLOGY AND ROCK MECHANICS							6	
Attitudes of beds: Strike and Dip measurements and their relevance to civil engineering; Different types of folds, faults, joints and fractures in rocks and their significance in civil engineering constructions; Geomechanical properties of rocks: Rock Quality Designation (RQD), Rock Mass Rating (RMR) and Geological Strength Index (GSI) and their importance in various civil engineering projects in Civil Engineering constructions.									
Unit – IV	GEO PROSPECTING							6	
Geological mapping techniques; Remote Sensing: Fundamentals and its role in geological mapping; Geophysical methods for subsurface investigations: Electrical, Seismic & Ground Penetrating Radar (GPR).									
Unit - V	GEOLOGICAL CONSIDERATIONS AND GEOHAZARDS							6	
Geological conditions necessary for designing and construction of important structures: Dams, Tunnels, Road cuttings and Coastal protection; Landslides & Earthquakes: Causes, prediction, and mitigation techniques, Case Studies on Major Engineering Failures Due to Geological Factors.									
Total Periods:								30	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Outline the internal structure of earth, causes of earthquakes and various landforms created.	K2
CO2	Summarize the various types of minerals, stones and engineering properties of rocks.	K2
CO3	Explain the various geological structures with their impact in engineering constructions	K2
CO4	Explain the role of geological mapping, remote sensing, geophysics for surface and subsurface investigations.	K2
CO5	Infer the construction of major civil engineering structures, and also mitigating against various geohazards	K2

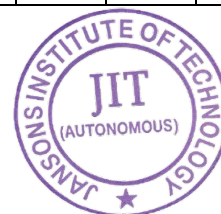
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	-	-	-	-	2	-	-	-	-	1	3	1	1
CO2	3	-	-	-	-	2	-	-	-	-	1	3	1	1
CO3	3	-	-	-	-	2	-	-	-	-	1	3	1	1
CO4	3	-	-	-	-	2	-	-	-	-	1	3	1	1
CO5	3	-	-	-	-	2	-	-	-	-	1	3	1	1
CO	3	-	-	-	-	2	-	-	-	-	1	3	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1	Parbin Singh, A Textbook of Engineering and General Geology, S. K. Kataria & Sons, New Delhi, 11th Revised Edition, 2023.
2	N. Chennakesavulu, Textbook of Engineering Geology, Macmillan Education India Pvt. Ltd., New Delhi, 3rd Revised Edition, 2021.
3	D. Venkata Reddy, Engineering Geology, Vikas Publishing House Pvt. Ltd., New Delhi, 2nd Revised Edition, 2022.
4	P. C. Varghese, Engineering Geology for Civil Engineering, PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2021.

Reference Books

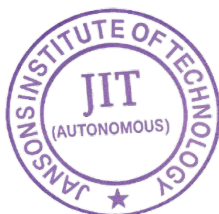
1	Robert F. Legget and Karrow P. F., Geology and Engineering, McGraw Hill Education, 3rd Edition (Reprint), 2018.
2	Dmitri P. Krynine and Walter R. Judd, Principles of Engineering Geology and Geotechnics, McGraw Hill Education (India), New Delhi, Indian Reprint, 2018.
3	F. G. Bell, Fundamentals of Engineering Geology, Butterworth-Heinemann (Elsevier), 2nd Edition (Reprint), 2019.
4	K. V. G. K. Gokhale, Principles of Engineering Geology, BS Publications, Hyderabad, 3rd Revised Edition, 2021.
5	Blyth, F. G. H. and Michael H. de Freitas, A Geology for Engineers, CRC Press, 8th Edition, 2017.

Web-links

1. https://onlinecourses.nptel.ac.in/noc23_ce107/preview



U24EC3306	BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING			L	T	P	C
				3	0	2	4
Course Objectives:		The objective is to introduce electric circuits, domestic wiring, electrical machines, analog devices, and sensors, covering their basics, principles, and applications.					
Unit - I	INTRODUCTION TO DC & AC CIRCUITS						9+6
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws – Energy Sources – Simple problems- Nodal Analysis, Mesh analysis with independent sources only (Steady state). Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection.							
Practical Exercises: 1. Verification of Ohms law. 2. Verification of Kirchhoff’s law.							
Unit - II	ELECTRICAL WIRING SYSTEMS						6+6
Domestic wiring– types of wires and cables– earthing– protective devices– switch fuse unit– Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker– safety precautions and First Aid.							
Practical Exercises: 1.Measurements of an earth resistance 2.Measurement of three phase power							
Unit - III	ELECTRICAL MACHINES						9+9
Construction and Working principle- DC Separately and Self excited Generators– EMF equation– Types and Applications– Working Principle of DC motors– Torque Equation– Types and Applications– Construction, working principle and Applications of Transformer– Synchronous motor and Three Phase Induction Motor.							
Practical Exercises: 1. Load test on DC Shunt Motor. 2. Load test on Single phase Transformer. 3. Load Test on Induction Motor							
Unit – IV	ANALOG ELECTRONICS						9+6
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes– Zener Diode –Characteristics Applications – Bipolar Junction Transistor– SCR– IGBT – Types, I-V Characteristics and Applications – Rectifier and Inverters.							
Practical Exercises: 1. Characteristics of PN and Zener Diodes. 2. Characteristics of BJT & SCR.							
Unit - V	SENSOR & TRANSDUCER SYSTEMS						9+3
Sensors – pneumatic controls with electrical actuator–types of valves and its applications– piezoelectric– hall effect– photo sensors– Strain gauge– LVDT– differential pressure transducer– optical and digital transducers– Smart sensors– Thermal Imagers.							
Practical Exercises: 1.Measurement of displacement of LVDT							
Total Periods:							45+30



TOTAL: 75 PERIODS

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Determine the electric circuit parameters for basic problems.	K3
CO2	Describe the concepts of domestic wiring and protective devices.	K2
CO3	Illustrate the working principles and applications of electrical machines.	K3
CO4	Examine the characteristics of analog electronic devices.	K3
CO5	Explain the types and operating principles of sensors and transducers	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

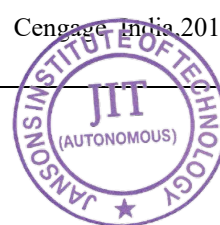
	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	1	2	2	-	-	-	-	-	-	-	-	-
CO2	2	2	-	1	1	3	2	2	-	-	-	-	-	-
CO3	3	3	2	2	2	-	1	-	-	-	-	-	-	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO5	2	2	2	2	2	2	2	-	-	-	-	-	-	-
CO	3	2	2	2	2	2	2	-	-	-	-	-	-	-

Text Books

1	D P Kothari and I.J Nagarath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education (India) Private Limited, Second Edition, 2020, ISBN-13: 978-9389811247.
2	A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, 2015, ISBN-13: 978-8177001006.
3	James A Svoboda, Richard C. Dorf, Dorf’s Introduction to Electric Circuits, Wiley, 2018, ISBN-13: 978-1119454151.
4	S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019, ISBN-13: 978-9353436612.

Reference Books

1	Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002, ISBN-13: 978-0071393072
2	H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010, ISBN-13: 978-0070702066
3	D P Kothari and I.J Nagarath, “Electrical Machines”, McGraw Hill Education (India) Private Limited, Fifth Edition, 2017, ISBN-13: 978-9352606401.
4	Muhammad H.Rashid, “Spice for Circuits and electronics”, 4th Edition., Cengage India, 2019, ISBN-13: 978-9386668653.



U24CE4305	SURVEYING LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives:	At the end of the course the student will possess knowledge about survey field techniques.				

Exp. No	Title	
1	Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset	
2	Pacing-Approximate Measurement	
4	Fly levelling using Dumpy level and Tilting level	
5	Check levelling	
6	Measurements of horizontal angles by reiteration and repetition and vertical angles	
7	Determination of elevation of an object using single plane method when base is Accessible/inaccessible.	
8	Determination of Tacheometric Constants	
9	Heights and distances by stadia Tacheometry	
10	Heights and distances by Tangential Tacheometry	
11	Traverse using Total station and Area of Traverse	
12	Determination of distance and difference in elevation between two inaccessible points using Total station	
13	Traversing using GPS	
14	Setting out works – Foundation marking using tapes single Room and Double Room by using Total Station	
15	Contouring-Radial,Grid,Longitudinal & Cross sectional	
Total Periods:		60

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Experiment the usage of basic surveying instruments like chain/tape, compass and levelling instruments	K3
CO2	Make use of levelling instrument for surveying operations	K3
CO3	Utilize theodolite for various surveying operations.	K3
CO4	Conduct necessary surveys for social infrastructures	K3
CO5	Prepare planimetric maps	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

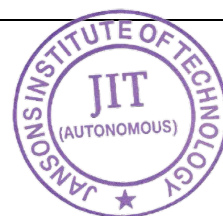
	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO2	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO3	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO4	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO5	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO	3	3	2	-	-	2	2	2	-	-	2	3	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Book s;1	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts I & II, Pune Vidyarthi Griha Prakashan, Pune, 31st Revised Edition, 2021.
2	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Surveying, Volume I & II, Laxmi Publications (P) Ltd., New Delhi, 18th Revised Edition, 2022.
3	K. R. Arora, Surveying, Volume I & II, Standard Publishers Distributors, New Delhi, 17th Revised Edition, 2021.

Virtual Lab Links: <http://nptel.ac.in/video.php?subjectId=105104101>



U24GE7301		PROFESSIONAL DEVELOPMENT		L	T	P	C
				0	0	2	1
Course Objectives:		Apply MS Word, MS Excel, and MS PowerPoint effectively for professional tasks while developing emotional intelligence, change management strategies, and essential professional skills for workplace success					
Exp. No	Title						
1	MS WORD: Create and format a document Working with tables Working with Bullets and Lists Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools Creating and Using document templates Inserting equations, symbols and special characters Working with Table of contents and References, citations Insert and review comments Create bookmarks, hyperlinks, endnotes footnote Viewing document in different modes Working with document protection and security Inspect document for accessibility						
2	MS EXCEL Create worksheets, insert and format data Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae Create and Work with different types of charts Use pivot tables to summarize and analyse data Perform data analysis using own formulae and functions Combine data from multiple worksheets using own formulae and built-in functions to generate results Export data and sheets to other file formats Working with macros Protecting data and Securing the workbook						
3	MS POWERPOINT Select slide templates, layout and themes Formatting slide content and using bullets and numbering Insert and format images, smart art, tables, charts Using Slide master, notes and handout master Working with animation and transitions Organize and Group slides Import or create and use media objects: audio, video, animation Perform slideshow recording and Record narration and create presentable videos						
4	Emotional Intelligence and Meta Communication Learn how to manage emotions and develop self-awareness to enhance communication and collaboration at work.						
5	What is Lateral Thinking? – Origin and History – Importance of Lateral Thinking – How to use it in Life-How to use it at Work?						



6	Professional Skills Communication Skills - Nonverbal Communication, Writing and Different Modes of Writing Career Skills - Resume Skills, Interview Skills, Group Discussion Skills, Exploring Career Opportunities Team Skills - Presentation Skills, Trust and Collaboration, Internal Communication Management Skills – Leadership, Managerial and Entrepreneurial Skills	
7	Career Planning and Goal Setting, Knowledge about SDG, COGNITIVE AND NON-COGNITIVE SKILLS SELF-AWARENESS: Assessing personal strengths and weaknesses - Goal setting: SMART goals framework - Building a growth mindset for continuous learning, Decision Making Engineering AI Assistants: Enhancing productivity, Design & simulation assistance, Problem-Solving & Decision Support, Coding & Automation, Manufacturing & Process Optimization, Project Management & Documentation.	
Total Periods:		30

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO1	Explain the fundamental features and functionalities of MS Word, MS Excel, and MS PowerPoint	K2
CO2	Interpret the emotional intelligence and their impact on personal and professional interactions.	K2
CO3	Infer the principles of change management and its impact on organizations and individuals.	K2
CO4	Describe the essential professional skills required for effective communication, teamwork, and workplace success.	K2
CO5	Explain the role of career planning, goal setting, SDGs, skills, and self-awareness in growth.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO	-	-	-	-	-	-	-	-	3	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

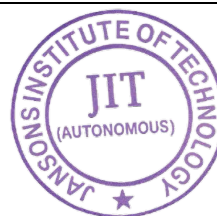
1. Slight 2. Moderate 3. Substantial (High)

Textbooks

1	"Microsoft Office 2019 Beginner: Learn The Basics of Microsoft Word, Excel, and PowerPoint" by M.L.Humphrey
2	"Emotional Intelligence" by Daniel Goleman was published by Bantam Books in 1995.
3	"Lateral Thinking: Creativity Step by Step" by Edward de Bono

Reference Books

1	Placement Interviews Skills for Success by Ananda murugan.S – 1st edition 2011
2	SOFT SKILLS: Personality, Body language and Communication skills Development GD, Interview Preparation & Questions by N.S. REDDY and NEO –2016
3	Communication Skills: Stepladders to Success for the Professional by Richard Ellis



U24GE7302		PRODUCT DEVELOPMENT / PROCESS DESIGN				L	T	P	C
						0	0	2	1
Course Objectives:		To equip students with hands-on experience in prototyping, understanding the entrepreneurial ecosystem, and leveraging resources for startup success.							
1		ENTREPRENEURIAL ECOSYSTEM						10	
Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network									
ACTIVITY									
- Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), - Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).									
2		PROTOTYPING						20	
Prototyping – Importance in entrepreneurial process – Types of Prototypes – Different methods – Tools & Techniques. Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes.									
ACTIVITY									
Students should for a team of maximum 4 members and make a Final Presentation of the prototype they have innovated.									
Total Periods:								30	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the significance of prototyping in the entrepreneurial process and identify different types, methods, and tools.	K2
CO2	Apply various prototyping techniques, including 3D printing, electronics, and software, to develop a functional prototype	K4
CO3	Analyze the components of the entrepreneurial ecosystem and evaluate different financing models.	K4
CO4	Engage with ecosystem partners such as incubators, investors, and accelerators to navigate startup support mechanisms.	K3
CO5	Develop a stakeholder network by interacting with successful entrepreneurs and reflect on real-world entrepreneurial experiences.	K3

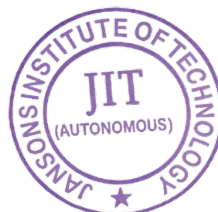
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	3	2	2	3		3			3	2	2	2
CO2	3	3	3	2	2	3		3			3	2	2	2
CO3	3	3	3	2	2	3		3			3	2	2	2
CO4	3	3	3	2	2	3		3			3	2	2	2
CO5	3	3	3	2	2	3		3			3	2	2	2
CO	3	3	3	2	2	3		3			3	2	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1	S.S. Khanka – Entrepreneurial Development, S. Chand Publishing, 2021.
2	P.C. Jain – Handbook for New Entrepreneurs, Oxford University Press, 2017.
3	Poornima M. Charantimath – Entrepreneurship Development and Small Business Enterprises, Pearson India, 2022.

Reference Books

1	Ramachandran K. – <i>Entrepreneurship: Theory and Practice</i> , McGraw Hill, 2021.
2	Reddy K. Sudarsanam – <i>Essentials of Entrepreneurship Development</i> , Himalaya Publishing House, 2017.
3	Kelley, Tom & Littman, Jonathan – <i>The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm</i> , Crown Business, 2001.
4	Ries, Eric – The Lean Startup : How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Business, 2011.



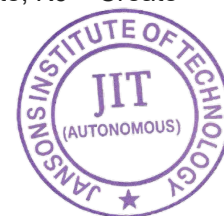
U24CE4401	STRENGTH OF MATERIALS		L	T	P	C
			3	1	0	4
Course Objectives:	Introduce fundamental concepts of Stress in simple and complex state, unsymmetrical bending in determinate and indeterminate beams.					
Unit - I	SIMPLE AND COMPOUND STRESSES					9+3
Concept of stress and strain, Elasticity and plasticity, Types of stresses and strains, Hooke's law, strain diagram for mild steel, Working stress, Factor of safety , Lateral strain, Poisson's ratio and volumetric strain, Stresses in simple and compound bars , Thermal stresses, Elastic constants, Thin cylindrical and spherical shells, Biaxial state of stress, Principal stresses and principal planes , Mohr's circle of stresses, Torsion on circular shafts.						
Unit - II	BENDING OF BEAMS					10+4
Types of beams and transverse loadings, Shear force and bending moment for simply supported, cantilever and Fixed beams, Calculation of maximum BM and SF and the point of contra flexure, under concentrated loads, Theory of simple bending, Bending stress distribution, Shear stress distribution.						
Unit - III	DEFLECTION OF BEAMS					9+3
Double Integration method, Macaulay's method, Area moment method, Conjugate beam method, Strain energy method for determinate beams.						
Unit – IV	INDETERMINATE BEAMS					9+3
Slope and deflection, Relationship between moment, slope and deflection, Propped Cantilever and Fixed Beams, Fixed end moments reactions, slope and deflection for, standard cases of loading, Continuous beams, support reactions and moments, Theorem of three moments, Shear Force and Bending Moment Diagrams.						
Unit - V	ADVANCED TOPICS					8+2
Unsymmetrical bending of beams, shearcenter applied, Thick cylinders, Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures. Theories of failure, Principal stress, principal strain, shear stress, strain energy and distortion energy theories application problems.						
Total Periods:						60

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the concepts of stress, strain, principal stresses and principal planes.	K3
CO2	Illustrate Shear force and bending moment in beams	K3
CO3	Classify deflection of beams by different methods	K3
CO4	Infer propped cantilever, fixed beams and continuous beams for external loadings.	K3
CO5	Summarize the stresses due to Unsymmetrical bending of beams and study the various theories of failure	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	1	1	-	2	-	-	-	-	2	3	2	2
CO2	3	2	1	1	-	2	-	-	-	-	2	3	2	2
CO3	3	2	1	1	-	2	-	-	-	-	2	3	2	2
CO4	3	2	1	1	-	2	-	-	-	-	2	3	2	2
CO5	3	2	1	1	-	2	-	-	-	-	2	3	2	2
CO	3	2	1	1	-	2	-	-	-	-	2	3	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	R. K. Rajput, Strength of Materials (Mechanics of Solids), S. Chand & Company Ltd., New Delhi, Revised Edition, 2022.
2	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Theory of Structures (Strength of Materials and Theory of Structures), Vol. II, Laxmi Publications (P) Ltd., New Delhi, Revised Edition, 2021.
3	Basavarajaiah and Mahadevappa, Strength of Materials, Universities Press (India) Pvt. Ltd., Hyderabad, 2nd Edition, 2021.

Reference Books

1	S. M. A. Kazimi, Solid Mechanics, McGraw Hill Education (India) Pvt. Ltd., New Delhi, Revised Edition, 2020.
2	William A. Nash, Schaum's Outline of Strength of Materials, McGraw Hill Education, 6th Edition, 2020.
3	D. K. Singh, Strength of Materials, Ane Books Pvt. Ltd., New Delhi, 2nd Edition, 2021.
4	E. P. Popov, Engineering Mechanics of Solids, PHI Learning Pvt. Ltd., New Delhi, 2nd Edition (Reprint), 2019.
5	Irving H. Shames and James M. Pitarresi, Introduction to Solid Mechanics, Prentice Hall, 3rd Edition (Indian Reprint), 2018.
6	Ferdinand P. Beer, E. Russell Johnston Jr., John T. DeWolf and David F. Mazurek, Mechanics of Materials, McGraw Hill Education, 8th SI Edition, 2020.
7	Basavarajaiah and Mahadevappa, Strength of Materials, Universities Press (India) Pvt. Ltd., Hyderabad, 2nd Edition, 2021.
8	V. N. Vazirani, M. M. Ratwani and S. K. Duggal, Analysis of Structures – Vol. I, Khanna Publishers, New Delhi, Revised Edition, 2021.

Web-links

1. https://onlinecourses.nptel.ac.in/noc23_me140/preview



U24CE4402		CONCRETE TECHNOLOGY			L	T	P	C
					3	0	0	3
Course Objectives:		To explore the various characteristics and methods of mix design on concrete as per IS codal provisions.						
Unit - I	CONSTITUENT MATERIALS						9	
Cement: Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading Requirements-Water- Quality of water for use in concrete								
Unit - II	ADMIXTURES						9	
Benefits of admixtures-Types-Accelerating Admixtures-Retarding admixtures-water reducing admixtures-superplasticizers-special admixtures-waterproofing admixtures-Anti-bacterial admixtures.								
Unit - III	MIX DESIGN						9	
Process of mix selection-mean and minimum strength-Quality Control-Factors governing the selection of mix proportions-BIS method of mix design-Mix selection of high performance and light weight aggregate-BIS & ACI Method of Mix Design								
Unit – IV	PROPERTIES OF FRESH AND HARDENED CONCRETE						9	
Workability-Tests for workability of concrete-Segregation and Bleeding-Determination of strength properties of hardened concrete-Compressive Strength-Split tensile strength-Flexural Strength-Modulus of elasticity-Accelerated curing test-Durability of concrete-Water Absorption-Permeability-Corrosion Test-Acid resistance.								
Unit - V	SPECIAL CONCRETES						9	
High Strength Concrete-High Performance concrete-Lightweight Concrete-Cellular Concrete-Self compacting concrete-Geopolymer Concrete-Bacterial Concrete-SIFCON-SIMCON								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Infer the requirements of cement, aggregates and water for concrete.	K2
CO2	Classify various admixtures to enhance the properties of concrete.	K2
CO3	Explain the design of concrete mix for various strength using BIS & ACI Method.	K3
CO4	Interpret the strength and durability parameters of concrete.	K2
CO5	Summarize the applications of special concrete.	K2

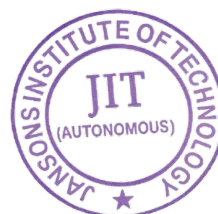
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	2	3	2	1
CO2	3	2	-	-	-	-	-	-	-	-	2	3	2	1
CO3	3	2	-	-	-	-	-	-	-	-	2	3	2	1
CO4	3	2	-	-	-	-	-	-	-	-	2	3	2	1
CO5	3	2	-	-	-	-	-	-	-	-	2	3	2	1
CO	3	2	-	-	-	-	-	-	-	-	2	3	2	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1	M. L. Gambhir, Concrete Technology, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 6th Edition, 2023.
2	M. S. Shetty, Concrete Technology: Theory and Practice, S. Chand & Company Ltd., New Delhi, 8th Revised Edition, 2023.
3	A. R. Santhakumar, Concrete Technology, Oxford University Press, New Delhi, 3rd Edition, 2022.

Reference Books

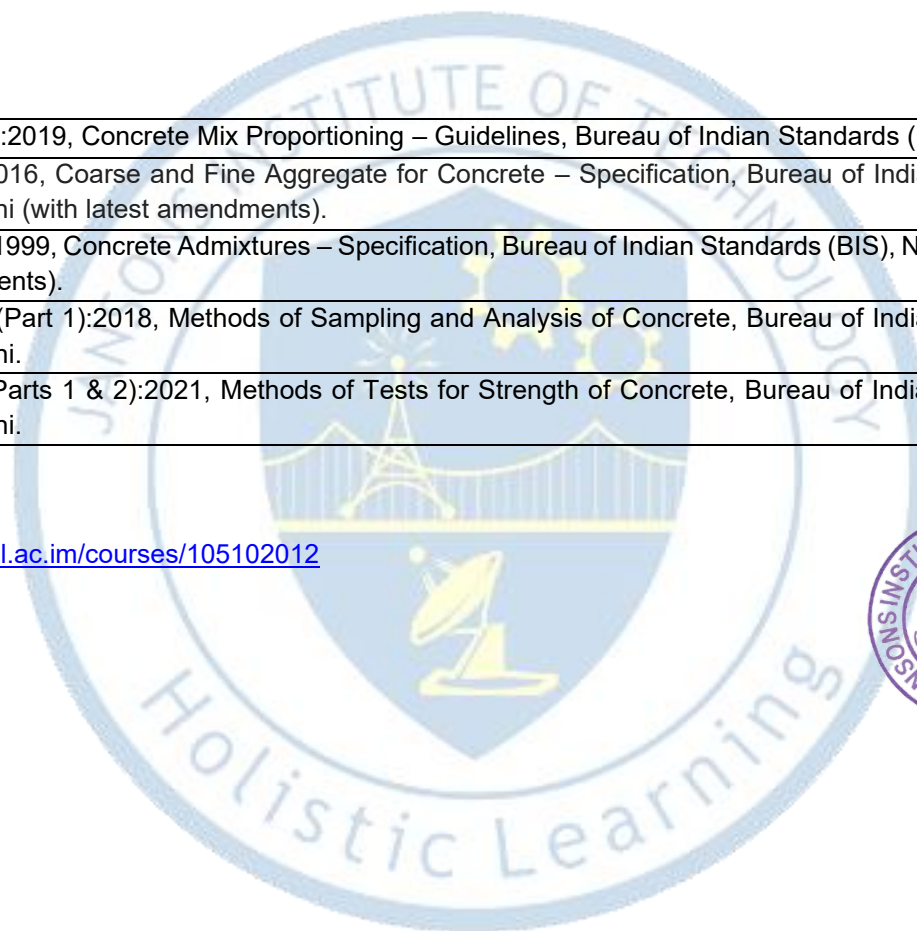
1	A. M. Neville, Properties of Concrete, Pearson Education, London, 5th Edition (Indian Reprint), 2022.
2	B. L. Gupta and Amit Gupta, Concrete Technology, Jain Book Agency, New Delhi, 2nd Revised Edition, 2021.
3	P. K. Mehta and Paulo J. M. Monteiro, Concrete: Structure, Properties and Materials, McGraw Hill Education, Latest Reprint.

Codes of Practice

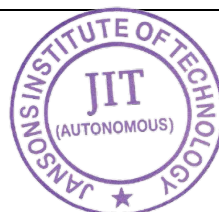
1	IS 10262:2019, Concrete Mix Proportioning – Guidelines, Bureau of Indian Standards (BIS), New Delhi.
2	IS 383:2016, Coarse and Fine Aggregate for Concrete – Specification, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
3	IS 9103:1999, Concrete Admixtures – Specification, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
4	IS 1199 (Part 1):2018, Methods of Sampling and Analysis of Concrete, Bureau of Indian Standards (BIS), New Delhi.
5	IS 516 (Parts 1 & 2):2021, Methods of Tests for Strength of Concrete, Bureau of Indian Standards (BIS), New Delhi.

Web-links

1. <https://nptel.ac.in/courses/105102012>



U24CY2401	ENVIRONMENTAL SCIENCES, CLIMATE CHANGE AND SUSTAINABILITY		L	T	P	C
			3	0	0	3
Course Objectives:		To understand the environmental issues, impacts of climate change, promoting sustainable practices, social responsibility, and conservation of natural resources.				
Unit - I	ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY					9
Great ancient civilizations and the environment, Industrial revolution and its impact on the environment. Definition, Scope and importance of Environmental Education; Ecosystem: components, energy flow; Ecosystem services: classification and their significance, Economic value of ecosystem services. Biodiversity: Biodiversity as a natural resource; Levels of biodiversity; Biodiversity in India and the world; values of biodiversity; hot-spots of biodiversity; Threats to biodiversity and ecosystems; conservation of biodiversity: In-situ and ex-situ; the role of traditional knowledge, community-based conservation. International Union for Conservation of Nation (IUCN) red list criteria and categories.						
Unit - II	ENVIRONMENTAL ISSUES, POLLUTION AND HEALTH					9
Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Definition of pollution; Point and non-point sources of pollution; Types, sources, environmental impacts and control methods of Air, Water, Soil, Noise and Radioactive Pollution; adverse impacts of various pollution on human health. Solid waste management: causes, effects, control measures and management of municipal solid wastes; E-waste Management; role of an individual in prevention of pollution; Occupational Health and Safety Management system (OHASMS) and its case studies.						
Unit - III	CLIMATE CHANGE: IMPACTS, ADAPTATION AND MITIGATION					9
Understanding climate change: Anthropogenic climate change from greenhouse gas emissions: past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Impacts, vulnerability and adaptation to climate change: Sea level rise, Ecosystems, animal species, agriculture, and Health. Climate change mitigation and adaptation strategies. Major International Environmental Agreements: Convention on Biological Diversity (CBD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment, United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; Conference of the Parties (COP). United Nations Environment Programme (UNEP) and Governance policy.						
Unit – IV	ENVIRONMENTAL MANAGEMENT AND SUSTAINABLE PRACTICES					9
Development, Effects of unplanned development - case studies. Economic growth - Gross Domestic Product (GDP), Sustainability: concept, needs and challenges; economic, social and aspects of sustainability; from unsustainability to sustainability; Sustainable Development: Goals, targets, Nation missions and environmental policy, indicators and intervention areas. Concept of Carbon Credit; Carbon Footprint; ISO14001; Environmental management in industry with case studies. Practices: Eco labelling; Circular economy; Material Life cycle assessment; Environmental Impact Assessment; Sustainable habitat: Green buildings, Green materials, Energy efficiency. Sustainable transports; Sustainable urbanization; Need of the Hour: Sustainable Industry, Innovation, and resilient Infrastructure. Significance of holistic value-based education for true sustainability.						
Unit - V	NATURAL RESOURCES AND ENVIRONMENTAL ACTS					9
Definition of resource; Classification of natural resources: biotic and abiotic, renewable and non-renewable; Significance and challenges of biotic resources: forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine). Significance, over exploitation and conservation: Water resources, Soil and mineral resources. Principle and applications of (a) Solar energy, (b) Wind energy (c) Hydrogen energy (d) Tidal energy (e) Geothermal energy and (f) Biomass energy. Significance of major Indian Environmental Legislation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; Wetlands (Conservation and Management Rules) 2017.						
Total Periods:						45



On completion of the course, the student can

COs	Statements	K - Level
CO1	Explain the functions of environment, ecosystems, biodiversity and the impact of human activities on their conservation.	K2
CO2	Outline the causes, effects of environmental pollution and contribution to the preventive measures in the society.	K2
CO3	Understand the climate change, its impacts, and mitigation measures.	K2
CO4	Interpret the significance of sustainable development in reducing environmental degradation, fostering economic prosperity, and propose innovative solutions for a more sustainable future.	K2
CO5	Summarize the importance of natural resources and various environmental acts.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 - Apply

CO - PO Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	-	-	-	-	2	3	-	-	-	2	-	-	-
CO2	2	1	-	-	-	2	3	-	-	-	2	-	-	-
CO3	2	1	-	-	-	2	3	-	-	-	2	-	-	-
CO4	2	1	-	-	-	2	3	2	-	-	2	-	-	-
CO5	2	-	-	-	-	2	3	2	-	-	2	-	-	-
CO	2	1	-	-	-	2	3	2	-	-	2	-	-	-

Text Books

1	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2	S S Dara and D D Mishra, "A Textbook of Environmental Chemistry and Pollution Control", Ninth revised and enlarged edition, 2011, S Chand publishing New Delhi.
3	Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4	Singh, J.S., Singh, S.P. and Gupta, S.R. (2017). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
5	R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38 .edition 2010.
6	Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.
7	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.

Reference Books

1	Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
2	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
3	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
4	Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
5	Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
6	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
7	Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

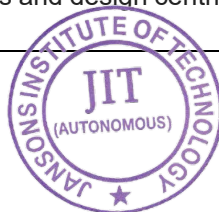


U24CE4403	HYDRAULICS ENGINEERING			L	T	P	C
			3	0	2	4	
Course Objectives:		Students will gain practical knowledge various hydraulics concepts through theoretical understanding and hands-on lab experiments.					
Unit - I	UNIFORM FLOW					9+8	
Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow – Velocity distribution in open channel - Steady uniform flow: Chezy's equation, Manning equation – Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.							
Lab Experiments:							
1. Calibration of Rotameter							
2. Flow through Orifice meter/mouthpiece, Venturimeter and Notches							
3. Bernoulli's Experiment							
Unit - II	VARIED FLOWS					9+4	
Dynamic equations of gradually varied - Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Numerical method: Direct step method and Standard step method – Change in Grades.							
Lab Experiments:							
1. To observe and analyze the water surface profile in gradually varied flow.							
2. To validate theoretical computations using the energy and momentum principles.							
Unit - III	RAPIDLY VARIED FLOWS					9+4	
Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Positive and Negative surges							
Lab Experiments:							
1. To study the formation of hydraulic jumps.							
2. To determine the energy loss and jump characteristics.							
Unit – IV	TURBINES					9+6	
Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed – Minimum Speed to start the pump.							
Lab Experiments:							
1. Characteristics of Pelton wheel turbine							
2. Characteristics of Francis turbine							
Unit - V	PUMPS					9+8	
Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation's in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in workdone.							
Lab Experiments:							
1. Characteristics of Centrifugal pumps							
2. Characteristics of Gear pump							
3. Characteristics of Submersible pump							
4. Characteristics of Reciprocating pump							
Total Periods:						75	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Experiment the basics of open channel flow,	K4
CO2	Summarize the characteristics of the steady gradually varied flow.	K4
CO3	Illustrate relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump.	K4
CO4	Demonstrate the working of turbines	K4
CO5	Apply the working principle of pump with characteristic curves and design centrifugal and reciprocating pumps	K4



Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	1	-	-	-	2	-	-	2	2	2	2
CO2	3	2	2	1	-	-	-	2	-	-	2	2	2	2
CO3	3	2	2	1	-	-	-	2	-	-	2	2	2	2
CO4	3	2	2	1	-	-	-	2	-	-	2	2	2	2
CO5	3	2	2	1	-	-	-	2	-	-	2	2	2	2
CO	3	2	2	1	-	-	-	2	-	-	2	2	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	A. K. Jain, Fluid Mechanics, Khanna Publishers, New Delhi, 13th Revised Edition, 2022.
2	P. N. Chandramouli, Applied Hydraulic Engineering, Yes Dee Publishing Pvt. Ltd., Chennai, 2nd Edition, 2021.
3	Centre for Water Resources, Anna University, Hydraulic Engineering Laboratory Manual, Anna University, Chennai, Revised Edition, 2022.
4	K. Subramanya, Flow in Open Channels, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 5th Edition, 2019.

Reference Books

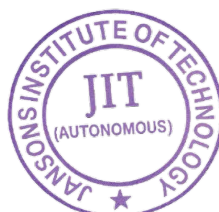
1	Ven Te Chow, Open-Channel Hydraulics, McGraw Hill Education, New York, International Edition (Latest Reprint), 2019.
2	P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, 22nd Revised Edition, 2022.
3	Larry W. Mays, Water Resources Engineering, John Wiley & Sons, 3rd Edition, 2019.

Web-links

- https://onlinecourses.nptel.ac.in/noc21_ce31/preview
- Virtual Lab link: <https://eerc03-iiith.vlabs.ac.in/>



U24CE4404		GEOTECHNICAL ENGINEERING I			L	T	P	C
					3	0	2	4
Course Objectives:		To impart knowledge on soil classification by index properties and engineering properties, and introduce concepts of compaction, stress, consolidation, and slope stability.						
Unit - I	SOIL CLASSIFICATION AND COMPACTION						9+8	
Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties – Significance – BIS classification system – Unified classification system – Compaction of soils – Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.								
Lab experiments								
1. Specific gravity of soil solids								
2. Grain size distribution – Sieve analysis								
3. Grain size distribution - Hydrometer analysis								
4. Liquid limit and Plastic limit tests								
5. Shrinkage limit and Differential free swell tests								
Unit - II	EFFECTIVE STRESS AND PERMEABILITY						9+8	
Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena–Permeability interaction – Hydraulic conductivity – Darcy's law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two-dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems. (Sheet pile and pier).								
Lab experiments								
1. Field density Test (Core cutter and Sand replacement method)								
2. Determination of moisture – density relationship using standard proctor compaction test.								
3. Permeability determination (constant head and falling head methods)								
Unit - III	STRESS DISTRIBUTION AND SETTLEMENT						9+4	
Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point load, Line load and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. - $\sqrt{t}$ and log t methods– e-log p relationship								
Lab experiments								
1. One dimensional consolidation test (Determination of co-efficient of consolidation demo only)								
Unit – IV	SHEAR STRENGTH						9+6	
Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.								
Lab experiments								
1. Direct shear test in cohesion less soil								
2. Unconfined compression test in cohesive soil								
3. Tri-axial compression test in cohesion less soil (Demonstration only)								
4. California Bearing Ratio Test								
Unit - V	SLOPE STABILITY						9+4	
Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop's method – Slope protection measures.								
Lab experiments								
1. Case Study on Soil Erosion and Slope Protection Measures.								
Total Periods:							75	



Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify various types of soils and its properties solve engineering problems	K3
CO2	Interpret the effective stress, permeability and its impact on an engineering solution	K4
CO3	Utilize the concepts of stress distribution and settlement under various conditions.	K4
CO4	Summarize the concept of soil shear strength and its significance in engineering solutions.	K4
CO5	Explain both finite and infinite slopes, components and processes as per needs and specifications.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	2	-	2	-	3	-	-	-	3	2	1
CO2	3	3	2	2	-	1	-	3	-	-	-	3	1	1
CO3	3	3	2	-	-	1	-	3	-	-	-	3	1	1
CO4	3	3	2	2	-	1	-	3	-	-	-	3	2	1
CO5	3	3	2	-	-	2	-	3	-	-	-	3	1	1
CO	3	3	2	2	-	1	-	3	-	-	-	3	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	V. N. S. Murthy, Soil Mechanics and Foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 3rd Edition (Reprint), 2021.
2	Gopal Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi, 3rd Edition (Reprint), 2022.
3	Swami Saran, Analysis and Design of Substructures: Limit State Design, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 3rd Edition, 2021.
4	K. R. Arora and G. R. Arora, Soil Mechanics and Foundation Engineering (Geotechnical Engineering), Standard Publishers Distributors, New Delhi, 9th Edition, 2021.

Reference Books

1	David F. McCarthy, Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Pearson Education, 8th Edition, 2017.
2	Donald P. Coduto, Man-chu Ronald Yeung and William A. Kitch, Geotechnical Engineering: Principles and Practices, Pearson Education, 3rd Edition, 2021.
3	Braja M. Das and Khaled Sobhan, Principles of Geotechnical Engineering, Cengage Learning, 9th Edition, 2023.
4	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation Engineering, Laxmi Publications (P) Ltd., New Delhi, 18th Revised Edition, 2022.
5	Karl Terzaghi, Ralph B. Peck and Gholamreza Mesri, Soil Mechanics in Engineering Practice, Wiley India Pvt. Ltd., 3rd Edition (Indian Reprint), 2019.
6	Joseph E. Bowles, Foundation Analysis and Design, McGraw Hill Education, 6th Edition (Indian Reprint), 2017.

Web-links

- https://onlinecourses.nptel.ac.in/noc22_ce03/preview
- Virtual lab : <https://gte-nitk.vlabs.ac.in/>



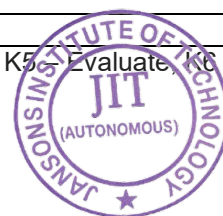
U24CE4405		ENVIRONMENTAL ENGINEERING			L	T	P	C
					3	0	2	4
Course Objectives:		To establish a strong foundation in the design of water supply scheme, and design of intake structures and sewerage system.						
Unit - I	WATER SUPPLY							9+8
Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, beneficial uses, Water quality standards, water quality indices, water safety plans, Estimation of surface and subsurface water resources, Predicting demand for water, Impurities of, water and their significance, Physical, chemical and bacteriological analysis, Waterborne diseases, Standards for potable water. Intake of water: Pumping and gravity schemes. Lab Experiments: Determination of pH, Turbidity, and Conductivity of water samples. Determination of Total Dissolved Solids (TDS) in water. Determination of Alkalinity and Acidity of water. Estimation of Hardness (Total and Temporary Hardness).								
Unit - II	WATER TREATMENT							9+6
Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, , Objectives, Unit operations and processes , Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation , Clarifloccuator , Plate and tube settlers , Pulsator clarifier - sand filters , Disinfection , softening, removal of iron and manganese, Defluoridation , Softening , Desalination process, Residue Management - Construction, Operation and Maintenance Lab Experiments: Jar Test for Coagulation and Flocculation. Determination of Chlorine Demand and Residual Chlorine. Determination of Iron and Manganese Concentration.								
Unit - III	WATER STORAGE AND DISTRIBUTION							9+4
Storage and balancing reservoirs , types, location and capacity, Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations, House service connections. Lab Experiments Study of Various Types of Pipes, Valves, and Fittings. Demonstration of Water Metering and Flow Measurement Devices.								
Unit – IV	PLANNING AND DESIGN OF SEWERAGE SYSTEM							9+6
Conveyance of sewage, Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Characteristics and composition of sewage, Population equivalent, Sanitary sewage flow Estimation, Sewer materials, Hydraulics of flow in sanitary sewers, Sewer design, Storm drainage, Storm runoff estimation, Sewer appurtenances, Corrosion in sewers, Prevention and control, drainage in buildings, Plumbing systems for drainage Lab Experiments: Determination of BOD and COD of Sewage Samples. Determination of Solids (Suspended, Dissolved, and Volatile) in Sewage. Study of Corrosion in Sewer Pipelines and Its Prevention								
Unit - V	SEWAGE TREATMENT AND DISPOSAL							9+6
Objectives, Selection of Treatment Methods, Principles, Functions, Activated Sludge Process and Extended aeration systems, Trickling filters, Sequencing Batch Reactor (SBR), UASB, Waste Stabilization Ponds, Other treatment methods, Reclamation and Reuse of sewage, Recent Advances in Sewage Treatment, Construction, Operation and Maintenance aspects., Discharge standards, sludge treatment, Disposal of sludge Lab Experiments: Determination of Sludge Volume Index (SVI) and MLSS in Activated Sludge Process. Study on Heavy Metal Analysis in Wastewater.								
Total Periods:								75

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Analyze water quality parameters and sources of water supply	K4
CO2	Explain the working principles of water treatment methods.	K4
CO3	Summarize the water storage and distribution systems	K4
CO4	Illustrate design sewerage and drainage systems.	K4
CO5	Infer the treatment and disposal methods for sewage and sludge	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	-	-	3	-	3	-	-	3	3	2	1
CO2	3	3	-	-	-	3	-	3	-	-	3	3	2	1
CO3	3	3	2	-	-	3	-	3	-	-	3	3	2	1
CO4	3	3	-	-	-	3	-	3	-	-	3	3	2	1
CO5	3	3	2	-	-	3	-	3	-	-	3	3	2	1
CO	3	3	1	-	-	3	-	3-	-	-	3-	3-	2	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	S. K. Garg, Environmental Engineering, Volume I (Water Supply Engineering), Khanna Publishers, New Delhi, Revised Edition, 2022.
2	P. N. Modi, Water Supply Engineering, Volume I, Standard Book House, New Delhi, 22nd Revised Edition, 2022.
3	S. K. Garg, Environmental Engineering, Volume II (Sewage Disposal and Sanitary Engineering), Khanna Publishers, New Delhi, Revised Edition, 2022.
4	K. N. Duggal, Elements of Environmental Engineering, S. Chand & Company Ltd., New Delhi, Revised Edition, 2021.
5	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Environmental Engineering, Volume II, Laxmi Publications (P) Ltd., New Delhi, 3rd Revised Edition, 2021.

Reference Books

1	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 3rd Revised Edition, 2022.
2	Central Public Health and Environmental Engineering Organisation (CPHEEO), Manual on Water Supply and Treatment, Ministry of Housing and Urban Affairs, Government of India, New Delhi, 3rd Edition (Updated), 2019.
3	Syed R. Qasim, Wastewater Treatment Plants: Planning, Design and Operation, CRC Press, 2nd Edition (Reprint), 2020.
4	Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata Mc. Graw – Hill Company, New Delhi, 2010.
5	Syed R. Qasim, Wastewater Treatment Plants: Planning, Design and Operation, CRC Press, 2nd Edition (Reprint), 2020.
6	N. F. Gray, Drinking Water Quality: Problems and Solutions, Cambridge University Press, 2nd Edition, 2017.

Codes / Manuals

1	CPHEEO, Manual on Water Supply and Treatment, Ministry of Housing and Urban Affairs, Government of India, New Delhi, 3rd Edition, 2019.
2	CPHEEO, Manual on Sewerage and Sewage Treatment Systems, Ministry of Housing and Urban Affairs, Government of India, New Delhi, Part A & Part B, 2013 (with latest updates).
3	Bureau of Indian Standards (BIS), IS 10500:2012 (with latest amendments), Drinking Water – Specification, New Delhi.
4	Bureau of Indian Standards (BIS), IS 1172:1993 (Reaffirmed), Code of Basic Requirements for Water Supply, Drainage and Sanitation, New Delhi.
5	Central Pollution Control Board (CPCB), General Standards for Discharge of Environmental Pollutants, Ministry of Environment, Forest and Climate Change, Government of India, Latest Notification.

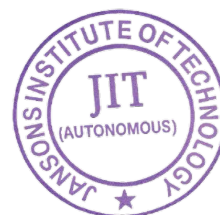
Web-links

<https://nptel.ac.in/courses/105107207>

https://onlinecourses.nptel.ac.in/noc20_ce23/preview

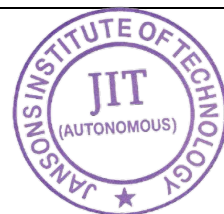
Virtual lab link : <https://ee1-nitk.vlabs.ac.in/>

Virtual lab link : <https://ee2-nitk.vlabs.ac.in/>



U24CE4406	MATERIALS TESTING LABORATORY	L	T	P	C
		0	0	4	2
Course Objectives:	At the end of the course the student will develop skills to test various construction materials.				

Title	
I	TESTS ON METALS
1	Tension test on mild steel rod
2	Torsion test on mild steel rod
3	Deflection test on metal beam
4	Double shear test on metal
5	Impact test on metal specimen (Izod and Charpy)
6	Hardness test on metals (Rockwell and Brinell Hardness Test)
II	TESTS ON CEMENT
7	Determination of fineness of cement
8	Determination of consistency of cement
9	Determination of specific gravity of cement
10	Determination of initial and final setting time of cement
III	TESTS ON FINE AGGREGATE
11	Determination of specific gravity and water absorption of fine aggregate
12	Determination of grading of fine aggregate
13	Determination of water absorption for fine aggregate
IV	TESTS ON COARSE AGGREGATE
14	Determination of compacted and loose bulk density of coarse aggregate
15	Determination of impact value of coarse aggregate
16	Determination of elongation index of coarse aggregate
17	Determination of flakiness index of coarse aggregate
18	Determination of aggregate crushing value of coarse aggregate
19	Determination of specific gravity and water absorption of coarse aggregate
V	TESTS ON BRICKS & CONCRETE
20	Determination of compressive strength of bricks
21	Determination of water absorption of bricks
22	Determination of efflorescence of bricks
23	Determination of slump of concrete
24	Determination of compressive strength of concrete-CUBE & CYLINDER
25	Determination of flowability of self-compacting concrete
VI	TEST ON WOOD
26	Determination of Compression test on wood
Total Periods: 60	



Course Outcomes

On completion of the course, the student can

Cos	Statements	K - Level
CO1	Infer the mechanical properties of steel.	K3
CO2	Examine the physical properties of cement	K3
CO3	Analyse the physical properties of fine and coarse aggregate	K3
CO4	Inspect the workability and compressive strength of concrete.	K3
CO5	Examine the strength of brick and wood	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO2	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO3	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO4	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO5	3	3	2	-	-	2	2	2	-	-	2	3	1	1
CO	3	3	2	-	-	2	2	2	-	-	2	3	1	1

Correlation levels 1, 2 and 3 are as defined below:

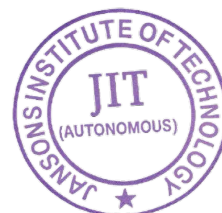
1. Slight 2. Moderate 3. Substantial (High)

References

1	Construction Materials Laboratory Manual, Anna University, Chennai-600 025.
2	IS 4031 (Part 1) – 1996 – Indian Standard Method for determination of fineness by drysieving.
3	IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for concrete
4	IS 383 – 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

Virtual Lab Links:

- <https://sm-nitk.vlabs.ac.in/List%20of%20experiments.html>
- <https://ms-nitk.vlabs.ac.in/exp/time-of-cement/references.html>



U24CE4407	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1
Course Objectives:	To enhance students' knowledge of emerging trends in Civil Engineering through research, presentations, and discussions.				
Strategy:	Every Student should prepare and make presentations/videos on Recent Trends and Innovations in the field of Civil Engineering and the same should be presented before the faculty in charge.				

Course Outcomes

On completion of the course, the student can

Cos	Statements	K - Level
CO1	Identify emerging trends and innovations in Civil Engineering	K2
CO2	Extend technical research and report-writing skills on advanced engineering topics.	K2
CO3	Engage in discussions and collaborate with peers to broaden technical knowledge.	K2
CO4	Enhance oral communication and deliver effective technical presentations	K2
CO5	Summarize advancements in construction materials, geotechnics, and infrastructure etc.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	-	-	-	-	2	-	3	3	-	3	3	-	-
CO2	-	-	-	-	-	2	-	3	3	-	3	-	-	-
CO3	-	-	-	-	-	2	-	3	3	-	3	-	-	-
CO4	-	-	-	-	-	2	-	3	3	-	3	-	-	-
CO5	3	-	-	-	-	2	-	3	3	-	3	3	-	-
CO	1	-	-	-	-	2	-	3	3	-	3	1	-	-

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)



U24CE4501		DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS			L	T	P	C
					3	1	0	4
Course Objectives:		To introduce the different design philosophy for reinforced concrete and discuss the limit state method of design of RC rectangular beams and to learn the concept in the design of RC flanged beams and design for shear and torsion and design of RC slabs and staircase, short RC columns, RC footing for walls, pad, sloped and combined rectangular footings.						
Unit - I	DESIGN PHILOSOPHY OF CONCRETE STRUCTURES						9+3	
Concept of Elastic method, ultimate load method and limit state method – Working stress method as detailed in IS code - Design of Singly Reinforced beam by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods								
Unit - II	LIMIT STATE METHOD - FLANGED BEAM, SHEAR & TORSION						9+3	
Analysis and design of flanged beams – Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Analysis and design of singly and doubly reinforced rectangular beams by limit State Method.- Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion - serviceability.								
Unit - III	LIMIT STATE DESIGN OF SLABS AND STAIRCASE						9+3	
Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase –Introduction to Flat Slab.								
Unit – IV	LIMIT STATE DESIGN OF COLUMNS						9+3	
Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.								
Unit - V	ADVANCED TOPICS						9+3	
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined footing.								
Total Periods:							45+15 =60	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Compare the principles of WSM and LSM and apply IS code procedures to calculate the moment of resistance for singly reinforced beams.	K2
CO2	Determine the behaviour of RC members under shear and torsion and compute the required reinforcement for flanged beams and bond requirements.	K3
CO3	Interpret the boundary conditions for different slab types and calculate the reinforcement required for slabs and dog-legged staircases.	K3
CO4	Classify columns based on loading/slenderness and determine the load-carrying capacity of short columns under axial and uniaxial loads.	K3
CO5	Analyse the pressure distribution under footings and solve design problems for axially loaded rectangular and combined footings.	K4

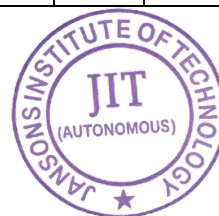
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	1	-	-	1	-	-	-	-	1	3	1	1
CO2	3	3	2	-	1	2	-	-	-	-	1	3	2	2
CO3	3	3	3	-	1	2	-	-	-	-	1	3	3	2
CO4	3	3	2	-	1	1	-	-	-	-	1	3	2	2
CO5	3	3	2	-	-	2	-	-	-	1	1	3	2	3
CO	3	3	2	-	1	2	-	-	-	1	1	3	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1.	Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, Revised Edition (Reprint), 2022.
2.	Krishna Raju, N. and Pranesh Rao, N., "Reinforced Concrete Design", New Age International Publishers, New Delhi, 4th Edition, 2021.
3.	Varghese, P.C., "Limit State Design of Reinforced Concrete", PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2023.
4.	Unnikrishna Pillai, S. and Devdas Menon, "Design of Reinforced Concrete Structures", McGraw Hill Education, New Delhi, 4th Edition, 2021.

Reference Books

1.	S. N. Sinha, Reinforced Concrete Design, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2nd Edition (Reprint), 2021.
2.	S. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 4th Edition, 2021.
3.	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design of Reinforced Concrete, Laxmi Publications (P) Ltd., New Delhi, Revised Edition, 2022.
4.	V. L. Shah and S. R. Karve, Limit State Theory and Design of Reinforced Concrete, Structures Publications, Pune, 7th Edition, 2020.
5.	Jack C. McCormac and Russell H. Brown, Design of Reinforced Concrete, Wiley India Pvt. Ltd., 11th Edition (Indian Reprint), 2021.
6.	Arthur H. Nilson, David Darwin and Charles W. Dolan, Design of Concrete Structures, McGraw Hill Education, 15th Edition (Reprint), 2020.

Codes of Practice

1.	IS 456:2000, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards (BIS), New Delhi
2.	IS 875 (Parts 1–5), Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Bureau of Indian Standards (BIS), New Delhi.
3.	IS 1893 (Part 1):2016, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards (BIS), New Delhi.
4.	SP 16, Design Aids for Reinforced Concrete to IS 456:2000, Bureau of Indian Standards (BIS), New Delhi.
5.	SP 24, Explanatory Handbook on IS 456:2000, Bureau of Indian Standards (BIS), New Delhi.
6.	SP 34, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards (BIS), New Delhi.

Web-links

1. <https://nptel.ac.in/courses/105105105>



U24CE4502		DESIGN OF STEEL STRUCTURAL ELEMENTS		L	T	P	C
				3	1	0	4
Course Objectives:		To impart basic knowledge to the students about limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections and to provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice					
Unit - I	INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS					9+3	
General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts							
Unit - II	DESIGN OF TENSION AND COMPRESSION MEMBERS					9+3	
Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect, Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory, Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base							
Unit - III	DESIGN OF BEAMS					9+3	
Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders							
Unit – IV	INDUSTRIAL STRUCTURAL ELEMENTS					9+3	
. Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design, Design of joints and end bearings–Introduction and applications of gantry girder							
Unit - V	PLASTIC ANALYSIS AND DESIGN					9+3	
Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portal frames using plastic design approach							
Total Periods:						45+15=60	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Analyze and design welded and bolted steel connections for structural safety and serviceability requirements.	K4
CO2	Evaluate and select appropriate steel sections, shapes, and sizes for tension and compression members under given loading conditions.	K4
CO3	Determine codal provisions for the analysis and design of steel tension and compression members.	K4
CO4	Analyze the design loads for industrial structures, including gantry girders, considering relevant load combinations.	K4
CO5	Interpret plastic analysis principles to assess the ultimate load capacity of steel beams and portal frames.	K3

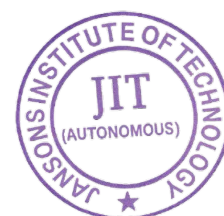
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11		01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2		3	2	-
CO2	3	2	2	-	-	-	-	-	-	-	2		3	2	-
CO3	3	2	2	-	-	-	-	-	-	-	2		3	2	-
CO4	3	2	2	-	-	-	-	-	-	-	2		3	2	-
CO5	3	2	2	-	-	-	-	-	-	-	2		3	2	-
CO	3	2	2	-	-	-	-	-	-	-	2		3	2	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1	Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 3rd Edition, 2024.
2	Bhavikatti S.S, Design of Steel Structures, Iik International Publishing House, New Delhi, 6th Edition, 2022.
3	N. Subramanian, Design of Steel Structures, Oxford University Press, New Delhi, 2nd Edition (Reprint), 2021.

Reference Books

1	M. L. Gambhir, Fundamentals of Structural Steel Design, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2nd Edition, 2020.
2	Jack C. McCormac and Stephen F. Csernak, Structural Steel Design, Pearson Education, 6th Edition, 2021.
3	Sarwar Alam Raz, Structural Design in Steel, New Age International (P) Ltd., New Delhi, Revised Edition, 2020.
4	Edwin H. Gaylord Jr., Charles N. Gaylord and James E. Stallmeyer, Design of Steel Structures, McGraw Hill Education, 5th Edition (Indian Reprint), 2019.

Indian Standards (Recommended)

1	IS 800:2007, General Construction in Steel – Code of Practice (with latest amendments).
2	IS 875 (Parts 1–5), Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures.
3	IS 1893 (Part 1):2016, Criteria for Earthquake Resistant Design of Structures (with latest amendments).
4	SP 6 (1), Handbook for Structural Engineers – Structural Steel Sections.
5	SP 38, Handbook on Timber Engineering (where applicable for combined design references).



U24CE4503		GEOTECHNICAL ENGINEERING II				L	T	P	C
						3	0	0	3
Course Objectives:		To impart fundamental and practical knowledge of foundation engineering, enabling analysis of soil–structure interaction and design of safe, economical, and sustainable foundations for varied geotechnical conditions							
Unit - I	SITE INVESTIGATION AND SOIL EXPLORATION						9		
Objectives and scope of site investigation – Planning of subsurface exploration – Desk study and reconnaissance – Methods of soil exploration: trial pits, auger boring, wash boring, percussion drilling, rotary drilling – Sampling methods: disturbed and undisturbed samples – Sample disturbance – Field tests: Standard Penetration Test (SPT), Cone Penetration Test (CPT), Vane shear test – Geophysical methods – Groundwater exploration – Soil investigation report.									
Unit - II	SHALLOW FOUNDATIONS AND BEARING CAPACITY						9		
Types of shallow foundations – Depth of foundation – Bearing capacity of shallow foundations – Terzaghi's bearing capacity theory – General and local shear failure – Bearing capacity factors – Effect of water table – Bearing capacity from field tests (SPT, CPT) – Plate load test – Allowable bearing pressure – Codal provisions (IS 6403).									
Unit - III	SETTLEMENT OF FOUNDATIONS						9		
Types of settlement: immediate, consolidation and secondary settlement – Elastic theory for settlement estimation – Consolidation settlement of clay layers – Settlement of foundations on sand – Schmertmann method – Differential settlement – Permissible limits of settlement – Remedial measures to control settlement.									
Unit – IV	DEEP FOUNDATIONS						9		
Types of deep foundations – Pile foundations: classification, materials and installation methods – Load carrying capacity of piles in cohesive and cohesionless soils (static analysis) – Dynamic pile formulae – Pile load tests – Pile group action and efficiency – Settlement of pile groups – Under-reamed piles – Codal provisions (IS 2911).									
Unit - V	RETAINING WALLS AND SPECIAL FOUNDATIONS						9		
Earth pressure theories: Rankine's and Coulomb's theories – Active, passive and at-rest earth pressures – Earth pressure due to surcharge and water table – Stability analysis of retaining walls: sliding, overturning and bearing capacity failure – Types of retaining walls (gravity, cantilever, counterfort) – Design principles of retaining walls – Machine foundations – Foundations on expansive soils and black cotton soils – Soil improvement techniques – Foundation failures and remedial measures.									
Total Periods:							45		

Course Outcomes

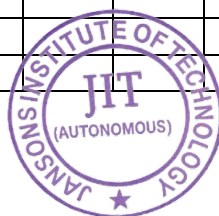
On completion of the course, the student can

COs	Statements	K-Level
CO1	Plan and interpret subsurface investigation data for selecting appropriate foundation systems.	K3
CO2	Examine bearing capacity and settlements of shallow foundations using analytical and codal methods.	K4
CO3	Estimate immediate and consolidation settlements of shallow foundations and assess permissible limits to ensure serviceability.	K4
CO4	Analyze pile foundations by evaluating load-carrying capacity, group action, and settlement under different soil and loading conditions.	K4
CO5	Evaluate earth pressures, assess stability of retaining walls, identify foundation failures, and recommend appropriate remedial and ground improvement measures.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	1	2		2					3	3	2	2
CO2	3	3	3	2		3					3	3	2	2
CO3	3	3	3	2		3					3	3	2	2
CO4	3	3	3	2		3					3	3	2	2



	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO5	3	3	3	2		3					3	3	2	2
CO	3	3	3	2		3					3	3	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	V. N. S. Murthy, Soil Mechanics and Foundation Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 3rd Edition (Reprint), 2021.
2	Braja M. Das and Nagaratnam Sivakugan, Principles of Foundation Engineering, Cengage Learning India Pvt. Ltd., New Delhi, 9th Edition, 2022.
3	K. R. Arora and G. R. Arora, Soil Mechanics and Foundation Engineering (Geotechnical Engineering), Standard Publishers Distributors, New Delhi, 9th Edition, 2021.
4	Karl Terzaghi, Ralph B. Peck and Gholamreza Mesri, Soil Mechanics in Engineering Practice, Wiley India Pvt. Ltd., New Delhi, 3rd Edition (Indian Reprint), 2019.

Reference Books

1	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundation Engineering, Laxmi Publications (P) Ltd., New Delhi, 18th Revised Edition, 2022.
2	Donald P. Coduto, Man-chu Ronald Yeung and William A. Kitch, Foundation Design: Principles and Practices, Pearson Education, 3rd Edition, 2021.
3	K. R. Venkataramaiah, Geotechnical Engineering, Universities Press (India) Pvt. Ltd., Hyderabad, Revised Edition, 2019.
4	Hans F. Winterkorn and Hsai-Yang Fang (Editors), Foundation Engineering Handbook, Springer, New York, 2nd Edition (Reprint), 2019.
5	R. F. Craig and Jonathan Knappett, Craig's Soil Mechanics, CRC Press, 9th Edition, 2024.
6	K. S. Nair, Design of Foundation Systems: Principles and Practices, McGraw Hill Education (India), Reprint Edition, 2020.
7	Braja M. Das and Khaled Sobhan, Principles of Geotechnical Engineering, Cengage Learning, 9th Edition, 2023.

CODES OF PRACTICE

1	IS 6403:1981 (Reaffirmed), Code of Practice for Determination of Bearing Capacity of Shallow Foundations, Bureau of Indian Standards (BIS), New Delhi.
2	IS 1904:1986 (Reaffirmed), Code of Practice for Design and Construction of Foundations in Soils, Bureau of Indian Standards (BIS), New Delhi.
3	IS 2911 (Parts 1–4), Code of Practice for Design and Construction of Pile Foundations, Bureau of Indian Standards (BIS), New Delhi (latest amendments).
4	IS 8009 (Parts 1 & 2), Code of Practice for Calculation of Settlement of Foundations, Bureau of Indian Standards (BIS), New Delhi.
5	IS 2950 (Parts 1 & 2), Code of Practice for Design and Construction of Raft Foundations, Bureau of Indian Standards (BIS), New Delhi.

Web-links

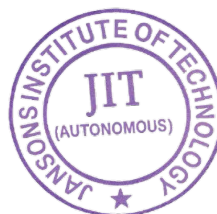
1. NPTEL – Geotechnical Engineering Courses (IITs) - <https://nptel.ac.in>



U24CE4504		TRANSPORTATION ENGINEERING		L	T	P	C
				3	0	2	4
Course Objectives:		To give an overview about the highway engineering with respect to, planning, design, construction and maintenance of highways as per IRC standards, specifications and methods.					
Unit - I	HIGHWAY PLANNING AND ALIGNMENT					9+6	
Significance of highway planning – Modal limitations towards sustainability - History of road development in India – factors influencing highway alignment – Soil suitability analysis – Road ecology - Engineering surveys for alignment objectives, conventional and modern methods - Classification of highways – Locations and functions – Typical cross sections of Urban and Rural roads. Lab Experiments: TEST ON AGGREGATES 1. Specific Gravity 2. Sieve analysis of coarse aggregate 3. Los Angeles Abrasion Test 4. Water Absorption of Aggregates							
Unit - II	GEOMETRIC DESIGN OF HIGHWAYS					9+6	
Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads – Hairpin bends – Lateral and vertical clearance at underpasses. Lab Experiments: TEST ON BITUMEN 1. Specific Gravity of Bitumen 2. Penetration Test							
Unit - III	DESIGN OF FLEXIBLE AND RIGID PAVEMENTS					9+6	
Pavement components and their role - Design principles -Design practice for flexible and rigid-Pavements (IRC methods only) – Embankments- Problems in Flexible pavement design. Lab Experiments TEST ON BITUMEN 1. Viscosity Test 2. Softening Point Test 3. Ductility Test							
Unit – IV	HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE					9+6	
Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Test on Bituminous mixes-Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures - Highway drainage – Construction machineries. Lab Experiments: TESTS ON BITUMINOUS MIXES 1. Stripping Test 2. Determination of Binder Content 3. Marshall Stability and Flow Values							
Unit - V	EVALUATION AND MAINTENANCE OF PAVEMENTS					9+6	
Pavement distress in flexible and rigid pavements – Types of maintenance – Pavement Management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements –Highway Project formulation Lab Experiments: 1. Demonstration of any one field testing equipment like skid resistance Tester/ benkelman beam etc							
Total Periods:						45+30=75	

Course Outcomes

On completion of the course, the student can



COs	Statements	K-Level
CO1	Explain the principles of highway planning and alignment, and describe the role of surveys and classifications in road development.	K3
CO2	Analyze the geometric design elements of highways, including sight distances, curves, gradients, and special considerations for hill roads.	K4
CO3	Describe the design principles of flexible and rigid pavements as per IRC guidelines, and explain the functions of pavement components.	K4
CO4	Explain the properties and testing methods of highway construction materials, and discuss modern construction practices and quality control measures.	K3
CO5	Identify pavement evaluation techniques, types of maintenance, and summarize the concepts of pavement management systems and project formulation.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	-	-	-	-	-	-	-	-	1	2	1	1
CO2	3	3	-	-	-	-	-	-	-	-	1	2	1	1
CO3	3	3	-	-	-	-	-	-	-	-	1	2	1	1
CO4	3	3	-	-	-	-	-	-	-	-	1	2	1	1
CO5	3	3	-	-	-	-	-	-	-	-	1	2	1	1
CO	3	3	-	-	-	-	-	-	-	-	1	2	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

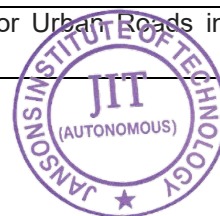
1	S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Highway Engineering, Nem Chand & Bros. (Khanna Publishers), New Delhi, 11th Revised Edition, 2023.
2	K. P. Subramanian, Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India) Pvt. Ltd., Chennai, 3rd Revised Edition, 2021.
3	L. R. Kadiyali and N. B. Lal, Principles and Practice of Highway Engineering, Khanna Technical Publications, New Delhi, 9th Edition, 2019.

Reference Books

1	Yang H. Huang, Pavement Analysis and Design, Pearson Education, 2nd Edition (Indian Reprint), 2020.
2	Ian D. Walsh, Philip Wright and Nicholas Thom (Editors), ICE Manual of Highway Design and Management, ICE Publishing, London, 2nd Edition, 2020.
3	Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, John Wiley & Sons, 7th Edition, 2021.
4	Paul H. Wright and Karen K. Dixon, Highway Engineering, John Wiley & Sons, 8th Edition, 2021.

CODES / MANUALS (Recommended)

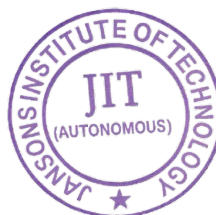
1	Indian Roads Congress (IRC), IRC:37-2018 – Guidelines for the Design of Flexible Pavements, Indian Roads Congress, New Delhi.
2	Indian Roads Congress (IRC), IRC:58-2015 – Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress, New Delhi.
3	Indian Roads Congress (IRC), IRC:SP:72-2015 – Guidelines for the Design of Flexible Pavements for Low Volume Rural Roads, Indian Roads Congress, New Delhi.
4	Ministry of Road Transport and Highways (MoRTH), Specifications for Road and Bridge Works (5th Revision), Indian Roads Congress, New Delhi, 2013 (with latest amendments).
5.	Indian Roads Congress (IRC), IRC:86 – Geometric Design Standards for Urban Roads in Plains, Latest Revision.



U24CE4505	COMPUTER AIDED STRUCTURAL DESIGN AND DETAILING	L	T	P	C
		0	0	4	2
Course Objectives:	The course objective is to equip students with the technical proficiency to design and detail structural elements by integrating theoretical principles of Reinforced Concrete and Steel Structures with modern computational tools. Students will learn to develop automated design algorithms using MS Excel to perform complex engineering calculations based on IS 456:2000 and IS 800:2007, while simultaneously mastering professional drafting techniques in AutoCAD to produce high-precision, site-ready structural drawings. By bridging the gap between mathematical modelling and graphical representation, the course aims to prepare students for real-world engineering workflows, emphasizing accuracy in reinforcement detailing, connection design, and compliance with national building codes.				

Group A-Rebar Detailing		
Expt. No.	Design (Excel)	Detailing (AutoCAD)
1	Simple Beams: Calculate how much steel is needed for a single beam.	The Cross-section showing the bars and the Longitudinal section.
2	Heavy-Duty Beams: Design beams with steel at both top and bottom (Doubly Reinforced).	Detailed layout showing how top and bottom bars are held by stirrups.
3	T-Beams: Design beams that are cast together with the slab.	The "T" shape cross-section and its connection to the slab.
4	Safety Checks: Calculate stirrup spacing to prevent cracks (Shear & Torsion).	Shear detailing: Drawing the "rings" (stirrups) closer at the ends.
5	Slabs: Design a floor for a room (One-way or Two-way).	The Reinforcement Plan showing "Cranked" or bent bars.
6	Stairs: Calculate the thickness and steel for a dog-legged staircase.	The Side View of the stairs showing how bars go from landing to flight.
7	Columns: Design a pillar to carry a building load.	The Column cross-section showing vertical bars and horizontal ties.
8	Footings: Design the "Base" that sits on the soil.	A Sectional Elevation showing the mesh of steel at the bottom.
Group B-Steel Connection Detailing		
Expt. No.	Design (Excel)	Detailing (AutoCAD)
9	Bolted Joints: Calculate how many bolts are needed so the joint won't snap.	A Plan View showing the exact spacing (Pitch and Gauge) of bolts.
10	Welded Joints: Calculate the thickness and length of the weld.	Standard Weld Symbols on a drawing of two plates joining.
11	Column Bases: Design the steel plate that connects a column to the concrete.	The Base Plate with anchor bolts and gusset angles.
12	Roof Trusses: Calculate the forces in a warehouse roof joint.	A Gusset Plate detail showing how multiple steel angles meet at one point.

Total Periods: 60



Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Examine the limit state design philosophies and apply MS Excel to compute reinforcement requirements for singly, doubly, and flanged RC beams.	K4
CO2	Identify the behaviour of members under shear and torsion and generate detailed longitudinal and ductile reinforcement drawings in AutoCAD.	K3
CO3	Interpret boundary conditions for slabs and staircases to calculate design parameters in Excel and draft professional reinforcement layouts in AutoCAD.	K4
CO4	Classify RC columns and steel connections to determine their load capacities using spreadsheet modelling and produce precise structural detailing.	K4
CO5	Analyze design problems for RC footings and steel column bases using automated calculators and prepare site-ready foundation plans and sectional drawings.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	3	1	-	1	2	-	1	3	2	1
CO2	3	2	3	-	3	2	-	1	3	-	1	3	3	1
CO3	3	3	3	-	3	2	-	1	3	-	1	3	3	1
CO4	3	3	2	-	3	1	-	1	2	-	1	3	2	1
CO5	3	2	3	-	3	2	-	1	3	1	1	3	2	1
CO	3	2	2	-	3	2	-	1	3	1	1	3	2	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	P. C. Varghese, Limit State Design of Reinforced Concrete, PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2023.
2	S. K. Duggal, Design of Steel Structures, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 3rd Edition, 2024.
3	N. Krishna Raju, Structural Design and Drawing, Universities Press (India) Pvt. Ltd., Hyderabad, 4th Edition, 2021.
4	Sham Tickoo, AutoCAD 2025 for Engineers and Designers, CADCIM Technologies, Pune, 2025 Edition.

Reference Books

1	S. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 4th Edition, 2021.
2	N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2nd Edition (Reprint), 2023.
3	S. S. Bhavikatti, Design of Steel Structures (IS 800:2007), I.K. International Publishing House Pvt. Ltd., New Delhi, 6th Edition, 2022.
4	Autodesk Inc., AutoCAD 2025 User Guide and Help Documentation, 2025.
5	Aslam Kassimali, Structural Analysis, Cengage Learning, 6th Edition, 2022.
6	R. C. Hibbeler, Structural Analysis, Pearson Education, 11th Edition, 2022.

Codes of Practice

1	IS 456:2000, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
2	IS 875 (Parts 1–5), Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Bureau of Indian Standards (BIS), New Delhi.
3	IS 800:2007, General Construction in Steel – Code of Practice, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
4	IS 1893 (Part 1):2016, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
5	SP 16, Design Aids for Reinforced Concrete to IS 456:2000, Bureau of Indian Standards (BIS), New Delhi.
6	SP 24, Explanatory Handbook on IS 456:2000, Bureau of Indian Standards (BIS), New Delhi.
7	SP 34, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards (BIS), New Delhi.

Web-links

1. <https://nptel.ac.in/courses/105105105>
2. https://onlinecourses.nptel.ac.in/noc25_ce65/preview
3. <https://www.autodesk.com/certification/overview>
4. <https://www.bis.gov.in/?lang=en>



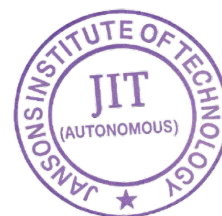
U24CE4506	INTERNSHIP				L	T	P	C
			0	0	0	2		
Course Objectives:	To enable students to acquire practical knowledge of civil engineering practices through industrial internship, fostering technical proficiency, professional ethics, communication, teamwork, and problem-solving skills while bridging the gap between academic learning and real-world engineering applications							
STRATEGY								
Students are required to individually undergo summer internship training in reputed construction companies, consulting firms, government departments, research institutes, testing laboratories, or infrastructure organizations for the prescribed duration. The internship provides practical exposure to real-world civil engineering practices related to planning, structural design, construction management, surveying, geotechnical investigations, transportation systems, environmental engineering, quality assurance, and project execution. During the training period, students are expected to actively participate in site activities, laboratory investigations, technical documentation, and engineering practices while adhering to professional ethics and safety regulations. The internship bridges the gap between classroom learning and professional practice, enhances technical competence, analytical thinking, communication skills, and prepares students for multidisciplinary engineering environments. Students shall maintain a detailed internship diary and record of their learning throughout the training period. Upon successful completion of the internship, each student shall prepare a comprehensive internship report documenting the organization profile, nature of work undertaken, engineering practices observed, software and equipment utilized, technical knowledge gained, challenges encountered, and outcomes achieved. The report shall be submitted within ten days from the commencement of the subsequent semester. Student performance will be evaluated based on the internship report, presentation, and assessment guidelines prescribed by the academic regulations.								
Total Periods:						4 Weeks		

Course Outcomes

On completion of the course, the student will be able to understand

COs	Statements	K-Level
CO1	Explain the professional practices, construction techniques, quality control measures, safety regulations, and engineering activities followed in civil engineering organizations and infrastructure projects.	K3
CO2	Apply civil engineering knowledge, modern engineering tools, professional ethics, teamwork, and communication skills to analyze field practices and prepare technical documentation based on internship experiences.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



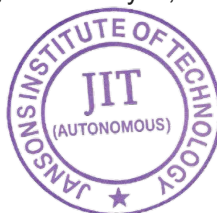
U24CE4601	STRUCTURAL ANALYSIS		L	T	P	C
			3	1	0	4
Course Objectives:		To develop students' ability to analyze statically determinate and indeterminate structures using classical and matrix methods, interpret structural behavior under different loading conditions, and apply analytical techniques for the safe and economical design of civil engineering structures				
Unit - I	SLOPE DEFLECTION & MOMENT DISTRIBUTION METHOD				9+3	
Analysis of determinate trusses - method of joints - method of sections- Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames- Support settlements- Stiffness - distribution and carry over factors — Analysis of continuous Beams- Plane rigid frames with and without sway						
Unit - II	FLEXIBILITY & STIFFNESS METHOD				9+3	
Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach- Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method						
Unit - III	INFLUENCE LINES FOR DETERMINATE & INDETERMINATE STRUCTURES				9+3	
Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influence lines for member forces in pin jointed plane frames. Muller Breslau's principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.						
Unit – IV	ARCHES & SUSPENSION BRIDGES AND SPACE TRUSSES				9+3	
Arches - Eddy's theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches - Parabolic and circular arches - influence lines, rib shortening– Settlement and temperature effects. Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients.						
Unit - V	APPROXIMATE ANALYSIS OF FRAME				9+3	
Approximate analysis for gravity loadings - substitute frame method for maximum moments in beams and columns - Approximate analysis for horizontal loads - portal method and cantilever method - assumptions - axial force, shearing force and bending moment diagrams.						
Total Periods:					60	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Compute bending moments and shear forces for swaying and non-swaying structures by Slope Deflection Method & Moment Distribution Method	K3
CO2	Interpret the indeterminate beams and rigid jointed frames using matrix flexibility & stiffness method.	K3
CO3	Sketch the influence lines for statically determinate and indeterminate structures & Compute the design parameters for three hinged, two hinged and fixed arches.	K3
CO4	Determine the Bending Moment for cables and stiffening girders.	K3
CO5	Interpret the rigid frames by approximate methods for gravity and horizontal loads.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	3	-	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	3	-	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	3	-	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	3	-	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	3	-	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	S. S. Bhavikatti, Structural Analysis, Vol. I & II, Vikas Publishing House Pvt. Ltd., New Delhi, 5th Edition, 2021.
2	B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Theory of Structures, Laxmi Publications (P) Ltd., New Delhi, Revised Edition, 2021.
3	Devdas Menon, Structural Analysis, Narosa Publishing House Pvt. Ltd., New Delhi, 2nd Edition (Reprint), 2021.
4	R. C. Hibbeler, Structural Analysis, Pearson Education, 11th Edition, 2022.

Reference Books

1	William Weaver Jr. and James M. Gere, Matrix Analysis of Framed Structures, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2nd Edition (Indian Reprint), 2021.
2	L. S. Negi and R. S. Jangid, Structural Analysis, McGraw Hill Education (India) Pvt. Ltd., New Delhi, Revised Edition, 2020.
3	C. S. Reddy, Basic Structural Analysis, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 4th Edition, 2019.
4	T. S. Thandavamoorthy, Theory of Structures, Oxford University Press, New Delhi, 2nd Edition, 2016 (Reprint 2021).



U24CE4602	ESTIMATION, COSTING AND VALUATION ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To provide students with knowledge of quantity estimation, costing of civil engineering works, valuation of properties, and preparation of detailed estimates for effective project planning and cost control.				
Unit - I	INTRODUCTION TO ESTIMATION				9
Introduction to estimation and costing – Purpose and importance – Types of estimates – Approximate estimates: plinth area method, floor area method, cubic content method – Detailed estimates – Data required for estimation – Units of measurement – Mode of measurement – Preparation of bar bending schedule.					
Unit - II	DETAILED ESTIMATION OF BUILDINGS				9
Detailed estimation of buildings – Methods of taking out quantities – Long wall and short wall method – Centre line method – Partly centre line and partly long wall method – Estimation of earthwork, foundation, superstructure – Estimation of RCC works – Abstract of cost.– (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)					
Unit - III	ESTIMATION OF OTHER CIVIL ENGINEERING WORKS				9
Estimation of roads – Estimation of irrigation works – Estimation of culverts and bridges – Estimation of water supply and sanitary works – Estimation of sewer lines – Estimation of electrical installations – Preparation of detailed and revised estimates.					
Unit – IV	COSTING, SPECIFICATIONS, AND CONTRACTS				9
Analysis of rates – Factors affecting rate analysis – Schedule of rates – Specifications: general and detailed specifications – Types of contracts – Tender documents – Earnest money deposit – Security deposit – Measurement book – Bills and payments.					
Unit - V	VALUATION ENGINEERING				9
Valuation – Purpose of valuation – Types of value – Depreciation and methods of depreciation – Sinking fund – Annuity – Capitalized value – Valuation of buildings – Fixation of rent – Mortgage – Lease – Sale deed – Case studies.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Analyze the principles and methods of estimation for civil engineering works.	K4
CO2	Prepare detailed estimates and quantity take-offs for buildings.	K4
CO3	Estimate costs of roads, irrigation, and public utility works.	K4
CO4	Identify rate analysis, specifications, and contract procedures.	K3
CO5	Apply valuation principles to assess the value of buildings and properties.	K4

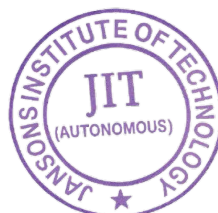
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	1	-	2	-	-	-	-	3	3	2	-
CO2	3	3	2	1	-	2	-	-	-	-	3	3	2	-
CO3	3	2	1	-	-	2	-	-	-	-	3	1	-	-
CO4	3	2	1	-	-	2	-	-	-	-	3	1	-	-
CO5	3	3	2	1	-	2	-	-	-	-	3	3	2	-
CO	3	2	2	1	-	2	-	-	-	-	3	2	2	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

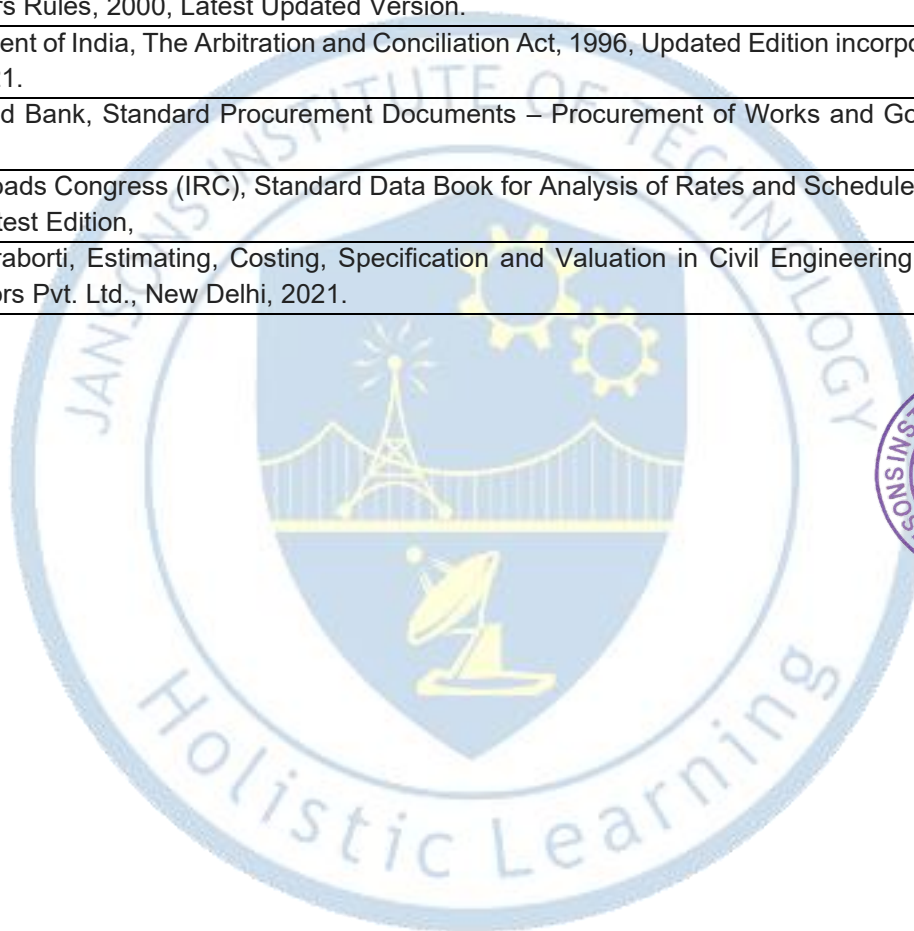


Text Books

1	B.N Dutta 'Estimating and Costing in Civil Engineering', CBS Publishers & Distributors (P) Ltd, 30th Revised Edition, 2023.
2	Rangwala, S.C., "Estimating, Costing and Valuation", Charotar Publishing House, Anand, 33rd Revised Edition, 2022
3	B.S.Patil, 'Civil Engineering Contracts and Estimates', 7th edition, University Press, 8th Edition, 2021.
4	D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 6th Edition, 2021.
5	K.K. Chitkara, "Construction Project Management", Tata McGraw Hill, New Delhi, 3rd Edition (Reprint), 2021.

Reference Books

1	Tamil Nadu Public Works Department (TNPWD), Handbook of Consolidated Data, Vol. I, Latest Edition (with current amendments).
2	Government of Tamil Nadu, Tamil Nadu Transparency in Tenders Act, 1998 and Tamil Nadu Transparency in Tenders Rules, 2000, Latest Updated Version.
3	Government of India, The Arbitration and Conciliation Act, 1996, Updated Edition incorporating amendments up to 2021.
4	The World Bank, Standard Procurement Documents – Procurement of Works and Goods, Latest Edition, 2023.
5	Indian Roads Congress (IRC), Standard Data Book for Analysis of Rates and Schedule of Rates, IRC, New Delhi, Latest Edition,
6	M. Chakraborti, Estimating, Costing, Specification and Valuation in Civil Engineering, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2021.



U24CE4603		PRESTRESSED CONCRETE STRUCTURES		L	T	P	C
				3	0	0	3
Course Objectives:		To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems					
Unit - I	INTRODUCTION – THEORY AND BEHAVIOUR					9	
Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post-tensioned and pre-tensioned members.							
Unit - II	DESIGN FOR FLEXURE AND SHEAR					9	
Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code							
Unit - III	DEFLECTION AND DESIGN OF ANCHORAGE ZONE					9	
Factors influencing deflections – Short-term deflections of uncracked members – Prediction of longterm deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pretensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pretensioned beams.							
Unit – IV	COMPOSITE BEAMS AND CONTINUOUS BEAMS					9	
Analysis and design of composite beams – Shrinkage strain and its importance – Differential shrinkage - Methods and applications of achieving continuity in continuous beams – Principles of design							
Unit - V	MISCELANEOUS STRUCTURES					9	
Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.							
Total Periods:						45	

Course Outcomes

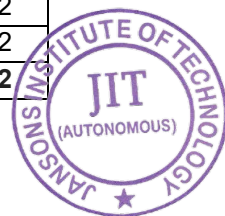
On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify prestressed concrete beams to satisfy strength, serviceability, and durability requirements.	K3
CO2	Categorize prestressed concrete members for shear and flexural performance under specified loading conditions.	K4
CO3	Determine ultimate deflections in prestressed concrete beams considering time-dependent effects.	K3
CO4	Explain the structural behavior of composite beams and continuous beams under various loading scenarios.	K3
CO5	Illustrate the design principles and applications of prestressed concrete water tanks, pipes, poles, and sleepers.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	3	2	2
CO2	3	2	2	-	-	-	-	-	-	-	2	3	2	2
CO3	3	2	2	-	-	-	-	-	-	-	2	3	1	1
CO4	3	2	2	-	-	-	-	-	-	-	2	3	1	2
CO5	3	2	2	-	-	-	-	-	-	-	2	3	2	2
CO	3	2	2	-	-	-	-	-	-	-	2	3	2	2



Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, 6th Edition (Reprint), 2021.
2	Pandit.G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributors Pvt. Ltd, 3rd Revised Edition, 2021.
3	N. Rajagopalan, Prestressed Concrete, Narosa Publishing House Pvt. Ltd., New Delhi, 2nd Edition (Reprint), 2022.

Reference Books

1	Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 3rd Edition (Indian Reprint), 2019.
2	Edward G. Nawy, Prestressed Concrete: A Fundamental Approach, Pearson Education, 6th Edition, 2020.
3	P. Dayaratnam, Prestressed Concrete Structures, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, Reprint Edition, 2021.
4	N. C. Sinha and S. K. Roy, Fundamentals of Prestressed Concrete, S. Chand & Company Ltd., New Delhi, 3rd Revised Edition, 2020.

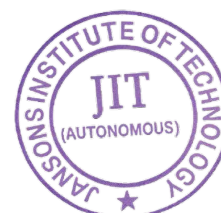
Indian Standards (Recommended);

1	IS 1343:2012, Code of Practice for Prestressed Concrete
2	IS 456:2000, Plain and Reinforced Concrete – Code of Practice
3	SP 16, Design Aids for Reinforced Concrete to IS 456.
4	SP 34, Handbook on Concrete Reinforcement and Detailing.



U24CE4603	DIGITAL CONSTRUCTION	L	T	P	C
		0	0	4	2
Course Objectives:	To teach students how to build a complete 3D Architectural BIM model, extract accurate quantities automatically, and produce professional-grade construction documents and visualizations.				

Week	Expt. No.	Experiment Name (The Revit Workflow)
1	1	Setting up the Project: Defining Levels (Heights) and Grids (Layout).
2	2	Basic Walls: Drawing exterior and interior walls with specific thicknesses.
3	3	Floors & Ceilings: Creating multi-layer floor systems and false ceilings.
4	4	Doors & Windows: Placing parametric components and adjusting their sizes.
5	5	Roof Design: Creating flat roofs, sloped roofs, and roofs by extrusion.
6	6	Vertical Circulation: Designing Stairs (Dog-legged/Spiral) and Railings.
7	7	Curtain Walls: Designing glass facades with mullions and panels.
8	8	Site & Topography: Creating the ground surface, paths, and landscaping.
9	9	Room Tags & Color Plans: Labeling rooms and creating color-coded area maps.
10	10	Schedules & Quantities: Automatically counting doors and calculating wall volumes.
11	11	Detailing & Annotations: Adding dimensions, text, and 2D detail components.
12	12	Rendering & Walkthrough: Setting up lights, materials, and creating a video tour.
13-15	Project	Final Sheet Composition: Placing all views on a title block for printing.



Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify Revit interface and create basic architectural elements like levels, grids, and walls.	K4
CO2	Categorize parametric families and customize properties for doors, windows, and curtain walls.	K4
CO3	Discover automated schedules and material take-offs for accurate project estimation and data management.	K4
CO4	Develop professional construction views including dynamic sections, elevations, and 3D perspectives.	K5
CO5	Produce a comprehensive project portfolio featuring high-quality renderings, walkthroughs, and sheet layouts.	K6

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	1	-	3	-	-	-	1	2	-	2	3	1
CO2	2	2	3	-	3	-	-	-	2	2	-	2	3	2
CO3	3	3	2	2	3	-	-	-	2	3	1	2	3	3
CO4	2	2	2	-	3	-	-	-	2	3	-	2	3	2
CO5	2	-	3	-	3	1	1	1	3	3	1	3	3	3
CO	2	2	2	2	3	1	1	1	2	3	1	2	3	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Autodesk Revit 2024 Architecture: No Experience Required, Eric Wing, Sybex (Wiley), Latest Edition.
2	Revit Architecture 2026 for Designers · Bloomsbury Publishing (2026) · Douglas R. Seidler · 2026 Edition

Reference Books

1	Mastering Autodesk Revit 2024, Robert Najnus & Brian Mackey, Wiley, Latest Edition.
2.	Exploring Autodesk Revit 2023 for Architecture · CADCIM Technologies / Published by CADCIM Technologies · Prof. Sham Tickoo · 19th Edition

Web-links

<https://www.autodesk.com/certification/all-certifications/bim-building-design-professional>



U24CE7701	DESIGN PROJECT	L	T	P	C
		0	0	6	3
Course Objectives:	To enable students to apply civil engineering knowledge and relevant design standards to analyse, design, and document solutions for real-time civil engineering problems.				

Course Strategies:

The student shall work individually or in a group on a design-based problem approved by the Head of the Department under the guidance of a faculty member. The work shall involve problem definition, data collection, analysis, design calculations, preparation of drawings, and documentation using appropriate software tools and relevant IS codes. The student shall submit a comprehensive design report after completing the work to the satisfaction of the supervisor.

The student will be evaluated based on:

- Periodic reviews
- Final design report
- Viva voce examination by a team of examiners including one external examiner.

Total : 90 Periods

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Examine civil engineering problems through literature review, standards, and site data to define design requirements.	K4
CO2	Differentiate between alternative design methodologies, materials, and codes of practice for civil engineering applications.	K4
CO3	Interpret the behavior of civil engineering systems using engineering principles and analytical tools.	K4
CO4	Compare design calculations, drawings, and models to ensure safety, economy, and code compliance.	K4
CO5	Organize project findings and design decisions into structured technical reports and presentations.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	3	1	2	-	1	-	-	-	-	3	3	3	2
CO2	2	2	3	1	-	2	1	-	-	-	3	3	2	3
CO3	3	3	2	2	2	-	-	-	-	-	3	3	2	2
CO4	2	2	3	2	2	2	2	-	-	1	3	2	2	3
CO5	-	-	-	-	1	-	1	2	3	2	3	1	1	1
CO	2	2	2	2	2	2	2	2	3	2	3	3	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



U24CE7702		INTERNSHIP		L	T	P	C
				0	0	0	2
Course Objectives:	To enable students to acquire practical knowledge of civil engineering practices through industrial internship, fostering technical proficiency, professional ethics, communication teamwork, and problem-solving skills while bridging the gap between academic learning and real-world engineering applications						
STRATEGY							
Students are required to individually undergo summer internship training in reputed construction companies, consulting firms, government departments, research institutes, testing laboratories, or infrastructure organizations for the prescribed duration. The internship provides practical exposure to real-world civil engineering practices related to planning, structural design, construction management, surveying, geotechnical investigations, transportation systems, environmental engineering, quality assurance, and project execution. During the training period, students are expected to actively participate in site activities, laboratory investigations, technical documentation, and engineering practices while adhering to professional ethics and safety regulations. The internship bridges the gap between classroom learning and professional practice, enhances technical competence, analytical thinking, communication skills, and prepares students for multidisciplinary engineering environments. Students shall maintain a detailed internship diary and record of their learning throughout the training period. Upon successful completion of the internship, each student shall prepare a comprehensive internship report documenting the organization profile, nature of work undertaken, engineering practices observed, software and equipment utilized, technical knowledge gained, challenges encountered, and outcomes achieved. The report shall be submitted within ten days from the commencement of the subsequent semester. Student performance will be evaluated based on the internship report, presentation, and assessment guidelines prescribed by the academic regulations.							
				Total Periods:		4 Weeks	

Course Outcomes

On completion of the course, the student will be able to understand

COs	Statements	K-Level
CO1	Explain the professional practices, construction techniques, quality control measures, safety regulations, and engineering activities followed in civil engineering organizations and infrastructure projects.	K3
CO2	Apply civil engineering knowledge, modern engineering tools, professional ethics, teamwork, and communication skills to analyze field practices and prepare technical documentation based on internship experiences.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



U24CE7801	PROJECT WORK/ INTERNSHIP/ APPRENTICESHIP	L	T	P	C
		0	0	14	7
Course Objectives:	To develop the ability to solve a specific civil engineering problem starting from its identification and literature review to the successful solution. To train students in project planning, execution, report preparation, and to face project reviews and viva voce examination confidently.				
	STRATEGY				
	- The student works on a topic approved by the Head of the Department under the guidance of a faculty member. - The student may carry out the work in an industry, research organization, consultancy, or academic environment solving any real time problems. - After completion of the work to the satisfaction of the supervisor, the student shall submit a comprehensive project report. - The student will be evaluated based on periodic reviews, the final project report, and viva voce examination conducted by a team of examiners including one external examiner.				
Total Periods:				300	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify real-time civil engineering problems and define project objectives based on field or industry requirements.	K6
CO2	Apply appropriate analysis, design, and construction practices to solve engineering problems.	K6
CO3	Use modern engineering tools, software, and standards relevant to civil engineering projects.	K6
CO4	Demonstrate professional ethics, teamwork, and project management skills.	K6
CO5	Prepare comprehensive project reports and present technical findings effectively.	K6

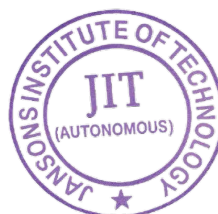
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	3	-	-	-	-	2	3	-	3	3	3	3
CO2	3	3	3	-	-	3	-	2	3	-	3	3	3	3
CO3	3	3	2	-	-	-	-	1	3	-	3	3	3	3
CO4	-	-	-	-	-	-	-	3	3	3	3	2	1	1
CO5	-	-	-	-	-	-	-	2	3	3	3	3	1	1
CO	3	2	2	-	-	1	-	2	3	1	3	3	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

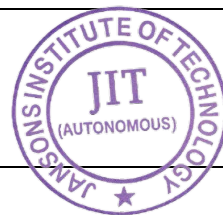


U24GE8501	INTRODUCTION TO WOMEN AND GENDER STUDIES	L	T	P	C
		3	0	0	3
Course Objectives:	To infer key gender concepts and feminist theories to understand gender as a social construct. It explores women's movements, gendered language, and media representations across global and local contexts. Students will critically analyze gender roles, power structures, and representations in society and media.				
Unit - I	CONCEPTS				12
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binarism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour - Gender Representation in Media and Literature -Feminist Movements and Gender Equality.					
Unit - II	FEMINIST THEORY				8
Intersectional Feminism - Post Colonial Feminism (Indian Context) – Transfeminism and Queer Feminist Perspectives Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist - Feminism and Cultural Representation - Contemporary Feminist Debates - Feminism and Literature - Feminism and Media Representation - Dalit Feminism (Indian Context).					
Unit - III	WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL				8
Rise of feminism in Europe and America. women's movement in India - Women's Suffrage Movement - Social Reform Movements and Women's Rights in India - Women and the Indian Freedom Struggle - Education and Women's Empowerment - Women and Legal Rights - Women in Politics and Leadership - Women and Economic Independence - Women's Organizations and Activism - Women and Human Rights - Feminist Activism in the Digital Age - Contemporary Challenges in Feminism.					
Unit – IV	GENDER AND LANGUAGE				8
Linguistic Forms and gender. gender and narratives - Gendered Communication Styles - Language and Gender Identity - Sexism in Language - Language and Power Relations - Politeness and Gender - Language and Gender Stereotypes - Gender Representation in Media Language - Gender and Discourse Analysis - Language Socialization and Gender - Language, Identity, and Culture - Future Directions in Gender and Language Studies.					
Unit - V	GENDER AND REPRESENTATION				9
Advertising and popular visual media - Gender and Representation in Alternative Media - Gender and social media - Gender Stereotypes in Media - Representation of Women in Film and Television - Masculinity in Media Representation - Gender Representation in News Media - Objectification and the Female Body in Media - Gender and Celebrity Culture - Representation of LGBTQ+ Identities in Media - Gender and Fashion Media - Gender Representation in Gaming and Digital Entertainment.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the foundation of gender concepts, constructed and maintained in society.	K2
CO2	Differentiate major feminist theoretical frameworks, critique gender inequalities and social structures.	K2/K4



COs	Statements	K-Level
CO3	Examine the historical development and impact of women's movements globally and in India, and evaluate their role in shaping gender discourse and policy.	K2/K5
CO4	Analyze the relationship between language and gender, including linguistic forms and gendered narratives, and how they influence social perceptions.	K2
CO5	Critically assess the portrayal of gender in mainstream, alternative, and digital media, recognizing patterns of representation, bias, and resistance.	K2/K6

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	-	-	-	-	-	3	-	3	-	-	-	3	-	-	-
CO2	-	-	-	-	-	3	-	2	-	-	-	3	-	-	-
CO3	-	-	-	-	-	3	-	2	-	-	-	3	-	-	-
CO4	-	-	-	-	-	3	-	3	-	-	-	3	-	-	-
CO5	-	-	-	-	-	3	-	3	-	-	-	3	-	-	-
CO	-	-	-	-	-	3	-	3	-	-	-	3	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

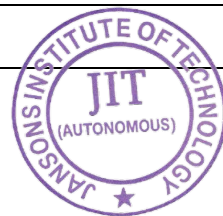
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Butler, Judith. <i>Gender Trouble: Feminism and the Subversion of Identity</i> . Routledge, 1990.
2	Beauvoir, Simone de. <i>The Second Sex</i> . Translated by Constance Borde and Sheila Malovany-Chevallier, Vintage, 2011.
3	Cameron, Deborah. <i>Gender and Language</i> . 2nd ed., Palgrave Macmillan, 2003.
4	Hall, Stuart, et al. <i>Representation: Cultural Representations and Signifying Practices</i> . Sage Publications, 2013.

Reference Links

1	https://archive.mu.ac.in/myweb_test/TYBA%20study%20material/Gender%20&%20Soc.pdf
2	https://revisesociology.com/2016/07/11/liberal-radical-marxist-feminist-perspectives-society-sociology/
3	https://ehne.fr/en/encyclopedia/themes/gender-and-europe/feminisms-and-feminist-movements/feminisms-and-feminist-movements-in-europe
4	https://egyankosh.ac.in/bitstream/123456789/58105/1/Unit13.pdf
5	https://gsdrc.org/topic-guides/gender/gender-and-media/



U24HS8501		ELEMENTS OF LITERATURE		L	T	P	C
				3	0	0	3
Course Objectives:		This course introduces the relevance of literature in developing reading, thinking, discussion, and writing skills while nurturing human sensibility. It provides basic knowledge of fiction, poetry, and drama and their key elements and techniques. It also presents major approaches to literary criticism and interpretation. Overall, it trains students to read and analyze literary texts with clarity and critical insight.					
Unit - I	RELEVANCE OF LITERATURE					9	
Enhances Reading, thinking, discussing, and writing skills, - Develops finer sensibility for better human relationship, - Increases understanding of the problem of humanity without bias, - Providing space to reconcile and get a cathartic effect.							
Unit - II	ELEMENTS OF FICTION					9	
Fiction – Narrative Techniques (Stream of Consciousness, Unreliable Narrator) fact, and literary truth, - Fictional modes and patterns, - Plot character and perspective - Characterization in Fiction - Narrative Perspective and Point of View - Time and Structure in Narrative - Setting and Atmosphere in Fiction							
Unit - III	ELEMENTS OF POETRY					9	
Poetry – Prosody (Meter, Rhyme, Rhythm) - Emotions and imaginations, - Figurative language, (Simile, metaphor, conceit, symbol, pun, and irony), - Personification and animation, - Rhetoric and trend - Imagery and Sensory Language - Tone, Mood, and Voice in Poetry - Sound Devices in Poetry - Symbolism and Allegory in Poetry - Forms and Structures of Poetry.							
Unit – IV	ELEMENTS OF DRAMA					9	
Drama as representational art (Modern Forms like Absurdist theatre, Postcolonial Drama beyond Tragedy/Comedy/ Satire) - Content mode and elements, - Theatrical performance, - Drama as narration, mediation, and persuasion, - Features of tragedy, comedy, and satire.							
Unit - V	LITERARY CRITICISM AND INTERPRETATION					9	
Approaches to Literary Criticism, - Modern Critical Theories, - Methods of Literary Interpretation, Practical Literary Analysis - Historical and Biographical Criticism - Reader-Response Criticism - Feminist and Gender Criticism - Postcolonial Criticism - Structuralism and Post-Structuralism - Comparative and Interdisciplinary Approaches.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	STATEMENTS	K-Level
CO1	Recall and explain the relevance of literature in enhancing reading, thinking, discussion, and writing skills and in developing human sensibility and unbiased understanding.	K2
CO2	Identify and explain the elements of fiction such as literary truth, fictional modes, plot, character, and narrative perspective.	K2/K3
CO3	Describe and illustrate poetic elements including figurative language, imagery, rhetoric, and poetic devices like simile, metaphor, symbol, and irony.	K2/K4
CO4	Explain and apply the elements of drama, theatrical modes, and the features of tragedy, comedy, and satire while reading dramatic texts.	K2
CO5	Summarize and apply major approaches to literary criticism and interpretation in practical literary analysis.	K2/K5

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	1	-	-	-	2	2	1	2	-	1	1	2	1
CO2	-	2	-	-	-	1	-	-	2	-	1	1	1	1
CO3	-	2	-	1	-	1	-	-	3	-	1	1	1	2
CO4	-	2	-	1	-	2	1	1	3	-	1	1	2	1
CO5	-	2	-	2	-	2	1	-	3	-	1	1	2	2
CO	-	2	-	1	-	2	1	0	3	0	1	1	2	1

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Text Books:

1	Kennedy, X. J., and Dana Gioia. <i>An Introduction to Literature</i> . 13th ed., Pearson, 2016.
2	Roberts, Edgar V., and Henry E. Jacobs. <i>Literature: An Introduction to Reading and Writing</i> . 11th ed., Pearson, 2015.
3	Foster, Thomas C. <i>How to Read Literature Like a Professor</i> . Harper Perennial, 2014.
4	Mays, Kelly J., editor. <i>The Norton Introduction to Literature</i> . 13th ed., W. W. Norton, 2018. Film Studies: An Introduction. Buckland, Warren. <i>Film Studies: An Introduction</i> . Hodder Education, 2015.
5	Barry, Peter. <i>Beginning Theory: An Introduction to Literary and Cultural Theory</i> . 4th ed., Manchester UP, 2017.

Reference Books:

1	Eagleton, Terry. <i>Literary Theory: An Introduction</i> . Anniversary ed., University of Minnesota Press, 2008.
2	Richards, I. A. <i>Practical Criticism</i> . Routledge, 2001.
3	Abrams, M. H., and Geoffrey Galt Harpham. <i>A Glossary of Literary Terms</i> . 11th ed., Cengage Learning, 2015.
4	Damrosch, David. <i>The Cambridge Introduction to Literature</i> . Cambridge UP, 2012.
5	Tyson, Lois. <i>Critical Theory Today: A User-Friendly Guide</i> . 3rd ed., Routledge, 2014.

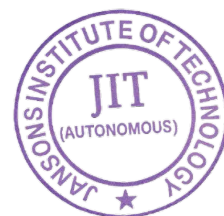
U24HS8502		FILM APPRECIATION		L	T	P	C
				3	0	0	3
Course Objectives:		In this course on film appreciation, the students will introduce broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.					
Unit - I	THE COMPONENT OF FILMS					9	
The material and equipment, - The story, screenplay, and script, -The actors, crew members, and the director, - The process of film making... Structure of a Film Narrative - Cinematography and Visual - Composition - Editing and Post-Production Techniques - Sound, Music, and Dialogue in Film - Genres and Styles of Cinema - Film Analysis and Interpretation.							
Unit - II	EVOLUTION OF FILM LANGUAGE					9	
Film language, form, movement etc., - Early cinema... silent film (Particularly French), - The emergence of feature films: Birth of a Nation – Digital Cinema & Streaming platforms – Globalization of Film Industries – Representation and Diversity in Modern Cinema							
Unit - III	FILM THEORIES AND CRITICISM/APPRECIATION					9	
Realist theory, - Psychoanalytic, Ideological, Feminists, - How to read documentaries, - Film Criticism / Appreciation - Documentary Styles and Techniques - Audience Reception and Film Interpretation - Cultural and Social Context in Film - Ethics and Representation in Documentary Films.							
Unit – IV	DEVELOPMENT OF FILMS					9	
Representative Soviet films, - Representative Japanese films, - Representative Italian films, - Representative Hollywood film and the studio system - French New Wave Cinema - German Expressionist Cinema - Indian Parallel Cinema - Global Film Movements and Cultural Influence - Film Festivals and International Recognition - Contemporary Trends in World Cinema.							
Unit - V	INDIAN FILMS					9	
The early era, - The important films made by the directors, - The ancient regional films, - The documentaries in India – Parallel Cinema Movement (Satyajit Ray, Shyam Benegal) – Contemporary Indian Cinema (Regional industries – Tamil, Malayalam, Marathi) - Music, Dance, and Narrative Style in Indian Films - Film Technology and Production in India - Indian Cinema in the Global Context.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	STATEMENTS	K-Level
CO1	Explain the fundamental components of films, including material and equipment, story, screenplay, script, roles of actors and crew, and the overall structure and process of filmmaking.	K2
CO2	Describe the evolution of film language and form, including movement, early cinema, silent film traditions, and the emergence of feature-length films.	K2
CO3	Interpret major film theories and approaches to film criticism and appreciation, including realist, psychoanalytic, ideological, and feminist perspectives, and apply methods to read documentaries.	K2/K4
CO4	Analyze the development of world cinema through representative Soviet, Japanese, Italian, and Hollywood films, including the impact of the studio system.	K2/K5
CO5	Summarize the growth of Indian cinema, including early era films, significant directors and their works, regional film traditions, and documentary filmmaking in India.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, K6 – Create



CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	1	1	-	-	2	-	-	-	2	-	1	1	-	1
CO2	1	2	-	-	-	-	-	-	2	-	1	1	-	1
CO3	-	2	-	1	-	2	2	-	2	-	1	2	1	2
CO4	-	2	-	1	-	2	-	-	2	-	1	1	1	1
CO5	1	2	-	-	-	2	1	-	2	-	1	1	2	1
CO	1	2	0	0	0	1	1	-	2	-	1	1	1	1

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Text Books:

1	Bordwell, David, and Kristin Thompson. Film Art: An Introduction. 12th ed., McGraw–Hill Education, 2019.
2	Monaco, James. How to Read a Film: Movies, Media, and Beyond. 4th ed., Oxford UP, 2009.
3	Understanding Movies. Giannetti, Louis. Understanding Movies. 14th ed., Pearson, 2017.
4	Film Studies: An Introduction. Buckland, Warren. Film Studies: An Introduction. Hodder Education, 2015.
5	Looking at Movies. Barsam, Richard, and Dave Monahan. Looking at Movies: An Introduction to Film. 6th ed., W. W. Norton, 2019.

Reference Books:

1	Kracauer, Siegfried. Theory of Film: The Redemption of Physical Reality. Princeton UP, 1997.
2	Film Theory and Criticism. Braudy, Leo, and Marshall Cohen, editors. Film Theory and Criticism. 8th ed., Oxford UP, 2016.
3	What Is Cinema? Bazin, André. What Is Cinema? Translated by Hugh Gray, University of California Press, 2005.
4	The Oxford History of World Cinema. Nowell-Smith, Geoffrey, editor. The Oxford History of World Cinema. Oxford UP, 1996.
5	Introduction to Documentary. Nichols, Bill. Introduction to Documentary. 3rd ed., Indiana UP, 2017.



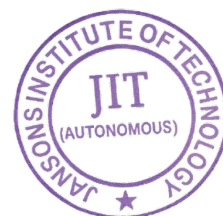
U24CY8501		DISASTER RISK REDUCTION AND MANAGEMENT			L	T	P	C
					3	0	0	0
Course Objectives:		To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management and acquaint with the skills for planning and organizing disaster response						
Unit - I	HAZARDS, VULNERABILITY AND DISASTER RISKS					9		
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced – Earthquake, Landslide, Flood, Drought, Fire etc. Technological disasters - Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc. Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, Inter relations between Disasters and Sustainable development Goals								
Unit - II	DISASTER RISK REDUCTION (DRR)					9		
Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System. Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.								
Unit - III	DISASTER MANAGEMENT					9		
Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)								
Unit – IV	TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT					9		
Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management								
Unit - V	DISASTER MANAGEMENT: CASE STUDIES					9		
Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters. Landslide Hazard Zonation: Earthquake Vulnerability. Assessment of Buildings and Infrastructure: Case Studies. Drought Assessment: Case Studies. Coastal Flooding: Storm Surge Assessment. Floods: Fluvial and Pluvial. Flooding: Case Studies; Forest Fire: Case Studies. Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management. Field work, Mock drill.								
					Total Periods:		45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamental concepts of hazards, vulnerability, and risks, and describe the diverse impacts of natural and human-induced disasters on society and the environment.	K2
CO2	Summarize the disaster risk reduction (DRR) framework and the roles of various stakeholders in implementing prevention, mitigation, and early warning strategies	K2
CO3	Outline the institutional frameworks, legislative acts, and policies governing disaster management and post-disaster recovery in the Indian context.	K2
CO4	Describe the integration of modern tools like GIS and IT in disaster response, and discuss the essential components of climate-resilient infrastructure and relief operations.	K2
CO5	Interpret real-world disaster scenarios through case studies to understand the effectiveness of mitigation strategies and the importance of field-based preparedness like mock drills.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	2	2	-	-	-	3	1	-	-	-	2	2	1	2	2
CO2	1	-	3	-	-	3	2	2	1	-	2	1	1	3	1
CO3	-	-	-	-	-	3	3	-	2	2	1	1	2	2	-
CO4	2	2	3	2	3	3	-	-	2	2	3	3	2	3	2
CO5	1	3	3	3	2	3	2	3	3	1	3	2	3	3	1
CO	1.5	2	3	2.5	2.5	3	2	2.5	2	2	2	2	2	2.5	1.5

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2	Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3	Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
4	Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.

Reference Books

1	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2	Government of India, National Disaster Management Policy, 2009.
3	Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

Website Link

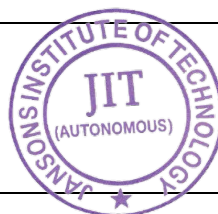
1. https://onlinecourses.swayam2.ac.in/ini25_hs32/preview



U24GE8502	WELL BEING WITH TRADITIONAL PRACTICES- YOGA, AYURVEDA AND SIDDHA	L	T	P	C
		3	0	0	0
Course Objectives:	Promote an enjoyable and balanced lifestyle through engaging health-oriented activities, encourage practical lifestyle changes to prevent common health disorders, enable effective emotional regulation across all situations, develop awareness of affordable and nutritious dietary practices, and strengthen natural immunity to enhance resistance against various health problems.				
Unit - I	INTRODUCTION TO YOGA				9
Meaning and definition of Yoga- Origin and historical development of Yoga- Importance of Yoga in modern life- Objectives and aims of Yoga- - Types of yoga- The Eight Limbs of Yoga-What yoga can bring to our life -Yoga and meditation. Principles and guidelines for yoga practice- Yogic diet and nutrition -Asanas: Meaning, types, and benefits- Classification of Asanas-Tadasana –Vrikshasana - Trikonasana – Padahastasana.					
Unit - II	YOGA FOR HEALTH AND WELL-BEING AND YOGA MUDRAS				9
Yoga for stress management- Yoga for improving concentration and memory-Yoga and immunity- Yoga Mudras and their Significance - Chin Mudra and Jnana Mudra for Mental Clarity- Prana Mudra for Energy Activation - Varuna Mudra for Hydration and Skin Health- Gyan Mudra for Concentration and Memory - Anjali Mudra for Emotional Balance-Mudras for Stress Reduction and Relaxation.					
Unit - III	ROLE OF AYURVEDA IN MAINTAINING HEALTH				9
Introduction to Ayurveda-Objectives and scope of Ayurveda-Fundamental Principles-Panchamahabhuta Theory (Five elements) - Tridosha Theory – Vata, Pitta, Kapha-Sapta Dhatus (Seven body tissues)-Malas (Body waste products)-Agni (Digestive fire)-Ojas (Vital essence and immunity)- Basic Therapies- Panchakarma (Introduction)- Rasayana (Rejuvenation therapy)- Herbal formulations.					
Unit – IV	PREVENTIVE AND LIFESTYLE MEDICINE IN AYURVEDA				9
Body constitution analysis-Genetic correlations and Ayurveda-Ayurveda and Lifestyle Disorders: Diabetes (Madhumeha) management-Hypertension and cardiovascular health-Stress and psychosomatic disorders-Concept of Satva, Rajas, Tamas-Mental health management-Sadvritta and ethical living-Meditation and mind-body balance.					
Unit - V	SIDDHA PREVENTIVE HEALTHCARE PRACTICES				9
Philosophy and origin of the Siddha system- Five elements (Pancha Bootham) and their role in health-Concept of three humors (Mukkutram) in disease prevention- Kayakalpa therapy for rejuvenation and longevity- Varma therapy and its role in preventive care- Role of traditional dietetics (Pathiyam) in maintaining health- Geriatric care and healthy ageing in Siddha-Siddha Detoxification Practices - Concept of spiritual discipline in disease prevention - Mind–body harmony in Siddha philosophy.					
Total Periods:					45

Course Outcomes

On completion of the course, the student able to



CO	Statements	K-Level
CO1	Demonstrate knowledge of yoga practices that promote mental clarity and reduce stress.	K3

CO	Statements	K-Level
CO2	Apply yoga techniques and therapeutic mudras effectively to enhance emotional balance and improve overall mental well-being.	K3
CO3	Explain the fundamental principles of Ayurveda and their role in maintaining health.	K3
CO4	Analyze the role of body constitution, and Ayurvedic approaches in the management of lifestyle disorders and mental well-being.	K3
CO5	Describe the philosophy and principles of the Siddha system for rejuvenation and healthy aging.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO - PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	1	-	-	-	-	2	-	-	-
CO2	-	-	-	-	-	1	-	-	-	-	2	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	2	-	-	-
CO4	-	-	-	-	-	1	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	1	-	-	-	-	2	-	-	-
CO	-	-	-	-	-	1	-	-	-	-	2	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

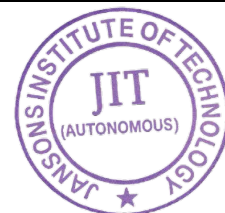
1	Yoga for Beginners - 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California.
2	Yoga for Promotion of Positive Health- R. Nagarathna& H. R. Nagendra, 2 nd Edition Published by Swami Vivekananda Yoga Prakashana.
3	Principles of Ayurveda - Dr. C. S. Munichandra, Kumar Publications, BaghAmberpet, Hyderabad, Telangana, India.
4	Siddha Maruthuvam (Sirappu)- Dr. R. Thiyagarajan, Published by Department of Indian Medicine and Homeopathy.

Reference Books

1	Light on Yoga: The Bible of Modern Yoga- Iyengar, B.K.S. (2015). HarperCollins Publishers India Pvt. Ltd., New Delhi, India.
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2	Saraswati, Swami Satyananda. (2008). Asana Pranayama Mudra Bandha, Yoga Publications Trust, Munger, Bihar, India (Bihar School of Yoga).
3	Light on Yoga: The Bible of Modern Yoga-Narayana, K, Scientific Publishers (India).
4	Textbook of Ayurveda – Vol. I: Fundamental Principles-Murthy, K. R. S., <i>Chaukhamba</i> Orientalia.
5	Ayurveda and Mental Health- Dr. N. S. Rathore, Dr. N. S. Rathore, SAGE Publications India Pvt. Ltd.
6	Siddha Therapy & Kayakalpa, Siddha Therapy & Kayakalpa,, CCRIMH / Siddha Research Publications,Janakpuri, New Delhi – 110058, India.
7	https://youtu.be/7CDb2cGnd4s .
8	https://youtu.be/_oDaV3U-KOg?si=FmYM7TvQs1y59VS6
9	https://youtu.be/S6bqxsjikVs?si=hxNBRH6TtKtHB6Z5

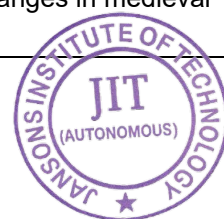


U24GE8503	HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	L	T	P	C
		3	0	0	3
Course Objectives:	To make the student understand the historical evolution of science and technology in India across ancient, medieval, colonial, and post-independence periods, develop historical thinking for engineers, examine the interaction between science, technology, and society, and analyse policy frameworks, institutional growth, and the social impact of modern technologies in a globalizing India.				
Unit - I	PRINCIPLES AND PERSPECTIVES OF SCIENCE & TECHNOLOGY				9
Meaning of History: Purpose, scope, and relevance to science and technology. Historical Thinking for Engineers: Objectivity, causation, generalization, Interpretation vs. evidence, Lessons from history for technological development. Science & Technology Concepts: Definitions of science and technology, Scope and importance for society and engineering, Interaction between science, technology, and society.					
Unit - II	EVOLUTION OF INDIAN SCIENCE THROUGH HISTORICAL PERSPECTIVES				8
Overview of historiography of science and technology in India. Key contributors and their works: D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina. Approaches and methods for studying the evolution of Indian science and technology.					
Unit - III	SCIENTIFIC AND TECHNOLOGICAL PROGRESS IN ANCIENT INDIA				9
Technological developments- prehistoric period - Stone tools and early innovations- Use of fire and primitive techniques, Emergence of agriculture and its influence on technological progress- Impact of agriculture on tools and settlement, Science and technology in the Vedic and Later Vedic periods- Knowledge of astronomy, mathematics, and medicine, Scientific and technological advancements from the 1st century AD to C-1200- Progress in mathematics, astronomy, and medicine-Temple architecture, metallurgy, and engineering.					
Unit – IV	SCIENCE AND TECHNOLOGY IN INDIA: MEDIEVAL AND COLONIAL PERIODS				11
Legacy of technology in Medieval India- Technological advancements in agriculture, irrigation, metallurgy, textiles, architecture, and craft production. Indo–Arab Interactions and Knowledge Exchange- Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences, Science and Technology on the eve of British conquest, Indian response to Western Science-Growth of techno-scientific institutions.					
Unit - V	SCIENCE AND TECHNOLOGY IN POST-INDEPENDENCE INDIA				8
The relationship between science, technology, and development in post-independent India, Evolution and formulation of science and technology policies, Major developments and achievements in the field of science and technology, science and technology in a globalizing Indian economy - Social impacts of emerging technologies, with special reference to Information Technology and Biotechnology - ISRO, DRDO, BARC, CSIR contributions.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Explain the scope of history, apply historical thinking, and analyse the role of science and technology in society.	K2
CO2	Extend historiographical approaches to study and evaluate the evolution of Indian science and contributions of key scholars.	K2
CO3	Relate technological and scientific developments in ancient India to societal progress from the prehistoric period to the 12th century.	K2
CO4	Interpret scientific and technological developments and knowledge exchanges in medieval and colonial India.	K2



CO	Statements	K-Level
CO5	Summarize the evolution, policies, achievements, and societal impacts of science and technology in post-independence India.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	1	-	-	1	-	-	1	-	-	-	2	1	-	-
CO2	2	-	-	1	-	-	1	1	1	1	2	1	-	-
CO3	2	-	-	1	-	-	1	1	1	1	2	1	-	-
CO4	2	-	-	1	-	-	1	1	1	1	2	1	-	-
CO5	2	-	-	1	-	-	1	1	1	1	2	1	-	-
CO	2	-	-	1	-	-	1	1	1	1	2	1	-	-

Correlation levels 1, 2 and 3 are as defined below:

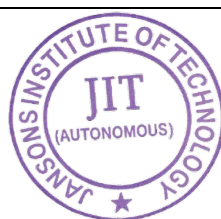
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Dharampal, Indian Science and Technology in the Eighteenth Century. Impex India, 1st Edition, July 1971.
2	Dr.Binod Bihari Satpathy, History of Science, Technology, and Medicine in India, Himalaya Publishing House, 2025.
3	Suvabrata Sarkar. History of Science, Technology, Environment, Routledge India, Taylor & Francis, London, 2022.
4	Arun Kumar Jha & Seema Sahay. Aspects of Science and Technology in Ancient India. Routledge India, 2023.
5	Kuppuram G & Kumudamani K. History of Science and Technology in India. Sundeep Prakashan, 1990.

Reference Books

1	Subbarayappa B.V, Science in India: A Historical Perspective, Rupa Publications India, 2025
2	Nandan Bhattacharya, The History and Philosophy of Science: An Indian Perspective, Routledge India, 2023.
3	Sarma K.V, A History of the Kerala School of Hindu Astronomy, Vishveshvarananda Institute of Sanskrit & Indological Studies, 1972.
4	Jaggi O.P, History of Science and Technology in India, Atma Ram & Sons, 1977.
5	Kamlesh Mohan, Science and Technology in Colonial India, <i>Routledge</i> (Taylor & Francis Group), 2023.

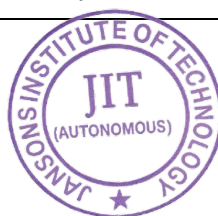


U24GE8504	POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY			L	T	P	C
				3	0	0	3
Course Objectives:		This course begins with an overview of human needs and desires and examines how various political and economic systems attempt to address them. It further explores critiques of these systems based on historical implementations and considers potential directions for the future.					
Unit - I	HUMANISM					9	
Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems - Human Dignity and Ethical Responsibility - Human Rights and Social Justice - Compassion and Empathy in Society - Peace and Conflict Resolution - Cultural Diversity and Human Unity - Sustainable Development and Human Welfare.							
Unit - II	CAPITALISM					9	
Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. Fascism and totalitarianism. World war I and II. Cold war - Corporate Capitalism and Multinational Corporations - Financial Capitalism and Banking Systems - Stock Markets and Investment Culture - Capitalism and Technological Innovation - Capitalism and Economic Inequality.							
Unit - III	COMMUNISM					9	
Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models - Revolutionary Theory and Social Transformation - Communist Movements in the 20th Century - Cold War and the Spread of Communism - Communism in the Contemporary Global Context.							
Unit – IV	HOLISTIC SELF GOVERNANCE					9	
Welfare state. Relation with human desires. Empowered human beings, satisfaction. Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives - Harmony between Individual and Society - Decentralized Decision-Making Systems - Human Dignity and Social Justice - Cultural Values and Social Harmony.							
Unit - V	CIVILIZATIONAL SUSTAINABILITY					9	
Relationship with nature. Essential elements of Indian civilization. Technology as driver of society, Role of education in shaping of society. Future directions - Spiritual Ecology and Environmental Ethics - Climate Change and Global Sustainability - Resilience of Civilizations through Adaptation - Indigenous Ecological Wisdom - Cultural Heritage and Continuity.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Recall the fundamental concepts of humanism, holistic thought, human desires, harmony in self, relationships, society, nature, and societal systems.	K1
CO2	Explain the principles, features, and impacts of capitalism and communism, including market systems, class theories, and major global political-economic developments.	K2



COs	Statements	K-Level
CO3	Apply the concepts of human harmony, welfare state, decentralized governance, and community-based living to interpret social and governance models.	K3
CO4	Analyze different ideological frameworks such as capitalism, communism, fascism, and holistic self-governance, and compare their societal and economic outcomes.	K2/K4
CO5	Evaluate civilizational sustainability, the role of technology and education in shaping society, and formulate value-based approaches to self-governance inspired by thinkers like Mahatma Gandhi	K2/K5+

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

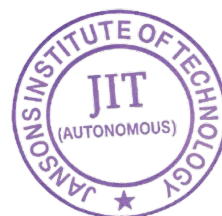
CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	1	1	-	-	-	2	2	-	-	-	1	-	1	-
CO2	-	2	-	-	-	2	2	-	1	-	1	-	1	1
CO3	-	2	1	-	-	3	2	1	1	-	2	1	2	2
CO4	-	3	1	1	-	3	2	-	2	-	2	1	2	2
CO5	-	2	2	1	-	3	3	1	2	1	3	2	3	2
CO	0	2	1	0	-	3	2	0	1	0	2	1	2	1

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Reference Books

1	Thomas Piketty – Capital in the Twenty-First Century (2014).
2	Amartya Sen – Development as Freedom (1999).
3	Vandana Shiva – Staying Alive: Women, Ecology, and Development (1989).
4	Elinor Ostrom – Governing the Commons (1990).
5	Joseph Stiglitz – Globalization and Its Discontents (2002).

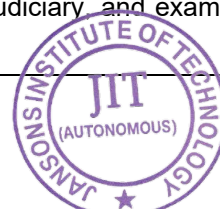


U24GE8505	STATE, NATION BUILDING AND POLITICS IN INDIA	L	T	P	C
		3	0	0	3
Course Objectives:	This course provides an understanding of the state, its functioning, and the role of politics and sovereignty in a globalized world. It covers the national movement, constitutional development, and the rationale for India's Parliamentary-federal system. The course also examines the philosophy of the Constitution and the evolving political system. Finally, it addresses contemporary challenges to national integration and nation-building, fostering a vision for a stronger India.				
Unit - I	NEED AND ROLE OF STATE AND POLITICS				9
State — Politics — Understanding the need and role of State and politics Concept of the State in India, Politics and Political Process in India, Constitutional Framework, Democracy and Governance, Citizenship, Rights and Social Justice					
Unit - II	CONCEPT OF SOVEREIGNTY				9
Development of Nation-State, sovereignty, sovereignty in a globalized world, Evolution of the Indian Nation-State, Post-Independence Nation-Building, Concept of Sovereignty in India, Challenges to Sovereignty in a Globalized World, Regional, Economic, and Political Dimensions of Sovereignty.					
Unit - III	STATE AND ITS ORGANS				9
Organs of State - Structure and Functions of the Executive, Role and Composition of the Legislature, Organization and Powers of the Judiciary, Principle of Separation of Powers and Checks & Balances, Forms of Government: Unitary vs. Federal and Presidential vs. Parliamentary.					
Unit – IV	THE CONSTITUTION OF INDIA				9
The idea of India— 1857 and the national awakening, 1885 Indian National Congress and development of national movement — its legacies, Constitution making and the Constitution of India, Goals, objective and philosophy—federal system.					
Unit - V	NATIONAL INTEGRATION AND CHALLENGES OF NATION-BUILDING				9
National integration and nation-building, Challenges of nation-building — State against democracy (Kothari) New social movements, The changing nature of Indian Political System, the future scenario.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Recall the basic concepts of State, politics, sovereignty, citizenship, constitutional framework, and national integration in the context of India	K1
CO2	Explain the need and role of the State, organs of government, constitutional philosophy, and the evolution of the nation-state and sovereignty.	K2
CO3	Apply the principles of democracy, governance, separation of powers, and federal structure to interpret contemporary political and administrative processes.	K3
CO4	Analyze the structure and functions of the Executive, Legislature, and Judiciary, and examine challenges to sovereignty, globalization, and nation-building.	K4



COs	Statements	K-Level
CO5	Evaluate issues related to national integration, social justice, and new social movements, and develop reasoned perspectives on the future of the political system and governance models.	K5

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

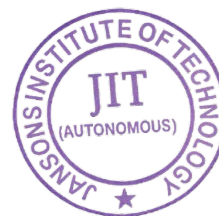
CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	1	1	-	-	-	2	1	-	-	-	1	-	1	-
CO2	1	2	-	-	-	2	2	-	1	-	1	-	1	-
CO3	-	2	1	-	-	3	2	1	1	-	2	1	2	1
CO4	-	3	-	1	-	3	2	-	2	-	2	1	2	2
CO5	-	2	1	1	-	3	3	2	3	1	3	2	3	2
CO	0	2	0	0	-	3	2	1	1	0	2	1	2	1

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Reference Books

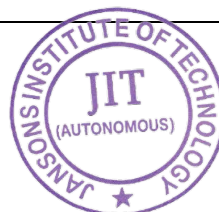
1	Madhav Khosla, The Indian Constitution, Oxford University Press. New Delhi, 2012.
2	Granville Austin – The Indian Constitution: Cornerstone of a Nation (Oxford University Press, 1966; revised editions)
3	Pratap Bhanu Mehta – The Burden of Democracy (Penguin, 2003)
4	Ramachandra Guha – India After Gandhi (HarperCollins, 2007)
5	Niraja Gopal Jayal – Citizenship and Its Discontents (Harvard University Press, 2013)



U24GE8506	INDUSTRIAL SAFETY			L	T	P	C
				3	0	0	3
Course Objectives:		It enables students to understand workplace exposures and hazards, and to conduct and participate in various industrial safety activities. The course also equips learners to assess hazards and their consequences using appropriate risk assessment techniques.					
Unit - I	SAFETY TERMINOLOGIES					9	
Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability-Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS - Safety Culture and Safety Climate.							
Unit - II	STANDARDS AND REGULATIONS					9	
Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis-code of practice IS 15656:2006 – Behaviour -Based Safety (BBS) and Legal Compliance.							
Unit - III	SAFETY ACTIVITIES					9	
Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment - Digital Safety Management Systems (E-Safety Reporting).							
Unit – IV	WORKPLACE HEALTH AND SAFETY					9	
Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release - Industrial Hygiene Monitoring and Control							
Unit - V	HAZARD IDENTIFICATION TECHNIQUES					9	
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment - Bow-Tie Risk Analysis Method.							
Total Periods:						45	

On completion of the course, the student can

COs	Statements	K - Level
CO1	Explain the basic concepts of safety.	K2
CO2	Describe statutory regulations and safety standards.	K2
CO3	Outline workplace safety activities.	K2
CO4	Interpret the impact of occupational exposures and their remedies.	K2
CO5	Summarize risk assessment techniques.	K2



	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	3	1	-	-	-	-	-	-	-	2	-	1
CO2	2	3	2	2	-	-	-	-	-	-	-	-	3	1
CO3	2	3	2	3	-	-	-	-	-	-	-	2	2	-
CO4	2	2	3	2	-	-	-	-	-	-	-	-	2	1
CO5	2	2	3	2	-	-	-	-	-	-	-	2	3	1
CO	2	2	3	2	-	-	-	-	-	-	-	2	3	1

Text Books

1	R.K. Jain and Prof. Sunil S. Rao,(2019) Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2	L. M. Deshmukh (2021) Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

Reference Books

1	Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.
2	John Ridley & John Channing (2008) Safety at Work: Routledge, 7th Edition.
3	Dan Petersen (2003) Techniques of Safety Management: A System Approach.
4	Alan Waring.(1996). Safety management system: Chapman &Hall,England
5	Society of Safety Engineers (2020) , USA

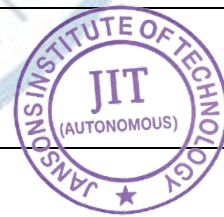


U24MA8501	Exploring Vedic Mathematics	L	T	P	C
		3	0	0	3
Course Objectives:	Familiarize students with the concepts of Vedic mathematics and the contributions made by Indian mathematicians. Through the use of Vedic methods, it seeks to develop quick and precise computational abilities.				
Unit – I	Contribution of Indian Mathematicians				9
Contribution of Indian Mathematicians: Pingala, Aryabhata I, Brahmagupta, Varahmihir, Bhaskara I, Aryabhata II, Bhaskara II, Neelkanth Somayya, Srinivasa Ramanujan, Bharti Krishna Tirtha – History of Vedic Mathematics and its Features.					
Unit – II	Vedic Mathematics: Addition and Subtraction				9
Sutras and Upsutras – Addition: without carrying, Dot Method (Shudh Vidhi) – Subtraction: Nikhilam Navatashcaramam Dashatah (All from 9 Las from 10) – Fraction: Addition and Subtraction: Urdhva Tiryakbhyam (Vertically and Crosswise).					
Unit – III	Vedic Mathematics: Multiplication and Division				9
Multiplication: Base Method: Nikhilam Sutra (any two numbers upto three digits) – Multiplication by Urdhva Tiryak Sutra: up to 3-digit numbers by multiplying vertically and diagonally, summing the results, and managing carries – Division by Urdhva Tirvak Sutra (Vinculum Method).					
Unit – IV	Vedic Mathematics: Squares and Cubes				9
Squares of any two-digit numbers: Base Method – Square of numbers ending in 5: Ekadhikena Purvena Sutra (By one more than the previous) - Yavadunam Sutra (By the Deficiency) – Cubes: Yavadunam Sutra (By the Deficiency).					
Unit – V	Vedic Mathematics: Solution of Linear Equations				9
Introduction of simple equations - Solutions of simple equations – Solutions of Linear Equations in one variable: Paravartya Yojayet (Transpose and Apply) - Solutions of Linear Equations in two variables: Ratio Comparison (Special Case), Sunyam Samyasamuccaye (When Sum is Same), Anurupye Sunyamanyat (If in ratio, the other is zero) - Practical applications of linear equations.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO01	Investigate the history of Indian mathematics, emphasizing important contributions from mathematicians and the development of Vedic Mathematics, while acknowledging India's important role in worldwide mathematical advancement	K2
CO02	Utilize Vedic sutras and upsutras to execute addition and subtraction effectively using approaches like the dot method and Nikhilam sutra and tackle fractional addition and subtraction issues with precision and swiftness	K3
CO03	Apply the base technique and Urdhva Tiryak sutra for multiplication and division, while employing vinculum methods to streamline calculations and enhance computational speed with large numbers	K3
CO04	Employ Vedic techniques such as Ekadhikena Purvena and Yavadunam sutra to calculate	K3



	squares and cubes, effectively addressing numerical problems while enhancing their mental math skills.	
CO05	Resolve basic linear equations with one or two variables through Vedic methods, and apply these methods in practical scenarios to enhance their problem solving and reasoning skills	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO–PO–PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO01	2	1	-	-	-	2	-	2	-	1	-	-	-	-
CO02	3	2	-	-	1	-	-	-	-	-	-	-	-	-
CO03	3	2	1	-	2	-	-	-	-	-	-	-	-	-
CO04	3	2	-	-	1	-	-	-	-	-	-	-	-	-
CO05	3	3	2	-	1	1	-	-	1	1	1	-	-	-
CO	2.8	2	1.5	-	0.8	1.5	-	-	1	1	1	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

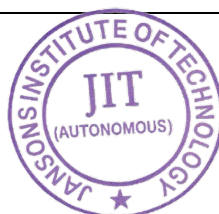
1.Slight 2. Moderate 3. Substantial (High)

Text Books

1	T.S. Bhanumurthy, A Modern Introduction to Ancient Indian Mathematics, Wiley Eastern Ltd, New Delhi.
2	Rajes Kumar Thakur, The Essential of Vedic Mathematics, Rupa Publications, New Delhi, 2019.
3	Atul Gupta, The Power of Vedic Maths, Second Edition, Jaico Publishing House, Mumbai, 2010
4	Ramnandan Shastri, For Competitive Exams Vedic Mathematics Made Easy, Arihant Publishers, New Delhi, 2012.
5	Chaitanaya A. Patil, Learn Vedic Speed Mathematics Systematically & Step by Step, 2018

Reference Books

1	S. K. Kapoor, Learning Vedic Mathematics on First Principles, Lotus Press, 2007.
2	Vandana Singhal, Vedic Mathematics For All Ages, Motilal Banarsidas Publishers.
3	Dhaval Bathia, Vedic Mathematics Made Easy, First Edition, Jaico Publishing House, Mumbai, 2005
4	Bharathi Krisna Tirthaji, Vedic Mathematics, Original Edition, Motilal Banarsidass Publisher & New Delhi, 1990.
5	V.G. Unkalkar, Magical World of Mathematics: Vedic Mathematics, Vandana publishers, Bangalore.



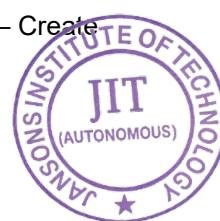
U24MA8502	Fundamentals of Astrology	L	T	P	C
		3	0	0	3
Course Objectives:	Provide basic knowledge of astronomical and astrological principles, as well as to foster comprehension of planetary effects and chart interpretation, including Muhurtham and horoscope matching.				
Unit – I	Foundations of Astrology	9			
Origin and introduction of Astrology - History of Astrology – Astrology: In terms of Science and Mathematics (Degree System) - Importance of Astrology. Detailed study of Universe and Galaxies related to astrology.					
Unit – II	Zodiac and Planets	9			
The Zodiac and the Solar system - signs of the Zodiac – Planets - Motion of Planets - Retrograde and Direct motion of Planets. Tithi, Vaara, Nakshatra, Yoga and Karana (Panchangm). Various systems in astrology (Nadi methods, Jamakkol Prasanam, Deva/Ashtamangala Prasanam)					
Unit – III	Astronomical Concepts	9			
Signs and Constellations – Vakkaram (reverse order) (Nodes (Rahu and Kethu) Sayana and Nirayana system - Latitude and Longitudes - Equator, Ecliptic - Lunar Eclipse, Solar Eclipse, Mundane astrology.					
Unit – IV	Planetary Effects	9			
Significations of Signs and Planets - Effect of Planets in 12 Houses – Navamsam – varga chakram - Strength of Planets for house judgment - Dasha System - Effects of Conjunction of one or more Planets.					
Unit – V	Chart Analysis Basics	9			
Rules and general conditions for analyzing a chart - Judgement of Houses / Bhava sign in general - Matching of Horoscopes - Introduction to Muhurtham, Yogangal: Dharma karmaathi yogam, neecha banga raja yogam, sivaraja yogam, vibareetha raja yogam, parvatha raja yogam, Gaja Kesari yogam, Chandra-Mangala yogam.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K - Level
CO01	Explain the origin, history, nature, and importance of Astrology as a science and art.	K2
CO02	Describe the Universe, zodiac, solar system, planets, and their direct and retrograde motions.	K2
CO03	Explain planets, signs, constellations, Rahu–Ketu, Sayana–Nirayana systems, and basic astronomical concepts.	K2
CO04	Describe significations of signs and planets, their effects in houses, planetary strength, Dasha, and conjunctions.	K2
CO05	Explain the general rules of chart analysis, house judgment, horoscope matching, and basics of Muhurtham.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO–PO–PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO01	3	2	--	-	-	1	-	2	-	-	1	-	-	-
CO02	3	3	2	-	-	1	-	2	-	-	1	-	-	-
CO03	3	3	2	1	-	1	-	2	-	-	1	-	-	-
CO04	3	3	3	2		2	-	2	1	-	1	-	-	-
CO05	3	3	3	3	1	2	-	2	2	1	1	-	-	-
CO	3	2.8	2.5	2	1	1.8	-	2	1.5	1	1	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1.Slight 2. Moderate 3.Substantial(High)

Text Books

1.	Pulippani Jothidam (300 Astrology Rules from an Ancient Tamil Work , Nakkirar S.Natarajan, Sptarishi Publications.
2.	Astrology For Beginners by Bangalore Venkata Raman
3.	GK win Degree System of Astrology: New Method of Astrology, Tirupur S.Gopala Krishnan (GK), Gk publications
4.	Prashna Shastra: Scientific Applications of Horary Astrology (Set of 2 Volumes) , Deepak Kapoor, Vinita Kapoor Publisher.

Reference Book

1	Astrology For Beginners by Motilal Banarsidass Publishing House
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U24CE5A02		PREFABRICATED STRUCTURES				L	T	P	C
						3	0	0	3
Course Objectives:		The objective of this course is to provide students with a fundamental understanding of prefabricated construction by explaining modular coordination and the behaviour of various structural systems. Students will learn to apply engineering principles to design efficient precast components and connections while accounting for the unique stresses of transportation and erection. Furthermore, the course aims to equip students with the ability to implement codal requirements to safeguard structures against abnormal loads and progressive collapse.							
Unit - I	INTRODUCTION						9		
Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standardization– Loads and load combinations– Materials – Production – Transportation – Erection.									
Unit - II	PREFABRICATED COMPONENTS AND SYSTEMS						9		
Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system-Large panel systems- block system.									
Unit - III	DESIGN PRINCIPLES						9		
Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping, stacking, transportation and erection of elements									
Unit – IV	JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS						9		
Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints, contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.									
Unit - V	DESIGN FOR ABNORMAL LOADS						9		
Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.									
Total Periods:								45	

Course Outcomes

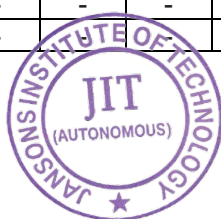
On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the principles of modular coordination and standardization, and summarize the logistical requirements for the production and transportation of precast elements.	K4
CO2	Illustrate the structural behavior of various precast systems and classify components such as shear walls, portal frames, and large panel systems based on their functional use.	K4
CO3	Apply design principles to determine efficient cross-sections and calculate the stresses induced during the stripping, stacking, and transport of precast elements.	K5
CO4	Relate force actions to joint types and design standard structural connections (e.g., beam-to-column or column-to-foundation) using appropriate sealants and detailing.	K5
CO5	Interpret codal provisions for abnormal loads and apply equivalent design load methods to prevent progressive collapse in prefabricated structures.	K5

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO–PO–PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	1	3	2	1
CO2	3	2	2	-	-	-	-	-	-	-	2	1	3	2	1
CO3	3	2	2	-	-	-	-	-	-	-	2	1	3	2	1
CO4	3	2	2	-	-	-	-	-	-	-	2	1	3	2	1
CO5	3	2	2	-	-	-	-	-	-	-	2	1	3	2	1
CO	3	2	2	-	-	-	-	-	-	-	2	1	3	2	1



Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	N. Krishna Raju, Prestressed Concrete, McGraw Hill Education (India), 6th Edition (Reprint), 2021.
2	Y. R. M. Rao, J. P. Annie and P. Easwary, Prestressed Concrete Analysis and Design, S. K. Kataria & Sons, 1st Edition, 2017 (Reprint 2024).
3	Shamsher Bahadur Singh, Analysis and Design of Prestressed Concrete Structures, Wiley India, 2023.

Reference Books

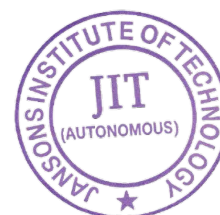
1	A. S. G. Bruggeling and G. F. Huyghe, Prefabrication with Concrete, CRC Press (formerly A. A. Balkema Publishers), Latest Reprint Edition, 2020.
2	Michael Levitt, Precast Concrete: Materials, Manufacture, Properties and Usage, CRC Press, Boca Raton, 1st Edition, 2019.
3	Alfred Steinle, Hubert Bachmann, Mathias Tillmann and Philip Thrift, Precast Concrete Structures, Ernst & Sohn, Berlin, 2nd Edition, 2019.
4	Indian Concrete Institute (ICI), Handbook on Precast Concrete Buildings, Indian Concrete Institute, Chennai, 2016.

Codes Of Practice

1	IS 15916:2010, Building Design and Erection Using Prefabricated Concrete – Code of Practice, Bureau of Indian Standards (BIS), New Delhi.
2	IS 456:2000, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
3	IS 11447:1985 (Reaffirmed), Code of Practice for Construction with Large Panel Prefabricates, Bureau of Indian Standards (BIS), New Delhi.
4	IS 16700:2017, Criteria for Structural Safety of Tall Concrete Buildings, Bureau of Indian Standards (BIS), New Delhi.
5	National Building Code of India (NBC) 2016, Bureau of Indian Standards (BIS), New Delhi.

Website Link:

<https://nptel.ac.in/courses/124105013>



U24CE5A03		STEEL CONCRETE COMPOSITE STRUCTURES				L	T	P	C
						3	0	0	3
Course Objectives:		To provide civil engineering students with fundamental knowledge of the concepts, behaviour, analysis, and design principles of steel–concrete composite structures, enabling them to understand the interaction between steel and concrete, apply relevant codal provisions, and appreciate practical applications, construction methods, and advantages of composite systems in modern buildings and bridge structures.							
Unit - I	INTRODUCTION TO COMPOSITE STRUCTURES						9		
Definition and classification of composite structures-Advantages and limitations of steel–concrete composite construction- Behaviour of composite sections under flexure- Load transfer mechanisms and interaction between steel and concrete- Comparison of composite, RCC, and steel structures-Applications of composite structures in buildings and bridges									
Unit - II	MATERIALS AND SHEAR CONNECTORS						9		
Structural steel: properties, grades, and stress–strain behaviour-Concrete in composite construction: role and performance- Types of shear connectors: headed studs, channel connectors, perfobond ribs-Behaviour and design principles of shear connectors- Failure modes of shear connectors-Codal provisions (IS 11384 / Eurocode overview)									
Unit - III	ANALYSIS OF COMPOSITE BEAMS						9		
Elastic and plastic analysis of composite beams-Effective width of concrete flange-Ultimate moment capacity of composite beams-Serviceability limit states: deflection and cracking- Long-term effects: creep and shrinkage-Design examples of simply supported composite beams									
Unit – IV	COMPOSITE COLUMNS AND SLABS						9		
Types of composite columns: concrete encased, concrete filled steel tubes-Behaviour and load-carrying mechanism of composite columns-Design philosophy and interaction diagrams-Composite slabs: profiled steel decking-Analysis and design of composite slabs-Construction aspects and advantages									
Unit - V	ANALYSIS OF PLATES						9		
Composite frames and floor systems-Introduction to composite bridges (steel girder–concrete deck systems)- Construction methods and sequence in composite structures-Fire resistance and durability of composite structures- Overview of seismic performance of composite structures- Case studies of composite buildings and bridges									
Total Periods:							45		

Course Outcomes

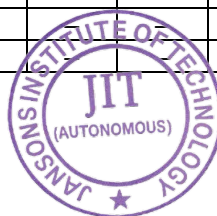
On completion of the course, the student can

COs	Statements	K-Level
CO1	Describe the fundamentals, classifications, and behavioural principles of steel–concrete composite structures and distinguish their performance from conventional RCC and steel structures	K4
CO2	Interpret the use of material properties and shear connector behaviour to evaluate design requirements and possible failure modes of shear connectors in composite construction.	K4
CO3	Calculate the flexural strength and serviceability performance of composite beams considering short-term and long-term effects as per relevant codal provisions.	K5
CO4	Determine the load-carrying capacity of composite columns and composite slabs using codal provisions and interaction principles.	K5
CO5	Illustrate the application of steel–concrete composite structural systems in buildings and bridges with reference to construction practices, fire resistance, and seismic behaviour.	K5

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	–	–	–	1	–	–	–	–	1	2	1	1
CO2	3	2	1	–	2	–	–	–	–	–	–	3	2	2
CO3	3	2	2	–	2	–	–	–	–	–	–	3	3	2



	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO4	3	2	2	–	2	1	–	–	–	–	–	3	3	3
CO5	2	1	1	–	–	2	1	1	1	–	2	2	1	2
CO	3	2	2	–	2	2	1	1	1	–	2	3	3	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	R. P. Johnson, Composite Structures of Steel and Concrete: Beams, Slabs, Columns and Frames for Buildings, Wiley-Blackwell, 4th Edition, 2018.
2	S. K. Duggal, Design of Steel Structures, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 3rd Edition, 2024. (Includes composite beam and column design concepts.)
3	R. Narayanan, Steel–Concrete Composite Structures, CRC Press (Taylor & Francis), Reprint Edition, 2020.
4	N. Subramanian, Design of Steel Structures, Oxford University Press, New Delhi, 2nd Edition (Reprint), 2021.

Reference Books

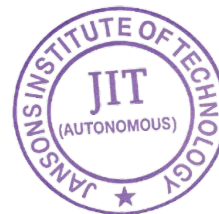
1	M. A. Bradford, Composite Steel and Concrete Structural Members: Fundamental Behaviour, Elsevier, 2nd Edition (Reprint), 2018.
2	S. S. Bhavikatti, Design of Steel Structures (IS 800:2007), I.K. International Publishing House Pvt. Ltd., New Delhi, 6th Edition, 2022.
3	B. Uy and M. A. Bradford, Design of Composite Steel and Concrete Structures, CRC Press, Latest Edition, 2019.

Codes of Practice

1	IS 11384:1985 (Reaffirmed), Code of Practice for Composite Construction in Structural Steel and Concrete, Bureau of Indian Standards (BIS), New Delhi.
2	IS 800:2007, General Construction in Steel – Code of Practice, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
3	IS 456:2000, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards (BIS), New Delhi (with latest amendments).
4	SP 16, Design Aids for Reinforced Concrete to IS 456:2000, Bureau of Indian Standards (BIS), New Delhi.
5	Eurocode 4 (EN 1994-1-1:2004 + A1:2015), Design of Composite Steel and Concrete Structures – Part 1-1: General Rules and Rules for Buildings, European Committee for Standardization (CEN).

Web-links

1. https://onlinecourses.nptel.ac.in/noc22_ar14/preview



U24CE5A04		Structural Health Monitoring		L	T	P	C
				3	0	0	3
Course Objectives:		This course introduces students to the integration of sensing and data analysis within civil infrastructure. It aims to develop the ability to design monitoring frameworks that detect structural distress early, leveraging knowledge of structural mechanics and digital technologies to transition from schedule-based maintenance to condition-based maintenance for safer, more resilient built environments.					
Unit - I	Framework of SHM in Civil Infrastructure					9	
Evolution from visual inspection to SHM; Components of SHM (Sensors, Data, Features, Decisions); Global vs. Local monitoring; Differences between SHM and traditional NDT (Rebound hammer, Ultrasonic pulse velocity).							
Unit - II	Sensors and Instrumentation for Civil Structures					9	
Strain monitoring (Vibrating wire, Electrical resistance); Displacement and Tilt meters; Corrosion sensors for RC structures; Fiber Bragg Grating (FBG) for long-span bridges; Environmental sensors (Temperature, Wind).							
Unit - III	Data Acquisition and Signal Interpretation					9	
Basics of Digital signals; Data acquisition hardware (DAQ); Dealing with "noise" in civil environments (traffic, wind); Introduction to Time-Domain and Frequency-Domain signatures; Data compression and transmission.							
Unit - IV	Vibration-Based Monitoring & Model Updating					9	
Fundamental natural frequencies of buildings/bridges; Effect of stiffness loss on modal parameters; Introduction to Finite Element (FE) model updating; Applications of "Digital Twins" to simulate structural damage..							
Unit - V	Practical Applications and Field Deployment					9	
SHM for Bridges (Case studies of iconic bridges); Monitoring of High-Rise buildings under wind/seismic loads; Dam health monitoring; Economic analysis of SHM; Future of SHM (IoT and AI in Civil Engineering).							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the necessity of SHM for aging infrastructure and classify the different levels of damage identification (Detection, Localization, Assessment, and Prediction).	K5
CO2	Select and justify the placement of specific sensors for a given structure (e.g., a suspension bridge or a multi-story RC building) to monitor critical stress points.	K4
CO3	Apply basic signal filtering techniques and interpret frequency spectra to distinguish between ambient vibrations and structural anomalies.	K4
CO4	Calculate changes in structural stiffness based on observed shifts in natural frequencies and relate these changes to potential structural degradation.	K5
CO5	Summarize the challenges of field deployment (weathering, power supply, data management) and illustrate how SHM data informs the life-cycle maintenance of a bridge.	K5

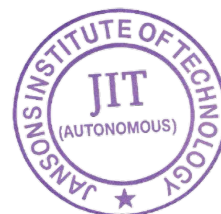
Knowledge Level: K1- Remember, K2- Understand, K3-Apply, K4-Analyze, K5- Evaluate, K6-Create

CO, PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	-	-	-	2	-	-	-	-	1	3	1	-
CO2	3	3	2	-	1	-	-	-	-	-	-	2	3	1
CO3	3	2	-	3	3	-	-	-	-	-	-	1	3	2
CO4	3	3	1	2	3	-	-	-	-	-	-	2	3	2
CO5	2	-	-	-	-	3	1	-	-	2	3	1	1	3
CO	3	2	1.5	2.5	3	2.5	1			2	2	2	3	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)



Text Books

1	V. M. Karbhari and F. Ansari, Structural Health Monitoring of Civil Infrastructure Systems, Woodhead Publishing (Elsevier), 2nd Edition, 2025.
2	Daniel Balageas, Christian-P. Fritzen and Alfredo Güemes, Structural Health Monitoring, ISTE Ltd. & John Wiley & Sons, 1st Edition (Reprint), 2020.
3	Charles R. Farrar and Keith Worden, Structural Health Monitoring: A Machine Learning Perspective, John Wiley & Sons, 1st Edition, 2013 (Latest Reprint, 2022).
4	Fu-Kuo Chang (Editor), Structural Health Monitoring 2023: Proceedings of the 14th International Workshop on Structural Health Monitoring, DEStech Publications, 2023.

Reference Books

1	Hua-Peng Chen and Ying-Qing Ni, Structural Health Monitoring of Large Civil Engineering Structures, Wiley-Blackwell, 1st Edition (Reprint), 2021.
2	Wieslaw Ostachowicz and Alfredo Güemes (Editors), New Trends in Structural Health Monitoring, Springer, 1st Edition (Reprint), 2019.
3	Charles R. Farrar and Keith Worden, Structural Health Monitoring: A Machine Learning Perspective, John Wiley & Sons, Latest Reprint, 2022.
4	Victor Giurgiutiu, Structural Health Monitoring of Aerospace Composites, Academic Press (Elsevier), 2nd Edition, 2022.

Codes / Guidelines

1	ISO 13374 (Parts 1–4), Condition Monitoring and Diagnostics of Machines – Data Processing, Communication and Presentation, International Organization for Standardization
2	ISO 17359:2018, Condition Monitoring and Diagnostics of Machines – General Guidelines, ISO.
3	ASCE, Structural Health Monitoring: Current State and Future Trends, American Society of Civil Engineers (ASCE), Latest Publications.
4	FHWA, Bridge Inspector's Reference Manual (BIRM), Federal Highway Administration, Latest Edition.
5	International Society for Structural Health Monitoring of Intelligent Infrastructure (ISHMII), Technical Reports and Guidelines, Latest Publications.

Web,links

1. <https://nptel.ac.in/courses/114106046>



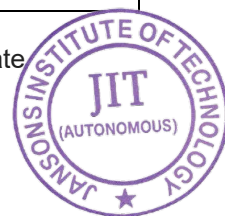
U24CE5A05		PRE-ENGINEERED BUILDING				L	T	P	C
						3	0	0	3
Course Objectives:		The primary objective of this course is to provide students with a comprehensive understanding of the Pre-Engineered Building (PEB) philosophy, contrasting it with conventional steel structures. Students will learn to plan, analyze, and design optimized structural components using tapered members and cold-formed sections according to international and national codes. The course aims to equip future engineers with the technical proficiency to oversee the entire lifecycle of a PEB project—from load calculation and component selection to cladding integration and safe site erection—ensuring structural integrity, cost-effectiveness, and sustainability.							
Unit - I	Introduction to PEB Concept							9	
Historical Evolution: Comparison between Conventional Steel Buildings (CSB) and Pre-Engineered Buildings (PEB)-System Components: Primary frames, secondary members (purlins, girts), cladding systems, and accessories-Advantages: Speed of construction, cost-effectiveness, flexibility in expansion, and seismic resistance-Applications: Industrial sheds, warehouses, aircraft hangars, and showrooms.									
Unit - II	Planning and Load Analysis							9	
Architectural Planning: Building dimensions (length, width, eave height), bay spacing, and roof slopes-Standard Codes: Introduction to MBMA (Metal Building Manufacturers Association), AISC, and IS 800:2007-Load Calculations: Dead Loads, Collateral Loads, Live Loads and Snow Loads-Wind Load Analysis: Calculation of pressure coefficients based on building geometry-Seismic Load considerations for lightweight structures.									
Unit - III	Design of Primary and Secondary Members							9	
Tapered Members: Design philosophy of built-up "I" sections with variable depth to optimize material- Secondary Systems: Design of cold-formed steel sections (Z and C purlins)-Bracing Systems: Design of rod, angle, and cable bracing for lateral stability-Connections: Design of bolted moment connections (end-plate connections) and shear connections.									
Unit – IV	Cladding, Insulation, and Accessories							9	
Types of composite columns: concrete encased, concrete filled steel tubes-Behaviour and load-carrying-Roofing and Walling: Profiled metal sheets, standing seam systems, and sandwich panels-Insulation: Glass wool, Rockwool, and PUF panels for thermal and acoustic efficiency-Functional Accessories: Ridge ventilators, gravity ventilators, skylights, gutters, and downspouts. -Mezzanine Systems: Design and integration of mezzanine floors within PEB structures.									
Unit - V	Erection and Quality Control							9	
Foundation and Anchoring: Design of anchor bolts and base plate templates- Erection Process: Sequences of assembly, crane requirements, and safety protocols-Maintenance: Corrosion protection, painting, and leak prevention-Software Integration: Overview of industry-standard software (e.g., STAAD.Pro, MBS, Tekla Structures).									
Total Periods:								45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the structural hierarchy of PEB systems and justify their selection over conventional steel buildings based on economic and functional parameters.	K4
CO2	Apply relevant Indian and International codes (IS 800, MBMA) to calculate dead, live, and wind loads acting on a building's envelope for various terrain categories.	K5
CO3	Analyze and design tapered "I" sections for primary frames and cold-formed "Z" or "C" sections for secondary members to ensure optimal material utilization.	K5
CO4	Identify and select appropriate roofing profiles, insulation materials, and ventilation accessories based on the thermal and functional requirements of industrial structures.	K5
CO5	Summarize the sequence of erection, foundation anchoring procedures, and quality maintenance protocols required to ensure the long-term durability of a metal building system.	K5

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	-	-	-	2	-	-	-	2	1	2	1	2
CO2	3	3	2	2	-	1	-	-	-	-	1	3	2	2
CO3	3	3	3	2	2	-	-	-	2	-	2	3	3	3
CO4	2	-	2	-	-	3	-	-	-	-	1	2	-	3
CO5	2	2	-	-	2	2	2	2	2	3	2	2	2	3
CO	2.5	2	2	2	2	2	2	2	2	3	2	2.5	2	2.5

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	K. S. Vivek & P. Vyshnavi, “ <i>Pre-Engineered Steel Building</i> ”, Lambert Academic Publishing, 2017 (1st Edition)
2	Santosh Kumar Panda, “Pre-Engineered Metal Building Structure Installation Handbook” , Lambert Academic Publishing, 2023 (1st Edition)
3	N. Subramanian, Design of Steel Structures, Oxford University Press, New Delhi, 2nd Edition (Reprint), 2021
4	S. K. Duggal, Design of Steel Structures, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 3rd Edition, 2024.

Reference Books

1	Metal Building Manufacturers Association (MBMA), Metal Building Systems Manual, MBMA, 2023 Edition.
2	American Institute of Steel Construction (AISC), Steel Construction Manual, 16th Edition, 2023.
3	S. S. Bhavikatti, Design of Steel Structures (IS 800:2007), I.K. International Publishing House Pvt. Ltd., New Delhi, 6th Edition, 2022.
4	Jack C. McCormac and Stephen F. Csernak, Structural Steel Design, Pearson Education, 6th Edition, 2021.

Web-links

1. <https://www.udemy.com/course/basics-of-pre-engineered-buildings-peb/>
2. <https://pebsteel.com/en/steel-structure-design-process-of-pre-engineered-building/>
3. <https://www.youtube.com/watch?v=ZqEdu8Q3YTw>



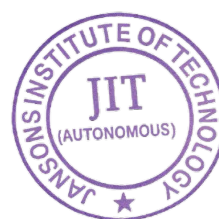
U24CE5A06		TALL BUILDINGS			L	T	P	C
					3	0	0	3
Course Objectives:		The primary objective of this course is to provide students with a comprehensive understanding of the structural behavior, analysis, and design principles of tall buildings. Students will explore the evolution of high-rise systems, learn to differentiate between various lateral load-resisting mechanisms, and evaluate the effects of wind and seismic forces. By the end of the course, students will be equipped to apply engineering principles to select appropriate structural forms and foundation systems, ensuring both the stability and serviceability of vertical urban structures in compliance with modern safety standards.						
Unit - I	Introduction and Design Philosophy					9		
History and Growth: Development of tall buildings, social and economic reasons for high-rises-Design Criteria: Dead loads, live loads, and the critical nature of Wind and Seismic loads-Serviceability: Vertical and lateral displacement (drift), human comfort criteria (perception of motion)-Materials: High-strength concrete, structural steel, and composite construction.								
Unit - II	Structural Systems - Lateral Load Resisting					9		
Classification of Systems: Interior vs. Exterior systems- Rigid Frames: Moment-resisting frames and their height limitations-Braced Frames: Types of bracing (X, K, Eccentric) and their efficiency-Shear Walls: Behavior of shear walls, coupled shear walls, and wall-frame interaction.								
Unit - III	Advanced Structural Forms					9		
Outrigger Systems: The role of outriggers and belt trusses in controlling drift-Tubular Systems: Framed tube, bundled tube (e.g., Willis Tower), and tube-in-tube- Diagrid Structures: Concept, geometry, and nodes (e.g., The Gherkin)- Core-and-Shell: Distribution of gravity and lateral loads between the central core and perimeter.								
Unit – IV	Analysis and Stability					9		
P-Delta Effect: Secondary effects of gravity loads on displaced structures-Dynamic Analysis: Introduction to modal analysis, natural periods of vibration, and damping-Wind Engineering: Vortex shedding, wind tunnel testing, and the use of Tuned Mass Dampers (TMDs)- Differential Shortening: Column shortening effects in concrete high-rises.								
Unit - V	Foundations and Special Topics					9		
Deep Foundations: Pile foundations, raft foundations, and combined Piled-Raft systems-Soil-Structure Interaction: How soil stiffness affects building frequency- Sustainability: Energy efficiency in tall buildings (Double-skin facades, vertical greenery)- Fire Safety: Structural fire engineering and evacuation strategies for high-rises.								
Total Periods:						45		

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Summarize the evolution of tall buildings and identify the critical design parameters, including gravity and lateral load paths.	K5
CO2	Illustrate the behavior of various lateral load-resisting systems and calculate the load distribution between frames and shear walls.	K5
CO3	Classify advanced structural forms like tubular and diagrid systems and select the most efficient system for a given building height.	K5
CO4	Explain the importance of dynamic analysis and apply methods to mitigate secondary effects like the P-Delta effect and vortex shedding.	K5
CO5	Describe specialized foundation types and assess the fire safety and sustainability requirements specific to high-rise construction.	K5

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	1	-	-	2	-	-	-	-	1	3	1	2
CO2	3	3	2	2	1	-	-	-	-	-	-	3	2	2
CO3	3	3	3	2	2	1	-	-	-	-	2	3	3	3
CO4	3	3	2	3	2	-	-	-	-	-	2	3	3	2
CO5	2	2	2	1	-	3	2	-	-	1	1	2	2	3
CO	3	2.5	2	2	1.5	2	2	-	-	1	1.5	3	2	2.5

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	B. S. Taranath, Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, CRC Press (Taylor & Francis), 1st Edition (Latest Reprint), 2016.
2	Bryan Stafford Smith and Alex Coull, Tall Building Structures: Analysis and Design, John Wiley & Sons, Reprint Edition, 2018.
3	B. S. Taranath, Tall Building Design: Steel, Concrete and Composite Systems, CRC Press (Taylor & Francis), 2nd Edition, 2017.

Reference Books

1	Wolfgang Schueller, High-Rise Building Structures, John Wiley & Sons, 2nd Edition (Reprint), 2019.
2	Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, PHI Learning Pvt. Ltd., New Delhi, 3rd Edition, 2023.
3	Lynn S. Beedle (Editor), Advances in Tall Buildings, Van Nostrand Reinhold, Latest Reprint Edition.
4	T. Paulay and M. J. N. Priestley, Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons, Reprint Edition, 2017.

Reference Books

1	IS 16700:2017, Criteria for Structural Safety of Tall Concrete Buildings, Bureau of Indian Standards (BIS), New Delhi.
2	IS 875 (Parts 1–5), Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Bureau of Indian Standards (BIS), New Delhi.
3	IS 1893 (Part 1):2016, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards (BIS), New Delhi (latest amendments).
4	IS 13920:2016, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards (BIS), New Delhi.

Web-links

1. <https://www.istructe.org/>



U24CE5B01		FORM WORK ENGINEERING				L	T	P	C
						3	0	0	3
Course Objectives:		The students will be able to know the detailed planning of formwork, design of forms and erection of form work.							
Unit - I	INTRODUCTION TO FORM WORK							9	
Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Overall Planning - Detailed planning - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.									
Unit - II	FORMWORK MATERIALS ASSESORIES & PRESSURES							9	
Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood - Steel – Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Finish - Sheathing boards working stresses - Repetitive member stress Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls.									
Unit - III	FORMWORK DESIGN							9	
Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.									
Unit – IV	FORMWORK FOR SPECIAL STRUCTURES							9	
Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system									
Unit - V	CASE STUDIES							9	
Formwork failures: Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry									
Total Periods:								45	

Course Outcomes

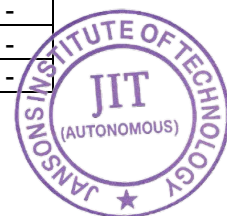
On completion of the course, the student can

COs	Statements	K-Level
CO1	Relate the detailed planning of formwork	K2
CO2	Illustrate about formwork materials, accessories, pressures and labour requirement	K2
CO3	Explain the design, construction and erection of formwork.	K2
CO4	Compare different types of form work used for special structures.	K2
CO5	Interpret the errors in design and judge the formwork failures through case studies.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-



Correlation levels 1, 2 and 3 are as defined below:

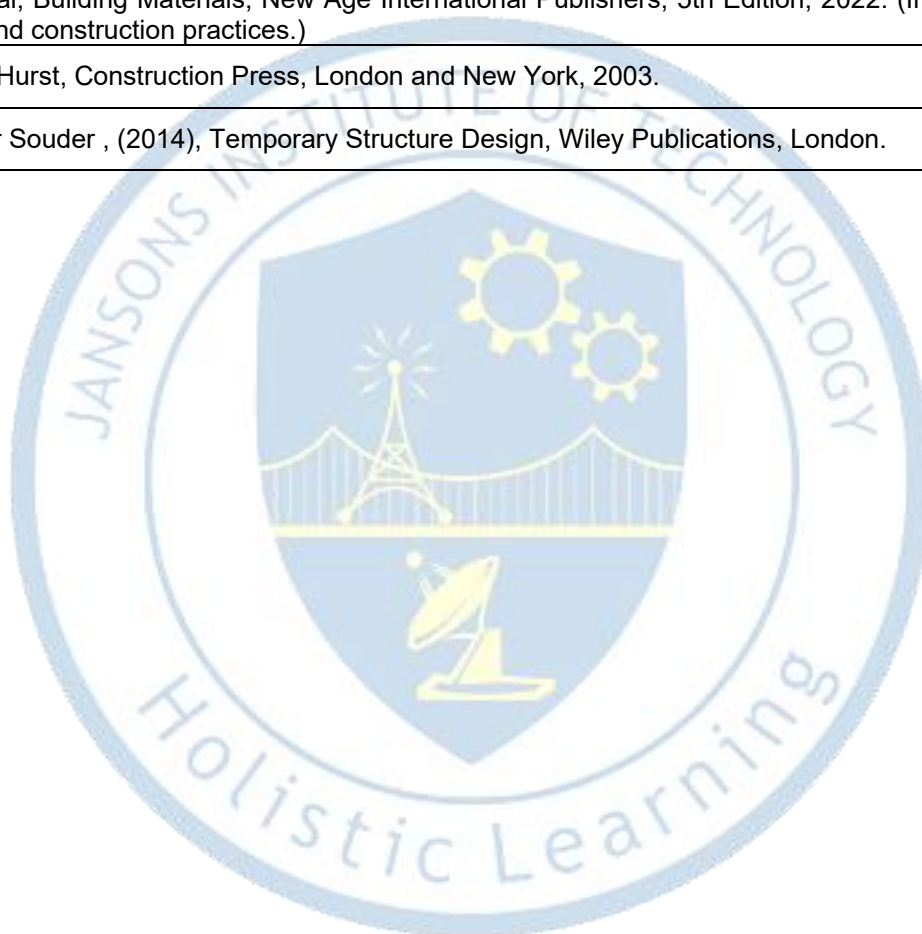
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Robert L. Peurifoy, Garold D. Oberlender, Clifford J. Schexnayder and Robert Schmitt, Formwork for Concrete Structures, McGraw Hill Education, 8th Edition, 2015.
2	K. N. Jha, Formwork for Concrete Structures, Tata McGraw Hill Education, New Delhi, 1st Edition (Reprint), 2012.
3	M. K. Hurd, Formwork for Concrete, American Concrete Institute (ACI), 8th Edition, 2016.

Reference Books

1	Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2	S. K. Duggal, Building Materials, New Age International Publishers, 5th Edition, 2022. (Includes formwork materials and construction practices.)
3	Michael P. Hurst, Construction Press, London and New York, 2003.
4	Christopher Souder , (2014), Temporary Structure Design, Wiley Publications, London.



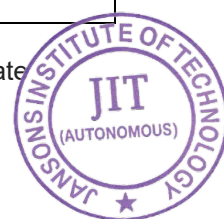
U24CE5B02	CONSTRUCTION EQUIPMENT AND AUTOMATION	L	T	P	C
		3	0	0	3
Course Objectives:	To understand selection, operation, cost analysis, and automation techniques of construction equipment used in modern civil engineering projects				
Unit - I	CONSTRUCTION EQUIPMENTS				9
Identification - Planning of equipment - Selection of equipment - Equipment management in projects - Maintenance management - Equipment cost - Operating cost - Cost control of equipment - Depreciation analysis - Replacement analysis - Safety management.					
Unit - II	CONSTRUCTION EQUIPMENT FOR EARTHWORK				9
Fundamentals of earthwork operations - Earth moving operations - Types of earthwork equipment - Tractors, motor graders, scrapers, front end waders - Dozer, excavators, rippers, loaders, trucks and hauling equipment, compacting equipment, finishing equipment - Case studies on earthwork equipment.					
Unit - III	AUTOMATION IN CONSTRUCTION INDUSTRY				9
Need, benefits and challenges of automation in construction-Automated equipment and machinery in civil projects-Automation in canal lining, road/highway construction-Automation in concrete technology-Role of sensors, data acquisition, and control systems (overview)					
Unit – IV	DRONES AND ROBOTICS IN CONSTRUCTION				9
Use of drones for-Aerial mapping and surveying-Real-time project monitoring-Quantity and quality assessment-Structural health monitoring-Introduction to robotics in construction-Bricklaying robots-Material handling robots-3D printing for building component					
Unit - V	ADVANCED TECHNOLOGIES				9
Virtual Reality (VR) and Augmented Reality (AR) applications in construction-Building Information Modeling (BIM) for planning and automation-Internet of Things (IoT) for site data integration-Future trends: autonomous machines and smart construction systems					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the role, classification and selection of construction equipment in civil engineering projects	K2
CO2	Explain the functions and working principles of earthmoving and material handling equipment.	K2
CO3	Illustrate the specialized construction and automation equipment for modern works.	K2
CO4	Interpret automation technologies like drones and robotics in construction workflows	K2
CO5	Interpret the construction technologies, safety standards and future trends in automation.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

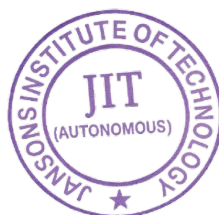
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., Construction Planning, Equipment and Methods, 9th Edn. McGraw Hill, Singapore, 2018.
2	Douglas D. Gransberg, Calin M. Popescu and Richard C. Ryan, Construction Equipment Management for Engineers, Estimators and Owners, CRC Press (Taylor & Francis), 2nd Edition, 2022.
3	S. V. Deodhar, Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 4th Edition, 2020.
4	Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company Pvt. Ltd., New Delhi, Latest Revised Edition, 2021.

Reference Books

1	David A. Day and Neal B. H. Benjamin, Construction Equipment Guide, John Wiley & Sons, 2nd Edition (Latest Reprint), 2019.
2	B. H. Chudley and Roger Greeno, Building Construction Handbook, Routledge, 13th Edition, 2024.
3	Autodesk, BIM for Construction Management, Autodesk Learning Resources, Latest Edition.
4	K. N. Jha, Construction Project Management: Theory and Practice, Pearson India Education Services Pvt. Ltd., 3rd Edition, 2021.



U24CE5B03		ADVANCED CONSTRUCTION TECHNIQUES				L	T	P	C
						3	0	0	3
Course Objectives:		To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques							
Unit - I	SUB STRUCTURE CONSTRUCTION						9		
Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.									
Unit - II	SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS						9		
Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting.									
Unit - III	CONSTRUCTION OF SPECIAL STRUCTURES						9		
Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks									
Unit – IV	REHABILITATION AND STRENGTHENING TECHNIQUES						9		
Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.									
Unit - V	DEMOLITION						9		
Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.									
Total Periods:								45	

Course Outcomes

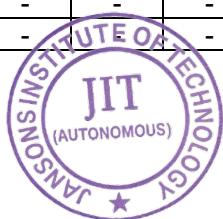
On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the modern construction techniques used in the sub structure construction	K2
CO2	Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings	K2
CO3	Outline the concepts of construction in special structures	K2
CO4	Illustrate various strengthening and repair methods for different cases	K2
CO5	Summarize the suitable demolition technique for demolishing a building.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	2	2	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-



Correlation levels 1, 2 and 3 are as defined below:

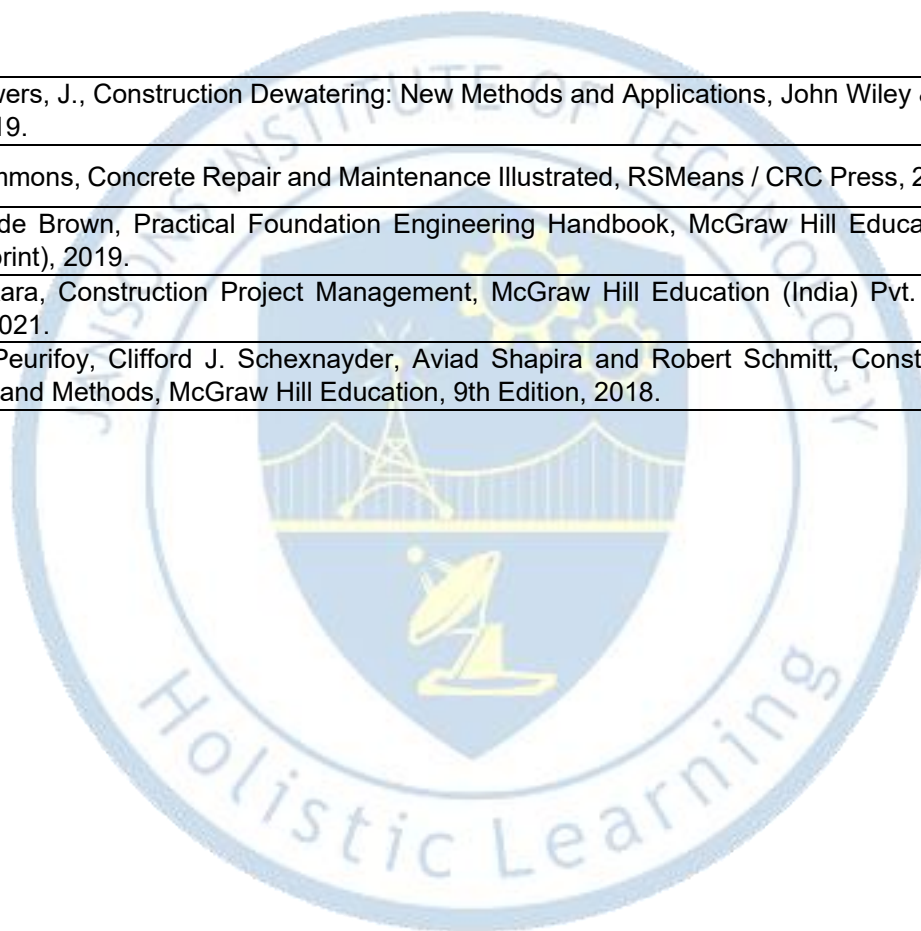
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	S. K. Sarkar and S. Saraswati, Construction Technology, Oxford University Press, New Delhi, 2nd Edition (Reprint), 2020.
2	Roy Chudley and Roger Greeno, Building Construction Handbook, Routledge, 13th Edition, 2024.
3	Francis D. K. Ching, Building Construction Illustrated, John Wiley & Sons, 6th Edition, 2020.
4	K. N. Jha, Construction Project Management: Theory and Practice, Pearson India Education Services Pvt. Ltd., 3rd Edition, 2021.

Reference Books

1	Patrick Powers, J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, Reprint Edition, 2019.
2	Peter H. Emmons, Concrete Repair and Maintenance Illustrated, RSMeans / CRC Press, 2nd Edition, 2018.
3	Robert Wade Brown, Practical Foundation Engineering Handbook, McGraw Hill Education, 2nd Edition (Latest Reprint), 2019.
4	K. K. Chitkara, Construction Project Management, McGraw Hill Education (India) Pvt. Ltd., 3rd Edition (Reprint), 2021.
5	Robert L. Peurifoy, Clifford J. Schexnayder, Aviad Shapira and Robert Schmitt, Construction Planning, Equipment and Methods, McGraw Hill Education, 9th Edition, 2018.



U24CE5B04	CONSTRUCTION ENGINEERING AND MANAGEMENT				L	T	P	C
					3	0	0	3
Course Objectives:	TO Understand the principles and practices of construction engineering and project management in civil engineering projects and Learn construction planning techniques including work breakdown structure, scheduling and resource allocation							
Unit - I	INTRODUCTION TO CONSTRUCTION MANAGEMENT						9	
Construction industry overview-Project lifecycle-Construction planning stages-Stakeholders in construction-Organizational structure-Work breakdown structure (WBS)- Productivity in construction								
Unit - II	PROJECT PLANNING & SCHEDULING						9	
Bar charts (Gantt charts)- Network techniques-CPM (Critical Path Method)- PERT analysis-Float and slack-Resource allocation-Time-cost trade-off								
Unit - III	COST MANAGEMENT & CONTRACTS						9	
Construction economics-Estimation and budgeting-Cost control techniques-Cash flow analysis-Tendering procedures-Types of contracts-Contract administration								
Unit – IV	CONSTRUCTION EQUIPMENT & SAFETY MANAGEMENT						9	
Equipment selection-Productivity analysis-Site safety planning-Hazard identification-Risk management-Safety regulations-Quality assurance and quality control								
Unit - V	MODERN CONSTRUCTION MANAGEMENT						9	
Lean construction-BIM (Building Information Modeling)- MIS in construction-Software tools (Primavera/MS Project)- Sustainable construction-Environmental considerations-Case studies								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Outline the construction planning and management concepts.	K2
CO2	Explain the scheduling techniques of CPM and PERT.	K2
CO3	Demonstrate the cost estimation, budgeting, and financial control.	K2
CO4	Infer contract management, safety and risk management.	K2
CO5	List the modern tools and technologies in construction management.	K1

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

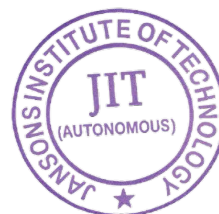
CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	1	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	1	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

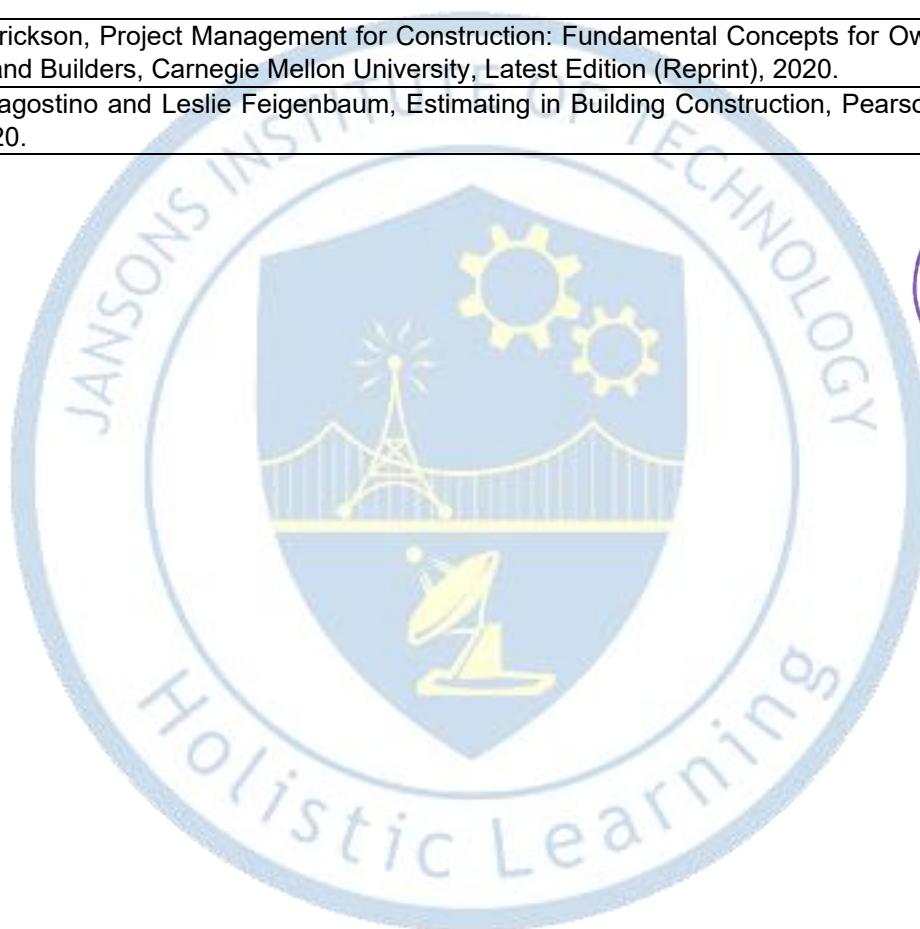
Text Books



1	K. K. Chitkara, Construction Project Management: Planning, Scheduling and Controlling, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 3rd Edition (Reprint), 2021.
2	S. C. Sharma, Construction Engineering and Management, Khanna Publishers, New Delhi, 2nd Revised Edition, 2021.
3	K. K. Chitkara, Construction Planning and Scheduling, Tata McGraw Hill Education, New Delhi, Reprint Edition, 2020.
4	K. N. Jha, Construction Project Management: Theory and Practice, Pearson India Education Services Pvt. Ltd., 3rd Edition, 2021.

Reference Books

1	Robert L. Peurifoy, Clifford J. Schexnayder, Aviad Shapira and Robert Schmitt, Construction Planning, Equipment and Methods, McGraw Hill Education, 9th Edition, 2018.
2	Sidney M. Levy, Project Management in Construction, McGraw Hill Education, 7th Edition, 2018.
3	James J. O'Brien and Fredric L. Plotnick, Construction Management, McGraw Hill Education, 10th Edition, 2021.
4	Chris Hendrickson, Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects and Builders, Carnegie Mellon University, Latest Edition (Reprint), 2020.
5	Frank R. Dagostino and Leslie Feigenbaum, Estimating in Building Construction, Pearson Education, 9th Edition, 2020.



		SUSTAINABLE AND GREEN CONSTRUCTION			L	T	P	C
					3	0	0	3
Course Objectives:		To understand the principles of sustainable development and green construction, Learn sustainable materials and eco-friendly construction technologies.						
Unit - I	FUNDAMENTALS OF SUSTAINABLE CONSTRUCTION						9	
Concept of sustainability-Sustainable development goals (SDGs)- Environmental impacts of construction- Principles of green construction-Carbon footprint and embodied energy-Climate change and construction sector- Sustainable design strategies								
Unit - II	GREEN BUILDING MATERIALS						9	
Sustainable construction materials-Recycled and renewable materials-Fly ash, GGBS, geopolymers concrete-Low carbon cement-Green insulation materials-Bamboo and timber construction-Waste minimization and reuse								
Unit - III	ENERGY EFFICIENT BUILDINGS						9	
Energy consumption in buildings-Passive design strategies-Building orientation-Natural ventilation and daylighting- Thermal comfort-Renewable energy integration (solar, wind)- Net-zero energy buildings								
Unit – IV	WATER AND RESOURCE MANAGEMENT						9	
Rainwater harvesting-Greywater recycling-Water-efficient plumbing-Sustainable site planning-Construction waste management								
Unit - V	GREEN BUILDING RATING SYSTEMS AND LIFECYCLE ASSESSMENT						9	
IGBC (Indian Green Building Council)- GRIHA rating system-LEED certification-Life Cycle Assessment (LCA)- Environmental impact assessment-Sustainable construction management practices								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain sustainability principles and environmental impacts of construction.	K2
CO2	List the green building materials and sustainable technologies.	K1
CO3	Explain the energy-efficient design strategies in building construction.	K2
CO4	Summarize water and resource management strategies for sustainable projects.	K2
CO5	Demonstrate the green building rating systems and lifecycle assessment methods.	K2

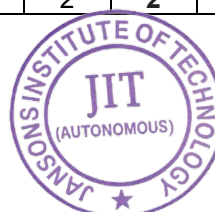
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	1	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	2	2	1	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

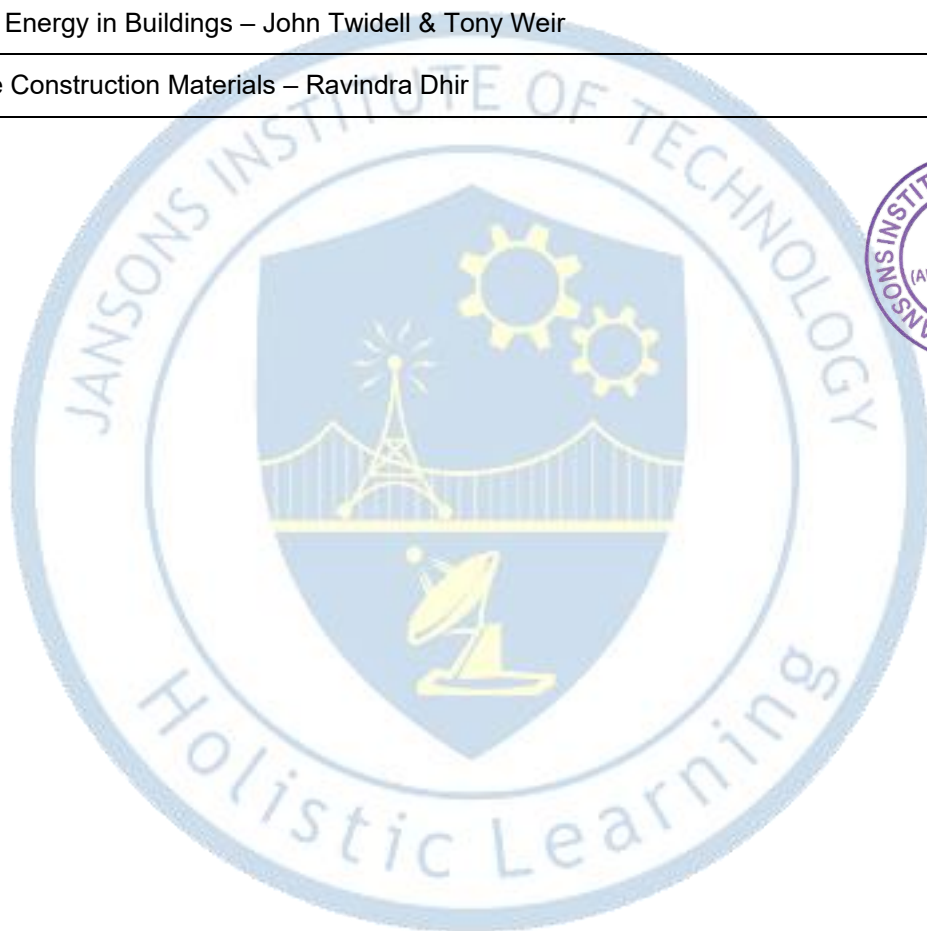


Text Books

1	Charles J. Kibert – Sustainable Construction: Green Building Design and Delivery
2	Integrated Design and Construction for Sustainable Buildings
3	K.S. Jagadeesh – Alternative Building Materials and Technologies

Reference Books

1	LEED Green Building Rating System Guide
2	GRIHA Manual (India)
3	Renewable Energy in Buildings – John Twidell & Tony Weir
4	Sustainable Construction Materials – Ravindra Dhir



		CONSTRUCTION PROJECT PLANNING SYSTEMS				L	T	P	C
						3	0	0	3
Course Objectives:		To understand construction project planning principles and to learn scheduling techniques used in construction projects.							
Unit - I	CONSTRUCTION PROJECT PLANNING							9	
Introduction to construction planning-Construction project life cycle-Planning stages and project organization-Work breakdown structure (WBS)- Defining activities and sequencing-Estimation of duration and resources									
Unit - II	SCHEDULING TECHNIQUES							9	
Construction scheduling basics-Bar charts and milestone charts-Network diagrams-Critical Path Method (CPM)- Activity-on-node and activity-on-arrow networks-Float calculation-Schedule presentation									
Unit - III	PERT AND ADVANCED SCHEDULING							9	
Program Evaluation Review Technique (PERT)- Probabilistic time estimation-Network analysis-Resource oriented scheduling-Lead and lag relationships-Advanced scheduling techniques									
Unit – IV	RESOURCE PLANNING AND OPTIMIZATION							9	
Resource allocation-Resource levelling and smoothing-Equipment planning-Cost-resource relationships- Project crashing techniques									
Unit - V	MONITORING, CONTROL AND PROJECT SYSTEMS							9	
Monitoring, Control and Project Systems-Earned value management-Progress tracking-Construction information systems-Decision support systems-Computer applications in project planning									
Total Periods:							45		

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the principles of construction project planning.	K2
CO2	Compare CPM and network techniques.	K2
CO3	Listout PERT and advanced scheduling methods.	K1
CO4	Summarize resource planning and optimization.	K2
CO5	Explain the concept of control projects using project planning systems and tools.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

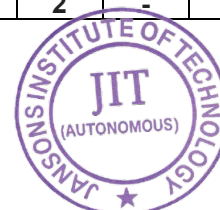
	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	1	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	1	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	1	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

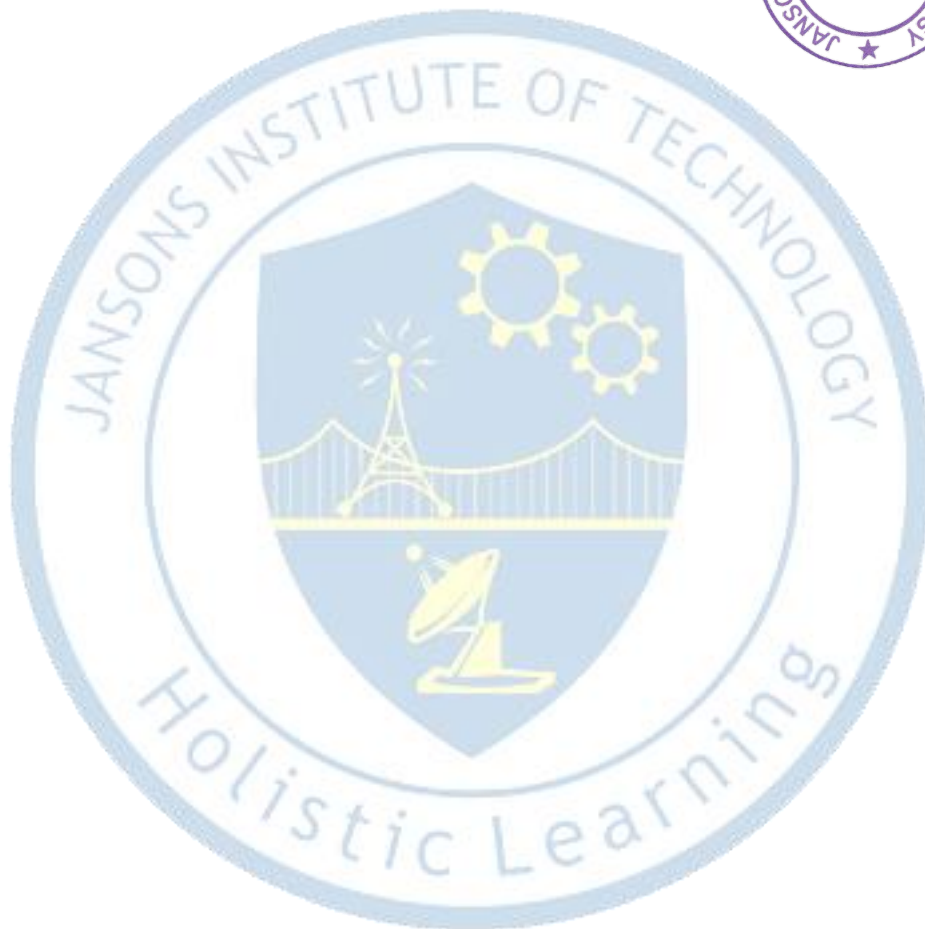
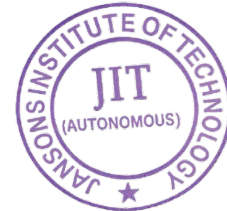
1	K.K. Chitkara – Construction Project Management
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2	K.K. Chitkara – Construction Project Scheduling & Control
3	Peurifoy & Oberlender – Construction Planning, Equipment and Methods

Reference Books

1	K.K. Chitkara – Project Management
2	Jimmie Hinze – Construction Planning and Scheduling
3	K.K. Chitkara – CPM and PERT Techniques

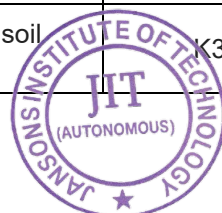


U24CE5C01	GEO-ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To provide students with fundamental knowledge of soil–waste interaction, contaminant transport, waste containment, remediation techniques, landfill systems, and sustainable waste stabilization practices for environmental protection.				
Unit - I	SOIL – WASTE INTERACTION				9
Role of Geo-environmental Engineering – sources, generation and classification of wastes – causes and consequences of soil pollution – case studies in soil failure -factors influencing soil pollutant interaction – modification of index, chemical and engineering properties – physical and physiochemical mechanisms.					
Unit - II	CONTAMINANT TRANSPORT AND SITE CHARACTERISATION				9
Transport of contaminant in subsurface – advection, diffusion, dispersion – chemical process – biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, Volatization, biodegradation – characterization of contaminated sites – soil and rock data–hydrological and chemical data – analysis and evaluation.					
Unit - III	WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES				9
In-situ containment – vertical and horizontal barrier – surface cover – ground water pumping system on subsurface drain – soil remediation – Soil Vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification, bio remediation, Phyto-remediation – ground water remediation – pump and treat , In-situ flushing, permeable reacting barrier, In-situ air sparging.					
Unit – IV	LANDFILLS AND SURFACE IMPOUNDMENTS				9
system – Source and characteristics of waste - site selection for landfills – components of landfills – liner soil, geomembrane, geosynthetic clay, geo-composite liner system – leachate collection – final cover design – monitoring landfill - Environmental laws and regulations.					
Unit - V	STABILISATION OF WASTE				9
Evaluation of waste materials – flyash, municipal sludge, plastics, scrap tire, blast furnace slag, construction waste, wood waste and their physical, chemical and biological characteristics – potential reuse – utilization of waste and soil stabilization.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply geo-environmental engineering principles to assess soil–waste interactions and their effects on soil properties.	K3
CO2	Analyze contaminant transport mechanisms and chemical and biological processes governing pollutant migration in subsurface environments.	K4
CO3	Implement appropriate containment and remediation techniques for the management of contaminated soil and groundwater.	K3
CO4	Examine landfill components, liner systems, leachate collection, final cover systems, and monitoring practices for effective waste containment.	K4
CO5	Utilize industrial and construction wastes for sustainable waste management and soil stabilization applications based on their characteristics.	K3



Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	3	-	-	-	-	3	2	2	1
CO2	3	3	-	-	-	3	-	-	-	-	3	2	2	1
CO3	2	3	3	-	-	3	-	-	-	-	3	2	2	1
CO4	2	2	3	-	-	3	-	-	-	-	3	2	2	1
CO5	2	2	2	-	-	3	-	-	-	-	3	2	2	1
CO	2	2	2	-	-	3	-	-	-	-	3	2	2	1

Correlation levels 1, 2 and 3 are as defined below:

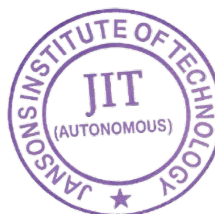
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Daniel, D.E. and Wu, J.T.H., "Geoenvironmental Engineering: Soil Contamination, Waste Containment and Remediation", McGraw Hill Education, New York, 2005.
2	Rowe, R.K., "Long-Term Performance of Geoenvironmental Systems", CRC Press, Boca Raton, 2005.
3	Koerner, R.M., "Designing with Geosynthetics", 6th Edition, Pearson Education, New Delhi, 2012.

Reference Books

1	Coduto, D.P., Yeung, M.R. and Kitch, W.A., "Geotechnical Engineering: Principles and Practices", 2nd Edition, Pearson Education, New Delhi, 2011.
2	Reddy, K.R. and Cameselle, C. (Eds.), "Electrochemical Remediation Technologies for Polluted Soils, Sediments and Groundwater", John Wiley & Sons, 2009.
3	Jury, W.A. and Horton, R., "Soil Physics", 6th Edition, Wiley, 2004.
4	Reddy, K.R. and Adams, J.A., "Sustainable Remediation of Contaminated Sites", Momentum Press, 2015.



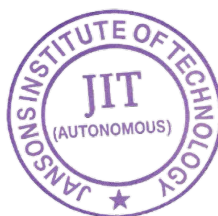
U24CE5C02	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3
Course Objectives:	To impart knowledge on identification of problematic soils and application of mechanical, hydraulic, chemical, and reinforcement-based ground improvement techniques to enhance soil performance and foundation stability.				
Unit - I	INTRODUCTION AND PROBLEMATIC SOILS				9
Need for ground improvement – classification of problematic soils: expansive soils, collapsible soils, soft clays, loose sands, organic soils – site investigation for ground improvement – selection criteria – improvement objectives – overview of ground improvement methods.					
Unit - II	MECHANICAL AND HYDRAULIC METHODS				9
Mechanical compaction – shallow and deep compaction methods – dynamic compaction – vibro compaction – blasting – hydraulic methods – drainage techniques – preloading – vertical drains – sand drains – prefabricated vertical drains – accelerated consolidation.					
Unit - III	CHEMICAL AND GROUTING METHODS				9
Chemical stabilization – lime, cement, fly ash, bitumen stabilization – deep soil mixing – grouting methods – permeation grouting – compaction grouting – jet grouting – applications and limitations.					
Unit – IV	REINFORCEMENT AND INCLUSION TECHNIQUES				9
Soil reinforcement principles – geosynthetics – geotextiles, geogrids, geocells – reinforced earth – stone columns – vibro replacement – encased stone columns – piles as ground improvement – soil nailing.					
Unit - V	SPECIAL TECHNIQUES AND CASE STUDIES				9
Ground freezing – electro-osmosis – vacuum consolidation – bio-mediated ground improvement – selection of techniques based on soil and site conditions – case studies – field applications – quality control and monitoring.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify problematic soils and evaluate the need for ground improvement.	K3
CO2	Analyze mechanical and hydraulic ground improvement techniques.	K4
CO3	Apply chemical stabilization and grouting methods for soil improvement.	K3
CO4	Examine ground improvement systems using reinforcement and structural inclusions for specific site conditions	K4
CO5	Evaluate ground improvement methods based on site conditions, economic feasibility, and environmental considerations.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	1	-	-	-	-	3	1	1	1
CO2	3	3	2	-	-	1	-	-	-	-	3	2	1	1
CO3	2	3	3	-	-	1	-	-	-	-	3	2	1	1
CO4	2	2	3	-	-	1	-	-	-	-	3	2	1	1
CO5	2	2	2	-	-	1	-	-	-	-	3	2	1	1
CO	2	2	2	-	-	1	-	-	-	-	3	2	1	1

Correlation levels 1, 2 and 3 are as defined below:

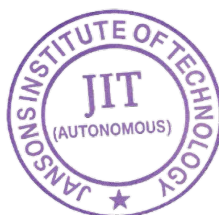
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Hausmann, M.R., "Engineering Principles of Ground Modification", McGraw Hill, New York, 1990.
2	Braja M. Das, "Principles of Foundation Engineering", 8th Edition, Cengage Learning, New Delhi, 2023.
3	Koerner, R.M., "Designing with Geosynthetics", 6th Edition, Pearson Education, New Delhi, 2012.
4	Moseley, M.P., Ground Treatment, Blackie Academic and Professionals, 2004.
5	Schaefer, V.R., Berg, R.R., Collin, J.G., Filz, G.M., Bruce, D.A. and Boutwell, G.P., Ground Modification Methods: Reference Manual, FHWA, 2006.

Reference Books

1	Mitchell, J.K. and Santamarina, J.C., "Biological Considerations in Geotechnical Engineering", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, 2005.
2	Coduto, D.P., Yeung, M.R. and Kitch, W.A., "Geotechnical Engineering: Principles and Practices", Pearson Education, New Delhi, 2011.
3	Kirsch, K. and Bell, A. (Eds.), Ground Improvement, 3rd Edition, CRC Press, 2013.
4	Han, J., Principles and Practice of Ground Improvement, 2nd Edition, John Wiley & Sons, 2023.



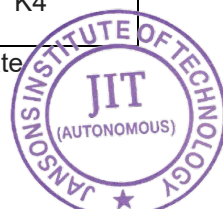
U24CE5C03	SOIL DYNAMICS AND MACHINE FOUNDATIONS	L	T	P	C
		3	0	0	3
Course Objectives:	To impart knowledge on identification of problematic soils and application of mechanical, hydraulic, chemical, and reinforcement-based ground improvement techniques to enhance soil performance and foundation stability.				
Unit - I	THEORY OF VIBRATION				9
Introduction – Nature of dynamic loads – Basic definitions – Simple harmonic motion – Fundamentals of vibration – Single degree and multi degree of freedom systems – Free vibrations of spring – Mass systems – Forced vibrations – Resonance – Viscous damping – Principles of vibrations measuring systems – Effect of transient and pulsating loads.					
Unit - II	DYNAMIC SOIL PROPERTIES				9
Dynamic stress-strain characteristics – Principles of measuring dynamic properties – Laboratory techniques – Field tests – Block vibration test – Factors affecting dynamic properties – Typical values. Mechanism of liquefaction – Influencing factors – Evaluation of liquefaction potential – Analysis from SPT test – Dynamic bearing capacity – Dynamic earth pressure.					
Unit - III	MACHINE FOUNDATIONS				9
Introduction – Types of machine foundations – General requirements for design of machine foundations – Design approach for machine foundation – Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.					
Unit – IV	DESIGN OF MACHINE FOUNDATION				9
Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modes of vibration of a rigid foundation – Foundations for reciprocating machines, impact machines, Two – Cylinder vertical compressor, Double-acting steam hammer –Codal recommendations – Empirical approach – Barken's method – Bulb of pressure concept – Pauw's analogy – Vibration table studies.					
Unit - V	VIBRATION ISOLATION				9
Vibration isolation – Types of isolation – Transmissibility – Passive and active isolation – Methods of isolation – Use of springs and damping materials – Properties of isolating materials – Vibration control of existing machine foundation.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain fundamentals of vibration theory and analyze free and forced vibration behavior of single and multi-degree-of-freedom systems.	K4
CO2	Evaluate dynamic soil properties, liquefaction potential, and dynamic bearing capacity using laboratory, field, and in-situ test data.	K4
CO3	Analyze soil–foundation interaction and vibration response of machine foundations using elastic half-space and mass–spring–dashpot models.	K4
CO4	Design block and framed machine foundations for reciprocating and impact machines as per codal and empirical approaches.	K4
CO5	Assess and implement suitable vibration isolation and control techniques for new and existing machine foundations.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	3	1	1	1
CO2	3	3	-	-	-	-	-	-	-	-	3	2	1	1
CO3	2	3	2	-	-	-	-	-	-	-	3	2	1	1
CO4	2	2	3	-	-	-	-	-	-	-	3	2	1	1
CO5	2	2	2	-	-	-	-	-	-	-	3	2	1	1
CO	2	2	1	-	-	-	-	-	-	-	3	2	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Vaidyanathan, C.V., and Srinivasalu, P., Handbook of Machine Foundations, McGraw Hill, 1995.
2	Das, B.M. and Ramana, G.V., Principles of Soil Dynamics, 2nd Edition, Cengage Learning, 2011.
3	KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing, New Delhi, 2000.
4	Moore, P.J., Analysis and Design of Foundations for Vibrations, Oxford and IBH, 1985.
5	Swami Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd. New Delhi 2010.

Reference Books

1	Kramer, S.L., Geotechnical Earthquake Engineering, Pearson Education, 1996.
2	Towhata, I., Geotechnical Earthquake Engineering, Springer, 2008.
3	Richart, F.E., Hall, J.R. and Woods, R.D., Vibrations of Soils and Foundations, Prentice-Hall, 1970.



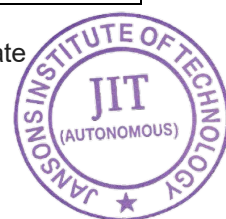
U24CE5C04	EARTHQUAKE RESISTANT STRUCTURES	L	T	P	C
		3	0	0	3
Course Objectives:	To impart knowledge on causes and effects of earthquakes, seismic response of structures, and principles of analysis and design of earthquake-resistant structures as per codal provisions.				
Unit - I	SEISMOLOGY AND SEISMIC HAZARDS				9
Causes of earthquakes – plate tectonics – seismic waves – magnitude and intensity – seismographs – seismic zoning of India – earthquake hazards – ground motion characteristics – response spectra – seismic risk and damage assessment.					
Unit - II	STRUCTURAL RESPONSE TO EARTHQUAKES				9
Dynamic response of structures – single degree and multi-degree of freedom systems – free and forced vibrations – damping – resonance – earthquake response of buildings – concepts of ductility, stiffness, strength, and energy dissipation.					
Unit - III	SEISMIC ANALYSIS OF STRUCTURES				9
Design philosophy for earthquake resistance – seismic loads and load combinations – codal provisions (IS 1893) – equivalent static method – response spectrum method – introduction to time history analysis – base shear calculation – distribution of seismic forces.					
Unit – IV	EARTHQUAKE RESISTANT DESIGN OF BUILDINGS				9
Seismic design concepts – structural configuration – lateral load-resisting systems – moment resisting frames – shear walls – braced frames – ductile detailing principles – codal provisions (IS 456, IS 13920) – masonry buildings – seismic design guidelines.					
Unit - V	SEISMIC CONTROL AND RETROFITTING				9
Earthquake-resistant construction practices – seismic isolation – base isolation techniques – energy dissipation devices – seismic retrofitting techniques – jacketing – shear wall addition – infill walls – case studies of earthquake-damaged structures.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain earthquake causes, seismic waves, ground motion characteristics, and seismic hazard assessment.	K4
CO2	Analyze dynamic response of structures subjected to earthquake loading using vibration theory concepts.	K4
CO3	Perform seismic analysis of structures using equivalent static and response spectrum methods as per codal provisions.	K4
CO4	Apply earthquake-resistant design principles and ductile detailing requirements for RC and masonry buildings.	K5
CO5	Evaluate and implement seismic control, base isolation, and retrofitting techniques for existing structures.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	1	1	-	-	-	-	-	-	3	1	1	1
CO2	3	3	1	1	-	-	-	-	-	-	3	2	1	1
CO3	2	3	1	1	-	-	-	-	-	-	3	2	1	1
CO4	2	2	1	1	-	-	-	-	-	-	3	2	1	1
CO5	2	2	1	1	-	-	-	-	-	-	3	2	1	1
CO	2	2	1	1	-	-	-	-	-	-	3	2	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

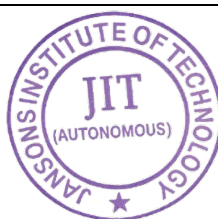
1	Anil K. Chopra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, Pearson Education, 5th Edition, 2017.
2	Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2023.
3	C. S. Prakash Rao, Earthquake Resistant Design of Structures, Wheeler Publishing, New Delhi, Revised Edition, 2018.

Reference Books

1	T. Paulay and M. J. N. Priestley, Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons, New York, Reprint Edition, 2015.
2	Mario Paz and William Leigh, Structural Dynamics: Theory and Computation, Springer, 6th Edition, 2021.
3	S. K. Duggal, Earthquake-Resistant Design of Structures, Oxford University Press, New Delhi, 2nd Edition, 2020.

Indian Standards and Guidelines

4	IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures
5	IS 4326: 2013 – Earthquake Resistant Design and Construction of Buildings
6	IS 13827: 1993 – Guidelines for Improving Earthquake Resistance of Earthen Buildings
7	IS 13828: 1993 – Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings

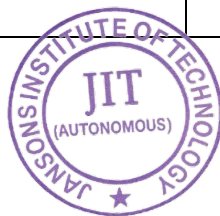


U24CE5C05	TUNNELING ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To understand, analyze, and apply principles of tunnel engineering including excavation methods, planning, construction techniques, and support systems for safe and efficient underground space utilization.				
Unit - I	TUNNELS AND UNDERGROUND SPACE APPLICATION	9			
History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposal defence facilities-submerged tunnels-underground library,museums.					
Unit - II	EXCAVATION TECHNIQUES	9			
Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures.					
Unit - III	PLANNING AND GEOMETRIC DESIGN OF TUNNELS	9			
Topographical –geological survey-rock sampling-testing-determination of location size shape and alignment-subsidence problem on soft ground –tunneling design in hard rock.					
Unit – IV	CONSTRUCTION OF TUNNEL	9			
Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of shield tunneling-factors affecting selection of shield-twin tunnel-NATM.					
Unit - V	DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION	9			
Classification of supports-active –passive-permanent-temporary-excavation support-steel supports-lining-grouting-ground freezing-environment in underground-various methods of ventilation.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the history, applications, and functional requirements of tunnels and underground space systems.	K3
CO2	Analyze various tunnel excavation techniques for soft ground and hard rock conditions and propose suitable remedial measures.	K4
CO3	Plan tunnel alignment and geometric design based on topographical and geological investigations, considering subsidence issues.	K4
CO4	Evaluate modern tunnel construction methods such as TBM, shield tunneling, and NATM for different site conditions.	K4
CO5	Design appropriate tunnel supporting systems and ventilation methods to ensure structural stability, safety, and environmental control.	K5



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	1	1	-	-	-	-	-	-	3	2	2	1
CO2	3	3	3	2	-	-	-	-	-	-	3	2	2	1
CO3	2	3	3	2	-	-	-	-	-	-	3	2	2	1
CO4	2	2	2	2	-	-	-	-	-	-	3	2	2	1
CO5	2	2	2	2	-	-	-	-	-	-	3	2	2	1
CO	2	2	2	2	-	-	-	-	-	-	3	2	2	1

Correlation levels 1, 2 and 3 are as defined below:

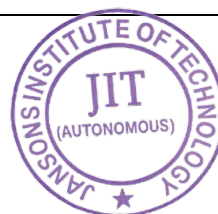
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Bickel, J. O., Kuesel, T. R. and King, E. H., Tunnel Engineering Handbook, Chapman & Hall / Kluwer Academic Publishers, 2nd Edition, 1996.
2	Evert Hoek and E. T. Brown, Underground Excavations in Rock, Institution of Mining and Metallurgy, London, Reprint Edition, 2015.
3	John C. Jaeger, Neville G. W. Cook and Robert W. Zimmerman, Fundamentals of Rock Mechanics, Blackwell Publishing, 4th Edition, 2007.

Reference Books

1	Z. T. Bieniawski, Engineering Rock Mass Classifications: A Complete Manual for Engineers and Geologists in Mining, Civil, and Petroleum Engineering, John Wiley & Sons, 1989 (Latest Reprint).
2	B. H. G. Brady and E. T. Brown, Rock Mechanics for Underground Mining, Springer, 3rd Edition, 2006.
3	R. B. Peck, Selected Writings on Soil Mechanics and Foundation Engineering, ASCE, Latest Reprint Edition.
4	B. Singh and R. K. Goel, Engineering Rock Mass Classification: Tunnelling, Foundations and Landslides, Elsevier, 2011.



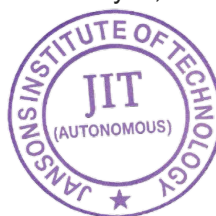
U24CE5C06	PILE FOUNDATION			L	T	P	C
				3	0	0	3
Course Objectives:		To understand, analyze, and apply principles of tunnel engineering including excavation methods, planning, construction techniques, and support systems for safe and efficient underground space utilization.					
Unit - I	PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE					9	
Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition –pile raft system – basic interactive analysis - criteria for pile socketing.							
Unit - II	AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS					9	
Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation –Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.							
Unit - III	LATERAL AND UPLIFT LOAD CAPACITIES OF PILES					9	
Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test.							
Unit – IV	STRUCTURAL DESIGN OF PILE AND PILE GROUPS					9	
Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration.							
Unit - V	CAISSONS					9	
Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the importance and applications of pile foundations, the roles and responsibilities of geotechnical engineers and contractors, and the functions of various piling equipment	K2
CO2	Determine the vertical load-carrying capacity of individual piles and pile groups, considering settlement criteria, field practices, and relevant codal provisions.	K3
CO3	Analyze the behavior and load-carrying response of piles subjected to lateral, uplift, and moment loads using analytical and experimental approaches.	K4
CO4	Design structural components of piles and pile groups, including pile caps and reinforcement detailing, based on strength and serviceability requirements.	K4
CO5	Analyze and design caisson foundations considering stability, construction methods, and seismic effects.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	1	1	-	-	-	-	-	-	3	2	2	1
CO2	3	3	3	2	-	-	-	-	-	-	3	2	2	1
CO3	2	3	3	2	-	-	-	-	-	-	3	2	2	1
CO4	2	2	2	2	-	-	-	-	-	-	3	2	2	1
CO5	2	2	2	2	-	-	-	-	-	-	3	2	2	1
CO	2	2	2	2	-	-	-	-	-	-	3	2	2	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

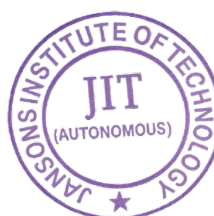
1	Braja M. Das and Nagaratnam Sivakugan, Principles of Foundation Engineering, Cengage Learning, 9th Edition, 2021.
2	P. C. Varghese, Design of Reinforced Concrete Foundations, PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2019.
3	Michael J. Tomlinson and John Woodward, Pile Design and Construction Practice, CRC Press, Taylor & Francis Group, 6th Edition, 2015.
4	L. C. Reese and W. F. Van Impe, Single Piles and Pile Groups Under Lateral Loading, CRC Press, Taylor & Francis, 1st Edition, 2011.

Reference Books

1	M. J. Tomlinson and R. Boorman, Foundation Design and Construction, Pearson Education, 8th Edition, 2014.
2	J. E. Bowles, Foundation Analysis and Design, McGraw Hill, 5th Edition (Reprint), 2017.
3	Donald P. Coduto, Man-chu Ronald Yeung and William A. Kitch, Foundation Design: Principles and Practices, Pearson Education, 3rd Edition, 2011..

Indian Standards / Codes

1	IS 2911 (Part 1 to Part 4):2010, Code of Practice for Design and Construction of Pile Foundations
2	IS 456:2000, Plain and Reinforced Concrete – Code of Practice, BIS, New Delhi, with latest amendments.
3	IS 1893 (Part 1):2016, Criteria for Earthquake Resistant Design of Structures – Part 1: General Provisions and Buildings, BIS, New Delhi.
4	IS 6403:1981, Code of Practice for Determination of Bearing Capacity of Shallow Foundations, BIS, New Delhi.



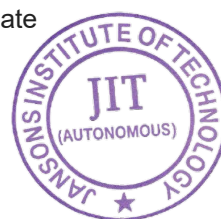
U24CE5D01	RAILWAYS, AIRPORTS, DOCKS AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To introduce the students about Railways planning, design, construction and maintenance and planning design principles of airport and harbor.				
Unit - I	RAILWAY PLANNING AND CONSTRUCTION				10
Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods--Geometric design of railway, gradient, super elevation, widening of gauge on curves- Level Crossings.					
Unit - II	RAILWAY CONSTRUCTION AND MAINTENANCE				8
Earthwork – Stabilization of track on poor soil - Track drainage – Calculation of Materials required for track laying - Construction and maintenance of tracks – Railway Station and yards and passenger amenities-Signalling					
Unit - III	AIRPORT PLANNING				7
Air transport characteristics - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area.					
Unit – IV	AIRPORT DESIGN				10
Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.					
Unit - V	HARBOUR ENGINEERING				10
Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Coastal Regulation Zone, 2011					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the components of railway permanent way, track geometry, route alignment, and principles of railway planning and construction.	K2
CO2	Analyze railway track construction, drainage, stabilization, maintenance practices, railway stations, yards, and signalling systems.	K4
CO3	Apply airport planning principles for site selection, airport classification, layout planning, and aircraft parking and circulation facilities.	K3
CO4	Design the geometric elements of runways and taxiways, including runway orientation, wind rose analysis, runway length, markings, and airport zoning.	K4
CO5	Analyze harbour planning and design principles, coastal structures, wave and tidal effects, inland water transport, and coastal protection measures	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	-	2
CO2	3	-	-	-	-	2	-	-	-	-	1	3	2	-
CO3	3	2	-	-	-	2	-	-	-	-	1	3	-	2
CO4	3	2	-	-	-	-	-	-	-	-	1	3	-	3
CO5	3	2	-	-	-	3	-	-	-	-	1	3	-	3
CO	3	2	-	-	-	2	-	-	-	-	1	3	-	2

Correlation levels 1, 2 and 3 are as defined below:

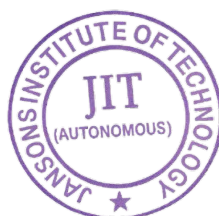
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	S. C. Saxena and S. P. Arora, A Course in Railway Engineering, Dhanpat Rai & Sons, New Delhi, 8th Edition (Reprint), 2017.
2	Robert H. Horonjeff, Francis X. McKelvey, William J. Sproule and Seth B. Young, Planning and Design of Airports, McGraw Hill Education, 5th Edition, 2010.
3	K. P. Subramanian, Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India) Pvt. Ltd., Chennai, Revised Edition, 2020.

Reference Books

1	C. Venkatramaiah, Transportation Engineering: Volume II – Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press (India) Pvt. Ltd., Hyderabad, Revised Edition, 2015.
2	J. S. Mundrey, Railway Track Engineering, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 4th Edition, 2017.
3	S. C. Rangwala, Railway Engineering, Charotar Publishing House Pvt. Ltd., Anand, Revised Edition, 2019.

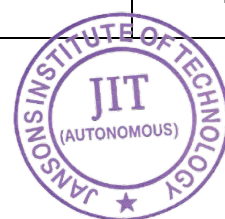


U24CE5D02	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3
Course Objectives:	To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety				
Unit - I	TRAFFIC SURVEYS AND ANALYSES	8			
Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems					
Unit - II	TRAFFIC FLOW AND ROADWAY CAPACITY	8			
Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed- Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes					
Unit - III	COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES	10			
Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self-Enforcing Techniques- Demand Management Techniques (TDM).					
Unit – IV	DESIGN OF ROAD INTERSECTIONS	10			
Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.					
Unit - V	DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS	9			
Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; Pedestrians: Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; Cycle Tracks: Principles of design, Design criteria, Design standards for Rural Expressways.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply science and engineering fundamentals to conduct traffic surveys and interpret traffic-related problems with reference to relevant standards and guidelines.	K3
CO2	Analyze traffic flow characteristics and evaluate their interrelationships under different traffic conditions.	K4
CO3	Apply traffic management strategies, including demand pricing and Intelligent Transportation Systems (ITS), to address transportation challenges.	K3



COs	Statements	K-Level
CO4	Analyze various traffic control and regulatory measures for improving the efficiency and safety of transportation networks.	K4
CO5	Evaluate different non-motorized transport facilities and develop suitable planning approaches for sustainable and accessible transportation.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	-	1	3	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	3	2	-
CO3	3	2	3	-	-	-	-	-	-	-	-	1	3	3	-
CO4	3	2	3	-	-	-	-	-	-	-	-	1	3	3	-
CO5	3	2	3	-	-	-	-	-	-	-	-	1	3	3	-
CO	3	2	2	-	-	-	-	-	-	-	-	1	3	3	-

Correlation levels 1, 2 and 3 are as defined below:

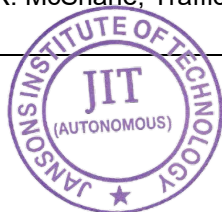
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	L. R. Kadiyali and N. B. Lal, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, Latest Revised Edition, 2017.
2	S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Highway Engineering, Nem Chand & Bros., Roorkee, 10th Edition, 2014.
3	P. Srinivasa Kumar, Introduction to Traffic Engineering, Universities Press, Hyderabad, 1st Edition, 2018.
4	Partha Chakroborty and Animesh Das, Principles of Transportation Engineering, PHI Learning Pvt. Ltd., New Delhi, 2nd Edition, 2017.
5	P. S. Papacostas and P. D. Prevedouros, Transportation Engineering and Planning, Pearson Education, 3rd Edition, 2015.

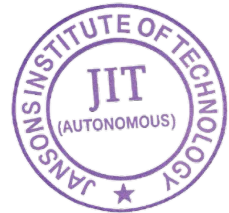
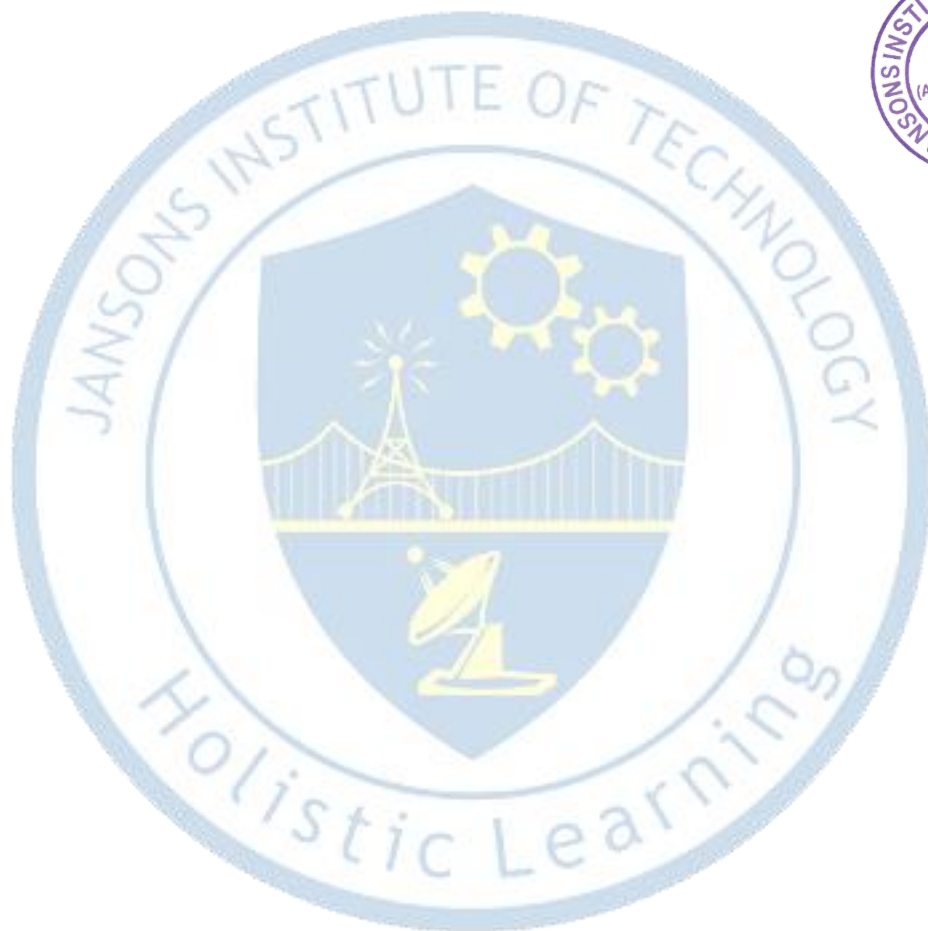
Reference Books

1	Indian Roads Congress (IRC), Specifications, Guidelines and Special Publications on Traffic Engineering, Traffic Planning and Management, IRC, New Delhi, Latest Editions.
2	S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Highway Engineering, Nem Chand & Bros., Roorkee, 10th Edition, 2014.
3	C. Jotin Khisty and B. Kent Lall, Transportation Engineering: An Introduction, Pearson Education, 3rd Edition, 2005.
4	Roger P. Roess, Elena S. Prassas and William R. McShane, Traffic Engineering, Pearson Education, 4th Edition, 2019.



Recommended Indian Codes / Guidelines

1	IRC:SP:41, Guidelines on Design of At-Grade Intersections in Rural and Urban Areas, Indian Roads Congress, New Delhi.
2	IRC:103, Guidelines for Pedestrian Facilities, Indian Roads Congress, New Delhi, 2012.
3	IRC:86, Geometric Design Standards for Urban Roads in Plains, Indian Roads Congress, New Delhi.
4	IRC:92, Guidelines for the Design of Interchanges in Urban Areas, Indian Roads Congress, New Delhi.
5	IRC:35, Code of Practice for Road Markings, Indian Roads Congress, New Delhi.
6	IRC:SP:55, Guidelines on Traffic Management in Work Zones, Indian Roads Congress, New Delhi

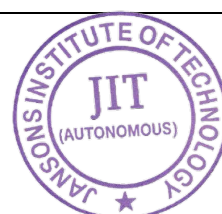


U24CE5D03	URBAN PLANNING AND DEVELOPMENT			L	T	P	C
				3	0	0	3
Course Objectives:		To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.					
Unit - I	INTRODUCTION					7	
Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas –Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)							
Unit - II	PLANNING PROCESS AND THEORIES					10	
Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept							
Unit - III	DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION					10	
Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town-Development Plan, urban nodes, Smart City Plan -Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.							
Unit – IV	PLAN IMPLEMENTATION					10	
Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.							
Unit - V	URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS					8	
Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamental concepts, issues, and terminology associated with urban planning and development.	K2
CO2	Analyze various theories and approaches of urban planning and city development.	K4
CO3	Apply planning principles to identify different types of plans, their strategies, and the processes involved in their preparation.	K4
CO4	Analyze planning standards, development constraints, and financial mechanisms involved in urban planning and development.	K3



COs	Statements	K-Level
CO5	Explain the major provisions and functions of relevant town and country planning acts and regulations.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	2	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	2	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	2	2	-	-	-	2	-	-	-	-	1	3	1	-
CO5	2	2	-	-	-	3	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	2	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

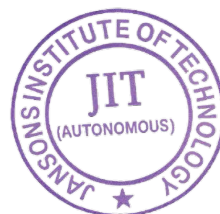
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002
2	George Chadwick, A Systems view of planning, Pergamon press, Oxford 2017
3	Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001
4	Edwin S.Mills and Charles M.Becker, Studies in Urban development, A World Bank publication, 1986

Reference Books

1	Government of Tamil Nadu, Tamil Nadu Town and Country Planning Act, 1971, and Rules made thereunder, Chennai, Latest Amendments.
2	K. R. Thooyavan, Human Settlements: A Planning Guide to Beginners, M.A. Publications, Chennai, Revised Edition, 2005.
3	Government of Tamil Nadu, Chennai City Municipal Corporation Act, 1919, Latest Amendments.
4	Government of India, The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013, with latest amendments.
5	Ministry of Housing and Urban Affairs (MoHUA), Government of India, National Urban Transport Policy, 2006, with subsequent updates.
6	Urban & Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development
7	Anthony E. J. Morris, History of Urban Form Before the Industrial Revolution, Routledge, 3rd Edition, 2013.

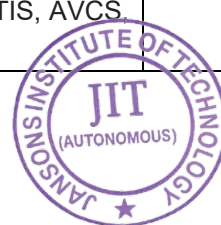


U24CE5D04	SMART CITIES & INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3
Course Objectives:	To help the leaners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities. To have an overview of ITS implementation in developing countries				
Unit - I	SMART PHYSICAL INFRASTRUCTURE				9
Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission -Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc					
Unit - II	SUSTAINABILITY AND SMART PLANNING				9
Relationship Between Sustainability and Smart planning - Place making project guidelines- Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services; Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.					
Unit - III	INTELLIGENT TRANSPORTATION SYSTEMS				9
Definition of ITS, Overview of application of ITS in Transportation Planning, Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)					
Unit – IV	ITS IN TRAFFIC MANAGEMENT				9
ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS)					
Unit - V	ITS IN TRANSPORTATION PLANNING				9
ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight –in Motion					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the concepts of smart cities and describe the role of technologies in smart physical infrastructure and urban management.	K2
CO2	Discuss the relationship between sustainability and smart planning, and summarize approaches for project monitoring, evaluation, and risk management.	K2
CO3	Describe the definition and applications of Intelligent Transportation Systems (ITS) in transportation planning, and explain the role of sensors and data collection techniques.	K2
CO4	Explain the functional areas of ITS in traffic management, including ATMS, ATIS, AVCS, and APTS.	K2



COs	Statements	K-Level
CO5	Discuss the role of ITS in transportation planning, and summarize its contributions to safety, security, sustainable mobility, and public transportation operations.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	3	-	-	-	-	-	-	-	1	3	-	3
CO2	3	3	3	-	-	-	-	-	-	-	1	-	3	3
CO3	3	3	-	-	-	-	-	-	-	-	1	3	2	-
CO4	3	-	3	-	-	-	-	-	-	-	1	3	-	3
CO5	3	3	3	-	-	-	-	-	-	-	1	3	3	3
CO	3	2	3	-	-	-	-	-	-	-	1	3	2	3

Correlation levels 1, 2 and 3 are as defined below:

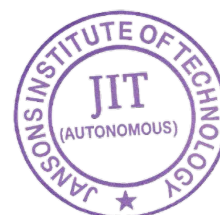
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	R. Srinivasa Kumar, Intelligent Transportation Systems, Universities Press (India) Pvt. Ltd., Telangana, 2022.
2	Kan Paul Chen and John Miles, TS Handbook 2000: Recommendations for the World Road Association (PIARC), PIARC, 2000.
3	Mashrur A. Chowdhury and Adel Sadek, Fundamentals of Intelligent Transportation Systems Planning, Artech House, 2003.

Reference Books

1	P. Sharma, Sustainable Smart Cities in India: Challenges and Future Perspectives, Springer, 2017.
2	Sameer Sharma, Smart Cities Unbounded: Ideas and Practice of Smart Cities in India, Bloomsbury India, 2018.
3	US Department of Transportation, Intelligent Transportation Primer, Washington, D.C., 2001.
4	Roger P. Roess, Elena S. Prassas and William R. McShane, Traffic Engineering, Pearson, 4th Edition, 2019.



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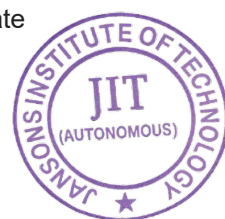
U24CE5D05	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.				
Unit - I	PAVEMENT MATERIALS AND SUBGRADE ANALYSIS	8			
Introduction – Pavement as layered structure – Pavement types -rigid and flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.					
Unit - II	DESIGN OF FLEXIBLE PAVEMENTS	10			
Flexible pavement design – Advantages and disadvantages -Factors influencing design of flexible pavement, Empirical – Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.					
Unit - III	DESIGN OF RIGID PAVEMENTS	9			
Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.					
Unit – IV	PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE	10			
Construction Techniques practice of flexible and concrete pavement Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).					
Unit - V	STABILIZATION OF PAVEMENTS	8			
Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Classify different types of rigid and flexible pavements based on their structural characteristics and applications.	K2
CO2	Apply the principles and design concepts of rigid pavements for determining pavement thickness and structural requirements.	K3
CO3	Determine the structural requirements of flexible pavements using appropriate pavement design principles and methods.	K3
CO4	Analyze the causes and mechanisms of distress in rigid and flexible pavements and recommend suitable remedial measures.	K4
CO5	Evaluate pavement stabilization techniques, testing procedures, and field quality control methods for pavement construction.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	-	3	2	-	-	-	-	-	-	1	-	1	-
CO3	3	-	3	2	-	-	-	-	-	-	1	3	1	-
CO4	3	2	3	3	-	2	-	-	-	-	1	3	1	-
CO5	3	2	-	-	2	2	-	-	-	-	1	3	1	-
CO	3	2	3	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

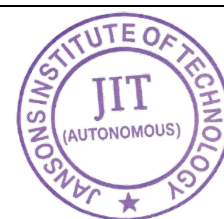
1	S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Highway Engineering, Nem Chand & Bros., Roorkee, 10th Revised Edition, 2014.
2	L. R. Kadiyali and N. B. Lal, Principles and Practice of Highway Engineering, Khanna Technical Publications, New Delhi, 8th Edition, 2013.
3	Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering: Principles and Practice, CRC Press, 3rd Edition, 2023.

Reference Books

1	E. J. Yoder and M. W. Witczak, Principles of Pavement Design, John Wiley & Sons, 2nd Edition, 2000.
2	Yang H. Huang, Pavement Analysis and Design, Pearson Education, 2nd Edition, 2004.
3	Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering: Principles and Practice, CRC Press, 3rd Edition, 2023.

Recommended Codes / Guidelines

1	IRC:37, Guidelines for the Design of Flexible Pavements, Indian Roads Congress, New Delhi, Latest Revision.
2	IRC:58, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress, New Delhi, Latest Revision.
3	IRC:81, Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique, Indian Roads Congress, New Delhi.
4	IRC:115, Guidelines for Structural Evaluation and Strengthening of Flexible Road Pavements, Indian Roads Congress, New Delhi.
5	IRC:SP:72, Guidelines for the Design of Flexible Pavements for Low Volume Rural Roads, Indian Roads Congress, New Delhi.



U24CE5D06	TRANSPORTATION PLANNING PROCESS	L	T	P	C
		3	0	0	3
Course Objectives:	To impart knowledge in the rudiments and stages in Transportation Planning Process				
Unit - I	TRANSPORTATION PLANNING PROCESS				8
Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology, analyses of data and presentation of results.					
Unit - II	TRIP GENERATION STAGE				9
Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.					
Unit - III	TRIP DISTRIBUTION STAGE				10
Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.					
Unit – IV	MODAL SPLIT STAGE				9
Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model					
Unit - V	TRAFFIC ASSIGNMENT STAGE				9
Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the principles of the transportation planning process and describe methods of data collection.	K3
CO2	Apply trip production and trip attraction models, including model calibration, for transportation planning applications.	K3
CO3	Analyze trip distribution models and their applications in transportation planning.	K3
CO4	Evaluate mode choice behaviour and assess the applicability of different mode split models.	K4
CO5	Formulate transportation planning models and assess their relevance in transportation system decision-making.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	-	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	2	-
CO3	3	-	3	-	-	-	-	-	-	-	1	3	3	-
CO4	3	2	3	-	-	-	-	-	-	-	1	3	3	-
CO5	3	2	3	-	-	-	-	-	-	-	1	3	3	-
CO	3	2	2	-	-	-	-	-	-	-	1	3	3	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Kadiyali. L.R., Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2019.
2	C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2009.
3	Michael J.Bruton, Introduction to Transportation Planning, Hutchinson, London, 1995.

Reference Books

1	J D Ortuzar and L G Willumsen. Modeling Transport. John Wiley and Sons, New York, 2011.
2	John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990.
3	C. JotinKhisty, Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 1998
4	Juan de Dios Ort zar and Luis G. Willumsen, Modelling Transport, John Wiley & Sons 2001
5	Chennai Comprehensive Traffic Study, Chennai Metropolitan Development Authority, 2007.
6	James H.Banks, Introduction to Transportation Engineering, Tata McGraw Hill Education Pvt Ltd, 2010



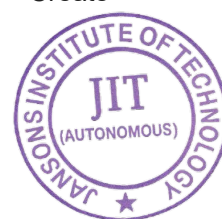
U24CE5E01	CLIMATE CHANGE ADAPTATION AND MITIGATION		L	T	P	C
			3	0	0	3
Course Objectives:	To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students					
Unit - I	INTRODUCTION					9
Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global Ocean circulation – El Nino and its effect - Carbon cycle						
Unit - II	ELEMENTS RELATED TO CLIMATE CHANGE					9
Greenhouse gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect						
Unit - III	IMPACTS OF CLIMATE CHANGE					9
Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas						
Unit – IV	MITIGATING CLIMATE CHANGE					9
IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies –carbon sequestration.						
Unit - V	ALTERNATE FUELS AND RENEWABLE ENERGY					9
Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.						
Total Periods:						45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain basic concepts of weather, climate system, global circulation, and carbon cycle related to climate change	K3
CO2	Analyze causes of climate change and the role of greenhouse gases and sector-wise carbon emissions.	K4
CO3	Assess the impacts of climate change on ecosystems, human health, agriculture, infrastructure, and socio-economic sectors	K4
CO4	Apply climate change mitigation and adaptation strategies including green infrastructure, energy efficiency, and carbon sequestration.	K3
CO5	Evaluate alternative fuels, renewable energy sources, and energy policies for sustainable and low-carbon development.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	-	-	-	2	-	-	-	-	3	2	1	1
CO2	2	3	-	-	-	2	-	-	-	-	3	2	1	1
CO3	2	3	-	-	-	2	-	-	-	-	3	2	1	1
CO4	1	2	-	-	-	2	-	-	-	-	3	2	1	1
CO5	1	2	-	-	-	2	-	-	-	-	3	2	1	1
CO	2	2	-	-	-	2	-	-	-	-	3	2	1	1

Correlation levels 1, 2 and 3 are as defined below:

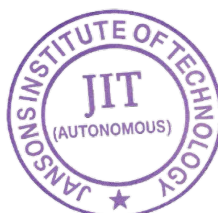
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	William F. Ruddiman, Earth's Climate: Past and Future, W. H. Freeman and Company, 3rd Edition, 2014.
2	Velma I. Grover, Global Warming and Climate Change: Volumes I & II, Science Publishers, 2005.
3	Sushil Kumar Dash, Climate Change: An Indian Perspective, Cambridge University Press India Pvt. Ltd., 2007.
4	John Houghton, Global Warming: The Complete Briefing, Cambridge University Press, 5th Edition, 2015.

Reference Books

1	Intergovernmental Panel on Climate Change (IPCC), Climate Change 2021: The Physical Science Basis, Contribution of Working Group I to the Sixth Assessment Report, Cambridge University Press, 2021.
2	Intergovernmental Panel on Climate Change (IPCC), Climate Change 2022: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Sixth Assessment Report, Cambridge University Press, 2022.
3	Jan C. van Dam (Ed.), Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.
4	Lovejoy, T. E. and Hannah, L. (Eds.), Climate Change and Biodiversity, TERI Press, 2005.

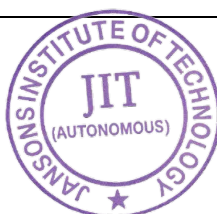


U24CE5E02	AIR AND NOISE POLLUTION CONTROL ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.				
Unit - I	GENERAL			9	
Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.					
Unit - II	SOURCES, CLASSIFICATION AND EFFECTS			9	
Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.					
Unit - III	SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING			9	
Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion – Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling.					
Unit – IV	AIR POLLUTION CONTROL MEASURES			9	
Control - Source correction methods - Control equipment's - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Absorption equipment's - adsorption and combustion devices (Theory and working of equipment's only).					
Unit - V	NOISE POLLUTION AND ITS CONTROL			9	
Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent					
Total Periods:				45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the structure and composition of the atmosphere, global climate, and ambient air quality standards.	K2
CO2	Classify the various types and sources of air pollutants and describe their effects on human health and the environment.	K2
CO3	Analyze the dispersion characteristics of air pollutants and apply appropriate atmospheric dispersion models.	K4
CO4	Evaluate the principles and performance of various control methods for particulate and gaseous pollutants.	K4



COs	Statements	K-Level
CO5	Assess the causes and effects of noise pollution and recommend suitable noise control and mitigation measures.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO–PO–PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	-	-	-	2	2	-	-	-	3	1	1	2
CO2	2	1	-	-	-	2	2	-	-	-	3	1	1	2
CO3	2	1	-	-	-	2	2	-	-	-	1	1	1	2
CO4	2	1	-	-	-	2	2	-	-	-	1	1	1	2
CO5	2	1	-	-	-	2	2	-	-	-	3	1	1	2
CO	2	1	-	-	-	2	2	-	-	-	2	1	1	2

Correlation levels 1, 2 and 3 are as defined below:

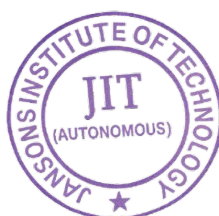
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	C. S. Rao, Environmental Pollution Control Engineering, Wiley Eastern Limited, New Delhi, 2006.
2	M. N. Rao and H. V. N. Rao, Air Pollution, Tata McGraw-Hill Education, New Delhi, 2017.
3	Y. Anjaneyulu, Air Pollution and Control Technologies, Allied Publishers Pvt. Ltd., New Delhi, 2019.
4	Vallero, D. A., Fundamentals of Air Pollution, 5th Edition, Academic Press, 2014.

Reference Books

1	Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2	Air Pollution act, India, 1987
3	Peterson and E. Gross Jr., "Hand Book of Noise Measurement", 7 th Edition, 1974
4	Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5	Antony Milne, "Noise Pollution: Impact and Counter Measures", David & Charles PLC, 1979.
6	Kenneth wark, Cecil F. Warner, "Air Pollution its Origin and Control", Harper and Row Publishers, New York, 1998.

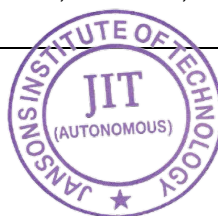


U24CE5E03	INDUSTRIAL WASTEWATER MANAGEMENT	L	T	P	C
		3	0	0	3
Course Objectives:	To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.				
Unit - I	INTRODUCTION				9
Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling – generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.					
Unit - II	INDUSTRIAL POLLUTION PREVENTION &WASTE MINIMISATION				9
Prevention vis a vis Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Periodic Waste Minimisation Assessments – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay-back period – Implementing & Promoting Pollution Prevention Programs in Industries.					
Unit - III	INDUSTRIAL WASTEWATER TREATMENT				9
Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease- Neutralisation- Removal of Inorganic Constituents – Precipitation, Heavy metal removal, Nitrogen & Phosphorous removal, Ion exchange, Adsorption, Membrane Filtration, Electro dialysis & Evaporation –Removal of Organic Constituents – Biological treatment Processes, Chemical Oxidation, Processes, Advanced Oxidation processes – Treatability Studies.					
Unit – IV	WASTEWATER REUSE AND RESIDUAL MANAGEMENT				9
Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion ,conditioning, dewatering and disposal of sludge – Management of RO rejects.					
Unit - V	CASE STUDIES				9
Industrial manufacturing process description, wastewater characteristics, source reduction optionsand waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify and explain the sources, characteristics, generation rates, and environmental impacts of industrial wastewater, along with applicable regulatory requirements and monitoring techniques.	K2
CO2	Apply pollution prevention and waste minimization principles to evaluate source reduction strategies and assess techno-economic feasibility using cost–benefit and payback analysis.	K3
CO3	Analyze and select appropriate industrial wastewater treatment processes for the removal of solids, oils, inorganic, and organic pollutants using physical, chemical, and biological methods.	K4



COs	Statements	K-Level
CO4	Design and evaluate wastewater reuse, zero liquid discharge systems, and residual management strategies, including sludge treatment and RO reject management.	K4
CO5	Develop and interpret industrial case studies by correlating manufacturing processes with wastewater characteristics, source reduction options, and treatment flow sheets for major industries.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO–PO–PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	-	-	-	-	2	2	-	-	-	3	-	-	2
CO2	2	-	-	-	-	2	2	-	-	-	3	-	-	2
CO3	2	-	-	-	-	2	2	-	-	-	1	-	-	2
CO4	2	-	-	-	-	2	2	-	-	-	1	-	-	2
CO5	2	-	-	-	-	2	2	-	-	-	3	-	-	2
CO	2	-	-	-	-	2	2	-	-	-	2	-	-	2

Correlation levels 1, 2 and 3 are as defined below:

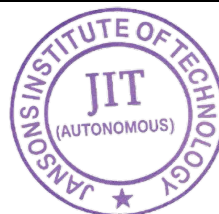
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Wesley Eckenfelder W., “ Industrial Water Pollution Control”, Second Edition, Mc Graw Hill, 2000
2	Paul L. Bishop, Pollution Prevention: - Fundamentals and Practice”, Mc-Graw Hill International, Boston, 2000.
3	Lawrance K. Wang, Yung Tse Hung, Howard H.Lo and Constantine Yapijakis “handlook of Industrial and Hazardous waste Treatment”, Second Edition, 2004.

Reference Books

1	"Industrial wastewater management, T reatment & disposal, Water Environment" Federation Alexandria Virginia, Third Edition, 2008.
2	Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017
3	Nelson Leonard Nemerow, “industrial waste Treatment”, Elsevier, 2007.
4	Waste water Treatment for pollution control and reuse by Soli. J. Arceivala, Shyam. R. Asolekar, Tata McGraw Hill, 2007

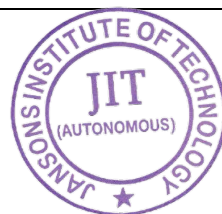


U24CE5E04	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	T	P	C
		3	0	0	3
Course Objectives:	To provide knowledge on waste minimization, storage, transport, recycling, processing, disposal, regulations, engineering principles, design, methods, and equipment.				
Unit - I	WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS	9			
Sources and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.					
Unit - II	WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING	9			
Waste sampling and characterization plan - waste generation rates and variation – physical composition, chemical and biological properties – hazardous characteristics – ignitability, corrosivity and TCLP tests –source reduction, segregation and onsite storage of wastes – waste exchange - extended producer responsibility - recycling of plastics, C&D wastes and E wastes.					
Unit - III	WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY	9			
Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenetic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery					
Unit – IV	BIOLOGICAL AND THERMAL PROCESSING OF WASTES	9			
Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis-plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.					
Unit - V	WASTE DISPOSAL	9			
Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites-Case studies					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the classification, characteristics, regulatory requirements, and integrated management approaches for solid and hazardous wastes.	K3
CO2	Apply waste characterization, source reduction, segregation, storage, and recycling principles for effective waste minimization and resource recovery.	K3



COs	Statements	K-Level
CO3	Analyze waste collection, transportation, material separation, recovery systems, and physio-chemical treatment methods for solid and hazardous wastes.	K4
CO4	Evaluate biological and thermal waste processing technologies based on resource recovery, energy generation, operational requirements, and environmental controls.	K4
CO5	Design sanitary and secure landfill systems considering site selection, liner and cover systems, leachate and landfill gas management, closure, and environmental monitoring.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes												PSO		
	01	02	03	04	05	06	07	08	09	10	11	12	01	02	03
CO1	3	3	-	-	-	3	-	-	-	-	3	1	3	1	1
CO2	3	3	-	-	-	3	-	-	-	-	3	1	3	1	1
CO3	3	3	-	-	-	3	-	-	-	-	3	1	3	1	1
CO4	3	3	-	-	-	3	-	-	-	-	3	1	3	1	1
CO5	3	3	-	-	-	3	-	-	-	-	3	1	3	1	1
CO	3	3	-	-	-	3	-	-	-	-	3	1	3	1	1

Correlation levels 1, 2 and 3 are as defined below:

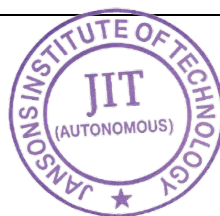
1. Slight 2. Moderate 3. Substantial (High)

Reference Books

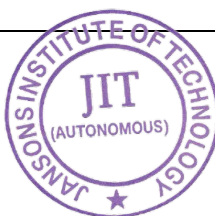
1	M. N. Rao, Razia Sultana and Sri Harsha Kota, Solid and Hazardous Waste Management: Science and Engineering, Butterworth-Heinemann, 2016.
2	William A. Worrell and P. Aarne Vesilind, Solid Waste Engineering: A Global Perspective, 3rd Edition, Cengage Learning, 2017.
3	John Pichtel, Waste Management Practices: Municipal, Hazardous, and Industrial, 2nd Edition, CRC Press, Taylor & Francis Group, 2014.
4	Cherry P. M., Solid and Hazardous Waste Management, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2018.

Reference Books

1	Gary C. Young, Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons, Wiley, 2010.
2	CPHEEO, "Manual on Municipal Solid waste management, Vol I, II and III, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2016.
3	Christensen, T. H., Solid Waste Technology & Management, Volumes I & II, Wiley, 2011.



U24CE5E05	ENVIRONMENT, HEALTH AND SAFETY POLICY AND LEGISLATIONS	L	T	P	C
		3	0	0	3
Course Objectives:	To impart comprehensive knowledge of environmental, health, and safety policies, legal frameworks, occupational hazards, risk management practices, and sustainable development principles for regulatory compliance and safe professional practice.				
Unit - I	INTRODUCTION TO EHS AND INTERNATIONAL ENVIRONMENTAL FRAMEWORK				9
Significance of Environment, Health and Safety (EHS) – need for EHS systems in workplaces – evolution of environmental and safety legislations – principles of environmental law – international environmental governance – sources and general principles of international environmental law – rights and obligations of states – major international conventions and declarations: Stockholm Declaration, Rio Declaration, Basel Convention, Convention on Biological Diversity, UNFCCC, Montreal Protocol, Kyoto Protocol – international initiatives on occupational safety and health – ergonomics and role of trade unions in workplace safety.					
Unit - II	INDIAN CONSTITUTIONAL PROVISIONS AND EHS LEGISLATIONS				9
Indian Constitution and environmental protection – constitutional provisions related to environment and health (Articles 14, 19, 21, 42, 47, 48-A, 51-A) – National Environmental Policy 2006 – administrative machinery for environmental protection – overview of Indian EHS legal framework – Factories Act – Mines Act – Building and Other Construction Workers Act – occupational health hazards and legal responsibilities – role of regulatory bodies – codes of practice and enforcement mechanisms.					
Unit - III	OCCUPATIONAL HEALTH, HYGIENE AND SAFETY SYSTEM				9
Occupational health and industrial hygiene – classification of health hazards: physical, chemical, biological, ergonomic and psychosocial – exposure pathways and health effects – exposure assessment and occupational exposure limits – hierarchy of hazard control measures – personal protective equipment (PPE) selection and use – safe design of workplaces – ventilation, lighting, noise and heat control – electrical safety – chemical and radiation safety – fire safety – safety practices at construction sites – machine guarding and process safety.					
Unit – IV	RISK MANAGEMENT, ENVIRONMENTAL REMEDIES AND MAJOR ACTS				9
Hazard identification and risk assessment – safety appraisal – job safety analysis – plant safety inspections – accident investigation, analysis and reporting – onsite and offsite emergency preparedness plans – common law principles: nuisance, negligence, strict and absolute liability – remedies under law of torts – penal provisions under IPC and CrPC – Public Interest Litigation – Public Liability Insurance Act, 1991 – National Green Tribunal Act, 2010 – major environmental legislations: Water Act, Air Act, Environment Protection Act – key environmental notifications including EIA and CRZ.					
Unit - V	SUSTAINABLE DEVELOPMENT, EHS MANAGEMENT SYSTEMS AND CASE LAWS				9
Environment–development relationship – concept of sustainable development – polluter pays principle – precautionary principle – public trust doctrine – EHS management systems – elements of EHS policy formulation, implementation, monitoring and review – overview of ISO 14001 and ISO 45001 standards – employee participation, training and safety culture – landmark environmental and industrial safety case laws – industrial and infrastructure sector case studies.					
Total Periods:					45



Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamentals of environmental, health, and safety policies, international conventions, and their role in sustainable development.	K3
CO2	Interpret Indian constitutional provisions, environmental laws, and occupational health and safety legislations applicable to industries and infrastructure projects.	K4
CO3	Identify occupational health hazards and apply industrial hygiene principles, exposure assessment, and control measures for workplace safety.	K3
CO4	Analyze environmental and safety risks using hazard identification, risk assessment, accident investigation, and emergency management techniques.	K4
CO5	Apply EHS management system principles, sustainability concepts, and legal precedents to ensure regulatory compliance and responsible professional practice.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

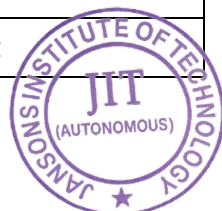
	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	-	-	-	2	3	-	-	-	3	2		
CO2	2	3	-	-	-	2	3	-	-	-	3	2		
CO3	2	3	-	-	-	2	3	-	-	-	3	2		
CO4	1	2	-	-	-	2	3	-	-	-	3	2		
CO5	1	2	-	-	-	2	3	-	-	-	3	2		
CO	2	2	-	-	-	2	3	-	-	-	3	2		

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

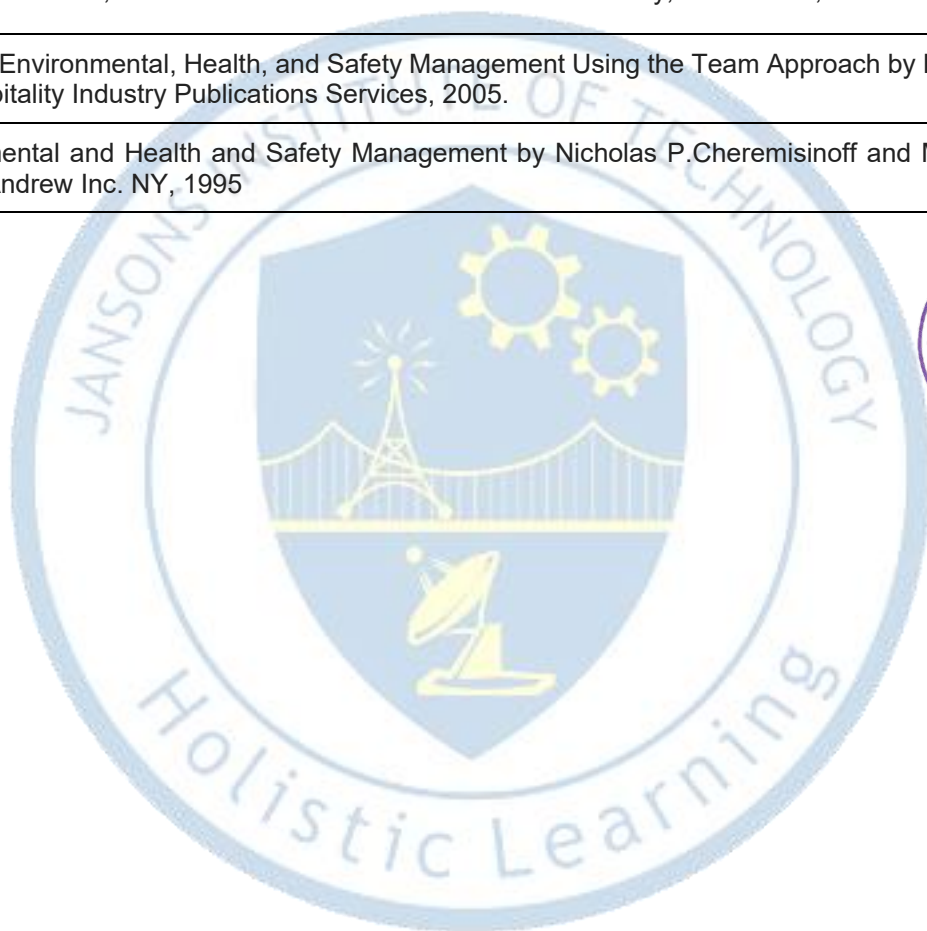
Text Books

1	Shyam Divan and Armin Rosencranz, Environmental Law and Policy in India, 4th Edition, Oxford University Press, New Delhi, 2019.
2	Phil Hughes and Ed Ferrett, Introduction to Health and Safety at Work, 7th Edition, Routledge / Elsevier, London, 2018.
3	M. Kaliannan and R. Rajan, Occupational Health and Safety Management, McGraw Hill Education, New Delhi, 2016.
4	Leelakrishnan P., Environmental Law in India, Butterworths, 1998
5	Shanthakumar S. , Environmental Law – An Introduction, Butterworths, 2004
6	Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India
7	Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012



Reference Books

1	P. Leelakrishnan, Environmental Law, 5th Edition, LexisNexis Butterworths, New Delhi, 2019.
2	L. M. Deshmukh, Industrial Safety Management, McGraw Hill Education, New Delhi, 2017.
3	Roger L. Brauer, Safety and Health for Engineers, 2nd Edition, Wiley India, New Delhi, 2016.
4	Herman K. Sauter, Handbook of Environmental Health and Safety, CRC Press, Boca Raton, 2014.
5	Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.
6	Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

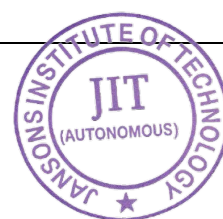


U24CE5E06		ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT		L	T	P	C
				3	0	0	3
Course Objectives:		To impart knowledge on environmental and social impact assessment concepts, legal frameworks, impact prediction methods, socio-economic analysis, mitigation planning, and application through real-world case studies..					
Unit - I	INTRODUCTION TO ENVIRONMENTAL IMPACT ASSESSMENT					9	
Historical development and evolution of Environmental Impact Assessment (EIA) – role of EIA in sustainable development – environmental clearance process – EIA in the project cycle – legal and regulatory framework for EIA in India – types of EIA and their limitations – EIA process: screening, scoping, terms of reference – baseline environmental setting – impact identification, analysis and mitigation – cross-sectoral issues – public consultation and public hearing process – accreditation of EIA consultants.							
Unit - II	IMPACT IDENTIFICATION, PREDICTION AND EVALUATION					9	
Impact identification methodologies – checklists, matrices and network methods – cost–benefit analysis – analysis of project alternatives – use of expert systems and decision-support tools in EIA – impact prediction techniques – mathematical and statistical models for environmental impact prediction – assessment of impacts on air quality, water resources, soil, noise, and biological environment – cumulative impact assessment and significance evaluation.							
Unit - III	SOCIAL AND SOCIO-ECONOMIC IMPACT ASSESSMENT					9	
Concept and scope of social and socio-economic impact assessment – relationship between social impacts and changes in community structure, livelihoods, and institutional arrangements – identification of stakeholders – methods for social impact assessment – qualitative and quantitative tools – impacts at individual, family, and community levels – vulnerable groups – communities in transition – displacement, resettlement, rehabilitation, and livelihood restoration measures.							
Unit – IV	EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN					9	
Environmental Management Plan (EMP) – components and objectives – preparation, implementation, and monitoring of EMP – mitigation and rehabilitation planning – policy framework and guidelines for environmental monitoring programmes – post-project environmental audit – documentation and reporting of EIA findings – quality assurance and quality control in EIA studies – ethical issues and professional responsibility in environmental and social impact assessment.							
Unit - V	CASE STUDIES AND APPLICATIONS					9	
Environmental and social impact assessment case studies related to mining projects – thermal and renewable power plants – cement industries – highway and transportation projects – petroleum refining and petrochemical industries – storage and handling of hazardous chemicals – common hazardous waste treatment, storage and disposal facilities – common effluent treatment plants – municipal solid waste management facilities – building and construction projects – lessons learned and best practices.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the concepts, legal framework, and procedural steps of environmental and social impact assessment in project planning.	K3
CO2	Apply impact identification, prediction, and evaluation techniques to assess environmental impacts of developmental projects.	K4



COs	Statements	K-Level
CO3	Analyze social and socio-economic impacts of projects and propose suitable mitigation, rehabilitation, and resettlement measures.	K4
CO4	Prepare and evaluate EIA documentation and Environmental Management Plans in compliance with regulatory and ethical requirements.	K3
CO5	Assess real-world projects through case studies and recommend sustainable and socially responsible development solutions.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	1	-	-	-	-	3	-	-	-	3	2	-	-
CO2	2	3	-	-	-	-	3	-	-	-	3	2	-	-
CO3	2	3	-	-	-	-	3	-	-	-	3	2	-	-
CO4	1	2	-	-	-	-	3	-	-	-	3	2	-	-
CO5	1	2	-	-	-	-	3	-	-	-	3	2	-	-
CO	2	2	-	-	-	-	3	-	-	-	3	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

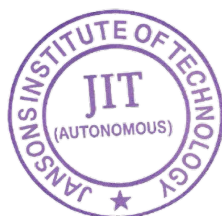
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Larry W. Canter, Environmental Impact Assessment, 2nd Edition, McGraw Hill Education, New Delhi, 2014.
2	Peter Morris and Riki Therivel, Methods of Environmental Impact Assessment, 3rd Edition, Routledge, London, 2016.

Reference Books

1	John Glasson, Riki Therivel and Andrew Chadwick, Introduction to Environmental Impact Assessment, 4th Edition, Routledge, London, 2012.
2	Frank Vanclay, International Handbook of Social Impact Assessment, Edward Elgar Publishing, UK, 2003.
3	H. S. Peavy and D. R. Row, Environmental Engineering, McGraw Hill Education, New Delhi, 2017.
4	Ministry of Environment, Forest and Climate Change, EIA Notification and Guidelines, Government of India, Latest Edition.



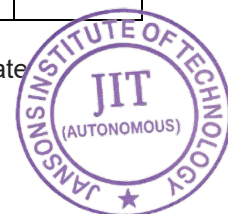
U24CE5F01	WATER QUALITY AND MANAGEMENT		L	T	P	C
			3	0	0	3
Course Objectives:	To understand the fundamentals of mathematical models and their importance in water quality modelling, and to impart the skills to use water quality modelling software for surface and groundwater quality modelling.					
Unit - I	MODELLING INSIGHTS					9
Engineers and Mathematical models-Water quality models – historical development - different types of models-- steps in model development - importance of model building.- calibration and verification of models- finite element, finite difference and finite volume methods						
Unit - II	POLLUTION TRANSPORT					9
Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water - Simple transport models –steady state and time variable solutions- conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport						
Unit - III	SURFACE WATER QUALITY MODELLING					9
Water quality modeling of streams, lakes and estuaries – water quality– model sensitivity – assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD-Streeter Phelp’s model for point and distributed sources – modified streeter Phelp’s equations.						
Unit – IV	GROUNDWATER QUALITY MODELLING					9
Groundwater flow and mass transport of solutes – groundwater quality modelling using numerical methods – Parameters, Input-output stresses, Initial and Boundary conditions- degradation of organic compounds in subsurface – Model calibration : steady state and unsteady state – sensitivity analysis – Model validation –seawater intrusion – basic concepts and modelling..						
Unit - V	WATER QUALITY MANAGEMENT MODELS					9
Exposure to surface water and groundwater quality modelling software's – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modelling multilayer groundwater flow system – Artificial recharge feasibility through modelling – Groundwater contamination, restoration and management.						
Total Periods:						45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply the principles of mathematical modeling and numerical discretization (Finite Element/Difference/Volume) to simulate environmental systems and historical water quality trends.	K3
CO2	Examine the mechanisms of advection, diffusion, and dispersion to derive governing equations for contaminant transport based on mass, momentum, and energy balances.	K3
CO3	Calculate dissolved oxygen deficits and contaminant concentrations in streams and estuaries using the Streeter-Phelps model and its modified variations.	K3
CO4	Simulate groundwater solute transport and seawater intrusion by defining boundary conditions, initial stresses, and organic degradation parameters in subsurface environments.	K3
CO5	Utilize industry-standard software (such as MODFLOW, WASP, or MIKE 21) to evaluate artificial recharge feasibility and develop groundwater restoration strategies.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	2	-	-	-	-	-	-	1	3	2	-
CO2	3	3	-	2	-	-	-	-	-	-	-	2	2	-
CO3	3	3	2	2	-	1	-	-	-	-	-	3	2	2
CO4	3	3	2	3	-	1	-	-	-	-	1	3	3	2
CO5	2	2	3	2	3	2	-	2	2	1	2	2	3	3
CO	3	2.5	2	2	3	1.5	-	2	2	1	1.5	2.5	2.5	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi 2018.
2	"Water Quality Modelling for Rivers and Streams" Authors: Benedini, Marcello, Tsakiris, George, Springer Netherlands 2017.

Reference Books

1	"Hydrodynamics and Water Quality: Modelling Rivers, Lakes, and Estuaries", Zhen-Gang Ji, John Wiley & Sons, 2018.
2	"Modelling Groundwater Flow and Contaminant Transport By Jacob Bear, A. H.-D. Cheng, Springer Science & Business Media, 2010.
3	"Mathematical Modelling of Groundwater Pollution" Ne-Zheng Sun, Alexander Sun, Springer New York, 2012

Web-links

1. <https://www.istructe.org/>



U24CE5F02	HYDROLOGY AND WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3
Course Objectives:	To introduce to the students, the concepts of hydrological processes, hydrological extremes , groundwater and quantify, regulate and manage water resources.				
Unit - I	PRECIPITATION AND ABSTRACTIONS				9
Hydrological cycle - Meteorological measurements – Types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen polygon and Iso-hyetal methods - Interception –Evaporation: Measurement, Evaporation suppression methods – Infiltration: Horton's equation -Double ring infiltrometer - Infiltration indices.					
Unit - II	RUNOFF				9
Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange's table and empirical methods - SCS-CN method – Stage discharge relationship -Flow measurements - Hydrograph – Unit Hydrograph – IUH.					
Unit - III	HYDROLOGICAL EXTREMES				9
Natural Disasters - Frequency analysis - Flood estimation - Flood management - Definitions of drought: Meteorological, Hydrological, Agricultural and Integrated - IMD method - NDVI analysis -Drought Prone Area Programme (DPAP).					
Unit – IV	RESERVOIRS				9
Classification of reservoirs - Site selection - General principles of design - Spillways -Elevation-Area Capacity curve - Storage estimation - Sedimentation - Life of reservoirs – Rule curve.					
Unit - V	GROUNDWATER AND MANAGEMENT				9
Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Calculate average areal precipitation and infiltration rates using methods like Thiessen Polygon, Iso-hyetal, and Horton's equation.	K3
CO2	Estimate catchment runoff and develop Unit Hydrographs to predict peak discharge for various storm events.	K3
CO3	Analyze hydrological extremes by applying frequency analysis and drought indices to propose flood and drought management strategies	K3
CO4	Explain reservoir design principles, including site selection, storage estimation, and the impact of sedimentation on reservoir life.	K2
CO5	Determine aquifer properties and groundwater flow parameters while evaluating artificial recharge and rainwater harvesting techniques.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	2	-	1	-	-	-	-	1	3	2	1
CO2	3	3	3	2	2	1	-	-	-	-	1	3	3	2
CO3	3	3	3	3	2	3	-	-	2	-	2	3	3	3
CO4	2	2	3	2	-	2	2	-	2	2	1	2	2	3
CO5	3	2	2	2	-	2	-	-	-	-	2	3	2	2
CO	3	3	3	2	2	2	2	-	2	2	1.5	3	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Subramanya K, "Engineering Hydrology"- Tata McGraw Hill, 2010
2	Jayarami Reddy P, "Hydrology", Tata McGraw Hill, 2008.

Reference Books

1	David Keith Todd. "Groundwater Hydrology", John Wiley & Sons, Inc. 2007
2	Ven Te Chow, Maidment, D.R. and Mays, L.W. "Applied Hydrology", McGraw Hill International Book Company, 1998.
3	Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998.
4	Bhagu R. Chahar, Groundwater Hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2017

Website link

1. <https://nptel.ac.in/courses/105103213>
 2. <https://nptel.ac.in/courses/105105214>



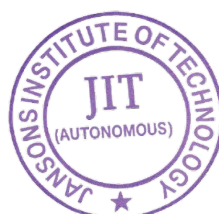
U24CE5F03		WATERSHED CONSERVATION AND MANAGEMENT				L	T	P	C
						3	0	0	3
Course Objectives:		To provide the technical, sociological understanding of a watershed and the engineering practices of watershed management for realizing the higher benefits.							
Unit - I	WATERSHED CONCEPTS							9	
Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil – Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization – Watershed Atlas									
Unit - II	SOIL CONSERVATION MEASURES							9	
Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation of Soil Loss – USLE Equation - Sedimentation									
Unit - III	WATER HARVESTING AND CONSERVATION							9	
Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways.									
Unit – IV	GIS FOR WATERSHED MANAGEMENT							9	
Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies.									
Unit - V	WATERSHED MANAGEMENT							9	
Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – People’s Participation – Evaluation of Watershed Management Programmes – Integrated Watershed Management – Case studies.									
Total Periods:								45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the morphological characteristics of a watershed and delineate its boundaries using toposheets and codification standards.	K3
CO2	Estimate soil loss using the USLE equation and design appropriate mechanical and agronomical conservation measures to mitigate erosion.	K3
CO3	Analyze catchment yield and design small-scale water harvesting structures like farm ponds, check dams, and percolation tanks.	K3
CO4	Interpret remote sensing data and apply GIS-based decision support systems for spatial modeling of watershed parameters.	K2/K3
CO5	Formulate a comprehensive watershed development plan incorporating economics, social participation, and sustainable land-use practices.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	2	1	-	-	-	-	2	3	2	1
CO2	3	3	3	2	-	2	-	-	-	-	1	3	3	2
CO3	3	2	3	2	-	2	-	1	-	1	2	3	2	3
CO4	2	2	2	3	3	1	-	-	-	-	3	2	3	2
CO5	2	3	3	2	2	3	2	3	3	3	3	2	3	3
CO	3	2.5	3	2	2.5	2	2	3	3	3	2	2.5	2.5	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

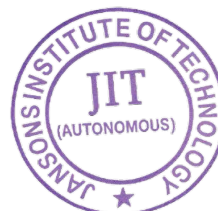
1	Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.
2	Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors Private Limited, New Delhi, 2020.

Reference Books

1	Glenn O Schwab. etal, Soil and Water Conservation engineering, Wiley India Private Limited, 2009.
2	Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, Second Edition 2009.
3	Vijay P. Singh, Donald K. Frevert, Watershed Models, CRC Press, 2005.
4	Vir Singh, Raj, Watershed Planning and Management, Bio- Green Publisher, 2016.

Website link

1. <https://nptel.ac.in/courses/105101010>
2. https://onlinecourses.swayam2.ac.in/cec25_ce01/preview



U24CE5F04	INTEGRATED WATER RESOURCES MANAGEMENT		L	T	P	C
			3	0	0	3
Course Objectives:	To introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory setting					
Unit - I	CONTEXT FOR IWRM					9
Water as a global issue: Key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.						
Unit - II	WATER ECONOMICS					9
Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies						
Unit - III	LEGAL ANDREGULATORYSETTINGS					9
Basic notion of law and governance: Principles of International and National law in the area of water management - Understanding UN law on non-navigable uses of International water courses - International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework: Case Studies.						
Unit – IV	WATER AND HEALTH WITHIN THE IWRMCONTEXT					9
Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.						
Unit - V	AGRICULTURE IN THE CONCEPT OF IWRM					9
Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.						
Total Periods:						45

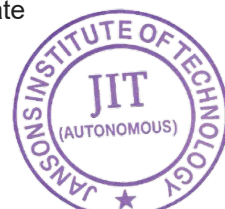
Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Demonstrate the context and principles of IWRM; Compare the conventional and integrated ways of water management.	K2
CO2	Listout the best economic option among the alternatives, illustrate the pros and cons of PPP through case studies	K1
CO3	Summarize the law and governance in the context of IWRM	K2
CO4	Compare the linkages between water-health and develop a HIA framework.	K2
CO5	Explain how the virtual water concept pave way to alternate policy options	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix



	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	1	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	1	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

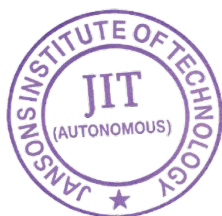
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. Fourth Edition 2018.
2	Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.

Reference Books

1	Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background Paper No: 3. Global water partnership, Stockholm, Sweden. 199
2	Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
3	Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
4	Tony Allan, Virtual Water: Tackling the Threat to Our Planet's Most Precious Resource, I. B. Taurus, 2011.
5	Convention on the Law of the Non-navigational Uses of International Watercourses. https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf



U24CE5F05	RAINWATER HARVESTING	L	T	P	C
		3	0	0	3
Course Objectives:	To gain knowledge and skills relevant to water conservation and management towards achieving the sustainability in water resources and relate the engineering				
Unit - I	BASICS OF RWH	9			
Water and its sources - Need for water conservation – Types of water demand - Conservation Methods - Global and Indian perspectives - National mission and goals towards rainwater harvesting – National water policy - Legislation on rainwater harvesting in India and Tamil Nadu.					
Unit - II	HYDROLOGY AND GROUND WATER	9			
Hydrological cycle – Precipitation - Rainfall measurement - Rain-gauges – Hyetograph - Infiltration - Runoff estimation – Rooftop runoff estimation. Ground water - Aquifer Properties – Darcy law and well hydraulics - Steady flow.					
Unit - III	METHODS OF RAINWATER HARVESTING	9			
Rainwater harvesting potential of an area-- Traditional harvesting practices – Rooftop harvesting - Methods of RWH structures – Site selection for rainwater harvesting - Surface runoff Harvesting-Ground water recharge - Artificial recharge					
Unit – IV	DESIGN OF RAINWATER HARVESTING STRUCTURES	9			
Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures – Recharge pit - Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft --Efficiency of RWH system					
Unit - V	MANAGEMENT OF RWH AND CASE STUDIES	9			
Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems – Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.					
Total Periods:					45

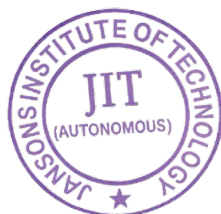
Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the need and importance of water conservation through global and Indian practices of rainwater harvesting	K1
CO2	Infer the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials	K2
CO3	Explain the various types of rainwater harvesting methods and apply it on the field	K1
CO4	List out the various RWH structures to harvest the rainwater in surface and subsurface	K1
CO5	List out the difficulties of RWH, evaluation methods and maintenance through various case studies	K1

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix



	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

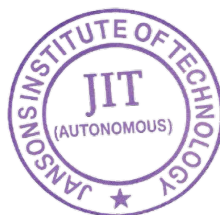
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	H.M Raghunath "Ground Water" 3rd Edition, New Age International 2007
2	Jayarami Reddy.P, (2005) "A Text book of Hydrology" Firewall media Publication
3	Ramakrishnan S, (2010), "Ground Water", Scitech Publications (India) Pvt Ltd

Reference Books

1	Proceedings of UNHABITAT Blue water series "Rainwater harvesting and utilization", Book 2 beneficiaries and capacity builders
2	Rain water Harvesting Techniques to Augment Ground Water: Ministry of Water Resources Central Ground Water Board Faridabad, 2003.
3	Rainwater Harvesting: Indian Railway Institute of Civil Engineering Pune, October 2015.
4	A Manual on "Rainwater Harvesting and Conservation": Government of India, Consultancy Service Organization Central Public Works Department, New Delhi
5	A Water Harvesting Manual for Urban Areas" issued by Centre for Science and Environment.
6	Traditional Water Harvesting Systems of India" C.P.R. Environmental Education Centre, Chennai, India (2004).



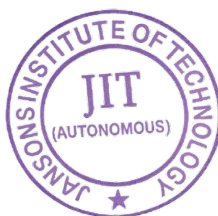
U24CE5F06	ENVIRONMENT AND IRRIGATION ENGINEERING DRAWING	L	T	P	C
		2	0	2	3
Course Objectives:	At the end of the semester student shall conceive, design and draw the irrigation and environmental engineering structures in detail showing the plan, elevation and Sections.				
	PART A: ENVIRONMENT ENGINEERING	15			
	1.WATER SUPPLY AND TREATMENT				
Design and Drawing of flash mixer, flocculator, clarifier – Rapid sand filter – Service reservoirs – Pumping station – House service connection for water supply and drainage					
	2.SEWAGE TREATMENT & DISPOSAL	15			
Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process – Aeration tank – Trickling filter – Sludge digester – Sludge drying beds – Septic tanks and disposal arrangements.					
	PART B: IRRIGATION ENGINEERING				
1. TANK COMPONENTS					
Fundamentals of design - Tank surplus weir – Tank sluice with tower head - Drawings showing foundation details, plan and elevation					9
2. IMPOUNDING STRUCTURE					
Design principles - Earth dam – Profile of Gravity Dam					6
3. CROSS DRAINAGE WORKS					
General design principles - Aqueducts – Syphon aqueduct (Type III) – Canal drop (Notch Type) – Drawing showing plan, elevation and foundation details.					6
4. CANAL REGULATION STRUCTURES					
General Principles - Direct Sluice - Canal regulator - Drawing showing detailed plan, elevation and foundation details					9
Total Periods:					60

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the basic principles and graphical representation used in environmental engineering systems such as water supply, sewerage and treatment units.	K4
CO2	Develop skills in preparing engineering drawings related to water supply networks, sewage systems and environmental infrastructure	K4
CO3	Understand irrigation engineering components and prepare drawings for canals, headworks, cross-drainage structures and irrigation layouts.	K4
CO4	Interpret standard engineering drawings and design details used in environmental and irrigation projects.	K4
CO5	Enhance drafting skills using conventional drawing practices and standards relevant to civil engineering works.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO3	3	1	2	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	1	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	2	-	-	-	-	-	-	-	2	2	-	-
CO	3	2	2	-	-	-	-	-	-	-	2	2	-	-

Correlation levels 1, 2 and 3 are as defined below:

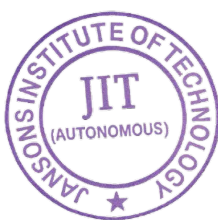
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2002
2	Garg, S.K., "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 1997
3	. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999
4	. Manual on "Sewerage and Sewage Treatment Systems- Part A, B and C" CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.

Reference Books

1	Mohanakrishnan. A, "A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu", Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2	Raghunath, H.M. "Irrigation Engineering", Wiley India Pvt. Ltd., New Delhi, 2011
3	Sharma R.K., "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 2002
4	Peary, H.S., ROWE, D.R., Tchobanoglous, G., "Environmental Engineering", McGraw- HillBook Co., New Delhi, 1995
5	Metcalf and Eddy, "Wastewater Engineering, Treatment and Reuse", Tata McGraw- Hill, New Delhi, 2010
6	Qasim, S.R., Motley, E.M and Zhu.G. "Water works Engineering – Planning, Design and Operation", Prentice Hall, New Delhi, 2009.
7	Qasim, S. R. "Wastewater Treatment Plants, Planning, Design & Operation", CRC Press, New York, 2010

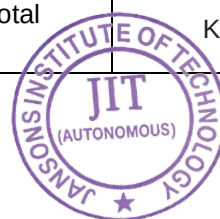


U24CE5G01	TOTAL STATION AND GPS SURVEYING	L	T	P	C
		3	0	0	3
Course Objectives:	To understand the working of Total Station and GPS and solve the surveying problems.				
Unit - I	FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES	7			
Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies – Refractive index (RI) – factors affecting RI - Computation of group for light and near infrared waves at standard and ambient conditions – Computation of RI for microwaves at ambient condition – Reference refractive index -Real-time application of first velocity correction. Measurement of atmospheric parameters - Mean refractive index – Second velocity correction -Total atmospheric correction - Use of temperature -pressure, transducers.					
Unit - II	ELECTRO-OPTICAL AND MICROWAVE	10			
Electro - optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments. COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land survey applications.					
Unit - III	SATELLITE SYSTEM	10			
Basic concepts of GPS – Historical perspective and development – applications -Geoid and Ellipsoid – satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces -Geodetic satellite – Doppler effect – Positioning concept – GNSS and IRNSS – SBAS: GAGAN and WAAS Different segments - space, control and user segments – satellite configuration – GPS signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability -Task of control segment – GPS receivers.					
Unit – IV	GPS DATA PROCESSING	10			
GPS observables – code and carrier phase observation – linear combination and derived observables – concept of parameter estimation – downloading the data – RINEX Format–Differential data processing – software modules - solutions of cycle slips, ambiguities - Multi path and other observational errors – satellite geometry and accuracy measures – Continuously Operating Reference System (CORS)– long base line processing - use of different processing software's: Open Source, Scientific and Commercial.					
Unit - V	SURVEYING METHODS AND APPLICATIONS	8			
Total Station: Traversing and Trilateration measurement and adjustment –Planimetric map and Contour map and Topography Mapping. GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing -Topography mapping using PPK and RTK methods.Total Station and GNSS applications					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamental concepts, components, and functions of Total Station surveying.	K2
CO2	Describe the characteristics of electromagnetic waves and their applications in Total Station and GNSS technologies.	K2



COs	Statements	K-Level
CO3	Outline the fundamental concepts, components, and operating principles of GNSS.	K2
CO4	Differentiate the measurement and working principles of electro-optical and microwave Total Stations and GPS.	K2
CO5	Summarize Total Station and GNSS data processing techniques and their applications in surveying and mapping.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

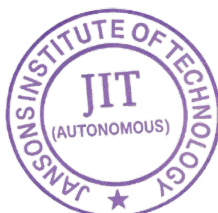
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition, 1996.
2	Satheesh Gopi, R A Sathish Kumar, Madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition, 2017.
3	Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003

Reference Books

1	R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2	Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
3	Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 3rd Edition, 2016.
4	Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

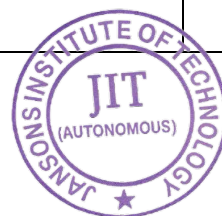


U24CE5G02	GEOSPATIAL REMOTE SENSING CONCEPTS	L	T	P	C
		3	0	0	3
Course Objectives:	To introduce the concepts of remote sensing processes and its components. To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation				
Unit - I	REMOTE SENSING AND ELECTROMAGNETIC RADIATION	7			
Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck’s law, Wien’s Displacement Law, Stefan’s Boltzmann law, Kirchoff’s law – Radiation sources: active & passive - Radiation Quantities					
Unit - II	EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL	10			
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.					
Unit - III	ORBITS AND PLATFORMS	10			
Motions of planets and satellites – Newton’s law of gravitation - Gravitational field and potential - Escape velocity - Kepler’s law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Lagrange Orbit.					
Unit – IV	SENSING TECHNIQUES	10			
Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites					
Unit - V	DATA PRODUCTS AND INTERPRETATION	8			
Photographic and digital products – Types, levels and open source satellite data products — selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the concepts and laws related to remote sensing.	K2
CO2	Describe the interaction of electromagnetic radiation with the atmosphere and earth materials.	K2
CO3	Discuss satellite orbits and explain the different types of satellites	K2



COs	Statements	K-Level
CO4	Explain the different types of remote sensors.	K2
CO5	Summarize the concepts involved in the interpretation of satellite imagery	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

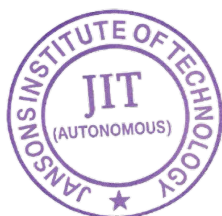
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Thomas M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York,2015.
2	George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018

Reference Books

1	Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.1, AmericanSociety of Photogrametry, Virginia, USA, 2002.
2	Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
3	Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 1988.
4	Introduction to Physics and Techniques of Remote Sensing , Charles Elachi and JacobVan Zyl, 2006 Edition II, Wiley Publication.
5	Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2011

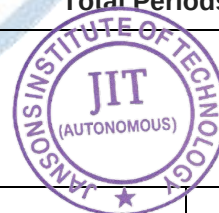


U24CE5G03	SATELLITE IMAGE PROCESSING	L	T	P	C
		3	0	0	3
Course Objectives:	To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.				
Unit - I	FUNDAMENTALS OF IMAGE PROCESSING				9
Information Systems - Encoding and decoding - acquisition, storage and retrieval –data products - satellite data formats - Digital Image Processing Systems - Hardware and software design consideration Scanner, digitizer - photo write systems.					
Unit - II	SENSORS MODEL AND PRE PROCESSING				9
Image Fundamentals – Sensor models – spectral response – Spatial response – IFOV, GIFOV & GSI – Simplified Sensor Models – Sampling & quantization concepts – Image Representation& geometry and Radiometry – Colour concepts – Sources of Image degradation and Correction procedures- Atmospheric, Radiometric, Geometric Corrections- Image Geometry Restoration- Interpolation methods and resampling techniques.					
Unit - III	IMAGE ENHANCEMENT				9
Image Characteristics - Histograms - Scattergrams – Univariate and multi variate statistics-enhancement in spatial domain – global, local & colour Transformations – PC analysis, edge detections, merging - filters - convolution – LPF, HPF , HBF, directional box, cascade – Morphological and adaptive filters – Zero crossing filters – scale space transforms – power spectrum – texture analysis – frequency transformations - Fourier, wavelet and curvelet transformations.					
Unit – IV	IMAGE CLASSIFICATION				9
Spectral discrimination - pattern recognition concepts - Baye’s approach - Signature and training sets – Separability test –Supervised Classification – Minimum distance to mean, Parallelepiped, MLC – Unsupervised classifiers – ISODATA,K-means-Support Vector Machine – Segmentation (Spatial, Spectral) – Tree classifiers - Accuracy assessment – Error matrix – Kappa statistics – ERGAS, RMS.					
Unit - V	ADVANCED CLASSIFIERS				9
Fuzzy set classification – sub- pixel classifier – hybrid classifiers, Texture based classification –Object based classifiers – Artificial Neural nets – Hebbian leaning – Expert system, types and examples – Knowledge systems.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the concepts of remote sensing and image processing systems.	K2
CO2	Describe the sources of error in satellite images and discuss methods to remove them.	K2
CO3	Illustrate appropriate image enhancement techniques based on image characteristics.	K2
CO4	Discuss methods for classifying satellite images and summarize approaches to evaluate classification accuracy.	K2
CO5	Summarize advanced image classification methods and explain their role in ongoing research within the field of image processing	K2



Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, New Jersey, 4th Edition, 2015.
2	Robert, A. Schowengerdt, Techniques for Image Processing and classification in Remote Sensing, Academic Press, 2012.

Reference Books

1	Robert, G. Reeves, - Manual of Remote Sensing Vol. I & II - American Society of Photogrammetry, Falls, Church, USA, 1983.
2	Richards, Remote sensing digital Image Analysis - An Introduction 5th Edition, 2012, Springer -Verlag 1993.
3	Digital Image Processing by Rafael C. Gonzalez, Richard Eugene Woods- Pearson/Prentice Hall, 2008
4	Fundamentals of Digital Image Processing by Annadurai Pearson Education (2006)
5	Digital Image Processing: PIKS Scientific Inside by William K. Pratt 4th Edition, Wiley Interscience, 2007.

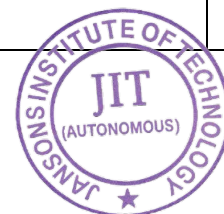


U24CE5G04	CARTOGRAPHY AND GIS			L	T	P	C
				3	0	0	3
Course Objectives:	To introduce concepts of Cartography and GIS To expose the process of map making and production To introduce GIS data structures, data input and data presentation						
Unit - I	ELEMENTS OF CARTOGRAPHY					9	
Definition of Cartography – Maps – Functions – Uses and Types of Maps – Map Scales and Contents – Map Projections – Shape, Distance, Area and Direction Properties – Perspective and mathematical Projections – Indian Maps and Projections – Map Co-ordinate System – UTM and UPS References.							
Unit - II	MAP DESIGN AND PRODUCTION					9	
Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine Transformations.							
Unit - III	FUNDAMENTALS OF GIS					9	
Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster Vs Vector Models – TIN and GRID data models.							
Unit – IV	DATA INPUT AND TOPOLOGY					9	
Scanner – Raster Data Input – Raster Data File Formats – Georeferencing– Vector Data Input – Digitizer– Datum Projection and Reprojection – Coordinate Transformation – Topology - Adjacency, Connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data Linking – Linking External Databases – GPS Data Integration – Raster to Vector and Vector to Raster Conversion.							
Unit - V	DATA QUALITY AND OUTPUT					9	
Assessment of Data Quality - Basic Aspects - Completeness, Logical Consistency, Positional Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards – Interoperability – OGC - Spatial Data Infrastructure – Data Output – Map Compilation – Chart / Graphs							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain appropriate map projections and coordinate systems used in map production, and describe how maps can be compiled and designed for specific purposes.	K2
CO2	Discuss the principles of coordinate and datum transformations.	K2
CO3	Explain the basic concepts and components of GIS, and describe techniques for spatial data storage and compression.	K2
CO4	Interpret the concepts of spatial data quality and data standards.	K2



COs	Statements	K-Level
CO5	Summarize the concept of spatial data inputs	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Arthur H. Robinson et al, "Elements of Cartography", 7th Edition, Wiley, 2002.
2	Kang – Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, Fourth Edition, 2017.
3	Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction to Geographical Information Systems, Pearson Education, Fourth Edition, 2011.

Reference Books

1	John Campbell, "Introductory Cartography", Wm. C.BrownPublishers,3rd Edition,2004
2	Chor Pang LO, Albert K. W. Yeung, "Concepts and Techniques of Geographic Information Systems", Pearson Education, 2nd Edition, November 2016. ISBN: 9789332581883



U24CE5G05	PHOTOGRAMMETRY	L	T	P	C
		3	0	0	3
Course Objectives:	To introduce basics and concepts of optics, aerial photography acquisition and mapping from aerial photographs				
Unit - I	PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY	9			
History - Definition, Applications – Types of Photographs, Classification – Photographic overlaps – Camera: metric vs. non-metric, Digital Aerial cameras – Multiple frame and Line cameras – Linear array scanner – Flight Planning – Crab & Drift– Computation of flight plan - Photogrammetry project Planning.					
Unit - II	GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS	9			
Photo coordinate measurement – Vertical photographs -geometry, scale, Coordinate system, Relief displacement – Stereoscopes – Stereoscopic parallax – parallax equations -Geometry, Scale, Coordinate system – Relief displacement -- Photo Interpretation.					
Unit - III	STEREOPLOTTERS & ORIENTATION	9			
Projection system, Viewing, Measuring and Tracing system Stereo plotters–Classification: Analog, semi analytical, Analytical and Digital systems – Interior orientation - Relative orientation – Absolute orientation - Collinearity condition and Coplanarity condition - Orientation: Two-dimensional coordinate transformations –Three-dimensional conformal coordinate transformation					
Unit – IV	AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO	9			
model – Strip and blocks of photographs – Aerotriangulation: strip adjustment, independent model triangulation, Bundle block Adjustment and GPS Aerotriangulation (INS and GNSS integration) - feature collection – DTM generation and Contour mapping – ortho rectification - mono plotting – stereo plotting					
Unit - V	DIGITAL PHOTOGRAMMETRY	9			
Photogrammetric Scanner – Digital Photogrammetry WorkStation – Work Station Basic system function – Storage System – Stereoscopic Viewing and Measuring System – Image properties - Image matching: template matching, feature based matching - DEM and DSM - Satellite photogrammetry principles					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the importance of photography as a means of mapping, and describe its functional and physical elements.	K2
CO2	Discuss the need for photogrammetric mapping and explain the relevance of accuracy standards and methods for achieving precise large-scale maps.	K2
CO3	Describe the standards of maps based on state-of-the-art tools and techniques, and summarize the production standards for photogrammetric map making.	K2
CO4	Explain current developments, issues, methods, and solutions in map making, and discuss methods of production.	K2
CO5	Interpret mapping methods by applying gained knowledge, and summarize their role in innovation and integration of mapping technology.	K2



Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

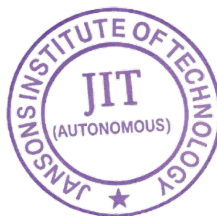
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014.
2	E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.

Reference Books

1	Golfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.
2	Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.
3	Manual of Photogrammetry – American society of Photogrammetry & R. S by Albert. D, 1980.
4	Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.
5	Digital Photogrammetry by – Y. Egels & Michel Kasser, Taylor & Francis group, 2003.



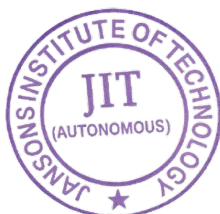
U24CE5G06	HYDROGRAPHIC SURVEYING			L	T	P	C
				3	0	0	3
Course Objectives:		To provide the necessary knowledge and practical instrument operational and data processing skills needed for them to confidently accomplish a bathymetric survey in the real world. To develop students' critical and creative thinking, as well as cooperative attitudes & behaviour of working with others.					
Unit - I		INTRODUCTION, TIDES AND DATUMS				9	
Overview of hydrographic surveying concepts- bathymetric and nautical charts- Basic tidal theory-tidal observations and predictions - common types of recording tide gauges - different vertical datums - Indian tides.							
Unit - II		SOUNDINGS				9	
Overview of depth data types- Working principle of echo sounders - characteristics and nature of underwater acoustic signals – transducers - error sources and calibrations- Advanced instrumentation.							
Unit - III		NAVIGATION AND POSITION FIXING				9	
Horizontal positioning methods and requirements - concept of line and surface of position - positioning and navigation using satellite positioning systems - differential GPS and Real-time kinematic (RTK)							
Unit – IV		PLANNING AND DATA PROCESSING				9	
General considerations for planning of an inshore hydrographic survey - ground and track control - practical soundings in inshore and coastal surveys - data processing and chart compilation - hydrographic software packages for data collection - processing and plotting.							
Unit - V		MARINE ENVIRONMENTAL MEASUREMENTS				9	
Methods of measuring and recording of currents - composition of the sea bed - and solids in suspension - Case Studies (The role of the hydrographic surveyor on different marine projects)							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamentals of hydrographic surveying.	K2
CO2	Discuss the different roles of a hydrographic surveyor in marine projects.	K2
CO3	Describe the appropriate techniques for different types of surveys.	K2
CO4	Explain the various options available during navigation.	K2
CO5	Interpret survey data and summarize its quality in relation to project requirements	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO3	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3	2	-	-	-	-	-	-	-	-	1	3	1	-
CO	3	2	-	-	-	-	-	-	-	-	1	3	1	-

Correlation levels 1, 2 and 3 are as defined below:

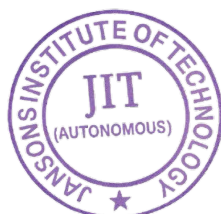
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	U.S. Army Corps of Engineers, (2002), Hydrographic Surveying, Document No. EM 1110-2-1003.
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Reference Books

1	De Jong, C. D., Lachapelle, G., Skone, S. & Elema, I. A. (2002), Hydrography, Delft University Press, The Netherlands.
2	Ingham, A. E. (1992), Hydrography for the Surveyor and Engineer, 3rd Edition revised by Abbott V. J., Blackwell Science.
3	International Hydrographic Organisation (1998), IHO Standards for Hydrographic Surveying (S-44), IHB Monaco.
4	Loweth, R. P. (1997), Manual of Offshore Surveying for Geoscientists and Engineers Chapman & Hall.
5	Pugh, D. (2004), Changing Sea Levels – Effects of Tides, Weather and Climate, Cambridge University Press
6	Sonnenberg, G. J. (1988), Radar and Electronic Navigation, Butterworths.



U24CB5V01		FINANCIAL MANAGEMENT				L	T	P	C
						3	0	0	3
Course Objectives:		To understand key financial decisions, sources of finance, and capital budgeting concepts learning capital structure, dividend policy, and working capital management tools.							
Unit - I	INTRODUCTION TO FINANCIAL MANGEMENT							9	
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.									
Unit - II	SOURCES OF FINANCE							9	
Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc									
Unit - III	INVESTMENT DECISIONS							9	
Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting – Payback -ARR – NPV – IRR –Profitability Index. Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.									
Unit – IV	FINANCING AND DIVIDEND DECISION							9	
Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure. Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy									
Unit - V	WORKING CAPITAL DECISION							9	
Working Capital Management: Working Capital Management - concepts - importance -Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies.									
Total Periods:								45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Identify and be familiar with the basic layers and its functions in computer networks.	K3
CO2	Apply the basics of networks to show how data flows from one node to another	K3
CO3	Construct the different types of routing algorithms	K3
CO4	Experiment with different types of protocols for various functions in the network	K3
CO5	Develop the operation of different application layer protocols	K3

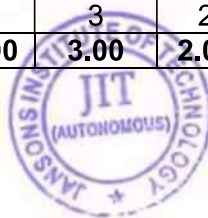
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	2	3	2	2	3	3	2	3	3	3	3
CO2	3	3	2	2	3	2	2	3	3	2	3	3	3	3
CO3	3	3	2	2	3	2	2	3	3	2	3	3	3	3
CO4	3	3	2	2	3	2	2	3	3	2	3	3	3	3
CO5	3	3	2	2	3	2	2	3	3	2	3	3	3	3
CO	3.00	3.00	2.00	2.00	3.00	2.00	2.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

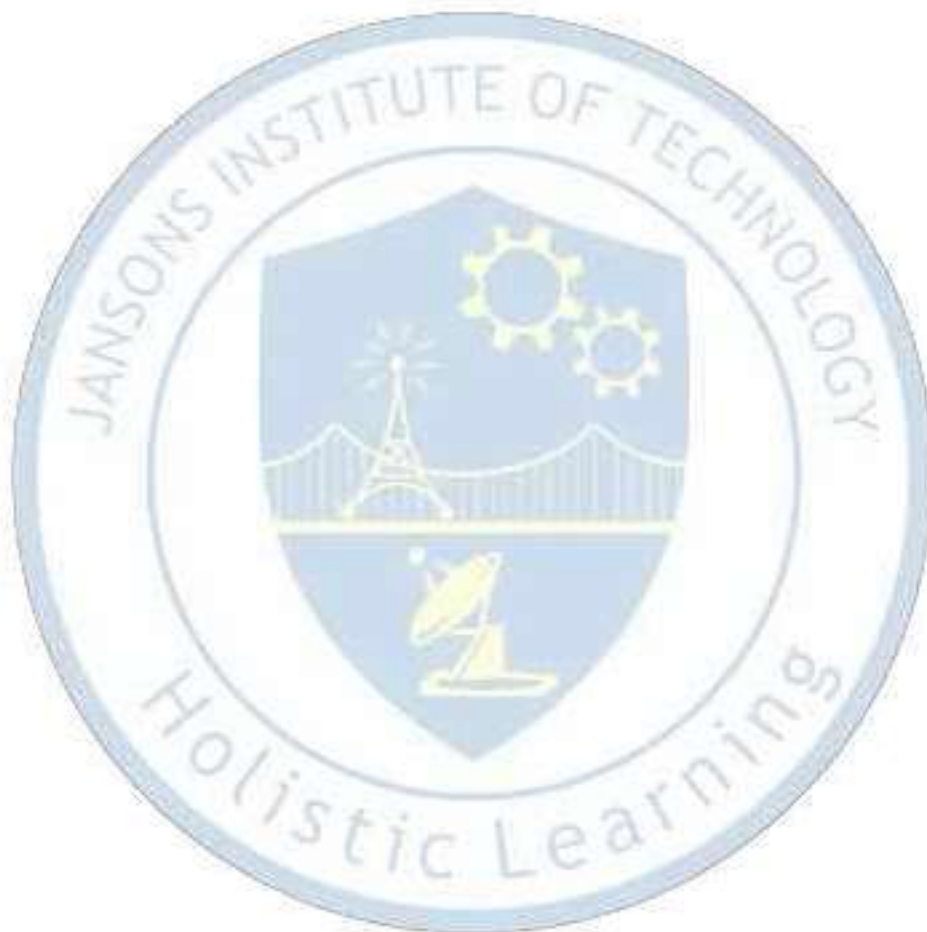


Text Books

1	M.Y. Khan and P.K.Jain, Financial Management: Text, Problems & Cases, Eight Edition, Tata McGraw Hill, 2024
2	Prasanna Chandra, Financial Management: Theory & Practice, Eleventh Edition, McGraw Hill Education (India) Pvt. L, 2022
3	M. Pandey, Financial Management, Eleventh Edition, Vikas Publishing House Pvt. Ltd, 2015

Reference Books

1	James C. Vanhorne, Fundamentals of Financial Management, 13 th Edition, PHI Learning, 2019
2	Srivatsava, Mishra, Financial Management, Oxford University Press, 2011



U24CB5V02		FUNDAMENTALS OF INVESTMENT			L	T	P	C
					3	0	0	3
Course Objectives:		To analyze the investment environment, value bonds and equities, apply security valuation approaches, build efficient portfolios through diversification, and understand investor protection mechanisms in India.						
Unit – I	THE INVESTMENT ENVIRONMENT						9	
The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.								
Unit – II	FIXED INCOME SECURITIES						9	
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.								
Unit – III	APPROACHES TO EQUITY ANALYSIS						9	
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation								
Unit – IV	PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES						9	
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India								
Unit – V	INVESTOR PROTECTION						9	
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply concepts of investment decision-making, classify asset types, interpret the functioning of Indian securities markets, and compute risk–return measures under taxation and inflationary conditions.	K3
CO2	Utilize bond valuation methods to calculate yields, differentiate bond features and categories, and appraise risks including default probability and credit ratings	K3
CO3	Employ analytical techniques to implement fundamental and technical approaches, examine market efficiency, and apply dividend-based and P/E multiple models for equity valuation	K3

COs	Statements	K-Level
CO4	Apply portfolio management principles to design diversified portfolios, quantify portfolio risk and return, assess mutual fund performance, and illustrate the role of financial derivatives in Indian markets.	K3
CO5	Apply regulatory frameworks to evaluate SEBI's functions, examine stock exchange practices, analyze grievance redressal mechanisms, and foster investor awareness and activism.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	2	3	-	3	3	3	3	-	3	3	3	3	3
CO2	2	2	3	-	3	3	3	3	-	3	3	3	3	3
CO3	2	2	3	-	3	3	3	3	-	3	3	3	3	3
CO4	2	2	3	-	3	3	3	3	-	3	3	3	3	3
CO5	2	2	3	-	3	3	3	3	-	3	3	3	3	3
CO	2.00	2.00	3.00	-	3.00	3.00	3.00	3.00	-	3.00	3.00	3.00	3.00	3.00

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Reference Books

1	Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
2	Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14 TH Edition, 2019.
3	ZviBodie, Alex Kane, Alan J Marcus, Pitabus Mohanty, Investments, McGraw Hill Education (India), 11 Edition (SIE), 2019
4	Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14 TH Edition, 2019.
5	Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5 th , Edition, 2017.



U24CB5V03	BANKING, FINANCIAL SERVICES AND INSURANCE			L	T	P	C
				3	0	0	3
Course Objectives:		To provide students with a clear understanding of insurance principles and fee-based financial services within the Indian financial system.					
Unit – I	INTRODUCTION TO INDIAN BANKING SYSTEM						9
Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.							
Unit – II	MANAGING BANK FUNDS/ PRODUCTS						9
Liquid Assets - Investment in securities - Advances - Loans. Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes. Designing deposit schemes– Asset and Liability Management – NPA’s – Current issues on NPA’s – M&As of banks into securities market							
Unit – III	DEVELOPMENT IN BANKING TECHNOLOGY						9
Payment system in India – paper based – e payment –electronic banking –plastic money – e-money – forecasting of cash demand at ATM’s –The Information Technology Act, 2000 in India – RBI’s Financial Sector Technology vision document – security threats in e-banking & RBI’s Initiative.							
Unit – IV	FINANCIAL SERVICES						9
Introduction – Need for Financial Services – Financial Services Market in India – NBFC – Leasing and Hire Purchase — mutual funds. Venture Capital Financing –Bill discounting –factoring – Merchant Banking							
Unit – V	INSURANCE						9
Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 –IRDA –Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival –settlement of claim							
Total Periods:							45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply the principles of banking operations by analyzing the structure and functions of the banking system in India, complying with key regulations by the RBI, managing banker-customer relationships, and effectively performing retail and wholesale banking operations including opening and operating various types of accounts.	K3
CO2	Develop strategies for effective asset and liability management in banks by designing deposit schemes, managing investments in securities, advances, and loans, handling negotiable instruments, and addressing contemporary issues such as NPAs and bank mergers in the securities market.	K3
CO3	Examine the payment systems in India, including paper-based and electronic modes, e-banking, plastic money, and e-money, by analyzing cash forecasting at ATMs, evaluating regulatory frameworks such as the Information Technology Act, 2000, RBI's technology vision, and assessing security threats and RBI initiatives in e-banking.	K4
CO4	Construct comprehensive financial service solutions by designing and integrating services such as NBFC operations, leasing and hire purchase schemes, mutual funds, venture capital financing, bill discounting, factoring, and merchant banking to meet the needs of the financial market in India.	K3
CO5	Analyze the structure and functioning of the insurance industry in India by examining the historical development, regulatory framework including the Insurance Act, 1938 and IRDA regulations, and evaluating life insurance products, annuities, unit-linked policies, policy lapses, revivals, and claim settlement processes.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	-	2	-	1	3	3	3	-	3	3	3	3	2
CO2	1	-	1	-	1	3	2	2	-	2	2	-	-	1
CO3	3	-	3	-	3	3	3	3	-	3	3	3	3	3
CO4	3	3	3	-	3	-	-	-	-	-	-	2	2	3
CO5	2	2	2	-	2	-	-	-	-	-	-	2	2	2
CO	2.20	2.50	2.20	-	2.00	3.00	2.67	2.67	-	2.67	2.67	2.50	2.50	2.20

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Padmalatha Suresh & Justin Paul, Management of Banking and Financial Services, Pearson, Delhi, 2017
2	M.Y. Khan Indian Financial System, McGraw Hill Education, 2015

Reference Books

1	Meera Sharma Management of Financial Institutions: With Emphasis on Bank and Risk Management, PHI Learning Pvt. Ltd., New Delhi, 2010.
2	Peter S. Rose & Sylvia C. Hudgins Bank Management and Financial Services, Tata McGraw Hill, New Delhi, 2017.
3	K.C. Shekhar & Lekshmy Shekhar Banking Theory and Practice, Vikas Publishing, 2015.
4	M.Y. Khan Indian Financial System, McGraw Hill Education, 2015.



U24CB5V04		INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS		L	T	P	C
				3	0	0	3
Course Objectives:		Apply blockchain and cryptocurrency concepts by constructing and demonstrating practical use cases involving distributed systems, consensus mechanisms, smart contracts, Ethereum networks, Web3 frameworks, Hyperledger protocols, and emerging blockchain platforms to solve real-world problems in decentralization, scalability, and privacy.					
Unit - I	INTRODUCTION TO BLOCKCHAIN					9	
Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.							
Unit - II	INTRODUCTION TO CRYPTOCURRENCY					9	
Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts- Deploying smart contracts on a blockchain							
Unit - III	ETHEREUM					9	
Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network							
Unit – IV	WEB3 AND HYPERLEDGE					9	
Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda							
Unit - V	EMERGING TRENDS					9	
Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply blockchain principles by constructing examples of distributed systems, consensus mechanisms, and decentralization methods to demonstrate how smart contracts and decentralized organizations function within different types of blockchain ecosystems.	K3
CO2	Build Bitcoin transactions by utilizing digital keys and addresses, demonstrating mining and wallet operations, and deploying smart contracts on blockchain platforms to explore the functionality and limitations of alternative cryptocurrencies.	K3
CO3	Choose appropriate components of the Ethereum ecosystem and development	K3



COs	Statements	K-Level
	environment to build private networks, deploy transactions, and utilize the Ethereum Virtual Machine for practical blockchain applications.	
CO4	Construct decentralized applications by deploying smart contracts, configuring POST requests, and utilizing development frameworks, while implementing Hyperledger Fabric and Corda to demonstrate distributed ledger solutions.	K3
CO5	Develop blockchain-based solutions by experimenting with platforms such as Kadena, Ripple, Rootstock, Quorum, and Tendermint to address challenges of scalability, privacy, and interoperability, while analyzing notable projects and research tools.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	3	3	1	3	3	3	3	3	3	2	2
CO2	3	3	2	3	3	-	3	3	3	3	3	3	2	3
CO3	3	3	2	3	3	1	3	3	3	3	3	2	1	2
CO4	3	3	2	3	3	1	3	3	3	3	3	-	2	1
CO5	3	3	2	3	3	1	3	3	3	3	3	2	2	1
CO	3	3	2	3	3	1	3	3	3	3	3	2.5	1.8	1.8

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained. Packt Publishing, 2nd Edition, 2018
2	Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018

Reference Books

1	Arshdeep Bahga, Vijay Madiseti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.
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U24CB5V05		FINTECH PERSONAL FINANCE AND PAYMENTS			L	T	P	C
					3	0	0	3
Course Objective:		Introduce learners to the fundamentals of FinTech and its role in personal finance, digital payment systems and platforms develop practical knowledge of personal financial planning using FinTech tools and familiarize with emerging trends in personal finance.						
Unit - I	INTRODUCTION TO FINTECH AND PERSONAL FINANCE						9	
Evolution of FinTech, Traditional vs Digital Financial Services, Basics of Personal Finance: Income, Expenses, Savings, Investments, Role of FinTech in Personal Financial Management, Overview of FinTech Ecosystem.								
Unit - II	DIGITAL PAYMENT SYSTEMS						9	
Digital Payment Instruments: Cards, Wallets, UPI, QR Codes, Payment Gateways and Aggregators, Mobile Banking and Internet Banking, Real-Time Payment Systems, Cross-Border Payments and Remittances.								
Unit - III	FINTECH TOOLS FOR PERSONAL FINANCIAL MANAGEMENT						9	
Budgeting and Expense Tracking Apps, Digital Savings and Investment Platforms, Robo-Advisors and Automated Wealth Management, Credit Scoring and Digital Lending Platforms, Buy Now Pay Later (BNPL) Models.								
Unit – IV	SECURITY, RISK, AND REGULATION IN FINTECH						9	
Cybersecurity Threats in Digital Payments, Data Privacy and Consumer Protection, Fraud Detection and Risk Management, Regulatory Frameworks (RBI, NPCI, Global Standards), Compliance and Ethical Issues in FinTech.								
Unit - V	EMERGING TRENDS AND FUTURE OF PERSONAL FINANCE						9	
AI and Big Data in Personal Finance, Blockchain and Cryptocurrencies in Payments, Open Banking and API-based Finance, Embedded Finance, Future Challenges and Opportunities in FinTech.								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamentals of FinTech and personal finance concepts	K2
CO2	Infer various digital payment systems and platforms	K2
CO3	Apply FinTech tools for budgeting, saving, and investing	K3
CO4	Solve security, risk, and regulatory issues in digital finance	K3
CO5	Identify emerging FinTech trends and their impact on personal finance	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	1	1	-	2	-	-	-	2	-	1
CO2	2	2	1	-	3	1	-	2	-	1	-	3	2	1
CO3	2	3	3	2	3	-	-	1	1	1	-	3	3	2
CO4	2	3	2	3	2	2	1	3	-	-	1	2	3	2
CO5	1	2	2	3	3	1	2	2	-	-	2	2	2	3
CO	2.00	2.40	2.00	2.67	2.40	1.25	1.50	2.00	1.00	1.00	1.50	2.40	2.50	1.80

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Financial Technology (FinTech) and Digital Banking in India — Jaspal Singh (2022)
2	Finance For Fintech Professionals – World Scientific (2022 edition)
3	Fintech Regulation In Practice: Navigate the Complexities and Opportunities of Regulation by <i>Maha El Dimachki</i> , 2024 edition.
4	Trends and Challenges of Electronic Finance: Perspectives from Emerging Markets by Ananda S., Tamanna Dalwai & Dharmendra Singh, 2025 edition.

Reference Books

1	Felix I. Lessambo “Fintech Regulation and Supervision Challenges Within the Banking Industry” 2023 edition
2	Financial Services Technology: Processes, Architecture and Solutions by Randall E. Duran, 2023 Edition



U24CB5V06		FINTECH			L	T	P	C
					3	0	0	3
Course Objective:		To familiarize foundational understanding of FinTech concepts with digital payment systems, electronic banking, blockchain, cryptocurrencies, FinTech applications in lending, insurance, wealth management, FinTech regulations and compliance frameworks.						
Unit - I	INTRODUCTION TO FINTECH						9	
Definition and scope of FinTech, Evolution of financial systems, Traditional finance vs FinTech, FinTech ecosystem: startups, regulators, banks, customers, Overview of global and Indian FinTech landscape.								
Unit - II	DIGITAL PAYMENTS AND ELECTRONIC BANKING						9	
Digital payment systems: UPI, wallets, cards, Online and mobile banking, Payment gateways and settlement systems, Role of FinTech in financial inclusion.								
Unit - III	BLOCKCHAIN AND CRYPTOCURRENCIES						9	
Blockchain fundamentals and architecture, Distributed Ledger Technology (DLT), Cryptocurrencies and crypto exchanges, Smart contracts and applications.								
Unit – IV	FINTECH IN LENDING, INSURANCE, AND WEALTH MANAGEMENT						9	
Peer-to-Peer (P2P) lending platforms, Digital lending and credit scoring, InsurTech models, Robo-advisors and wealth management tools.								
Unit - V	REGULATION, SECURITY, AND FUTURE TRENDS						9	
FinTech regulations and compliance frameworks, Cybersecurity and data privacy issues, Ethical challenges in FinTech, Emerging trends: AI, Big Data, Open Banking.								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Understand the fundamentals, evolution, and ecosystem of FinTech	K2
CO2	Illustrate digital payment systems and electronic banking technologies	K2
CO3	Identify blockchain technology, cryptocurrencies, and smart contracts	K3
CO4	Apply FinTech concepts in lending, insurance, and wealth management domains	K3
CO5	Select regulatory, security, and ethical challenges and future trends in FinTech	K3

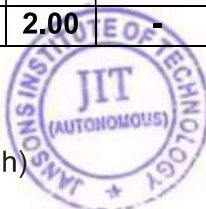
Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	1	-	-	-	-	-	-	2	1	-
CO2	2	3	1	-	2	-	-	-	-	-	-	3	2	1
CO3	2	3	2	1	2	-	-	-	-	-	-	3	2	1
CO4	1	2	3	2	2	-	-	-	-	-	-	3	3	2
CO5	1	2	-	3	3	1	1	2	-	1	2	2	2	3
CO	1.80	2.40	2.00	2.00	2.00	1.00	1.00	2.00	-	1.00	2.00	2.60	2.00	1.75

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

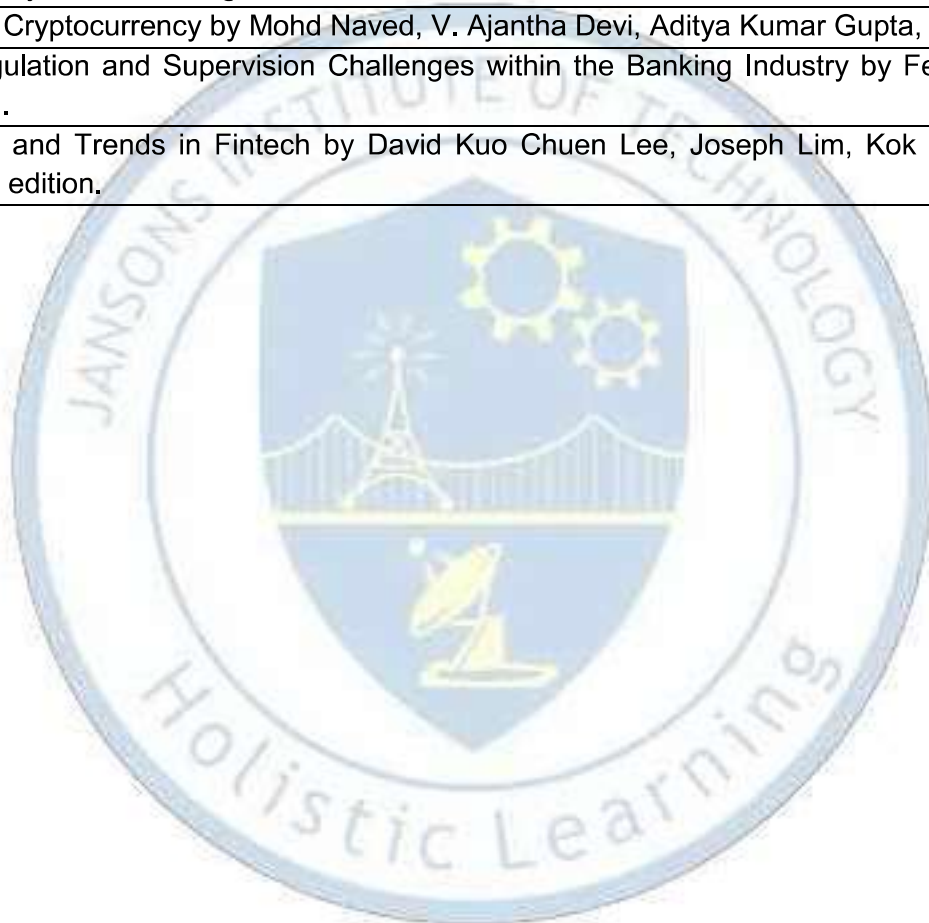


Text Books

1	Ross P. Buckley, Douglas W. Arner & Dirk A. Zetsche "FinTech: Finance, Technology and Regulation — Cambridge University Press" 2024 edition
2	Fintech Regulation In Practice: Navigate the Complexities and Opportunities of Regulation, by Maha El Dimachki, 2024 edition.
3	Understanding Cybersecurity Management in FinTech: Challenges, Strategies, and Trends by Gurdip Kaur, Ziba Habibi Lashkari, and Arash Habibi Lashkari 2022 edition.

Reference Books

1	Jayanta Chakraborti, Shalini Aggarwal & Pardeep Kumar "FinTech 5.0: The Journey from Cryptocurrency to Neobanking" 2025 edition
2	Fintech and Cryptocurrency by Mohd Naved, V. Ajantha Devi, Aditya Kumar Gupta, 2023 edition.
3	Fintech Regulation and Supervision Challenges within the Banking Industry by Felix I. Lessambo, 2023 edition.
4	Applications and Trends in Fintech by David Kuo Chuen Lee, Joseph Lim, Kok Fai Phoon & Yu Wang, 2023 edition.



U24CB5W01		FOUNDATIONS OF ENTREPRENEURSHIP		L	T	P	C
				3	0	0	3
Course Objectives:		To develop a strong foundation in entrepreneurship and technopreneurship by understanding skills, ownership, environment, and technology-driven ventures through practical and global insights.					
Unit - I	INTRODUCTION TO ENTREPRENEURSHIP					9	
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.							
Unit - II	BUSINESS OWNERSHIP & ENVIRONMENT					9	
Types of Business Ownership – Business Environmental Factors – Political-Economic- Sociological- Technological-Environmental-Legal aspects – Human Resources Mobilisation-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration							
Unit - III	FUNDAMENTALS OF TECHNOPRENEURSHIP					9	
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends							
Unit – IV	APPLICATIONS OF TECHNOPRENEURSHIP					9	
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching – Managing Technology based Product / Service entrepreneurship — Success Stories of Technopreneurs - Case Studies							
Unit - V	EMERGING TRENDS IN ENTREPRENEURSHIP					9	
Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing- Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneurship - NGO Entrepreneurship – Recent Entrepreneurial Developments - Local – National – Global perspectives.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Make use of core entrepreneurship concepts to analyze traits, classifications, economic contributions, and growth factors through measurable evaluation.	K3
CO2	Identify business ownership types and environmental factors while applying HR, finance, marketing, and operations concepts in measurable scenarios.	K3
CO3	Utilize technopreneurship concepts to evaluate its principles, scope, and socio-economic impact through measurable contemporary scenarios.	K3
CO4	Apply technology entrepreneurship concepts across contexts by integrating intrapreneurship, networking, and product launch strategies to achieve measurable outcomes.	K3
CO5	Develop business strategies for diverse entrepreneurial models, including	K3

COs	Statements	K-Level
	franchising and technopreneurship, through measurable local and global analyses.	

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	1	3	3	2	2	2	3	3	3	3	3	3	3	3
CO2	1	3	3	2	2	2	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO	1.60	3.00	3.00	2.60	2.60	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	S. S. Khanka, "Entrepreneurial Development", Revised Edition, S. Chand Publishing, 2023
2	Robert D. Hisrich, Michael P. Peters & Dean A. Shepherd, "Entrepreneurship", 11th Edition, McGraw-Hill Education, 2024
3	Peter F. Drucker, "Innovation and Entrepreneurship", Routledge Modern Classics Edition, 2025 Reprint
4	Brad Feld & Jason Mendelson, "Venture Deals", 4th Edition, Wiley, 2023

Reference Books

1	Donald F. Kuratko, "Entrepreneurship: Theory, Process, Practice", 12th Edition, Cengage Learning, 2023
2	Thomas H. Byers, Richard C. Dorf & Andrew J. Nelson, "Technology Ventures: From Idea to Enterprise", 5th Edition, McGraw-Hill Education, 2024
3	Tidd & Bessant, "Managing Innovation", 8th Edition, Wiley, 2024
4	Eric Ries, "The Lean Startup", Updated Edition, Crown Business, 2023



U24CB5W02	TEAM BUILDING AND LEADERSHIP MANAGEMENT FOR BUSINESS	L	T	P	C
		3	0	0	3
Course Objectives:	It provides a comprehensive understanding of team dynamics, formation, and management, including virtual and multicultural teams, while developing measurable skills in leadership, coaching, mentoring, motivation, conflict resolution, and global practices.				
Unit - I	INTRODUCTION TO MANAGING TEAMS				9
Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) -Multicultural Teams.					
Unit - II	MANAGING AND DEVELOPING EFFECTIVE TEAMS				9
Team-based Organizations- Leadership roles in team-based organizations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building – Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others – Team Building at the Top - Leadership in Teamwork Effectiveness					
Unit - III	INTRODUCTION TO LEADERSHIP				9
Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.					
Unit – IV	LEADERSHIP IN ORGANISATIONS				9
Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model – Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership - Role of Ethics and Values in Organisational Leadership.					
Unit - V	LEADERSHIP EFFECTIVENESS				9
Leadership Behaviour - Assessment of Leadership Behaviors - Destructive Leadership - Motivation and Leadership - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Build effective teams by applying team dynamics and development strategies to achieve measurable outcomes in coaching, decision-making, and multicultural or virtual environments.	K3
CO2	Construct high-performance teams by applying leadership, coaching, and mentoring to enhance trust, skills, and overall teamwork effectiveness with measurable outcomes.	K3
CO3	Develop a comprehensive understanding of leadership by analyzing traits, intelligence, and leader-follower dynamics while demonstrating measurable skills in	K3

COs	Statements	K-Level
	delegation, empowerment, and use of leadership power.	
CO4	Utilize leadership styles and theories—LMX, situational, contingency, path-goal, transactional, transformational, and charismatic—to solve organizational challenges while integrating measurable ethics and values.	K3
CO5	Model effective leadership by evaluating motivation, conflict, negotiation, and cultural influences while addressing destructive and global leadership challenges with measurable strategies.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	1	-	-	-	-	-	-	2	-	3	-	2	2	2
CO2	1	3	2	1	2	-	-	2	2	3	-	3	3	3
CO3	1	3	3	2	3	-	-	2	2	3	-	3	3	3
CO4	1	3	2	2	3	-	3	3	2	3	-	3	3	3
CO5	1	3	2	3	3	-	3	2	2	3	-	3	3	3
CO	1.00	3.00	2.25	2.00	2.75	-	3.00	2.20	2.00	3.00	-	2.80	2.80	2.80

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	W.G. Dyer, J.H. Dyer & W.G. Dyer Jr., "Team Building: Proven Strategies for Improving Team Performance", 6th Edition, Wiley, 2024
2	Hughes, Ginnett & Curphy, "Leadership: Enhancing the Lessons of Experience", 10th Edition, McGraw-Hill Education, 2023
3	Daniel Levi, "Group Dynamics for Teams", 6th Edition, Sage Publications, 2023

Reference Books

1	Richard L. Daft, "The Leadership Experience", 8th Edition, Cengage Learning, 2022
2	Peter G. Northouse, "Leadership: Theory and Practice", 9th Edition, Sage Publications, 2022
3	Stephen P. Robbins & Timothy A. Judge, "Organizational Behavior", 19th Edition, Pearson, 2023



U24CB5W03		CREATIVITY AND INNOVATION IN ENTREPRENEURSHIP			L	T	P	C
					3	0	0	3
Course Objectives:		To develop students' creativity and creative intelligence by understanding creative processes, tools, personality traits, and environments that enhance innovation. It also seeks to build competence in innovation, entrepreneurship, and designing responsible and innovative business models through systematic analysis, design thinking, and opportunity evaluation.						
Unit - I	CREATIVITY						9	
Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment- Creative Technology- - Creative Personality and Motivation								
Unit - II	CREATIVE INTELLIGENCE						9	
Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training--Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment								
Unit - III	INNOVATION						9	
Innovation: Definition- Levels of Innovation- Incremental Vs Radical Innovation-Product Innovation and Process- Technological, Organizational Innovation – Indicators- Characteristics of Innovation in Different Sectors. Theories in Innovation and Creativity- Design Thinking and Innovation- Innovation as Collective Change-Innovation as a system								
Unit – IV	INNOVATION AND ENTREPRENEURSHIP						9	
Innovation and Entrepreneurship: Entrepreneurial Mindset, Motivations and Behaviours- Opportunity Analysis and Decision Making- Industry Understanding – Entrepreneurial Opportunities- Entrepreneurial Strategies – Technology Pull/Market Push – Product -Market fit								
Unit - V	INNOVATIVE BUSINESS MODELS						9	
Innovative Business Models: Customer Discovery-Customer Segments-Prospect Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models – Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Select suitable forms of creativity by evaluating context, environment, personality, technology, and motivation in practical scenarios.	K3
CO2	Utilize creative intelligence through convergent thinking and training techniques while overcoming barriers to design measurable creativity-enhancing environments.	K3
CO3	Make use of innovation concepts by differentiating types and levels across domains	K3



COs	Statements	K-Level
	and using design thinking to implement and measure innovation effectively.	
CO4	Develop an entrepreneurial mindset by evaluating motivations and opportunities and applying measurable strategies to achieve product–market fit.	K3
CO5	Construct innovative business models by defining customer segments and value propositions while implementing measurable, responsible innovation strategies.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	3	3	-	-	3	3	3	3	3	3	3
CO2	2	3	2	3	3	1	3	3	3	3	3	1	1	1
CO3	2	3	2	3	3	2	3	3	3	3	3	1	1	1
CO4	2	3	3	3	3	1	3	3	3	3	3	2	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	2	2	2
CO	2.40	3.00	2.40	3.00	3.00	1.75	3.00	3.00	3.00	3.00	3.00	1.80	1.80	1.80

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Paul Trott, "Innovation Management & New Product Development", 6th Edition, Pearson, 2023
2	Tidd & Bessant, "Managing Innovation: Integrating Technological, Market and Organizational Change", 8th Edition, Wiley, 2024
3	V. K. Narayanan & G. S. Balasubramanian, "Innovation: A Strategic Management Perspective", 2nd Edition, Cengage Learning India, 2023
4	Stephen P. Robbins & Timothy A. Judge, "Organizational Innovation and Change", Pearson, 2024

Reference Books

1	A. Dale Timpe, Creativity, Jaico Publishing House, 2003.
2	Brian Clegg, Paul Birch, Creativity, Kogan Page, 2009
3	Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata Mc Graw Hill, 2004.



U24CB5W04	PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS	L	T	P	C
		3	0	0	3
Course Objectives:	It provides a comprehensive understanding of marketing management by covering concepts, marketing mix, research, product, pricing, promotion, distribution, and contemporary practices like CRM, relationship, and e-marketing for measurable skill development.				
Unit – I	INTRODUCTION TO MARKETING MANAGEMENT				9
Introduction - Market and Marketing – Concepts- Functions of Marketing - Importance of Marketing - Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.					
Unit – II	MARKETING ENVIRONMENT				9
Introduction - Environmental Scanning - Analysing the Organisation’s Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.					
Unit – III	PRODUCT AND PRICING MANAGEMENT				9
Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) – Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies – National and Global Pricing.					
Unit – IV	PROMOTION AND DISTRIBUTION MANAGEMENT				9
Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)- Logistics Management- Introduction to Retailing and Wholesaling.					
Unit – V	CONTEMPORARY ISSUES IN MARKETING MANAGEMENT				9
Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business – Services Marketing - E-Marketing or Online Marketing.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Choose appropriate marketing concepts and functions to design an effective mix using traditional 4Ps, modern elements, and additional 3Ps for measurable organizational outcomes.	K3
CO2	Model effective marketing strategies by analyzing environmental factors and leveraging measurable insights from marketing research and information systems for informed decision-making.	K3
CO3	Organize product activities by classifying products, analyzing life cycles, and formulating branding strategies while applying measurable pricing approaches for	K3

COs	Statements	K-Level
	domestic and global markets.	
CO4	Plan promotional and distribution activities by integrating marketing channels and communication tools while applying measurable strategies for STP, logistics, retailing, and wholesaling to achieve organizational goals.	K3
CO5	Utilize relationship marketing and CRM concepts to manage customer loyalty and interactions while implementing measurable strategies in services and e-marketing to improve business performance.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	3	3	3	3	3	3	3	3	3	3	2	2	2
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO3	2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO5	2	3	3	3	3	2	3	3	3	3	3	3	3	3
CO	2.20	3.00	3.00	3.00	3.00	2.60	3.00	3.00	3.00	3.00	3.00	2.80	2.80	2.80

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)s

Text Books

1	V.S. Ramaswamy & S. Namakumari, "Marketing Management: Global Perspective, Indian Context", 7th Edition, Sage Publications India, 2023
2	S.A. Sherlekar & Dr. P. Krishnamoorthy, "Marketing Management", Revised Edition, Himalaya Publishing House, 2023
3	Dhruv Grewal & Michael Levy, "Marketing", 8th Edition, McGraw-Hill Education, 2024

Reference Books

1	Philip Kotler, Kevin Lane Keller, Alexander Chernev, "Marketing Management", 16th Edition, Pearson, 2022
2	C.B. Gupta & N. Rajan Nair, "Marketing Management: Text and Cases", 18th Edition, Sultan Chand & Sons, 2022
3	Tapan K. Panda & Sunil Sahadev, "Marketing Management: A Strategic Approach", Oxford University Press, 2023

4	Kerin, Hartley & Rudelius, "Marketing", 14th Edition, McGraw-Hill Education, 2023
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U24CB5W05	HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS	L	T	P	C
		3	0	0	3
Course Objectives:	It provides a comprehensive understanding of Human Resource Management by covering HR planning, recruitment, development, performance appraisal, compensation, and emerging trends to effectively manage organizational human capital.				
Unit – I	INTRODUCTION TO HRM				9
Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.					
Unit - II	HUMAN RESOURCE PLANNING				9
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends					
Unit – III	RECRUITMENT AND SELECTION				9
Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.					
Unit – IV	TRAINING AND EMPLOYEE DEVELOPMENT				9
Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices					
Unit – V	CONTROLLING HUMAN RESOURCES				9
Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends - Case Studies - HR software exposure					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Construct a comprehensive understanding of HRM by analyzing its concepts, scope, and challenges while applying measurable knowledge of HR roles, policies, and audits.	K3
CO2	Experiment with planning tools and techniques for job analysis, rotation, and descriptions while using measurable approaches for career planning, succession, HRIS, and current HR trends.	K3
CO3	Apply recruitment strategies by selecting suitable internal, external, and digital sources, and implementing measurable selection, interview, and engagement processes.	K3



COs	Statements	K-Level
CO4	Model effective training programs by analyzing training needs, managing induction, and integrating measurable compensation, benefits, and Green HRM practices.	K3
CO5	Choose appropriate performance appraisal, grievance, and collective bargaining methods while implementing measurable strategies for discipline, promotions, transfers, and union-management relations.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	2	2	2	1	1	2	1	3	3	3	2	2
CO2	3	2	2	2	2	1	1	3	1	3	3	3	2	2
CO3	3	2	2	2	2	1	1	3	1	3	3	3	2	2
CO4	3	2	2	2	2	1	1	3	1	3	3	3	2	2
CO5	3	2	2	2	2	1	1	3	1	3	3	3	2	2
CO	3.00	2.00	2.00	2.00	2.00	1.00	1.00	2.80	1.00	3.00	3.00	3.00	2.00	2.00

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Dessler & Varkkey – Human Resource Management, 16th Ed., Pearson, 2023
2	Mondy & Noe – Human Resource Management, 16th Ed., Cengage, 2022
3	DeCenzo, Robbins & Verhulst – Fundamentals of Human Resource Management, 8th Ed., Wiley (Reprint 2023)

Reference Books

1	Aswathappa & Dash – Human Resource Management: Text and Cases, 10th Ed., McGraw Hill, 2024
2	Gomez-Mejia, Balkin & Cardy – Managing Human Resources, 8th Ed., Pearson/PHI, 2023
3	Ivancevich, Konopaske & Matteson – Organizational Behavior and Management, 12th Ed., McGraw Hill, 2022
4	P. Subba Rao – Essentials of Human Resource Management & Industrial Relations, 4th Ed., Himalaya Publishing, 2022



U24CB5W06	FINANCING NEW BUSINESS VENTURES			L	T	P	C
				3	0	0	3
Course Objectives:		It provides comprehensive knowledge of launching new ventures, including registration, location, government support, financing options, and fund-raising strategies for sustainable growth.					
Unit - I		ESSENTIALS OF NEW BUSINESS VENTURE				9	
Setting up new Business Ventures – Need - Scope - Franchising - Location Strategy, Registration Process - State Directorate of Industries- Financing for New Ventures - Central and State Government Agencies - Types of loans – Financial Institutions - SFC, IDBI, NSIC and SIDCO.							
Unit - II		INTRODUCTION TO VENTURE FINANCING				9	
Venture Finance – Definition – Historic Background - Funding New Ventures- Need – Scope – Types - Cost of Project - Means of Financing - Estimation of Working Capital - Requirement of funds – Mix of Debt and Equity - Challenges and Opportunities - NPV, IRR, Payback.							
Unit - III		SOURCES OF DEBT FINANCING				9	
Fund for Capital Assets - Term Loans - Leasing and Hire-Purchase - Money Market instruments – Bonds, Corporate Papers – Preference Capital- Working Capital Management- Fund based Credit Facilities - Cash Credit - Over Draft.							
Unit – IV		SOURCES OF EQUITY FINANCING				9	
Own Capital, Unsecured Loan - Government Subsidies, Margin Money- Equity Funding – Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital							
Unit - V		METHODS OF FUND RAISING FOR NEW VENTURES				9	
Investor Decision Process - Identifying the appropriate investors- Targeting investors- Developing Relationships with investors - Investor Selection Criteria- Company Creation- Raising Funds – Seed Funding- VC Selection Criteria – Process- Methods- Recent Trends							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

Cos	Statements	K-Level
CO1	Develop a structured plan for launching new ventures by assessing scope, location, registration, franchising, and financing options through government agencies and financial institutions.	K3
CO2	Build a comprehensive understanding of venture finance by evaluating funding needs, cost components, working capital, debt–equity mix, and financing challenges using measurable parameters.	K3
CO3	Apply debt financing and working capital tools—including term loans, leasing, bonds, cash credit, and overdraft—in measurable financial scenarios.	K3



Cos	Statements	K-Level
CO4	Identify suitable equity financing sources—including private equity, angel funding, crowdfunding, and venture capital—through measurable financial case analyses.	K3
CO5	Make use of investor decision process to identify and secure suitable funding sources, including seed and venture capital, using measurable investment criteria and trends.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	3	3	3	-	3	2	3	3	3	3	3	3
CO2	3	3	3	3	3	1	3	2	3	3	3	3	3	3
CO3	2	3	2	3	3	1	3	2	3	3	3	3	3	3
CO4	2	3	3	3	3	1	2	2	3	3	3	3	3	3
CO5	2	3	3	3	3	1	3	3	3	3	3	3	3	3
CO	2.40	3.00	2.80	3.00	3.00	1.00	2.80	2.20	3.00	3.00	3.00	3.00	3.00	3.00

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Brealey, Myers & Allen, "Principles of Corporate Finance", 14th Edition, McGraw-Hill Education, 2023
2	Ross, Westerfield & Jaffe, "Corporate Finance", 13th Edition, McGraw-Hill Education, 2024
3	Prasanna Chandra, "Projects: Planning, Analysis, Selection, Financing, Implementation & Review", 10th Edition, McGraw-Hill Education, 2022
4	Yescombe, E.R, "Principles of Project Finance", 3rd Edition, Academic Press (Elsevier), 2024
5	Andrew Metrick & Ayako Yasuda, "Venture Capital and the Finance of Innovation", 3rd Edition, Wiley, 2021

Reference Books

1	Brad Feld & Jason Mendelson, "Venture Deals", 4th Edition, Wiley, 2023
2	Thomas H. Byers, Richard C. Dorf & Andrew J. Nelson, "Technology Ventures: From Idea to Enterprise", 5th Edition, McGraw-Hill Education, 2024
3	Josh Lerner, Ann Leamon & Felda Hardyman, "Venture Capital, Private Equity, and the Financing of Entrepreneurship", 3rd Edition, Wiley, 2022



U24GE5X01	PRINCIPLES OF PUBLIC ADMINISTRATION	L	T	P	C
		3	0	0	3
Course Objectives:	The course aims to help students understand the meaning, scope, importance, and evolution of Public Administration. It introduces major administrative approaches, theories, and thinkers, along with new trends in administration. The course also develops knowledge of key administrative processes such as leadership, communication, and decision making.				
UNIT - I	INTRODUCTION TO PUBLIC ADMINISTRATION				9
Meaning, nature and scope of Public Administration; importance of Public Administration; Public Administration as an art and science; role of Public Administration in a welfare state; evolution and growth of Public Administration.					
UNIT - II	NEW TRENDS IN PUBLIC ADMINISTRATION				9
New Public Administration – meaning and objectives; New Public Management – concept and features; Public Administration and Private Administration – meaning; similarities and differences; changing role of the government.					
UNIT - III	APPROACHES AND INTERDISCIPLINARY RELATIONS				9
Relationship of Public Administration with Political Science, History and Sociology; Classical Approach – meaning and features; Scientific Management Approach – principles and limitations.					
UNIT – IV	ADMINISTRATIVE THEORIES				9
Bureaucratic Approach – Max Weber and features of bureaucracy; merits and demerits of bureaucracy; Human Relations Approach – Elton Mayo and Hawthorne Experiments; Ecological Approach – Fred W. Riggs and his model.					
UNIT - V	ADMINISTRATIVE PROCESSES				9
Leadership – meaning, importance, styles and approaches; Communication – meaning, types, process and barriers; Decision Making – meaning, types, techniques and process.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the meaning, nature, scope, and importance of Public Administration.	K2
CO2	Describe the evolution of Public Administration and recent trends such as New Public Administration and New Public Management.	K2



COs	Statements	K-Level
CO3	Illustrate the interdisciplinary relationships of Public Administration and the basic ideas of classical and scientific management approaches.	K2
CO4	Explain major administrative theories and contributions of thinkers like Max Weber, Elton Mayo, and Fred W. Riggs.	K2
CO5	Describe the concepts and processes of leadership, communication, and decision making in public administration.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	-	-	-	-	-	-
CO5	-	-	-	-	-	1	1	2	-	-	-	-	-	-
CO	-	-	-	-	-	2	2	2	-	-	-	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

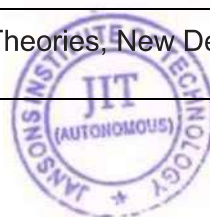
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Avasthi and Maheswari: Public Administration in India, Agra:Lakshmi Narain Agarwal,2013.
2	Ramesh K Arora: Indian Public Administration, New Delhi: Wishwa Prakashan, 2012.

Reference Books

1	R.B. Jain: Public Administration in India,21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.
2	Rumki Basu: Public Administration:Concept and Theories, New Delhi:Sterling, 2013



3	R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.
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U24GE5X02	CONSTITUTION OF INDIA		L	T	P	C
			3	0	0	3
Course Objectives:	The course introduces students to the historical development and making of the Indian Constitution. It explains the fundamental rights, duties, directive principles, and key constitutional institutions at the Union and State levels.It develops awareness of constitutional values such as secularism, social justice, and minority safeguards for understanding democratic governance.					
UNIT - I	CONSTITUTIONAL BACKGROUND					9
Constitutional development in India from 1909 to 1947; making of the Indian Constitution; Constituent Assembly – composition, role, and functioning.						
UNIT - II	RIGHTS, DUTIES AND DIRECTIVE PRINCIPLES					9
Fundamental Rights-meaning, significance, and enforcement; Fundamental Duties -purpose and importance; Directive Principles of State Policy-objectives and relevance in governance.						
UNIT - III	UNION GOVERNMENT					9
President-powers and functions; Parliament-structure, composition, and functions; Supreme Court-composition, powers, and role in the constitutional framework.						
UNIT – IV	STATE GOVERNMENT					9
Governor -powers and functions; State Legislature-composition and functions; High Court -structure, powers, and jurisdiction.						
UNIT - V	CONSTITUTIONAL VALUES					9
Secularism-meaning and significance; Social Justice-principles and application; safeguards for minorities under the Constitution.						
Total Periods:						45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the historical development and the making of the Indian Constitution.	K2
CO2	Infer the role and functioning of the Constituent Assembly.	K2

COs	Statements	K-Level
CO3	Illustrate the Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy.	K2
CO4	Compare the structure, powers, and functions of key Union and State government institutions including the President, Parliament, Supreme Court, Governor, State Legislature, and High Courts.	K2
CO5	Describe constitutional values such as secularism, social justice, and safeguards for minorities in India.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	2	-	-	1	-	-	-	-	-
CO2	-	-	-	-	-	2	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	2	2	-	2	-	-	-	-	-
CO5	-	-	-	-	-	1	2	2	3	1	-	-	-	-
CO	-	-	-	-	-	2	2	2	2	1	-	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Basu. D.D.: Introduction to Indian Constitution ; Prentice Hall; New Delhi
2	Kapur. A.C: Indian Government and Political System; S.Chand and Company Ltd., New Delhi.

Reference Books

1	Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
2	Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi



U24GE5X03	PUBLIC PERSONNEL ADMINISTRATION	L	T	P	C
		3	0	0	3
Course Objectives:	The course introduces students to the meaning, scope, and importance of personnel administration and different types of personnel systems.It also explains recruitment, training, promotion, service conditions, employee relations, and compensation in public organizations.				
UNIT - I	INTRODUCTION TO PERSONNEL ADMINISTRATION				9
Meaning, scope, and importance of personnel administration; types of personnel systems – bureaucratic, democratic, and representative systems.					
UNIT - II	CIVIL SERVANTS AND ADMINISTRATION				9
Generalist vs. specialist roles; relationship of civil servants with the political executive; integrity and ethical conduct in administration.					
UNIT - III	RECRUITMENT, TRAINING, AND PROMOTION				9
Recruitment – direct recruitment and recruitment from within; training – kinds and objectives; promotion policies and procedures.					
UNIT – IV	SERVICES AND SERVICE CONDITIONS				9
All India Services – structure and functions; service conditions of personnel; role and functions of the State Public Service Commission.					
UNIT - V	EMPLOYEE RELATIONS AND COMPENSATION				9
Employer-employee relations; wage and salary administration; allowances, benefits, and incentives.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Illustrate the meaning, scope, importance, and types of personnel administration systems.	K2
CO2	Infer the role of civil servants, their relationship with the political executive, and ethical standards in administration.	K2

COs	Statements	K-Level
CO3	Explain the processes of recruitment, training, and promotion in public services.	K2
CO4	Describe the structure, functions, and service conditions of All India Services and State Public Service Commissions.	K2
CO5	Compare employer–employee relations and the principles of wage, salary administration, allowances, and benefits.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO	-	-	-	-	-	2	2	2	-	-	-	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Stahl Glean O: Public Personnel Administration
2	Parnandikar Pai V.A: Personnel System for Development Administration
3	Bhambhiru . P: Bureaucracy and Policy in India

Reference Books

1	Dwivedi O.P and Jain R.B: India's Administrative state.
2	Muttalis M.A: Union Public Service Commission.

3	Bhakara Rao .V: Employer Employee Relations in India
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U24GE5X04	ADMINISTRATIVE THEORIES	L	T	P	C
		3	0	0	3
Course Objectives:	To understand the concepts, scope, and evolution of Public Administration.To study organizational theories, behaviour, motivation, leadership, and decision-making.To learn the contributions of major administrative thinkers and their relevance to modern administration.				
UNIT - I	INTRODUCTION TO PUBLIC ADMINISTRATION	9			
Meaning, nature, scope, and significance of Public Administration; Evolution of Public Administration as a discipline; Identity and status of Public Administration.					
UNIT - II	ORGANIZATIONAL THEORIES	9			
Theories of organization with special reference to Scientific Management Theory, Classical Organizational Model, and Human Relations Theory.					
UNIT - III	ORGANIZATIONAL BEHAVIOUR AND DESIGN	9			
Organizational goals and behaviour; Groups in organizations and group dynamics; Principles and approaches to organizational design.					
UNIT – IV	MOTIVATION, LEADERSHIP, AND DECISION-MAKING	9			
Motivation theories: content, process, and contemporary theories; Leadership theories: traditional and modern approaches; Decision-making process and techniques.					
UNIT - V	ADMINISTRATIVE THINKERS	9			
Contributions of Kautilya, Woodrow Wilson, C. I. Barnard, and Peter F. Drucker to administrative thought.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Interpret the concepts, scope, importance, and development of Public Administration as an academic discipline.	K2
CO2	Summarize the fundamental organizational theories including Scientific Management, Classical, and Human Relations approaches.	K2
CO3	Discuss organizational objectives, group behaviour, group processes, and organizational design concepts.	K2

COs	Statements	K-Level
CO4	Outline motivation theories, leadership styles, and the methods involved in administrative decision-making.	K2
CO5	Describe the ideas and contributions of prominent administrative thinkers and their relevance to administration.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO5	-	-	-	-	-	3	2	2	-	-	-	-	-	-
CO	-	-	-	-	-	2	2	2	-	-	-	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Crozior M : The Bureaucratic phenomenon (Chand)
2	Blau. P.M and Scott. W : Formal Organizations (RKP)
3	Presthus. R : The Organizational Society (MAC)

Reference Books

1	Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
2	Keith Davis : Organization Theory (MAC)



U24GE5X05	INDIAN ADMINISTRATIVE SYSTEM	L	T	P	C
		3	0	0	3
Course Objectives:	To provide students with a comprehensive understanding of the structure, functioning, and constitutional framework of Indian administration, and to develop insight into contemporary administrative issues, governance, and accountability mechanisms.				
UNIT - I	EVOLUTION AND CONSTITUTIONAL FRAMEWORK OF INDIAN ADMINISTRATION				9
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India.					
UNIT - II	DISTRICT AND LOCAL ADMINISTRATION IN INDIA				9
Role, powers, and functions of the District Collector. Relationship between the District Collector and the Superintendent of Police. Role of the Block Development Officer in planning and implementation of development programmes. Structure and functioning of local government institutions.					
UNIT - III	PANCHAYATI RAJ AND URBAN LOCAL GOVERNANCE				9
Main features of the 73rd Constitutional Amendment Act, 1992 with special reference to Panchayati Raj Institutions. Salient features of the 74th Constitutional Amendment Act, 1992 relating to urban local bodies.					
UNIT – IV	CONTEMPORARY ISSUES IN INDIAN ADMINISTRATION				9
Coalition politics in India and its impact on governance and administration. Concepts of integrity and vigilance in Indian administration, including mechanisms to promote ethical governance.					
UNIT - V	CORRUPTION AND INSTITUTIONAL MECHANISMS FOR ACCOUNTABILITY				9
Nature and causes of corruption in public administration. Ombudsman system in India. Structure, powers, and functions of Lokpal and Lokayukta.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
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COs	Statements	K-Level
CO1	Illustrate the evolution and constitutional framework of the Indian administrative system.	K2
CO2	Describe the roles and functions of district and local administrative institutions in India	K2
CO3	Summarize the features of the 73rd and 74th Constitutional Amendment Acts and their significance in local governance.	K2
CO4	Discuss contemporary issues such as coalition politics, integrity, and vigilance in Indian administration.	K2
CO5	Explain the nature of corruption and the role of Lokpal, Lokayukta, and ombudsman institutions in ensuring accountability.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO	-	-	-	-	-	2	2	2	-	-	-	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	S.R. Maheswari : Indian Administration
2	Khera. S.S : Administration in India
3	Ramesh K. Arora : Indian Public Administration

Reference Books

1	T.N. Chaturvedi : State administration in India	
2	Basu, D.D : Introduction to the Constitution of India	

U24GE5X06	PUBLIC POLICY ADMINISTRATION	L	T	P	C
		3	0	0	3
Course Objectives:	To familiarize students with different approaches to policy analysis, enabling them to critically assess and select appropriate frameworks for evaluating public policies.				
UNIT - I	FOUNDATIONS AND SCOPE OF PUBLIC POLICY				9
Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Public policy relationship with social sciences especially with political science and Public Administration.					
UNIT - II	APPROACHES AND MODELS OF POLICY ANALYSIS				9
Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System’s Approach – Dror’s Optimal Model					
UNIT - III	PUBLIC POLICY PROCESS AND STAGES OF POLICY MAKING				9
Major stages involved in Policy making Process – Policy Formulation – Policy Implementation – Policy Evaluation.					
UNIT – IV	INSTITUTIONAL ACTORS IN PUBLIC POLICY MAKING				9
Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.					
UNIT - V	OVERVIEW OF MAJOR PUBLIC POLICIES IN INDIA				9
Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the meaning, scope, and significance of public policy	K2
CO2	Extend and apply various approaches to policy analysis	K2

COs	Statements	K-Level
CO3	Identify and describe the major stages of the policy-making process	K2
CO4	Examine the roles of key stakeholders in the policy-making process	K2
CO5	Compare the specific public policies, such as the New Economic Policy, Population Policy, Agriculture Policy, and Information Technology Policy	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	2	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	3	2	3	-	-	-	-	-	-
CO5	-	-	-	-	-	3	2	2	-	-	-	-	-	-
CO	-	-	-	-	-	2	2	2	-	-	-	-	-	-

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Reference Books

1	Rajesh Chakrabarti & Kaushik Sanyal : Public Policy in India, Oxford University Press, 2016
2	Kuldeep Mathur : Public Policy and Politics in India, Oxford University Press, 2016.
3	Bidyutv Chakrabarty: Public Policy: Concept, Theory and Practice, 2015.
4	Pradeep Saxena : Public Policy Administration and Development
5	Sapru R.K. : Public Policy: Formulation, Implementation and Evaluation, Sterling Publishers, 2016.



U24CB5Y01		STATISTICS FOR MANAGEMENT			L	T	P	C
					3	0	0	3
Course Objectives:		Provide foundational knowledge in sampling distributions, estimation, hypothesis testing, and both parametric and non-parametric methods, also develop analytical skills in correlation and regression for effective data interpretation and decision making.						
Unit - I		INTRODUCTION					9	
Basic definitions and rules for probability - Conditional probability independence of events - Baye's theorem - Random variables - Moments - Moment generating functions - Probability distributions: Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.								
Unit - II		SAMPLING DISTRIBUTION AND ESTIMATION					9	
Introduction to sampling distributions - Sampling distribution of mean and proportion - Application of central limit theorem - sampling techniques - Estimation: Point and Interval estimates for population parameters of large sample and small samples - Determining the sample size.								
Unit - III		TESTING OF HYPOTHESIS - PARAMETIRC TESTS					9	
Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z test) – One sample and two sample tests for means of small samples (t-test) - F-test for two sample standard deviations - ANOVA one way and two-way classification.								
Unit – IV		NON-PARAMETRIC TESTS					9	
Chi-square test for single sample standard deviation - Chi-square tests for independence of attributes and goodness of fit - Sign test for paired data - Rank sum test - Kolmogorov-Smirnov - test for goodness of fit - Comparing two populations - Mann-Whitney U test - Kruskal Wallis test - One sample run test.								
Unit - V		CORRELATION AND REGRESSION					9	
Correlation - Scatter diagram - Karl Pearson's coefficient of correlation - Coefficient of determination - Rank Correlation (Spearman's rank correlation) - Concept of regression - Regression lines and regression coefficients - Estimation of regression equation - Method of Least Squares - Standard Error of estimate and interpretation of results.								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Apply the quantitative techniques to obtain objective solutions in business decision-making.	K3
CO2	Use an appropriate analytical technique to solve business problems.	K3
CO3	Construct an appropriate statistical technique to analyse data sets and interpret the results accurately.	K3
CO4	Make use of the relevant analytical and research skills in both research and	K3

COs	Statements	K-Level
	business environments.	
CO5	Develop the statistical techniques to solve problems in workplace settings.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2		1						1	1			
CO2	3	2		1						1	1			
CO3	3	2		1						1	1			
CO4	3	2		1						1	1			
CO5	3	2		1						1	1			
CO	3	2		1						1	1			

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Richard I. Levin, David S. Rubin, Masood H.Siddiqui, Sanjay Rastogi, Statistics for Management, Pearson Education, 8th Edition, 2017.
2	Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.
3	David R. Anderson, Dennis J. Sweeney, Thomas A.Williams, Jeffrey D.Camm, James J.Cochran, Statistics for business and economics, 13th edition, Thomson (South – Western) Asia, Singapore, 2016.
4	T N Srivastava and Shailaja Rego, Statistics for Management, Tata McGraw Hill, 3rd Edition 2017.

Reference Books

1	Prem. S. Mann, Introductory Statistics, Wiley Publications, 9th Edition, 2015.
2	N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.
3	Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
4	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

U24CB5Y02		DATA MINING FOR BUSINESS INTELLIGENCE			L	T	P	C
					3	0	0	3
Course Objectives:		To understand the concepts of data mining and business intelligence, explore data preprocessing and warehousing, apply major data mining techniques, analyze business decision-making using BI systems, and interpret insights using visualization and reporting tools.						
Unit - I	INTRODUCTION TO DATA MINING & BUSINESS INTELLIGENCE						9	
Basics of Data Mining – KDD Process – Types of Data – Types of Patterns – Importance of Data Mining for Business – Role of BI in Decision Making – BI Architecture – Business Metrics and KPIs – Applications of Data Mining in Marketing, Finance, Retail and Healthcare – Introduction to Real-time BI and Big Data Analytics								
Unit - II	DATA PREPROCESSING & DATA WAREHOUSING						9	
Data Quality – Missing Data Handling – Noise and Outlier Detection – Data Cleaning – Data Integration and Transformation – Discretization and Normalization – Data Reduction Techniques – ETL: Extraction, Transformation and Loading – Data Warehouse Characteristics – OLTP vs OLAP – Star and Snowflake Schemas – Fact and Dimension Tables – OLAP Operations (Roll-up, Drill-down, Slice, Dice, Pivot).								
Unit - III	DATA MINING TECHNIQUES						9	
Classification: Decision Trees, Naïve Bayes, k-Nearest Neighbour – Prediction and Regression Basics – Clustering: k-Means, Hierarchical Clustering – Cluster Evaluation – Association Rule Mining: Apriori and FP-Growth Algorithms – Support, Confidence and Lift – Model Evaluation Measures: Accuracy, Precision, Recall, F-measure, ROC and AUC – Overfitting and Model Pruning.								
Unit – IV	BUSINESS INTELLIGENCE SYSTEMS & TOOLS						9	
BI Lifecycle – Data Analysis and Insights – Principles of Data Visualization – Dashboards and Scorecards – Static and Interactive Reporting – KPI Dashboards – Introduction to BI Tools (Power BI, Tableau, Qlik Sense) – Basic Operations: Data Importing, Modeling and Visualization – SQL Server BI Tools: SSIS, SSAS, SSRS – Role of OLAP Cubes in BI.								
Unit - V	APPLICATIONS OF DATA MINING IN BUSINESS						9	
Customer Analytics – Customer Segmentation – Churn Prediction – Lifetime Value Prediction – Marketing Analytics: Recommendation Systems, Cross-sell and Up-sell Analysis – Fraud Detection and Risk Analysis – Retail Analytics: Market Basket Analysis, Demand Forecasting – Case Studies in Banking, Healthcare, Telecom and E-commerce – Ethical, Legal and Privacy Issues in Data Mining..								
Total Periods:							45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Outline the fundamentals of data mining and business intelligence concepts.	K2
CO2	Explain data preprocessing techniques and data warehouse operations for analytical processing	K2

COs	Statements	K-Level
CO3	Apply classification, clustering, and association rule mining techniques for business datasets.	K3
CO4	Utilize business intelligence tools for reporting, visualization, and KPI dashboard development.	K3
CO5	Analyze real-world business problems and interpret insights using data mining applications.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	2	1	2	1	-	1	1	1	1	1	2	1	1
CO2	2	2	2	2	2	-	1	1	1	1	1	2	2	1
CO3	3	3	2	3	3	1	1	1	2	1	1	3	2	1
CO4	2	2	3	3	3	1	1	1	2	2	1	2	3	2
CO5	3	3	2	3	2	2	2	2	2	2	1	3	2	2
CO	2.40	2.40	2.00	2.60	2.20	1.33	1.20	1.20	1.60	1.40	1.00	2.40	2.00	1.40

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Jiawei Han, Jian Pei, Hanghang Tong, Data Mining: Concepts and Techniques, Fourth Edition, Morgan Kaufmann / Elsevier, 2022.
2	Galit Shmueli, Peter C. Bruce, Peter Gedeck, Nitin R. Patel, Inbal Yahav, Data Mining for Business Analytics: Concepts, Techniques and Applications in Python, Second Edition, Wiley, 2023.
3	Dr. Jyotiranjana Hota, Data Mining and Business Intelligence: Data-Driven Strategy for Business Transformation, First Edition, Wiley / Academic Press, 2025
4	Ivo D. Dinov, Data Science and Predictive Analytics: Biomedical and Health Applications Using R, Second Edition, Springer, 2023.

Reference Books

1	Foster Provost, Tom Fawcett, Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking, Second Edition, O'Reilly Media, 2023.
2	Dean Abbott, Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Second Edition, Wiley, 2023.
3	Jack A. Hyman, Luca Massaron, Paul McFedries et al., Data Analytics and Visualization All-in-One for Dummies, Wiley, 2024
4	R.N. Prasad, Seema Acharya, Fundamentals of Business Analytics, First Edition, Wiley India, 2011.
5	Subhash Sharma, Applied Business Analytics: Integrating Business Process, Big Data, and Advanced Analytics, First Edition, McGraw-Hill Education, 2017.



U24CB5Y03		HUMAN RESOURCE ANALYTICS		L	T	P	C
				3	0	0	3
Course Objectives:		To introduce the foundations and importance of Human Resource Analytics, explain the role of HR data and metrics in decision-making, illustrate analytical and predictive methods for workforce insights, and describe the strategic and ethical implications of applying analytics in HR functions.					
Unit - I	INTRODUCTION TO HR ANALYTICS					9	
Understanding HR Analytics – Evolution of HR Analytics – Role of Data in HR Decision Making – Types of HR Data – HR Metrics and KPIs – HR Scorecards – Importance of Evidence-Based HR – Applications of HR Analytics in Recruitment, Performance Management, Retention and Engagement.							
Unit - II	HR DATA MANAGEMENT & METRICS					9	
HRIS: Concepts and Components – Workforce Data Sources – Data Cleaning and Validation – Employee Demographic Data, Job Data, Compensation Data – HR Metrics: Recruitment Metrics, Training Metrics, Performance Metrics, Retention Metrics – HR Dashboards – Data Visualization for HR Reporting.							
Unit - III	ANALYTICAL METHODS IN HR					9	
Descriptive Analytics in HR – Workforce Trends and Pattern Identification – Predictive Analytics Concepts – Regression Analysis for HR – Predicting Attrition, Performance, Absenteeism – Identifying High-Potential Employees – Predictive Models for Hiring and Promotion – Data Interpretation for HR Decision Support.							
Unit – IV	HR ANALYTICS TOOLS & APPLICATIONS					9	
Introduction to HR Analytics Tools (Excel, Power BI, Tableau, SPSS, Python basics) – HR Dashboard Creation – Employee Survey Analytics – Competency Mapping Analytics – Talent Acquisition Analytics – Compensation Analytics – Case Studies in HR Analytics Implementation – Challenges in Deploying HR Analytics.							
Unit - V	STRATEGIC & ETHICAL DIMENSIONS OF HR ANALYTICS					9	
Strategic HR Analytics – Linking HR Analytics to Business Outcomes – Workforce Planning and Optimization – ROI of HR Initiatives – Ethical Issues in HR Data – Data Privacy, Bias, Transparency & Fairness – Responsible Use of Analytics – Future Trends in People Analytics and AI in HR.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the fundamental principles and applications of Human Resource Analytics.	K2
CO2	Discuss HR data sources, HR metrics, and analytical reporting for workforce insights.	K2
CO3	Interpret HR analytical methods for predicting employee performance and retention.	K2
CO4	Summarize the use of HR analytics tools for visualization, dashboards, and decision support.	K2
CO5	Illustrate strategic, ethical, and organizational dimensions of HR Analytics in real-world contexts.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	-	-	3	-	3	3	-	2	2	3	3	3
CO2	3	3	-	-	3	-	3	3	-	3	3	3	3	3
CO3	3	3	-	-	3	-	3	3	-	3	3	3	3	3
CO4	3	3	-	-	3	-	3	3	-	3	3	3	3	3
CO5	3	3	-	-	3	-	3	3	-	3	3	3	3	3
CO	3.00	3.00	-	-	3.00	-	3.00	3.00	-	2.80	2.80	3.00	3.00	3.00

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Jonathan Ferrar, David Green, Excellence in People Analytics: How to Use Workforce Data to Create Business Value, Second Edition, Kogan Page, 2023.
2	Ben Waber, People Analytics: How Social Sensing Technology Will Transform Business and What It Tells Us About the Future of Work, Updated Edition, FT Press / Pearson, 2022.
3	JDipak Kumar Bhattacharyya, HR Analytics: Understanding Theories and Applications, Second Edition, Sage Publications India, 2023.
4	Martin R. Edwards, Kirsten Edwards, Predictive HR Analytics: Mastering the HR Metric, Second Edition, Kogan Page, 2023.

Reference Books

1	Tracey Smith, HR Analytics: The What, Why and How, Second Edition, Kogan Page, 2023.
2	Bernard Marr, Data-Driven HR: How to Use Analytics and Metrics to Drive Performance, Updated Edition, Kogan Page, 2022.
3	Jean Paul Isson, Jesse Harriott, People Analytics in the Era of Big Data: Changing the Way You Attract, Acquire, Develop and Retain Talent, Second Edition, Wiley, 2022.



U24CB5Y04	MARKETING AND SOCIAL MEDIA WEB ANALYTICS		L	T	P	C
			3	0	0	3
Course Objectives:		To showcase the opportunities that exist today to leverage the power of the marketing, web and social media				
Unit - I	MARKETING ANALYTICS				9	
Basics of marketing analytics-Marketing budget and performance measurement-Marketing metrics and their applications-Financial impact of marketing strategies-Geographic analysis and data exploration-Market basket analysis-Customer Lifetime Value (CLV) and Marketing ROI Analysis.						
Unit - II	COMMUNITY BUILDING AND MANAGEMENT				9	
Evolution and basics of social media-Goals and audience of social media-Influencers and social media theories-Community building strategies-Promoting and linking social media platforms-Viral marketing and digital PR-Managing online identity and communities-Social media for business use-Social Media Content Strategy and Engagement Planning-Social Media Crisis Management and Community Moderation						
Unit - III	SOCIAL MEDIA POLICIES AND MEASUREMENTS				9	
Social media policies and etiquette-Privacy and ethical issues-Future trends in social media-Social media tracking and analytics-Campaign performance analysis-Understanding user behavior on social platforms-Sentiment Analysis and Social Listening Techniques.						
Unit – IV	WEB ANALYTICS				9	
Introduction to web analytics-Data collection methods-Qualitative and business analysis-KPIs and planning-Web analytics strategy components-Web data analysis and reporting-User Journey Mapping and Conversion Funnel Analysis-A/B Testing and Website Optimization Techniques						
Unit - V	SEARCH ANALYTICS				9	
Search engine optimization (SEO)-User engagement and behaviour-Web traffic and usability analysis-Content management systems-Data visualization and RSS feeds-Mobile platforms and user-centered design-Understanding search pattern-Keyword Research and Competitive Search Analysis.						
Total Periods:					45	

On completion of the course, the student can

COs	Statements	K - Level
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CO1	Identify fundamental concepts tools and metrics of marketing web and social media analytics related to performance measurement data interpretation and digital marketing decision making	K3
CO2	Outline the structure evolution and purpose of social media platforms community building practices and management strategies including policies ethics and privacy considerations	K2
CO3	Analyze marketing web and social media data to understand user behavior engagement and campaign performance effectiveness	K3
CO4	Develop data driven insights and strategies to support marketing decision making and solve marketing related problems	K3
CO5	Build basic analytical reports dashboards and summaries to monitor key performance indicators for marketing web and social media analytics	K3

CO - PO Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	-	1	-	1	2	2	2	-	2	2	2	2	1
CO2	1	-	1	-	1	2	1	1	-	1	1	1	1	-
CO3	3	-	3	-	3	3	3	3	-	3	3	3	3	3
CO4	2	2	3	-	3	-	1	1	-	1	1	1	2	1
CO5	1	1	2	-	2	-	2	2	-	2	2	2	2	2
CO	1.80	1.50	2.00	-	2.00	2.33	1.80	1.80	-	1.80	1.80	1.80	2.00	1.75

Text Books

1	Social Media and Web Analytics – Gupta, Mukul & Gupta et al. (2025 edition) – Comprehensive coverage of social media analytics, web metrics, tools, and integration of web & social analytics.
2	Web and Social Media Analytics – M. M. Sankar, Fezeena Khadir & Senthilmurugan (2023) – Focuses specifically on analytics practices for web and social media including recent tools & trends.
3	Essentials of Marketing Analytics – Joseph F. Hair, Dana E. Harrison & Haya Ajjan (Recent edition) – Covers fundamental marketing analytics concepts and models, useful for Units I, IV & V

Reference Books

1	Digital Marketing and Social Media Web Analytics – Bharti Publications (<i>Latest edition</i>) – Designed for students studying digital marketing and analytics basics including web and social data.
2	Social Media Analytics and Practical Applications – Kumar & Qiu (<i>Routledge</i>) – Focus on practical techniques and case examples of social media analytics in business.
3	Social Analytics: Network and Text Methods with NodeXL and R – Miranda (<i>Prospect Press</i>) – Good for Unit II/III topics involving analysis tools (network/text analytics).

U24CB5Y05		OPERATION AND SUPPLY CHAIN ANALYTICS		L	T	P	C
				3	0	0	3
Course Objective:		To provide in-depth knowledge of advanced quantitative models and analytical methods used in operations and supply chain management and to understand recent developments in the field					
Unit - I	INTRODUCTION						9
Basics of analytics including descriptive predictive and prescriptive analytics-Concept of data driven supply chains-Transformation of supply chains using analytics-Challenges in implementation and implementation roadmap-Supply Chain Analytics Architecture and Data Sources.							
Unit - II	WAREHOUSING DECISIONS						9
Mathematical programming models for warehouse decisions-Facility location models such as P median and dynamic location models-Layout planning and space determination methods-Heuristic approaches for warehouse optimization-Automation and Technology Enabled Warehouse Analytics.							
Unit - III	INVENTORY MANAGEMENT						9
Inventory aggregation and lot sizing models-Multi echelon inventory systems-Aggregate inventory planning-Supply chain risk analysis including transit supply and delivery risks-Risk pooling strategies in inventory management-Demand Forecasting Models for Inventory Control.							
Unit – IV	TRANSPORTATION NETWORK MODELS						9
Basics of graphs and network models-Shortest path minimal spanning tree and maximum flow problems-Transportation and transshipment models-Set covering and set partitioning problems-Traveling salesman and vehicle routing heuristics-Scheduling algorithms for supply chain operations-Network Design and Capacity Planning Models.							
Unit - V	MCDM MODELS						9
Multi criteria decision making models in supply chain management-Analytic Hierarchy Process and Analytic Network Process-Data Envelopment Analysis-Fuzzy logic based decision models-TOPSIS and its applications in supply chains-Integrated MCDM Approaches for Supply Chain Partner Selection							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Analyze supply chain data using descriptive predictive and prescriptive analytics to evaluate operational performance and identify patterns in inventory transportation and warehousing systems	K4
CO2	Extend quantitative supply chain models to address multi echelon inventory dynamic lot sizing and risk considerations under real world constraints	K2
CO3	Explain the principles and functioning of transportation network models facility location methods and inventory management techniques used in supply chain	K2

COs	Statements	K-Level
	analytics	
CO4	Outline multi criteria decision making models such as AHP ANP DEA fuzzy logic and TOPSIS and their role in supporting supply chain decisions	K2
CO5	Apply analytical tools techniques and optimization methods to solve warehousing inventory transportation and supply chain decision problems	K3

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	1	-	1	1	2	2	-	2	2	2	1	1
CO2	1	-	1	-	2	3	1	1	-	1	1	1	1	-
CO3	3	-	3	-	3	3	3	2	-	3	2	3	3	2
CO4	2	3	2	-	2	-	1	1	-	1	1	2	1	1
CO5	1	2	3	-	3	-	2	2	-	2	2	3	2	3
CO	1.80	2.00	2.00	-	2.20	2.33	1.80	1.60	-	1.80	1.60	2.20	1.60	1.75

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Supply Chain and Operations Analytics: Areas, Analytics Formulations, and Results — Bhattacharya, Maitra & Bhattacharyya (Routledge / 2022–2024). A modern, application-focused book that covers analytics formulations across supply chain and operations.
2	Introduction to Supply Chain Analytics — Dmitry Ivanov (Springer, recent edition) — concise, up-to-date treatment of management, modeling and technology perspectives in SCA. Good as a companion text.

Reference Books

1	Supply Chain Analytics — T. A. S. Vijayaraghavan (Wiley India, 2021) — practical coverage of analytics techniques applied to forecasting, inventory and distribution.
2	Supply Chain Analytics: Concepts, Techniques and Applications (Springer / Palgrave style titles, ~2021–2023) — an accessible introduction to concepts, methods and case studies in SCA.



U24CB5Y06	FINANCIAL ANALYTICS			L	T	P	C
				3	0	0	3
Course Objectives:	To provide knowledge of corporate finance and financial market analytics using quantitative methods for investment evaluation, risk analysis, and portfolio management. It introduces time-series analysis, technical indicators, and basic machine learning techniques for market prediction. The course also develops skills to design and evaluate credit risk models for informed financial decision-making.						
Unit - I	CORPORATE FINANCE ANALYSIS					9	
Introduction to corporate financial analytics – Basics of financial predictive modeling – Project evaluation and cash flow estimation – Cost of capital and sensitivity analysis – Indifference point and financial break-even modeling – Capital budgeting techniques: Payback Period, NPV, IRR, MIRR – Scenario and what-if analysis – Financial distress and bankruptcy prediction: Beaver’s ratios, Ohlson logistic model, Altman Z-score and early warning indicators.							
Unit - II	FINANCIAL MARKET					9	
Risk and return estimation for bonds and stocks – Adjustments for stock splits, dividends, and mergers – Multi-series visualization – Data acquisition from web portals and APIs – Data cleaning and normalization – Nature of financial time-series data – Trend and seasonality – Exponential Weighted Moving Averages – Value at Risk (VaR) – ARMA, ARCH, and GARCH models for volatility.							
Unit - III	PORTFOLIO ANALYSIS					9	
Modern Portfolio Theory – Risk–return trade-off – CAPM and beta estimation – Sharpe ratio and portfolio performance measures – Markowitz mean–variance optimization – Cluster analysis for portfolio categorization – Introduction to derivatives – Binomial option pricing – Black–Scholes model – Option implied volatility and basic Greeks.							
Unit – IV	TECHNICAL ANALYSIS					9	
Technical indicators and chart patterns – RSI, ROC, MACD, Moving Averages, Candlestick charts and trend analysis – Design and simulation of trading strategies – Fundamental vs technical signals – Machine learning for price prediction – ANN and SVM – Model validation and overfitting in financial data.							
Unit - V	CREDIT RISK ANALYSIS					9	
Foundations of credit risk – Data pre-processing and feature engineering – Decision trees for risk classification – Logistic regression for credit scoring – Evaluation of credit models using accuracy, ROC, and AUC – Bias and explainability in financial models – Design of simple end-to-end credit risk decision systems.							
Total Periods:						45	



On completion of the course, the student can

COs	Statements	K - Level
CO01	Apply corporate finance analytics techniques to evaluate investment projects by estimating cash flows, analyzing cost of capital, and performing capital budgeting using Payback, NPV, IRR, and MIRR methods, enabling practical financial decision-making and identification of financial viability in corporate scenarios.	K3
CO02	Analyze financial market data to estimate and predict risk and return for bond and stock investments by performing data acquisition, cleansing, visualization, and time-series modeling using EWMA, VaR, ARMA, ARCH, and GARCH techniques for volatility assessment.	K4
CO03	Evaluate portfolio performance and associated risk by applying modern portfolio theory concepts such as CAPM, Sharpe ratio, and mean-variance optimization, and by using clustering techniques and option pricing models to assess diversified investment portfolios.	K4
CO04	Examine market trends and price movements by interpreting technical indicators and chart patterns, simulating trading strategies, and applying machine learning models such as ANN and SVM to predict share prices while assessing model accuracy and overfitting.	K4
CO05	Develop credit risk assessment models by pre-processing financial data and applying decision tree and logistic regression techniques, and evaluate credit scoring performance using standard metrics to support data-driven financial decision systems.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	-	1	1	-	-	-	-	-	-	2	1	-
CO2	2	2	-	2	1	-	-	-	-	-	-	2	2	-
CO3	1	2	1	1	1	-	-	-	-	-	-	1	2	1
CO4	1	2	2	2	2	-	-	-	-	-	-	1	2	2
CO5	2	2	2	1	2	-	-	-	-	-	-	2	2	2
CO	1.60	1.80	1.67	1.40	1.40	-	-	-	-	-	-	1.60	1.80	1.67

Correlation levels 1, 2 and 3 are as defined below:



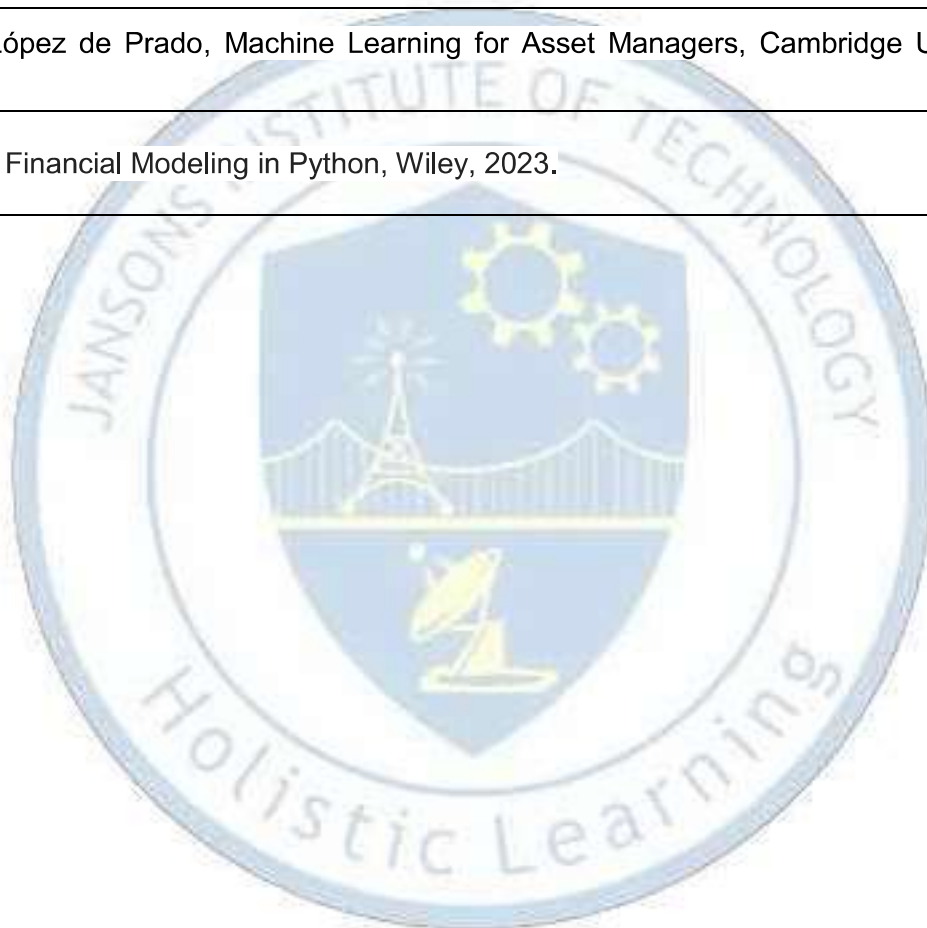
1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	John C. Hull, Options, Futures, and Other Derivatives, Pearson Education, 2022
2	James Chen, Essentials of Financial Analytics: Data-Driven Finance and Investment, Wiley, 2023.
3	Tomasz R. Bielecki and Marek Rutkowski, Credit Risk: Modeling, Valuation and Hedging , Springer, 2022..

Reference Books

1	Marcos López de Prado, Machine Learning for Asset Managers, Cambridge University Press, 2022..
2	Ben Sita, Financial Modeling in Python, Wiley, 2023.



U24GE5Z01	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	L	T	P	C
		3	0	0	3
Course Objectives:	To provide comprehensive knowledge on sustainable development principles and their integration into planning, design, operation and management of infrastructure systems while ensuring environmental protection, social equity and economic viability.				
Unit - I	CONCEPT OF SUSTAINABLE DEVELOPMENT				9
Fundamental concepts and evolution of sustainable development. Environmental, social and economic pillars of sustainability and the triple bottom line approach. Sustainability indicators. UN Sustainable Development Goals and their linkage to infrastructure growth. Impacts of climate change on infrastructure systems and adaptive planning strategies. Environmental Impact Assessment and Life Cycle Assessment methodologies for infrastructure evaluation. Concepts of carbon neutrality and sustainable resource efficiency in infrastructure projects.					
Unit - II	ECO-URBAN INFRASTRUCTURE				9
Principles of sustainable urban planning and integrated land use development. Smart cities mission, intelligent urban services and digital infrastructure. Public transportation systems, non-motorized transport and transit-oriented development. Green building concepts, sustainable housing strategies and rating systems such as LEED and GRIHA. Low-impact development techniques and urban heat island mitigation measures. Urban resilience planning and inclusive infrastructure for equitable community development.					
Unit - III	SUSTAINABLE WATER AND WASTE SYSTEMS				9
Sustainable water resource planning, water supply systems and demand-side management. Rainwater harvesting, aquifer recharge and watershed management practices. Wastewater treatment technologies, reuse strategies and decentralized sanitation systems. Integrated solid waste management and circular economy principles. Resource recovery from waste and waste-to-energy technologies. Plastic waste management and sustainable material recovery systems.					
Unit – IV	GREEN ENERGY AND CLEAN TECHNOLOGY				9
Application of renewable energy systems including solar, wind, biomass and hybrid energy solutions in infrastructure. Energy efficiency measures and green technologies in buildings and utilities. Sustainable transportation planning, electric vehicles, alternative fuels and mass transit systems. Carbon footprint analysis, greenhouse gas mitigation and climate action strategies. Energy auditing and demand-side energy management. Concepts of green hydrogen and emerging clean energy technologies.					
Unit - V	RESILIENT AND SMART INFRASTRUCTURE				9
Concept of resilient infrastructure and disaster risk reduction strategies. Climate-resilient design approaches and adaptation techniques for infrastructure systems. Smart infrastructure technologies including IoT-enabled monitoring, GIS-based planning and data-driven decision making. Public–Private Partnership (PPP) frameworks in sustainable infrastructure development. Infrastructure financing mechanisms and green bonds. Case studies on sustainable and resilient infrastructure projects.					
Total Periods:					45



On completion of the course, the student can

COs	Statements	K - Level
CO1	Explain principles of sustainable development, SDGs, EIA and LCA in infrastructure projects.	K2
CO2	Apply sustainable urban planning concepts including green buildings, smart cities and public transport systems.	K3
CO3	Analyze sustainable water, waste management and circular economy practices in infrastructure systems.	K4
CO4	Illustrate renewable energy, sustainable transportation and carbon reduction strategies	K2
CO5	Develop resilient and smart infrastructure solutions considering societal, environmental and economic factors	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze

CO - PO Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	1	2	1	2	3	1	-	1	2	-	-	-
CO2	3	2	3	2	2	2	3	1	2	1	2	-	-	-
CO3	2	3	3	2	2	2	3	1	2	1	2	-	-	-
CO4	3	2	3	2	2	2	3	1	1	1	2	-	-	-
CO5	2	3	3	2	2	3	3	2	2	2	3	-	-	-
CO	3	2	3	2	2	2	3	1	1	1	2	-	-	-

Text Books

1	Grigg, N. S. (1988). Infrastructure engineering and management (1st ed.). Wiley-Interscience. ISBN-13: 9780471849742.
2	Proag, V. (2021). Infrastructure planning and management: An integrated approach (1st ed.). Springer International Publishing. ISBN-13: 978-3-030-48558-0.

Reference Books

1	Theis, T., & Tomkin, J. (2018). Sustainability: A comprehensive foundation (1st ed.). 12th Media Services. ISBN-13: 9781680921533.
2	Mulder, K. (2006). Sustainable development for engineers: A handbook and resource guide (1st ed.). Routledge. ISBN-13: 9781874719199.

3	Rogers, P. P., Jalal, K. F., & Boyd, J. A. (2007). An introduction to sustainable development (1st ed.). Earthscan. ISBN-13: 9781844075218.
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U24GE5Z02		SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT		L	T	P	C
				3	0	0	3
Course Objectives:		To impart knowledge on ecological principles, sustainable resource management, smart irrigation, waste-to-energy technologies, and sustainability assessment for developing environmentally responsible and resilient agricultural systems.					
Unit - I	ECOLOGICAL AND SUSTAINABLE APPROACHES IN MODERN AGRICULTURE					9	
Ecosystem Concepts and Structure – Biotic and Abiotic components of Ecosystem - Ecosystem Processes - Energy Flow and Ecological Pyramid - Ecological services and agriculture – Industrial Agriculture and Food System Challenges–Technology-driven intensification vs ecological imbalance, Life Cycle Assessment (LCA) tools for food systems - Concept and Dimensions of Sustainability - Characteristics and Practices of Sustainable Agriculture - Regenerative vs. Sustainable Agriculture Systems - Future-Ready Ecological Agriculture.							
Unit - II	SUSTAINABLE SOIL, NUTRIENT AND PEST MANAGEMENT					9	
Concept of Sustainable Soil - Soil Organic Matter & Carbon Management - Soil Degradation & Restoration - Sustainable Nutrient Management – Principles - Integrated & Precision Nutrient Management - Soil–Plant–Microbe Interactions - Sustainable Pest Management – Concepts - Ecological & Biological Pest Control - Emerging Innovations & Integrated Approaches.							
Unit - III	WATER MANAGEMENT AND SMART IRRIGATION IN AGRICULTURE					9	
Soil Water Dynamics in Climate - Plant Yield Response to Water & Water Productivity - Reducing Evaporation - Enhancing Soil Moisture Conservation - Rainwater Harvesting & Nature-Based Solutions - Irrigation Scheduling , Decision Support System - Improving Agricultural Water Productivity - Localized & Micro-Irrigation Systems - Fertigation - Nutrient–Water Integration - Advanced Irrigation Systems & Sustainable Water Use Innovations.							
Unit – IV	ENERGY AND AGRICULTURAL WASTE MANAGEMENT					9	
Introduction to Agricultural Wastes - Composition and Characterization of Agricultural Wastes - Sustainable Technologies for Waste Management - Value-Added Products from Agricultural Wastes - Renewable Energy from Agricultural Wastes - Advanced Waste-to-Energy Technologies - Circular Economy & Resource Optimization - Case Studies & Emerging Trends.							
Unit - V	EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS					9	
Introduction to Sustainability in Agriculture - Principles and Dimensions of Sustainable Agriculture - Indicators of Sustainability in Agriculture - On-Farm Evaluation of Agro ecosystem Sustainability - Alternative Agriculture: Concepts & Approaches - Alternative Farming Techniques - Community Food Systems: Goals & Components - Sustainable Agriculture to Community Food Systems – Case Studies.							
Total Periods:						45	



On completion of the course, the student can

COs	Statements	K - Level
CO1	Discuss ecosystem structure, sustainability principles, and agricultural systems supporting ecological farming practices.	K2
CO2	Apply principles of sustainable soil, nutrient, and pest management to improve agroecosystem productivity and resilience.	K3
CO3	Implement water management and smart irrigation techniques to enhance water use efficiency and crop productivity.	K3
CO4	Analyze agricultural waste and energy strategies to promote circular economy and renewable energy applications.	K4
CO5	Assess alternative agriculture practices and community food system components to determine their role in sustainable development.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create.

CO - PO Matrix

CO Code	Programme Outcome (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	1	2	1	2	3	2	1	-	-	2	1	2
CO2	2	3	2	2	2	2	3	2	1	-	-	2	2	2
CO3	2	3	2	2	3	2	3	1	1	-	-	3	3	2
CO4	2	2	2	2	2	3	3	2	1	1	1	3	2	3
CO5	2	3	2	3	2	3	3	2	2	1	1	2	2	3
Avg.	2	3	2	2	2	2	3	2	1	1	1	2	2	2

Text Books

1	Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021.
2	Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer, 2016.
3	Agriculture Waste Management and Bioresource: The Circular Economy Perspective — Suruchi Singh, Pardeep Singh, Anu Sharma & Moharana Choudhury, John Wiley & Sons, ISBN 978-1119808138, 2022.

Reference Books

1	Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020.
2	Principles of Sustainable Soil Management in Agroecosystems – Edited by Rattan Lal & B.A. Stewart, CRC Press, ISBN 978-1466513464, 2013.

engineering scaffolds are emphasized - The role of composites in enhancing mechanical and biological performance

Unit – IV	METALS AS BIOMATERIALS	9
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Overview of biomedical metals - their types - properties, and performance in biological environments. Detailed study of stainless steel, cobalt–chromium alloys - titanium alloys – tantalum - Nitinol, and magnesium - based biodegradable metals - Discussion on surface modification for osteointegration, corrosion behavior, and biological tolerance of implant metals - highlights clinical applications in medical implants and devices - Performance evaluation of metals in biological environments.

Unit - V	NANOBIOMATERIALS	9
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Introduction to Metallic nanobiomaterials–Nanopolymers-Nanoceramics- Nanocomposites-Carbon based nanobiomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosize nanofibres-Nano and micro features and their importance in implant performance-Nanosurface and coats-Applications nanoantibiotics-Nanomedicines- Biochips – Biomimetics- BioNEMs -Biosensor Bioimaging/Molecular Imaging- Challenges, safety concerns, and future perspectives of nanobiomaterials

	Total Periods:	45
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Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Explain the definition, classification, properties, and biocompatibility requirements of biomaterials and relate them to implant performance and tissue response.	K2
CO2	Describe the structure, properties, polymerization methods, and biomedical applications of major biopolymers including biodegradable and natural polymers.	K2
CO3	Apply knowledge of bioceramics and biocomposites to identify suitable materials for orthopedic implants and tissue engineering applications.	K3
CO4	Apply the properties and behavior of metallic biomaterials to select appropriate metals for specific biomedical implants and devices.	K3
CO5	Explain the characteristics, synthesis, and biomedical applications of nanobiomaterials and their role in advanced diagnostics and therapy.	K2

CO – PO – PSO Articulation Matrix



	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	2	-	-	-	2	1	-	-	-	1	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	1	1	1	2
CO3	3	3	2	1	2	2	-	-	-	-	1	2	2	2
CO4	3	3	2	1	2	2	-	-	-	-	1	2	2	2
CO5	3	2	1	1	2	2	1	-	-	-	2	3	3	2
CO	3	2	1	1	1	1	-	-	-	-	1	2	2	2

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani, "Introduction to Biomaterials: Basic Theory with Engineering Applications", Cambridge University Press, 2014.
2	Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, "Biomaterials Science: An Introduction to Materials in Medicine", Third Edition, Academic Press, 2013.
3	Joon Park, R. S. Lakes, "Biomaterials: An Introduction", Third Edition, Springer, 2007.
4	Vasif Hasirci, Nesrin Hasirci, "Fundamentals of Biomaterials", Springer, 2018.
5	Sujata V. Bhat, "Biomaterials", Narosa Publishing House, 2002.

Reference Books

1	Donglu Shi, "Introduction to Biomaterials", Tsinghua University Press, 2006.
2	M. Jaffe, W. Hammond, P. Tolas, T. Arinzeh, "Characterization of Biomaterials", Woodhead Publishing, 2013.



3	Leopold Javier Rios Gonzalez, "Handbook of Research on Bioenergy and Biomaterials: Consolidated and Green Processes", Apple Academic Press, 2021.
4	Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad, "Functional Bionanomaterials", Springer, 2020.
5	Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, "Biomaterials Science: An Introduction to Materials in Medicine", Fourth Edition, Elsevier, 2020.



U24GE5Z04		MATERIALS FOR ENERGY SUSTAINABILITY			L	T	P	C
					3	0	0	3
Course Objectives:		To familiarize students with the challenges and demands of energy sustainability by providing fundamental knowledge of electrochemical devices, various types of fuel cells, novel photovoltaic materials, and supercapacitors, along with the materials used in these energy systems and their practical applications in modern energy technologies.						
Unit - I		SUSTAINABLE ENERGY SOURCES					9	
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy.								
Unit - II		ELECTROCHEMICAL DEVICES					9	
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiaterd hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO2, LiFePO4, LiMn2O4) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based).								
Unit – III		FUEL CELLS					9	
Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell – Fuel utilization – electrolyte membrane (proton conducting and anion conducting) – Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) – Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates).								
Unit – IV		PHOTOVOLTAICS					9	
Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application – Crystalline silicon solar cells – thin film silicon solar cells – multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se2 solar cells – Cadium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells – Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials .								
Unit - V		SUPERCAPACITORS					9	
Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) – design of supercapacitor-three and two electrode cell-parameters of supercapacitor-Faradaic and non – Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials – Polyaniline (PANI), a ternary hybrid compositeconductive polypyrrole hydrogels.								
Total Periods:							45	

Course Outcomes



On completion of the course, the student can

COs	Statements	K-Level
CO1	Explain the basic concepts and importance of energy sustainability.	K2
CO2	Interpret the principles of different electrochemical devices.	K2
CO3	Explain the working of fuel cells and their application.	K2
CO4	Illustrate various Photovoltaic applications and the materials used in them.	K2
CO5	Interpret the types of supercapacitors and the performance of various materials.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO– PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	-	2	-	-	2	1	-	-	1	2	-	1	-
CO2	3	-	2	-	1	2	-	-	-	1	2	-	1	1
CO3	3	-	2	-	1	2	-	-	-	1	1	-	1	1
CO4	3	-	2	-	1	2	1	-	-	1	2	-	2	1
CO5	3	-	2	-	1	2	1	-	-	1	1	-	1	-
CO	3	-	2	-	1	2	1	-	-	1	2	-	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	John A Kilner, Stephen J Skinner, Stuart J C Irvine and Peter P Edwards — Functional materials for sustainable energy applications, Woodhead Publishing, Elsevier, 2012.
2	Wolf Vielstich, Arnold Lamm, Hubert A Gasteiger and Harumi Yokokawa — Handbook of Fuel Cells: Fuel Cell Technology and Applications, Wiley, 2003.
3	Conway B E — Electrochemical Supercapacitors: Scientific Fundamentals and Technological Applications, Kluwer Academic / Plenum Publishers, New York, 1999.
4	Parnia Forouzandeh, Vignesh Kumaravel and Suresh C Pillai — Electrode Materials for Supercapacitors: A Review of Recent Advances, Catalysts, 2020.
5	Viswanathan B and Aulice Scibioh M — Materials for Supercapacitor Applications, CRC Press, 2013.

Reference Books

1	Amanda Ndubuisi, Sara Abouali, Kalpana Singh and Venkataraman Thangadurai — Recent Advances, Practical Challenges, and Perspectives of Intermediate Temperature Solid Oxide Fuel Cell Cathodes, J. Mater. Chem. A, 2022.
2	Crompton T R — Batteries reference book, Newners, 3rd Edition, 2002.
3	Neeraj Kant and Pushpendra Singh — Review of Next Generation Photovoltaic Solar Cell Technology and Comparative Materialistic Development, Materials Today Proceedings, 2022.
4	Peter Wurfel and Uli Wurfel — Physics of Solar Cells: From Principles to New Concepts, Wiley-VCH, 2016.
5	François Beguin and Elzbieta Frackowiak — Handbook of Supercapacitors, Wiley-VCH, 2013.



U24GE5Z05		GREEN TECHNOLOGY				L	T	P	C
						3	0	0	3
Course Objectives:		To impart knowledge of green chemistry and green engineering principles, pollution control, waste management, and green synthesis, and to develop skills for designing safe, energy-efficient, and sustainable chemical processes using green metrics and nanotechnology.							
Unit - I	PRINCIPLES OF GREEN CHEMISTRY							9	
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.									
Unit - II	POLLUTION TYPES							9	
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling									
Unit - III	GREEN REAGENTS AND GREEN SYNTHESIS							9	
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions									
Unit – IV	DESIGNING GREEN PROCESSES							9	
Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention.									
Unit - V	GREEN NANOTECHNOLOGY							9	
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology.									
Total Periods:								45	

Course Outcomes

On completion of the course, the student can

COs	Statements	K-Level
CO1	Experiment with the principles of green chemistry and green engineering, including historical concepts and green metrics.	K3
CO2	Solve problems related to pollution, waste management, and chemical hazards using sustainable approaches.	K3
CO3	Construct chemical processes and products using environmentally benign methods, alternate solvents, and energy-efficient techniques.	K3
CO4	Design safe and sustainable chemical processes and products with real-time monitoring and process intensification.	K3
CO5	Utilize advanced technologies, including nanotechnology, for green synthesis, environmental remediation, and renewable energy applications.	K3

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

CO – PO – PSO Articulation Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	3	3	2	2	3	2	2	3	3	2	3	3	3	3

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO2	2	3	3	3	3	2	3	3	3	2	2	3	3	2
CO3	3	3	3	3	3	2	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	2	3	3	3	3
CO5	3	3	3	3	3	2	3	3	3	2	3	3	3	3
CO	2.80	3.00	2.80	2.80	3.00	2.00	2.80	3.00	3.00	2.00	2.80	3.00	3.00	2.80

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Samir B. Billatos and Nadia A. Basaly, Green Technology and Design for the Environment, First Edition, Taylor & Francis (CRC Press), 2017
2	Green Chemistry – An introductory text - M. Lancaster, RSC, 2016.
3	Green Chemistry metrics - Alexi Lapkin and david Constable (Eds) , Wiley publications, 2008.

Reference Books

1	Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017.
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collection, storage, processing, and visualization. Data quality assurance, validation, and quality control techniques. Regulatory overview and role of digital technologies such as IoT, remote sensing, and GIS in modern environmental monitoring.

Total Periods:

45

On completion of the course, the student can

COs	Statements	K - Level
CO01	Explain the concepts, classification, and regulatory framework of environmental standards at national and international levels.	K2
CO02	Apply appropriate environmental monitoring and sampling techniques for air, water, and industrial emissions.	K3
CO03	Analyze environmental samples using conventional and instrumental analytical methods to determine key pollution parameters.	K4
CO04	Evaluate environmental monitoring programmes and conduct environmental risk assessment for informed decision-making.	K5
CO05	Analyze automated environmental data acquisition and management systems considering regulatory requirements.	K4

Knowledge Level: K1 – Remember, K2 – Understand, K3 - Apply

CO - PO Matrix

CO Code	Programme Outcome (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	1				2	3	1			1			
CO2	3	2	2	2	1	2	3				1			
CO3	3	3	2	3	2		2				1			
CO4	2	3	2	2		3	3	2			1			
CO5	2	2	3	2	3	2	3				2			
Avg.	3	2	2	2	1	2	3	1			1			

Text Books

1	Environmental monitoring Handbook, Frank R. Burden, © 2002 by The McGraw-Hill Companies, Inc.
2	Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc
3	Peavy, H.S., Row, R., and Tchobanoglous, G., <i>Environmental Engineering</i> , McGraw Hill, New York.
4	Metcalf & Eddy, <i>Wastewater Engineering: Treatment and Reuse</i> , McGraw Hill.

Reference Books

1	Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.
2	H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, <i>Instrumental Methods of Analysis</i> , CBP Publishers and Distributors, New Delhi, 1988.
3	Heaslip, G. (1975) <i>Environmental Data Handling</i> . John Wiley & Sons. New York.

4	Sawyer, C.N., McCarty, P.L., and Parkin, G.F., <i>Chemistry for Environmental Engineering and Science</i> , McGraw Hill.
5	CPCB and WHO Environmental Monitoring Guidelines.

U24GE5Z07	INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3
Course Objectives:	To make the students understand the global and Indian energy scenario, this course provides knowledge of conventional and renewable energy sources, energy efficiency, and the environmental impacts of energy utilization. It also introduces the concept of sustainable development, emphasizes the potential of renewable energy technologies, and familiarizes students with energy policies and planning for sustainable development.				
Unit - I	ENERGY SCENARIO				9
Comparison of energy scenario – India and World – energy sources – generation mix – consumption pattern – T&D losses – energy demand – per capita energy consumption – energy pricing – energy security – carbon emissions and climate impact – future energy outlook and challenges.					
Unit - II	ENVIRONMENTAL EFFECTS OF ENERGY SYSTEMS				9
Conventional energy sources – emissions from fuels – impact on air, water, and land – environmental standards and regulations – pollution measurement, monitoring, and control techniques – mitigation strategies for sustainable energy use.					
Unit - III	SUSTAINABLE DEVELOPMENT				9
Sustainable development – concepts and key stakeholders – Sustainable Development Goals (SDGs) – social development: poverty, its concepts, measures, and impacts – globalization and economic growth – economic development: income distribution, economic inequalities, and growth patterns.					
Unit – IV	RENEWABLE ENERGY TECHNOLOGY				9
Renewable energy – sources and potential – technologies for harnessing solar, wind, hydro, biomass, and ocean energy – working principles – benefits and limitations of each technology – energy storage and integration with the grid – role of renewable energy in sustainable development.					
Unit - V	ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT				9
Overview of national and state energy policies – objectives and implementation of the National Solar Mission – role and framework of the Central Electricity Authority – National Hydrogen Mission – energy and climate policy initiatives – State Energy Action Plans – strategies for renewable energy integration – roadmap for ethanol blending – approaches for improving energy efficiency – planning a balanced and sustainable energy mix.					
Total Periods:					45

Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Explain the global and Indian energy scenarios.	K2
CO2	Explain the energy projects, evaluate their environmental impacts, and propose appropriate mitigation and control strategies.	K2
CO3	Illustrate the importance of sustainable development and assess its influence on human resource development.	K2
CO4	Interpret renewable energy technologies to promote sustainable development.	K2
CO5	Explain energy policies and planning approaches for achieving sustainable development.	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	-	1	-	-	2	-	-	-	1	1	-	-
CO2	2	2	1	2	-	-	2	1	1	1	2	1	1	-
CO3	2	1	-	1	-	1	2	1	1	1	2	1	1	-
CO4	2	2	2	1	1	-	2	1	1	1	2	1	-	1
CO5	2	2	1	1	-	2	2	1	1	1	2	1	-	1
CO	2	2	1	1	-	1	2	1	1	1	2	1	1	1

Correlation levels 1, 2 and 3 are as defined below:

1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Rathore N S & Panwar, N L <i>Renewable Energy Sources for Sustainable Development</i> , New India Publishing Agency, 2007
2	Mirjana Radovanovic, <i>Sustainable Energy Management: Planning, Implementation, Control, and Strategy</i> (2nd Edition), 2022
3	Amjad Anvari-Moghaddam, <i>Sustainable Energy Systems Planning, Integration and Management</i> , MDPI AG, Basel, Switzerland, 2020
4	David Borge-Diez & Enrique Rosales-Asensio, <i>Sustainable Energy Planning in Smart Grids</i> , Elsevier Science & Technology, 2023.
5	John Joseph Puthenkulam, <i>Sustainable, Affordable, Reliable and Modern Energy: A Road Map for India</i> , Springer Nature Switzerland AG, 2026.

Reference Books

1	Robert Ristire and Jack P. Kraushaar, "Energy and the environment", Willey, 2025.
2	Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
3	Twidell, J.W. & Weir A., "Renewable Energy Resources", EFNSpon Ltd., UK, 2015.
4	Dhandapani Alagiri, <i>Energy Security in India Current Scenario</i> , The ICFAI University Press, 2006.
5	M.H. Fulekar, Bhawana Pathak, R K Kale, "Environment and Sustainable Development" Springer, 2016.



U24GE5Z08		ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT		L	T	P	C
				3	0	0	3
Course Objectives:		To understand the types of energy sources, to create awareness on energy audit, to acquaint the techniques adopted for performance evaluation of thermal, to familiarize on the procedures adopted for performance evaluation of electrical utilities and to learn the concept of sustainable development and the implication of energy usage.					
Unit - I	ENERGY AND ENVIRONMENT					9	
Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, International frame works: UNFCCC, COP Start Contents here – Sustainable energy alternatives: Solar, Wind, biomass, hydrothermal, geothermal.							
Unit - II	ENERGY AUDITING					9	
Need and types of energy audit: preliminary, detailed, targeted and investment-grade Audits - Energy management (audit) approach - understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.							
Unit - III	ENERGY EFFICIENCY IN THERMAL UTILITIES					9	
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters - Insulation and Refractories - Commercial waste heat recovery devices: recuperators, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermo compression – case studies and applications.							
Unit – IV	ENERGY CONSERVATION IN ELECTRICAL UTILITIES					9	
Demand side management: concept, strategies and benefits - Power factor improvement: causes, methods and benefits – Energy efficient transformers: loses, design improvement and Maintenance practices - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers.							
Unit - V	SUSTAINABLE DEVELOPMENT					9	
Sustainable Development: Concepts and Stakeholders - Sustainable Development Goal (SDG). Globalization and Economic growth: positive impact, negative impacts and case studies - Economic development: Economic inequalities, Income and growth - Social development: Poverty, conceptual issues and measures, impact of poverty.							
Total Periods:						45	

Course Outcomes

On completion of the course, the student can

CO	Statements	K-Level
CO1	Explain the prevailing energy scenario	K2
CO2	Apply and familiarize on energy audits and its relevance	K3
CO3	Apply the concept of energy audit on thermal utilities	K3
CO4	Explain relevant techniques for energy improvement in electrical utilities	K2
CO5	Interpret the development on human resource development	K2

Knowledge Level: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6 – Create



CO – PO– PSO Mapping Matrix

	Programme Outcomes											PSO		
	01	02	03	04	05	06	07	08	09	10	11	01	02	03
CO1	2	1	-	-	-	-	-	-	-	-	2	2	2	-
CO2	2	1	-	-	-	1	-	-	-	-	2	2	2	-
CO3	3	2	-	1	1	-	-	-	-	-	2	2	2	-
CO4	3	2	2	2	2	2	-	-	-	-	2	2	3	2
CO5	3	2	2	2	3	3	2	2	2	2	3	2	3	3
CO	3	2	2	2	2	2	2	2	2	2	2	2	2	2

Correlation levels 1, 2 and 3 are as defined below: 1. Slight 2. Moderate 3. Substantial (High)

Text Books

1	Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, "Energy and the Environment", 4th Edition, Wiley, 2022
2	Pratap Bhattacharyya, "Climate Change and Greenhouse Gas Emission", New India Publishing Agency- Nipa, 2020
3	Matthew John Franchetti, Defne Apul "Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies" CRC Press, 2012

Reference Books

1	M.H. Fulekar, Bhawana Pathak, R K Kale, "Environment and Sustainable Development" Springer, 2016.
2	Energy Manager Training Manual (4 Volumes) available at http://www.em-ea.org/gbook1.asp , a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India. 2004.
3	Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.
4	W.R. Murphy and G. McKay "Energy Management" Butterworths, London 1987.
5	Eastop, T.D & Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical, ISBN-0-582-03184, 1990.

