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Question Paper Code : 51579

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Fourth Semester

Mechanical Engineering

MA 2266/MA 42/MA 1254/080120014/10177 SN 401 — STATISTICS AND NUMERICAL METHODS

(Common to Automobile Engineering and Production Engineering)

(Regulation 2008/2010)

(Common to PTMA 2266 – Statistics and Numerical Methods for B.E. (Part-Time) Second Semester – Production Engineering – Regulation 2009)

Time : Three hours Maximum : 100 marks

Statistical tables may be permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define Type – I and Type – II errors.

2. State the conditions for applying χ^2 test.

3. What are the basic principles of experimental design?

4. State any two advantages of a Completely Randomized Experimental Design.

5. State the order of convergence and condition for convergence of Newton-Raphson method.

6. Write the procedure involved in Gauss elimination method.

7. State any two properties of divided differences.

8. What is 'inverse interpolation'?

9. State the advantages of Runge-Kutta method over Taylor Series method.

10. Convert the differential equation $y''(x) + y'(x) + y = 0$ into finite difference equivalent form.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) A manufacturer of light bulbs claims that an average of 2% of the bulbs manufactured by him are defective. A random sample of 400 bulbs contained 13 defective bulbs. On the basis of the sample, can you support the manufacturer's claim at 5% level of significance? (8)

(ii) A survey of 320 families with 5 children each revealed the following distribution :

No. of boys :	5	4	3	2	1	0
No. of girls :	0	1	2	3	4	5
No. of families :	14	56	110	88	40	12

Is this result Consistent with the hypothesis that male and female births are equally probable? (8)

Or

(b) (i) In a random sample of 100 men taken from village A, 60 were found to be consuming alcohol. In another sample of 200 men taken from village B, 100 were found to be consuming alcohol. Do the two villages differ significantly in respect of the propotion of men who consume alcohol? (8)

(ii) Two independent samples of sizes 9 and 7 from a normal population had the following values of the variables.

Sample I :	18	13	12	15	12	14	16	14	15
Sample II :	16	19	13	16	18	13	15		

Do the estimates of population variance differ significantly at 5% level of significance? (8)

12. (a) Four varieties A, B, C, and D of a fertilizer are tested in a Randomized Block Design with four replications. The plot yields in pounds are as follows :

A12	D20	C16	B10
D18	A14	B11	C14
B12	C15	D19	A13
C16	B11	A15	D20

Analyse the experimental yield. (16)

Or

(b) Analyse the variance in the Latin square of yields (in kgs) of paddy where P, Q, R, S denote the different methods of cultivation :

S122	P121	R123	Q122
Q124	R123	P122	S125
P120	Q119	S120	R121
R122	S123	Q121	P122

Examine whether different method of cultivation have significantly different yields. (16)

13. (a) (i) Solve the equation $x \log_{10} x = 1.2$ using Newton–Raphson method. (8)

(ii) By Gauss Jordan elimination method. Find the inverse of the matrix $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 0 & -1 \\ 2 & -1 & 2 \end{bmatrix}$. (8)

Or

(b) (i) Solve the following set of equations using Gauss–Seidal iterative procedure

$-10x + 2y + 2z = 4$; $x - 10y + 2z = 18$; $x + y - 10z = 45$. (8)

(ii) Find the numerically largest eigenvalue of $\begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$ by using power method. (8)

14. (a) (i) Find polynomial $f(x)$ by using Lagrange's formula and hence find $f(4)$ for (8)

x :	1	3	5	7
$f(x)$:	24	120	336	720

(ii) Evaluate $\int_0^1 \frac{dx}{(1+x)}$ by using

Simpson's one-third rule and hence deduce the value of $\log_e^2$. (8)

Or

(b) (i) Construct Newton's forward interpolation polynomial for the following data :

x :	1	2	3	4	5
$f(x)$:	1	–1	1	–1	1

and hence find $f(3.5)$, $f'(3.5)$. (8)

(ii) The velocity v of a particle at a distance s from appoint on its path is given as follows :

s in meter :	0	10	20	30	40	50	60
v m/sec :	47	58	64	65	61	52	38

Estimate the time taken to travel 60 meters by using Trapezoidal rule and Simpson's 3/8 rule. (8)

15. (a) (i) Apply Taylor series method to find and approximate value of y when $x = 0.1, 0.2$ given that $\frac{dy}{dx} = x + y$, $y(0) = 1$. (8)

(ii) Solve the BVP $y'' + y = 0$, $y(0) = 1$, $y(1) = 0$ using finite difference method, taking $h = 0.25$. (8)

Or

(b) (i) Using Milne's predictor corrector method find $y(4.4)$ given $5xy' + y^2 - 2 = 0$ given $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$. (8)

(ii) Evaluate $y(1.2)$ and $y(1.4)$ correct to three decimal places by the modified Euler method, given that $\frac{dy}{dx} = (y - x^2)^3$; $y(1) = 0$ taking $h = 0.2$. (8)