Reg. No. : | | | | | | | | | | | | |

Question Paper Code : X 20496

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Sixth Semester
Electrical and Electronics Engineering
EE 6604 – DESIGN OF ELECTRICAL MACHINES
(Also common to Design of Electrical (Regulations 2013)
PTEE6604 – Machines for B.E. (Part-Time) – Fifth Semester (Regulations 2014))

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Give the electrical properties of insulating materials.
2. Define rating of a motor.
3. What is Carter's gap coefficient ?
4. What are real and apparent flux densities ?
5. In transformers, why the low voltage winding placed near the core ?
6. How the heat dissipation is improved by providing the cooling tubes in transformers ?
7. Stepped core section is preferred to a square section for transformer, give reason.
8. Explain the phenomena of cogging.
9. What is run away speed ?
10. Mention the uses of damper windings in a synchronous machine.

PART – B **(5×13=65 Marks)**

11. a) Describe the desirable properties and classification of Magnetic materials.

(OR)

b) A field coil has a heat dissipating surface of 0.15 m^2 and a length of mean turn of 1 m. It dissipates loss of 150 W, the emissivity being 34 W/m^2–°C. Estimate the final steady temperature rise of the coil and its time constant if the cross section of the coil is 100 × 50 mm^2. Specific heat of copper is 390 J/Kg °C. The space factor is 0.56. Copper weighs 8900 kg/m^3.

12. a) i) Output Equations and Main Dimensions of DC Machine. **(7)**

ii) Determine the length and diameter of armature core for a 55 kW, 110 V, 1000 rm, 4 pole shunt generator, assuming the specific electric and Magnetic loadings as 26,000 ampere conductors per metre and 0.5 W/m^2 respectively. The pole arc should be about 70% of pole pitch and length of core about 1.1 times the pole arc. Allow 10 A for the field current and assume a voltage drop of 4 V for the circuit. **(6)**

(OR)

b) Calculate the mmf required for the airgap of a machine having core length of 0.32 m, including 4 ducts of 10 mm each ; pole arc = 0.19 m; slot pitch = 65.4 mm; slot opening = 5 mm; airgap length = 5 mm; flux per pole = 52 m Wb; Given carter's coefficient is 0.18 for opening/gap and is 0.28 for opening/gap = 2.

13. a) Derive the output equation of a single phase transformer in terms of core and window area.

(OR)

b) A 250 kVA, 6600/400 V, 3-phase core type transformer has a total loss of 4800 watts on full load. The transformer tank is 1.25 m in height and 1 m × 0.5 m in plan. Design a suitable scheme for cooling tubes if the average temperature rise is to be limited to 35 °C. The diameter of the tubes is 50 mm and are spaced 75 mm from each other. The average height of the tubes is 1.05 m.

14. a) Explain the factors that affect the length of Air gap in an Induction Motor.

(OR)

b) A 90 kW, 500 V, 50 Hz, three phase, 8 pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors/slot. The slip ring voltage, on open circuit is to be about 400 V at no load. Find suitable rotor winding. Identify number of rotor slots, number of conductors/ slot, coil span, number of slots per pole. Assume power factor = 0.9 and the efficiency is 0.85.

15. a) Find the main dimensions of a 100 MVA, 11 KV, 50 Hz, 150 rpm, three phase water wheel generator. The average gap density is 0.65 wb/m^2 and ampere conductors per meter are 40,000. The peripheral speed should not exceed 65 m/s at normal running speed in order to limit the runaway peripheral speed.

(OR)

b) Describe the procedure for the design of Field winding of Alternator.

PART – C **(1×15=15 Marks)**

16. a) Describe the various Types of Transformer Cooling.

(OR)

b) A single phase 440 V, 50 Hz, transformer is built from stampings having a relative permeability of 1000. The length of the flux path is 3 m, the area of cross section of the core is 3×10^{-3} m^2 and the primary winding has 1000 turns. Estimate the maximum flux and no load current of the transformer. The iron loss at the working flux density is 2.6 W/Kg. Iron weighs 7.8×10^3 Kg/m^3. Stacking factor is 0.9.