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

Question Paper Code : 52505

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Sixth Semester
Electrical and Electronics Engineering
EE 2355 – DESIGN OF ELECTRICAL MACHINES
(Regulations 2008)
(Common to PTEE2355 – Design of Electrical Machines for B.E. (Part-Time) Fifth Semester – EEE – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. Name the magnetic materials used for DC machines yoke, transformer stampings and permanent magnet.
2. How is heat produced in a rotating electrical machine ?
3. Calculate the output co-efficient of a dc shunt generator from the given data. Bg = 0.89 Wb/m^2; ac = 3200 amp. cond/m; $\psi = 0.66$.
4. State the difference between armature winding of dc machine and stator winding of ac machine.
5. Why stepped core is generally used for transformer ?
6. Give the expression for magnetizing current.
7. What are the ranges of specific magnetic loading in induction motor ?
8. What are the problems that occur in induction motor due to certain combinations of stator and rotor slots ?
9. What is the limiting factor for the diameter of synchronous machine ?
10. What is the use of damper winding ?

PART – B **(5×16=80 Marks)**

11. a) i) What are the properties of ideal insulating materials ? What is the common insulating materials used in electrical Engineering ? **(8)**

ii) A 350 KW, 500 V, 450 rpm, 6-pole, dc generator is built with an armature diameter of 0.87 m and core length of 0.32 m. The lap wound armature has 660 conductors. Calculate the specific electric and magnetic loadings. **(8)**

(OR)

b) i) Mention the different types of duties of a machine. **(8)**

ii) Show and explain the temperature rise/cooling curve of electrical machines. **(8)**

12. a) i) Derive the expression for mmf of air gap with smooth and slotted armatures. **(6)**

ii) Calculate the apparent flux density at a particular section of a tooth from following data : **(10)**

Tooth width = 12 mm, slot width = 10 mm, gross core length = 0.32 m, number of ducts = 4, each 10 mm wide, real flux density = 2.2 Wb/m^2, permeability of teeth corresponding to real flux density = 31.4 $\times 10^{-6}$ H/m, stacking factor = 0.9.

(OR)

b) i) What are the factors to be considered for the selection of number of poles in dc machine ? **(6)**

ii) Determine the total commutator losses for a 800 KW, 400 V, 300 rpm, 10 pole generator having following data :
commutator diameter = 100 cm, current density in brush contact = 0.075 A/mm^2, brush pressure = 14.7 KN/m^2, coefficient of friction = 0.23, brush contact drop = 2.2 V. **(10)**

13. a) i) What are the factors to be considered for choosing the type winding for a core type transformer ? **(6)**

ii) Calculate the dimension of the core, the number of turns and cross-sectional area of conductors in the primary and secondary windings of a 100 KVA, 2300/400 V, 50Hz 1-phase shell type transformer. Ratio of magnetic and electric loadings equal to 480 $\times 10^{-8}$. B_m = 1.1 Wb/m^2 , δ = 2.2 A/mm^2, k_w = 0.3, stacking factor = 0.9, Depth of stacked core/width of central limb = 2.6, Height of window/Width of window = 2.5. **(10)**

(OR)

b) i) List the various methods of cooling of transformers. Describe any one in detail. **(6)**

ii) A single phase 400 V, 50 Hz transformer is built from stampings having a relative permeability of 1000. The length of the flux path is 2.5 m, the area of the cross section of the core is 2.5 $\times 10^{-3}$ m^2 and the primary winding has 800 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 weight 7.8 $\times 10^3$ kg/m^3. stacking factor is 0.9. **(10)**

14. a) i) What are the factors to be considered for estimating the length of air gap in induction motor ? **(6)**

ii) A 90 KW, 500 V, 50 Hz, 3-phase, 8-pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors/slot. If the slip ring voltage on open circuit is not to exceed 400 volt, find a suitable rotor winding by estimating number of slots, number of conductors/slot, coil span, slip-ring voltage on open circuit, approximate full load current per phase in rotor. Assume η = 0.9 and p.f. = 0.86. **(10)**

(OR)

b) Show the procedure to construct the circle diagram for induction motor and how various quantities are measured from circle diagram. **(16)**

15. a) i) Derive output equation of synchronous machine. **(8)**

ii) Mention the factors that govern the design of field system of alternator. **(8)**

(OR)

b) Determine for a 250 KVA, 1100 V, 12 pole, 500 rpm, 3-phase alternator :

1) Air gap diameter,
2) Core length,
3) Number of stator conductors,
4) Number of stator slots and
5) Cross-section of stator conductors.

Assuming average gap density as 0.6 Wb/m^2 and specific electric loading of 30,000 amp cond/m. L/τ = 1.5. **(16)**
