
B.E. (FULL-TIME) DEGREE END SEM EXAMINATIONS NOV/DEC 2012
ELECTRICAL AND ELCTRONICS ENGINEERING
VI SEMESTER (REGULATION 2008)

EE9355 : DESIGN OF ELECTRICAL APPARATUS

Time: 3 Hours Max. Marks: 100

Answer ALL Questions

PART – A (10 x 2 = 20 Marks)

1 How the magnetization curve is made use of in the design of electrical machines?
2 Draw the magnetic circuit of a D.C machine.
3 How will you select the back and front pitch for a wave winding?
4 Mention the guiding factors for selection of number of poles.
5 While winding a transformer, circular coils are preferred in comparison to rectangular coils, why?
6 How the heat dissipation is improved by the provision of cooling tubes?
7 List the undesirable effects produced by certain combination of rotor and stator slots.
8 With a sketch indicate the location of damper windings in a synchronous machine.
9 Write the merits of using digital computers in designing electrical machines
10 What are the advantages and disadvantages of Finite element method for electrical machine design

PART – B (5 x 16 = 80 Marks)

11 a (i) Write short notes on computer aided design.
(ii) Write the step by step procedure for finding the magnetic flux density for any electrical apparatus using FEM.

12 a (i) Derive the expressions for reluctance of air-gap in machines with smooth armature and slotted armature.
(ii) A 6-pole D.C. machine has the following design data. Armature diameter=30cm, armature core length=15cm,length of air gap at pole center =0.25cm,flux per pole=12milliweb. Field form factor=0.65. Calculate the amp. turns required for the air gap
- if the armature surface is smooth
- if the armature surface is slotted and the gap expansion factor is 1.2

OR

b (i) Discuss the basic properties of conducting and insulating materials
(ii) Mention the various methods of cooling electrical machines. Explain any of them.

13 a (i) Derive the output equation of a DC machine.
(ii) Determine the no. of poles, main dimensions, pole pitch and armature mmf/pole of a 92 Kw , 220v , 1480 rpm , dc motor whose full load efficiency is 89.76%. Specific magnetic loading is 0.545 T and specific electric loading is 32750 AC/m. the pole arc to pole pitch ratio as 0.67 . Assume square pole face.

OR

b (i) Deign the shunt field winding of a 6-pole, 440 v, and dc generator allowing a drop of 15% in the regulator. The following design data are available. mmf per pole=7200 AT, mean length of turn=1.2m , winding depth=3.5 cm ; watts per sq.m. of cooling surface=650. Calculate the inner, outer and end surface of the cylindrical field coil for cooling. Take diameter of the insulted wire to be 0.4 mm greater than the bare wire. Assume 2 micro-ohm-cm as the resistivity of copper at the working temperature.

14 a (i) Determine the dimension of the core, the number of turns, and the cross-section area of conductors in primary and secondary windings of a 100 kVA, 2200/480 V, 1-phase, core type transformer, to operate at a frequency of 50Hz, by assuming the following data. Approximate Volt per turn = 7.5 Volt. Maximum flux density=1.2 Wb/m^2. Ratio of effective cross-sectional area of core to square of diameter of circumscribing circle is 0.6. Ratio of height to width of window is 2, Window space factor = 0.28. Current density = $2.5A/mm^2$.

OR

b (i) Why the core is stepped? Prove that cruciform core has net iron area = $0.56d^2$ where d is the diameter of circumscribing circle

(ii) A 3 phase core type transformer having 26 kW Iron loss and 99 kW copper losses in immersed in oil. The length, width and height of the oil tank are 2.7 m, 1.1 m, 3.5 m respectively. Assuming specific heat dissipation due to radiation and convection respectively 6 and 6.5 $w/.m^2/C$. Calculate temperature raise of the transformer without cooling tubes. Also estimate the no of cooling tube required to keep the temperature raise at 50 C using standard tubes of 50mm in diameter and 3.3 m long.

15 a (i) Estimate the stator core dimensions, number of stator slots and number of stator conductors per slot for a 100kw, 3300V, 50Hz, 12 pole star connected slip ring induction motor. Assume average gap density =$0.4wb/m^2$; Conductors per metre =25000A/m; Efficiency =0.9; Power factor =0.9 and winding factor =0.96. Choose main dimensions to give best power factor. The slot loading should not exceed 500-ampere conductors.

(ii) State the factors for separation of D and L for salient pole rotor machine.

OR

b (i) Design a cage rotor for a 40HP, 3-phase, 400V, 50Hz, 6 pole, delta connected induction motor having a full load η of 87% and a full load pf of 0.85. Take D = 33cm and L = 17cm. Stator slots = 54, conductors per slot = 14. Assume suitably the missing data if any.