Code No. 3115

FACULTY OF ENGINEERING

B.E. 4/4 (E & EE) I-Semester (Supplementary) Examination, June/July, 2011

ELECTRICAL MACHINE DESIGN

Time : Three Hours] [Maximum Marks : 75

Answer **ALL** questions from Part A. Answer any **FIVE** questions from Part B.

PART—A (Marks : 25)

1. Define super conductivity and transient temperature. 3
2. Differentiate between grain oriented and non-oriented steel sheet. 2
3. Explain leakage flux from salient poles. 2
4. Define Curter's gap coefficient. 3
5. What is window space factor ? What factors influence it ? 3
6. Write the importance of cooling curve. 2
7. Prove that volume of active parts is proportional to the torque of a D.C. machine. 3
8. Why the power factor is poor when the machine is designed with high specific magneting loading ? 2
9. What are the different approaches of computer aided design of electrical machine ? 2
10. Draw the flow chart for a synthesis method of computer aided design. 3

PART—B (Marks : 50)

11. (a) Compare the conducting properties of copper and aluminium and state relative merits. 5

    (b) Write details of different magnetic materials used in electrical machine design. 5

12. (a) Derive the expression for the specific slot permeance of a semi closed rectangular slot with single layer winding on it. 5

    (b) Calculate MMF required for air gap of a machine having core length = 0·32 m including 4 ducts of 10 mm each. Pole arc = 0·19 m, slot pitch = 65·4 mm, slot opening = 5 mm, air-gap length = 5 mm, flux per pole = 52 m wb. Given Carter's coefficient is 0·18 for open/gap = 1 is 0·28 when open/gap = 2. 5

13. (a) Derive the expression for quantity of cooling medium. 5

(b) The tank of 100 kVA natural coil cooled transforms has the length × width × height as (0·65 × 1·55 × 1·85) m respectively. The full load loss = 13·1 kW; loss due to radiation = 6 W/m^2-°C; loss due to convection = 6·5 W/m^2-8°C. Improvement in convection due to tubes = 50%. Temperature rise = 40°C; length of each tube = 1 m; diameter of tube = 50 mm. Find number of tubes for this transformer for cooling. 5

14. (a) Derive the output equation and power developed by armature of D.C. machine as meter and generator. 5

(b) Find the main dimensions and no. of poles of a 25 kW, 220 V, 1500 rpm short motor so that square pole face is obtained. The overuse gap flux density is 0·5 Wb/m^2 and ac = 22000 Ac/m. The ratio of pole arc to pole pitch = 0·7. Efficiency = 90%. 5

15. (a) Derive the output equation of ac machine. 5

(b) Estimate the diameter, core length size and no. of conductor and no. of slots for stator of 10 MVA, 11 kV, 50 Hz, 2 pole star connected turbo alternator with 60° phase spread, B_{av} = 20·55 Wb/m^2, ac = 36000 A/M. Current density = 5 A/mm^2, peripheral speed = 160 m/s, winding is arranged to 5^{th} harmonic. 5

16. Explain about computer aided design of 3 ϕ induction motor with symbols and design procedure. 10

17. Write short notes on any **TWO** :

(a) Specific magnetic and electric loading of dc machine 5

(b) Different types of slot leakage fluxes 5

(c) Output equation of 3 ϕ transformers. 5