Paper code: EE-011	**Roll No.**									

B. Tech.
(SEM VI) EVEN SEMESTER EXAMINATION, 2015-16
ELECTRICAL MACHINE DESIGN & CAD

[Time: 3 hrs] **[Max.Marks:100]**

Note: Answer all five questions.

1. Answer any four parts of the following: - **[5x4=20]**

(a) Give the classifications of insulating materials? Why it is temperature based.
(b) What are the factors which limit the design of a machine?
(c) Name the basic structural parts of an electromagnetic rotating machine and draw a neat diagram to show the flux path.
(d) State Simpson's rule to find total mmf for teeth.
(e) What are the modern trends in the design and manufacturing techniques of electrical machines?
(f) How the no load is current estimated for a three phase core type transformer?

2. Answer any two parts of the following: - **[10x2=20]**

(a) Derive output equation for a 3-Phase core type transformer and state how the main dimensions are estimated. Explain why stepped core is used in transformer.

(b) Calculate approximate main dimensions for a 200 KVA, 6600/400 V, 50 Hz 3 phase core type transformer. The following data may be assumed: emf per turn= 10V; maximum flux density = 1.1 Wb/m^2; current density = 2.5 A/mm^2; window space factor = 0.3, stacking factor = 0.9. Use a 3 stepped core.
For a three stepped core:
Width of the stepped core= 0.9 d and net iron area = 0.6 d^2
Where d is the diameter of circumscribing circle.

(c) A300 KVA, 3-phase,50-Hz, 6600/400V, Delta/Star core type transformer intended for lighting load is to be designed with approximately 8.5V per turn and a flux density of 1.2T. Take a 3-stepped core and yoke area 15% more than core area. Determine :
(i) Core section and yoke section.
(ii) Primary & secondary turns per phase.

3. Answer any two parts of the following: - **[10x2=20]**

(a) Develop Output Equation for a 3-phase induction motor. Why the output equation of motor is in KW and that of a syn. generator in KVA. Specify usual values of electric and magnetic loading.

(b) Determine D, L, airgap and commutator diameter of a 20 KW, 230 V 4 pole 1500 rpm D C shunt generator. Assume ac 20000, B 0.5 T and the ratio of L/ pole pitch 0.9.

(c) A 20-kw, 3-phase, 4-pole, 50-Hz, 400 V delta connected cage rotor induction motor has 48 stator slots, each containing 10 conductors. Design suitable number of rotor slots and determine the value of bar and end ring currents. The machine has efficiency of 87% and power factor 0.83 lagging. Also find the bar and end ring sections, if current density is 6.0 A/mm2. Assume rotor mmf as 85% of the stator mmf.

4. Answer any two parts of the following: - **[10x2=20]**

(a) Derive the output equation for a 3-phase synchronous machine. Explain specific electric loading and magnetic loading Also discuss how main dimensions are estimated taking into account peripheral speed limit.

(b) Design the stator frame for a 1000 KVA, 3300V, 50 Hz, 16 pole star connected, 3-phase water wheel generator. The following information must be included in the design:

(i) Internal diameter and gross length of stator frame.
(ii) Number of stator conductors
(iii) Number of stator slots.

Given: Specific magnetic loading = 0.55 Tesla, Specific electric loading = 22,000 amp-conductor per meter. Assume any other data if needed.

(c) Determine from fundamentals the slot leakage reactance for two layer winding of a synchronous machine. Show the MMF distribution curve and the basic assumptions made.

5. Answer any two parts of the following: - **[10x2=20]**

(a) Explain Synthesis method of CAD for Electric rotating machine. Develop the flow chart for determining stator turns per phase of a synchronous generator.

(b) Write a program with flowchart to estimate the main dimensions of 2000 kVA, 50 Hz, 3 phase, 150 rpm water wheel generator. The specific magnetic loading is 0.85 wb/m^2 and the specific electric loading is 23,000 ampere-conductor/m. Pole arc to pole pitch ratio is 0.67

(c) Discuss concept of optimization. Give a general procedure for optimization of design of electrical machines with a suitable example.

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