Code No. 6177 / O / S

FACULTY OF ENGINEERING

B.E. 4/4 (EEE) I – Semester (Old) Examination, July 2014

Subject: Electric Machine Design

Time: 3 Hours **Max.Marks: 75**

Note: Answer all questions from Part A. Answer any five questions from Part B. Missing data, if any, may suitably be assumed.

PART – A (25 Marks)

1 Define 'Transition temperature'. 2
2 Write a short note on CRGO steel. 3
3 compare electric and magnetic circuits. 3
4 Define 'Heating time constant'. 2
5 List the various factors that effect the choice of specific electric loading. 3
6 Calculate the peripheral speed of a D.C machine whose diameter is 0.5 mts and runs at a speed of 1000 r.p.m. 2
7 What are the properties of transformer oil? 3
8 Calculate the volume of active parts of a 3φ induction motor whose KVA input = 5.18, output coefficient = 109 and runs at 25 r.p.s. 2
9 Define SCR and what is its significance related to synchronous machine. 3
10 What are the advantages of computer aided design of electrical machines. 2

PART – B (50 Marks)

11 Explain in detail about the broad classification of electrical engineering materials used in design with suitable examples. 10
12 Calculate the m.m.f required for the air-gap of a machine having core length of 0.32 mts including 4 ducts of 20 mm each, pole are = 0.22 mts, slot pitch = 65 mm, slot opening = 10 mm, air gap length = 10 mm; flux per pole = 50 mwbs. Given carter's coefficient is 0.18 for opening/gap = 1 and is 0.28 for opening/gap = 2. 10
13 a) Derive the suppression for temperature rise of an electrical machine with respect to time, when the machine is run under steady load conditions starting from rest. 5
b) Calculate the apparent flux density at a particular section of a tooth from the following data: Tooth width = 14 mm, slot width = 10 mm, gross core length = 0.35 mts, no. of ventilating ducts = 4, each 10 mm wide, B_{real} = 2.4 T, permeability of teeth corresponding to real flux density = 3.14×10^{-6} H/mt, stacking factor = 0.9. 5
14 a) Calculate the suitable dimensions of armature core of a D.C shunt generator, whose rating is 50 kW, 4 pole, 600 r.p.m, if the full load terminal voltage is 220 volts. If the maximum gap density is 0.8 T and the armature ampere conductors per metre are 25,000. Assume full load terminal voltage drop is 2% of rated terminal voltage, and that the field current is 1% of rated full load current ratio of pole are to pole pitch is 0.65. 5
b) Explain the factors to be considered for selection of poles in a D.C machine. 5
15 Derive the output equation(s) of a D.C. machine and that of a non-rotating A.C. machine from fundamentals. 10
16 A 250 KVA, 6600 / 400 volts, 3φ core type transformer has a total loss of 4800 W at full load. The transformer tank is 1.25 mts in height and (1 mt x 0.5 mts) in plan. Design a suitable scheme of cooling tubes if the average temperature rise is to be limited to 35°C. The diameter of each tube is 50 mm and are spaced 75 mm from each other. The average height of tubes is 1.05 mt. Specific heat dissipation from tank walls is 6 W / mt^2 – °C and 6.5 W/mt^2 – °C due to radiation and convection respectively. Assume that the convection is improved by 35% due to convection. 10
17 Explain the analysis and synthesis methods of computer aided design of electrical machines with neat flow charts. 10

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Code No. 6406 / N / S

FACULTY OF ENGINEERING

B.E. 4/4 (EEE) I – Semester (New) (Suppl.) Examination, July 2014

Subject: Electric Machine Design

Time: 3 Hours **Max.Marks: 75**

Note: Answer all questions from Part A. Answer any five questions from Part B.

PART – A (25 Marks)

1		What are the major drawbacks of using aluminium as a conductor for the windings of transformer and rotating electrical machines?	2
2		Name the parts of a DC machine for which the magnetic material is needed and also mention that magnetic material.	2
3		Draw the magnetization curves for two magnetic materials, one of a very good quality and the other of a poor quality material. Explain the reasons for the differences in the magnetization curves.	3
4		Define carter's coefficient in connection with air gap of electrical machines.	2
5		On what factors does the selection of number of poles in case of machine design?	2
6		Explain how the main dimensions of a DC machine can be separated from its output equation.	3
7		What do you mean by 'window space factor' in the case of transformer design? Give its significance.	2
8		A transformer when connected to 2000 V, 25 Hz supply has a core loss of 1500 W of which 1000 W are due to hysteresis. Find the core loss and eddy current loss if the same transformer is connected to 4000 V, 50 Hz supply.	3
9		What are the main considerations in the selection of specific electric and magnetic loadings for the design of an induction motor?	3
10		List the advantages of digital computers.	3

PART – B (50 Marks)

11	a)	Classify the magnetic materials based on its permeability. Mention the types of magnetic materials. Explain the properties.	5
	b)	Explain the principle of super conductivity. Mention the applications of the superconductors.	5
12	a)	Write short notes on various types of enclosures and cooling methods available for machines.	5
	b)	Calculate the apparent flux density at a section of the teeth of an armature of a dc machine from the following data at that section. Slot pitch: 2.4 cm; slot width: 1.2 cm Length of the armature core including 5 ducts each 1 cm wide: 38 cm, core stacking factor: 0.92, True flux density in the teeth at the section is 2.2 Tesla for which the ampere turns required per cm is 700.	5
13	a)	State the factors on which the length of air gap depends. How is it estimated?	5
	b)	Determine the main dimensions, no. of poles and length of air gap of 600 kW, 500 V, 900 Ω pm generator. Assume average gap density as 0.6 wb/m^2 and ampere conductor per metre as 35000. The ratio of pole arc to pole pitch is 0.75 and the efficiency is 91%. The following are the design constraints:	

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Peripheral speed ⊁ 40 m/s, frequency of flux reversals ⊁ 50 Hz, current per brush arm ⊁ 400 A and armature mmf per pole ⊁7500 A. The mmf required for air gap is 50 per cent of armature mmf and gap contraction factor is 1.15. 5

14 a) Derive the output equation of 3-Ph induction motor. 5

b) Calculate the KVA output of a 1-Ph transformer from the following data:

$$\frac{\text{Core height}}{\text{Distance between core centres}} = 2.8$$

$$\frac{\text{Dismeter of circumscribing circle}}{\text{Distance between core centres}} = 0.56$$

$$\frac{\text{Net iron area}}{\text{Area of circumscribing circle}} = 0.7$$

Current density = 2.3 A/mm^2
Window space factor = 0.27
Frequency = 50 Hz
Flux density of core = 1.2 Wb/m^2
Distance between core centres = 0.4 5

15 Discuss in detail about all the approaches available for computer aided design. Illustrate them with flow charts. 10

16 a) List the various types of ventilating methods and cooling methods. 5

b) A 50 MVA turbo – alternator has a total loss of 1500 kW. Calculate the volume of air required per second and also the fan power if the temperature rise in the machine is to be limited to 30^{o}C. The other data given is:
Inlet temperature of air = 25^{o}C
Barometric height = 760 mm of Hg
Pressure = 2 KN/m^2
Fan efficiency = 0.4

17 Give a brief treatise on the following:

a) Specific magnetic and electric loading 5

b) Optimization procedure. 5

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