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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2060/2026 **Roll No.** | | | | | | | | | | |

B. Tech.

(SEM. VI) EXAMINATION, 2007

CONVENTIONAL & COMPUTER AIDED DESIGN OF ELECTRICAL MACHINES

Time : 3 Hours] *[Total Marks : **100***

Note : ***(1)*** *Attempt all the **five** questions.*
(2) *All questions carry **equal** marks.*
(3) *Make assumptions and assume suitable data wherever required.*

1. Attempt any **four** of the following : **5×4=20**

(a) How does the specific magnetic loading affect the design of electrical machines?

(b) How is the size of the electrical machine affected by the choice of insulating material used for the machine?

(c) Why is 1/3 periphery of the rotor unslotted for Turbo generator?

(d) Explain the property of CRGO steel and its application in electrical machines.

(e) Discuss the merits of using digital computer in designing the electrical machine.

(f) Mention various methods that are commonly used for the cooling of electrical machines and explain one of them.

2 Answer any **two** of the following : **10×2=20**

(a) What do you understand by specific electrical loading, discuss its affect on the following :
   (i) Parallel operation of the alternator
   (ii) Regulation
   (iii) Short Circuit Ratio (SCR)
   (iv) Efficiency.

   Also give their approximate values for turbo and water wheel generators.

(b) Derive the output equation for a 3-phase alternator and explain the effect of specific electrical loading and magnetic loading on the output of the alternator, also discuss, how main dimensions are estimated.

(c) A 300 kVA, 3phase, 50 Hz, 6600/400 volts, delta/star core type trays former intended for lighting load is to be designed with approximately 8.5 volts per turn and a flux density of 1.35 Tesla. Take a 3 stepped core and Yoke area 15% more than core area. Calculate.
   (a) Core section and Yoke section
   (b) Primary and secondary turns per phase

3 Answer any **two** of the following : **10×2=20**

(a) Estimate the main dimensions of stator slots and number of stator conductors per slot for a 100 HP, 3300 Volt, 50 Hz, 12 poles star connected slip ring induction motor, Assume Slot pitch = 16.0 mm, Average gap density = 0.4 Wb/m^2, Ampere conductor per meter = 25,000, efficiency = 90% L/T_p=1.2, Power factor = 0.9, Winding factor = 0.96, Current density = 4 A/mm^2.

(b) Design the slator frame for a 500 kVA, 6600V, 50 Hz, 12 pole star connected, 3 phase water wheel generator. The following informations 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 = 0.56 Tesla, Specific electric loading = 26,000 amp-conductor per meter. Assume any other data if needed.

(c) What do you understand by slot leakage reactance for a 3 phase alternator having single layer winding in the slots, determine the expressions for leakage reactance. The slot is of open type.

4 Answer any **two** of the following : **10×2=20**

(a) Draw the flow chart for overall design of a transformer. The design must include

(i) Efficiency

(ii) Design of tank and cooling system

(iii) Cost

(iv) Main dimensions, core and yoke dimensions.

(b) Write a program to design a 30 kW, 440 V, 3 phase, 6 pole 50 Hz delta connected squirrel cage induction motor, the design must include:

(i) Main dimensions of the slator frame

(ii) Number of turns per phase in stator winding

(iii) Number of stator slots

(c) Develop a software in 'C' for estimating the performance of a water wheel generator from the given design data.

5 Attempt any **two** of the following : **10×2=20**

(a) Write a computer program to determine the diameter and length of a 10 MVA, 11 kV, 8 pole, 3 phase, 50 Hz star connected synchronous generator. Maximum air gap flux density is 0.88 Tesla. The ampere conductor/ meter length of periphery is varying from 20,000 to 40,000 ampere/meter. The peripheral speed should not exceed 80 meter/second. Pole arc to pole pitch ratio varies between 0.6 to 0.7.

(b) Draw the flow chart for overall design of 3 phase induction motor. The design must include

(i) Winding design

(ii) Losses and Efficiency

(iii) Conductor size

(iv) Temperature rise

(c) What is the role of damper bars in the alternator, write a computer program for the field winding design of a 3 phase alternator.
