

Code No: R32021

R10**Set No. 1****III B.Tech II Semester Supplementary Examinations, April/May - 2019****ELECTRICAL MACHINE DESIGN**

(Electrical and Electronics Engineering)

Time: 3 hours**Max. Marks: 75****Answer any FIVE Questions**
All Questions carry equal marks

- 1 a) Briefly discuss the modern trends in the design of electric machines. [6M]
b) List and explain various conducting materials used in electrical machines. [9M]
- 2 a) Compare between single layer and double layer windings. [4M]
b) A 4 pole, simplex lap wound d.c. armature has 64 slots and 1152 conductors. The number of commutator segments is 192. Determine the number of coil sides per slot, number of turns per coil and the winding pitches. Draw up the winding table. Specify whether the winding is symmetrical or not. [11M]
- 3 a) Discuss the main parts of a d.c. commutator machine. [3M]
b) Derive the output equation of a d.c. machine. [5M]
c) Find the main dimensions of a 200 kW, 250V, 6 pole, 100 rpm generator. The maximum value of flux density in the gap is 0.87 Wb/m^2 and the ampere conductors per meter of armature periphery are 31000. The ratio of pole arc to pole pitch is 0.67 and the efficiency is 91 percent. Assume the ratio of length of core to pole pitch = 0.75. [7M]
- 4 a) Draw and explain the constructional details of a three-phase core type transformer. [7M]
b) What is the need for cooling in transformers? List and briefly discuss various cooling schemes for transformers. [8M]
- 5 a) Show that the output of a 3-phase core type transformer is: [7M]
 $Q = 5.23 f B_m H d^2 H_w \times 10^{-2} \text{ kVA}$,
where f = frequency, Hz; B_m = maximum flux density, Wb/m^2 ; d = effective diameter of the core, m; H = magnetic potential gradient in limb, A/m; H_w = height of window, m.
b) The current densities in the primary and secondary windings of a transformer are 2.2 and 2.1 A/mm^2 respectively. The ratio of transformation is 10:1 and the length of mean turn of the primary is 10 percent greater than that of the secondary. Calculate the resistance of the secondary winding given that the primary winding resistance is 10Ω . [8M]
- 6 a) Compare the squirrel cage induction motor with wound rotor machine. [6M]
b) What are the main dimensions of the induction motor? What are the desired values of L/τ , peripheral speed and width of ventilation ducts. [9M]

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- 7 A 90 kW, 500V, 50Hz, 3 phase, 8 pole induction motor has a star connected stator winding accommodated in 63 slots with 6 conductors per slot. If the slip ring voltage on open circuit is to be about 400 V, find a suitable rotor winding, stating: a) number of slots b) number of conductors per slot c) coil span d) slip ring voltage on open circuit e) approximate full load current per phase in rotor. Assume efficiency = 0.9, power factor = 0.86. [15M]
- 8 Find the main dimensions of a 100 MVA, 11 kV, 50 Hz 150 r.p.m., 3-phase waterwheel generator. The average gap density is 0.65 Wb/m² and ampere conductors perimeter are 40000. The peripheral speed should not exceed 65 m/s at normal running speed in order to limit run-away peripheral speed. [15M]

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