Code No: **R32021** **R10** **Set No. 1**

**III B.Tech II Semester Supplementary Examinations, December – 2015**

# ELECTRICAL MACHINE DESIGN

**(Electrical and Electronics Engineering)**

**Time: 3 hours** **Maximum Marks: 75**

**Answer any FIVE Questions**

**All Questions carry equal marks**

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1 a) What are the main considerations to evolve a good design? Explain. [8M]

b) What are the different cooling techniques used in the design of electrical machines? Explain. [7M]

2 a) Explain the advantages of single layer windings in detail with the help of suitable diagrams. [7M]

b) Draw the winding diagram in developed for a simplex lap wound 24 slot, 2 pole DC armature with 24 commutator segments. Also draw the sequence diagram to show the position of brushes. [8M]

3 a) What are the factors that will get effected while choosing specific electric and specific magnetic loadings in DC machines. [7M]

b) Find the main dimensions of 100 kW, 100V, 6 pole, 1000 rpm generator. The maximum value of flux density in the gap is 0.9 $Wb/m^2$ and the ampere conductors per meter of armature periphery are 30000. The ratio of pole arc to pole pitch is 0.7 and the efficiency is 92%. Assume the ratio of length of core to pole pitch = 0.75. [8M]

4 a) Explain about the construction of single phase transformers in detail. [7M]

b) Calculate the dimensions of the core of a 100 kVA, 2000/500V single phase core type transformer to operate at a frequency of 50 Hz, assuming the following data; approximate voltage per turn, 8 V; maximum flux density, 1.1 $Wb/m^2$ ; ratio of effective cross sectional area of core to square of diameter of circumscribing circle, 0.62; ratio of height to width of window, 2; window space factor 0.3; current density 3 $A/mm^2$. [8M]

5 a) Explain in detail about the design of transformer winding and coils. [7M]

b) A 300 kVA, 6000/400 V, three phase delta/star core type transformer has a maximum flux density of 1.2 $Wb/m^2$ and the total weight of the core is 600 Kg. The magnetizing VA/Kg and the iron loss/Kg corresponding to 1.2 $Wb/m^2$ are 25 and 2.5W respectively. Calculate the no load current if the mmf required for joints is 2.5% of that for iron. [8M]



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6 a) Explain the principle of operation of induction motors in detail. [7M]

b) Find the values of diameter and length of stator core of a 8 kW, 220 V, 50 Hz, 4 pole, three phase induction motor for best power factor. Given the specific magnetic loading = 0.35 $Wb/m^2$; specific electric loading = 20000 A/m; efficiency = 0.9; and power factor = 0.86. [8M]

7 a) What is the necessity of air gap? Explain the factors that get effected while choosing the length of air gap in induction motors. [7]

b) What is short circuit current? Derive the value in squirrel cage induction motor. [8]

8 a) Explain in detail about the design of salient pole field coil. [7]

b) Determine the main dimension for a 1200 kVA, 50 Hz, three phase, 375 rpm alternator. The average airgap flux density is 0.6 $Wb/m^2$ and the ampere conductors per meter are 25000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which the maximum permissible peripheral speed is 40 m/sec. The runaway speed is 1.4 times the synchronous speed. [8]

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