

Reg. No. :

--	--	--	--	--	--	--	--	--	--

Question Paper Code: 55034

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fifth Semester

Electrical and Electronics Engineering

15UEE504 - ELECTRICAL MACHINE DESIGN

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Which of the following is the major consideration to evolve a good design?
 - Cost
 - Durability
 - Compliance with performance criteria as laid down in specifications
 - All the above
- The design of mechanical parts is particularly important in case of _____ speed machines.
 - low
 - medium
 - high
 - All the above
- D.C. windings are
 - sometimes 2-layer type
 - never 2-layer type
 - always 2-layer type
 - none of these
- In a D.C. machine the number of brush arms is _____ the number of poles.
 - less than
 - equal to
 - greater than
 - none of these
- Which test is conducted on transformers to check its ability to withstand the transient voltages due to lightning etc?
 - Induced over voltage test
 - Partial discharge test
 - Impulse test
 - none of these

6. The density of transformer oil is around
 (a) 1.2gm / cc (b) 1.0 gm/cc (c) 0.95 gm/cc (d) 0.80 gm/cc
7. In case of induction motor, with increase in supply voltage, which of the following increases?
 (a) Power factor (b) Slip (c) Torque (d) All the above
8. In most AC machines, it is usually a standard practice to use
 (a) fractional slot winding With full-pitch coils
 (b) fractional slot winding with chorded coils
 (c) integral slot winding with chorded coils
 (d) integral slot winding with full pitch coils
9. If a synchronous motor fails to start, the probable cause could be
 (a) low voltage (b) too much load at starting
 (c) single phasing (d) None of these
10. In case a synchronous motor starts but fails to develop full torque, the probable cause could be
 (a) low excited voltage (b) reverse field winding
 (c) open or short circuit (d) None of these

PART - B (5 x 2 = 10 Marks)

11. How the area of cross section of a conductor is estimated?
12. List out the different losses in a DC generator.
13. Why is the core of the transformer laminated?
14. What is rotating transformer?
15. How is cylindrical pole different from salient pole in a synchronous machine?

PART - C (5 x 16 = 80 Marks)

16. (a) (i) Describe the various methods of cooling of heat dissipation. (8)
 (ii) Give the limitations in the design of Electrical apparatus? Explain them. (8)

Or

- (b) A 15 kW, 230 V, 4 – pole dc machine has the following data: armature diameter = 0.25 m armature core length =0.125 m, length of air gap at pole =2.5 mm, flux per pole = 11.7×10^{-3} Wb, (pole arc / pole pitch) = 0.66 . Calculate the mmf required

for air gap (i) if the armature surface is treated as smooth (ii) if armature is slotted and gap contraction factor is 1.18. (16)

17. (a) Derive the output equation of a dc machine and factors affecting armature length. (16)

Or

- (b) Calculate the main dimensions of a 20 HP, 1000 rpm, 400 V, dc motor. Given that $B_{av} = 0.37 \text{ wb/m}^2$ and $a_c = 16000 \text{ amp.cond/ m}$. Assume an efficiency of 90 %. (16)

18. (a) Derive the output equation of a single phase and three phase transformer. (16)

Or

- (b) A 250 KVA, 6600/400V, 3-phase core type transformer has a total loss of 4800 watts on full load. The transformer tank is 1.25 m in height and 1m x 0.5 m in plan. Design a suitable scheme for cooling tubes if the average temperature rise is to be limited to 35 °C. The diameter of the tube is 50mm and the tubes are spaced 75 mm from each other. The average height of the tube is 1.05 m. (16)

19. (a) Explain the design procedure of squirrel cage rotor with necessary equations. (16)

Or

- (b) A 90 kW 500V 50Hz 3-phase induction motor has a star connected stator winding in 63 slots with 6 conductors per slot. If the slip ring voltage on open circuit is not to exceed 400V, find a suitable rotor winding by estimating no. of slots, coil span slip ring voltage on open circuit. Take efficiency =90% and power factor = 0.86. (16)

20. (a) Derive the output equation of a synchronous machine with necessary steps. (16)

Or

- (b) Determine the dimensions of 100kVA, 50Hz 3-phase 375 rpm alternator. Take $B_{av} = 0.45 \text{ Wb/m}^2$ and $a_c = 28000 \text{ amp.cond/m}$. Given that Length/Pole pitch = 1 to 5. The maximum peripheral speed is 50m/s and the runaway speed is 1.5 times the synchronous speed. (16)

