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**Question Paper Code: 57101**

B.E./B.Tech. DEGREE EXAMINATION, DEC 2020

Fifth Semester

Electrical Engineering

15UEE504 - ELECTRICAL MACHINE DESIGN

(Regulation 2015)

Duration: One hour

Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

**(Answer any six of the following questions)**

- Unit for specific electric loading CO1- R
  - Ampere-conductors
  - Ampere-conductors /m
  - Ampere/m
  - Ampere
- For generators CO1- R
  - $P_a = P$
  - $P_a = P/\eta$
  - $P_a = P/P_o$
  - $P_a = \eta P$
- Real flux density is 2.2 T and permeability is  $31.4 \times 10^{-6}$  H/m. CO2- R

the magnetic field intensity

  - 70.063 AT
  - $70.063 \text{ AT/m}^2$
  - $70.063 \text{ AT/m}$
  - $70.063 \text{ AT/m}^3$
- When ducts are present CO2- R
  - Slot pitch reduces
  - Length reduces
  - Diameter reduces
  - None of the above
- A 3-phase 900 kVA, 3 kV /  $\sqrt{3}$  kV ( $\Delta/Y$ ), 50 Hz transformer has primary (high voltage side) resistance per phase of  $0.3 \Omega$  and secondary (low voltage side) resistance per phase of  $0.02 \Omega$ . Iron loss of the transformer is 10 kW. The full load % efficiency of the transformer operated at unity power factor is \_\_\_\_\_ (up to 2 decimal places). CO3- R
  - 97.20
  - 102.5
  - 99.5
  - 93.5

6. The percentage impedance of a 100 kVA, 11kV / 400V, delta/wye, 50 Hz transformer is 4.5% . For the circulation of half the full load current during short circuit test, with low voltage terminals shorted, the applied voltage on the high voltage side will be\_\_\_\_\_ CO3- R
- (a) 247.5 V      (b) 230.5      (c) 249.8      (d) 228.7
7. In an induction motor, rotor speed is always CO4- R
- (a) Less than the stator speed      (b) More than the stator speed
- (c) Equal to the stator speed      (d) None of the above
8. An induction motor of 10 HP at 750 rpm has efficiency of 83%. An induction motor of 100 HP at 750 rpm can be expected to have an efficiency of CO4- R
- (a) 81%      (b) 83%      (c) 90%      (d) 99.9 %
9. What is the range of SCR (Short Circuit Ratio) for turbo alternators? CO5- R
- (a) 0.5 to 0.7      (b) 0.05 to 0.07      (c) 0.15 to 0.17      (d) 0.25 to 0.27
10. What is the application of synchronous compensators? CO5- R
- (a) Control of real power      (b) Control of active power
- (c) Control of reactive power      (d) Control of apparent power

PART – B (3 x 8= 24 Marks)

**(Answer any three of the following questions)**

11. Determine the factors affecting the choice of specific magnetic loading in rotating machines. CO1- E (8)
12. Solve the main dimension of number of poles of a 37 KW, 230 v , 1400 rpm dc shunt motor , so that a square pole face is obtained . the average gap density is  $0.6 \text{ Wb/m}^2$  and the ampere conductors per metre are 24000. The ratio of pole arc to pole pitch is 0.67. and the full load efficiency is 90 percent. CO2- C (8)
13. Evaluate the kVA output of a single phase transformer from following data; Core height/distance between core centres = 2.8 ; diameter of circumscribing circle/ distance between the core centres = 0.56 ; net iron area / area of circumscribing circle = 0.7, Current density =  $2.3 \text{ A/mm}^2$ , window space factor = 0.27, frequency = 50Hz, flux density of core =  $1.2 \text{ Wb/m}^2$  , distance between core centres = 0.4m. CO3- E (8)

14. The following design data are provided for an induction motor. CO4- C (8)  
Calculate
- (i) No load maximum flux
  - (ii) Length of air gap
  - (iii) number of turns per phase
  - (iv) rotor bar current and area
  - (v) end ring current and area and
  - (vi) losses in bars and end rings. Diameter of stator -15cm, Length of stator-9cm, Average flux density – 0.45 Tesla, Efficiency- 84% Power Factor- 0.86, 3 phase, 4 pole, 400v delta connected 10 KW, Frequency- 50HZ, Current density-  $5\text{A/mm}^2$ , Stator slots- 36, Rotor slots-30, Length of rotor bar-15cm, Mean dia. Of end ring-12cm.
15. Calculate the main dimensions for a 1000 kVA, 50 Hz, 3 phase, 375 rpm alternator. The average air gap flux density is  $0.55\text{ Wb/m}^2$  and the ampere conductors per meter are 28000. 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 50 m/s. The run-away speed is 1.8 times the synchronous speed. CO5- E (8)