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Question Paper Code: 57101A

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)

1. Specific resistance of Aluminium is_____ times that of Copper.   CO1- R

    (a) 2   (b) 1.64   (c) 0.64   (d) 0.82

2. For generators   CO1- R

    (a) Pa= P   (b) Pa = P/η   (c) Pa = P/Po   (d) Pa= ηP

3. Real flux density is 2.2 T and permeability is 31.4 x 10 -6 H/m.   CO2- R
    the magnetic field intensity

    (a) 70.063 AT   (b) 70.063 AT/ m^2 (c) 70.063 AT /m   (d) 70.063 AT /m^3

4. When ducts are present   CO2- R

    (a) Slot pitch reduces   (b) Length reduces

    (c) Diameter reduces   (d) None of the above

5. A 3-phase 900 kVA, 3 kV / √3 kV (Δ/Y), 50 Hz transformer has primary   CO3- R
    (high voltage side) resistance per phase of 0.3 Ω and secondary (low
    voltage side) resistance per phase of 0.02 Ω. 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).

    (a) 97.20   (b) 102.5   (c) 99.5   (d) 93.5

6. The percentage impedance of a 100 kVA, 11kV / 400V, delta/wye, 50 Hz   CO3- R
   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____

   (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   CO4- R
   induction motor of 100 HP at 750 rpm can be expected to have an
   efficiency of

   (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. Illustrate the various duty types of Electrical machines with neat   CO1- E   (8)
    diagrams.

12. Derive an output equation for DC machine in terms of output   CO2- C   (8)
    coefficient. Also write the significance of output coefficient in
    the machine design.

13. The tank of 1250 kVA natural oil cooled transformer has the   CO3- E   (8)
    dimensions length, width and height as $0.65 \times 1.55 \times 1.85$ m
    respectively. The load loss = 13.1 kW, loss dissipation due to
    radiations 6 W/m.sq – ^{0}C. improvement in convection due to
    provision of tubes = 40% , temperature rise is 40 ^{0}C , length of
    each tube is 50 mm. Find the number of tubes for this
    transformer. Neglect the top and bottom surface of the tank as
    regards the cooling..

57101A

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- 5A/mm^2,Stator slots- 36, Rotor slots-30,Length of rotor bar- 15cm,Mean dia. Of end ring-12cm.

15. Derive the output equation for a synchronous machine.   CO5- E   (8)

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