A

Question Paper Code: 54326

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2024

Fourth Semester

Electronics and Communication Engineering

15UEE426- PRINCIPLE OF ELECTRICAL MACHINES

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. How the eddy current losses are reduced in a DC machine?   CO1-R

    (a) using low hysteresis co-efficient material

    (b) using stalloys

    (c) using laminated core

    (d) using high electrical resistive material

2. Select a relation between torque and armature current for a series   CO1-R
    motor, in case of prior to magnetic saturation.

    (a) $T \infty KI_a$ (b) $T \infty \Phi I_a^2$ (c) $T \infty \Phi I_a$ (d) $T \infty I_a^2$

3. As I_o is very small, the no-load primary copper loss is negligibly small   CO2-U
    which means that no-load primary input is practically equal to the
    _____ in the transformer.

    (a) iron loss   (b) copper loss   (c) hysteresis loss   (d) eddy current loss

4. Give the condition for maximum efficiency of a transformer.   CO2-R

    (a) iron loss = copper loss   (b) iron loss + copper loss = total loss

    (c) copper loss = (iron loss)^2 (d) total loss = copper loss + 2(iron loss)

5. The stator of a 3-phase induction motor has three slots per pole per phase. If supply frequency is 50Hz, calculate the number of stator poles and total number of slots on the stator. CO3-U

   (a) 6-poles,32-slots   (b) 6-poles, 54-slots   (c) 12-poles,32-slots   (d) 12-poles,54-slots

6. Find the slip value of a 3-phase, 4-pole induction motor at the time of starting CO3-U

   (a) 0   (b) 1   (c) 2   (d) 0.02

7. Which alternator is called as high-speed alternator? CO4-R

   (a) Salient pole   (b)Smooth cylindrical type

   (c) Projected pole type   (d) a & b

8. A synchronous motor is said to be over-excited at the condition _____ . CO4-R

   (a) $E_b = V$ (b) $E_b < V$ (c) $E_b > V$ (d) $E_b = 2V$

9. Name the additional winding which is provided for a single phase motor to be self starting. CO5-R

   (a) auxillary winding   (b) main winding   (c) running winding   (d) lap winding

10. Calculate the step angle of a stepper motor having three phases with 4-rotor poles and 6-stator poles _____. CO5-U

   (a) 45°   (b) 60°   (c) 30°   (d) 90°

PART – B (5 x 2= 10Marks)

11. Draw the various characteristics of a DC shunt generator. CO1-R

12. Give a view on inrush current in a transformer. CO2-R

13. Why is rotor rheostat starter unsuited for a squirrel cage motor? CO3-U

14. How can we change the operating speed of synchronous motor? CO4-U

15. What are the various methods of making a single phase induction motor self starting? CO5-U

PART – C (5 x 16= 80Marks)

16. (a) (i) Derive the EMF equation of a DC generator. CO1-U (10)
       (ii) A 230 Volts DC shunt motor on no-load runs at a speed of CO1-U (6)
       1200rpm and draws a current of 4.5 Amperes. The armature and
       shunt field resistances are 0.3 ohm and 230 ohms respectively.

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Calculate the back EMF induced and speed, when loaded and drawing a current of 36 Amperes.

Or

(b) Why Starters are necessary in a motor? Explain in detail the construction and working operation of 4-point starter.   CO1-U   (16)

17. (a) With the circuit explain how to obtain equivalent circuit by conducting Open Circuit and Short Circuit test in a single phase transformer.   CO2-U   (16)

Or

(b) (i) Derive the EMF equation of the single phase transformer.   CO2-U   (8)

(ii) Discuss the constructional details of a single phase transformer with neat sketches and working principle.   CO2-U   (8)

18. (a) (i) Develop the approximate equivalent circuit of a 3-phase induction motor.   CO3-U   (8)

(ii) Derive the expression for torque under running condition of a 3-phase induction motor and obtain the condition for maximum torque.   CO3-U   (8)

Or

(b) With neat diagrams, explain the working of   CO3-U   (16)

   (i)   Stat-Delta Starter

   (ii)   Auto Transformer Starter for 3 phase induction motor.

19. (a) (i) Describe with neat sketches, the constructional details of an Alternator.   CO4-U   (10)

(ii) Derive the EMF equation of an Alternator.   CO4-U   (6)

Or

(b) Explain about the starting methods of Synchronous motor.   CO4-U   (16)

20. (a) (i) Explain in detail the operation of a capacitor start and run induction motor.   CO5-U   (8)

(ii) Discuss in detail the operation of a hysteresis motor.   CO5-U   (8)

Or

(b) Explain the construction and principle of operation of a Permanent Magnet Brushless DC Motor.   CO5-U   (16)

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