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**Reg. No. :**

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**Question Paper Code: 54326**

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

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 motor, in case of prior to magnetic saturation. CO1-R
  - (a)  $T \propto KI_a$
  - (b)  $T \propto \Phi I_a^2$
  - (c)  $T \propto \Phi I_a$
  - (d)  $T \propto I_a^2$
  
3. As  $I_o$  is very small, the no-load primary copper loss is negligibly small which means that no-load primary input is practically equal to the \_\_\_\_\_ in the transformer. CO2-U
  - (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)<sup>2</sup>
  - (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)  $45^\circ$  (b)  $60^\circ$  (c)  $30^\circ$  (d)  $90^\circ$

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 1200rpm and draws a current of 4.5 Amperes. The armature and shunt field resistances are 0.3 ohm and 230 ohms respectively. CO1-U (6)

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) Star-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)

