

Time Allowed : 3 Hours

Full Marks : 200

If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.

Answers may be written either in English or in Bengali but all answers must be in one and the same language.

**ANSWER ANY FIVE QUESTIONS**

1. (a) Develop the circle diagram of an 3-phase induction motor from the approximate equivalent circuit. Show, how the (i) stator and rotor losses, (ii) efficiency and slip, (iii) torque can be determined.
- (b) A 3 phase 500 KW, 3.3 KV, 50 Hz star connected induction motor works at a full load power factor of 0.7 lag. A delta connected capacitor bank is used to raise the full load power factor to 0.9 lag. Calculate the capacitance of the bank. If each capacitor is rated at 420 V, 50 Hz, compute the capacitance of each unit. The motor efficiency is 86%.

If this induction motor is fed by a distribution circuit calculate the percentage saving in the energy lost in this distribution circuit, as power factor is improved from 0.7 to 0.9 lag. 20 + 20

2. (a) Why cylindrical rotor synchronous generators are used in Thermal Power Plant and salient pole synchronous generator are used in Hydral Power Plant ? Explain in details.
- (b) A 1500 KW, 2200 V, 3 ph. 50 Hz, star connected CR synchronous motor has armature resistance of  $0.32 \Omega$  per phase. Its open circuit data are given below :-

field current, A	5.00	10.00	15.00	20.00	25.00	30.00
O.C.Voltage Ef	760	1500	2140	2650	3040	3340

An exciting current of 15 A, produces a short circuit current of 750 A.

Core loss = 60 KW, friction & Windage loss = 40 KW

Draw the V-curves at half-load, for the synchronous motor running at rated voltage and rated frequency. 15 + 25

3. (a) Write a short notes on any one of the following lamps :-
  - (i) low pressure sodium vapour lamps popularly known as tube light.
  - (ii) C F L.
- (b) A resistance over employing nichrome wire is to be operated from 220 V, single phase supply and is to be rated at 16 KW. If the temperature of the element is to be limited to  $1170^{\circ}\text{C}$  and average temperature of the charge is  $500^{\circ}\text{C}$  find the diameter and length of the element wire.

radiating efficiency = 0.57, emissivity = 0.9 specific resistance of nichrome =  $109 \times 10^{-8} \Omega \text{m}$ .

- (c) Derive the expression of speed and current of a D.C. shunt motor during starting. Plot the speed vs. time and starting current vs. time curves. 12 + 16 + 12

P. T. O.



4. (a) Draw and explain the operation of a four-quadrant dc. chopper-fed drive system.
- (b) A 200 V, 60A, d.c. series motor has armature and series field resistance of  $0.06 \Omega$  and  $0.04 \Omega$  respectively. Running on no load with field winding connected to a separate DC source, the motor gave the following magnetization characteristics as 500 rpm.

$I_f$	10	20	30	40	50	60	70
$V_t$	53	98	125	142	153	162	168

The motor is controlled in regenerative braking by a chopper with input voltage of 200 V.

- Calculate the motor speed for duty ratio 0.4 at motor braking torque equal to rated value.
- Calculate the maximum allowable motor speed for maximum permissible values of current of 60A and duty ratio 0.9.
- What resistance must be inserted in the armature circuit for the motor to run at 800 rpm. without exceeding armature current beyond 60 A ? The duty ratio of the chopper has a range from 0.1 to 0.9.
- Calculate the value of the diverter resistance to be connected in parallel with the series field to run the motor at 800 rpm without exceeding the armature current beyond 60A.

10 + 30

5. (a) Write short notes on :-

- Spectral density & Auto correlation
- Random signals
- Random process
- PSK and MSK

- (b) What is the importance of electrostatic precipitator. Describe one electrostatic precipitator (ESP).

5x4+20

6. (a) Write short notes on :-

- Power MOSFET
- IGBT

- (b) Draw a cyclo converter circuit. Explain its operation with all necessary diagram.

10 x 2 + 20

7. (a) Explain equal area criterion of rotor angle stability of a two machine system.

- (b) Describe operating principle of a mho relay.

- (c) What are the advantages of HVDC transmission over HVAC transmission?

- (d) Define various types of buses used in load flow analysis.

10+10+10+10

8. Write short notes on :-

- C R G O S
- Solar Cell
- L E D
- Energy Audit
- Power spectral Density
- Starting of single-phase Induction Motor
- Universal motor
- Indoor Lighting Design.

5 x 8

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