UNIT-1

1. **Explain the principle pf operation of dc machine. Derive the expression for the back emf in a dc motor. Briefly explains the role it plays in starting and running of the motor.**
2. Define armature reaction and discuss its effect on the performance of dc machines.
3. Based on field winding and armature winding connections and schematic diagrams, explain different types of D.C. machines.
4. **Describe methods to control the speed of D.C. motors.**
5. Explain the Ward-Leonard system for controlling the speed of dc motor.
6. **Why starter is used to start the motor. Explain why a dc motor draws high current at starting? Also give constructional details of a 3 point starter.**
7. Explain various losses involved in dc machine and discuss how they vary? Find efficiency and application of dc motor.

8. **Explain the working principle of 3-phase induction motor with construction. The rotor of induction motor cannot run at synchronous speed. Explain why?**
9. **Explain, how rotating magnetic field is produced in 3-phase induction motor, when 3-phase supply is fed to it? Draw the phasor diagrams.**
10. Explain Constructions of I.M ,With the help of rotor equivalent circuit of an 3 Φ induction motor ,show that the power transferred magnetically from stator to rotor is given by I_2^2 r/s per phase(various notations used are standard and carry usual meaning). With single line diagram,
11. Describe power flow in a 3-phase induction motor. Also explain why it is advantageous to operate induction motor with a slip as small as possible?
12. Derive torque, mechanical power and rotor output equations of a 3-phase induction motor connected from A.C. mains.
13. **Derive, draw and explain torque speed characteristic of three phase induction motor. Also show the effect of increase of rotor resistance on it.**

14. A 230 V series motor is taking 50 A .Resistance of armature and series field working winding is 0.2 Ω and 0.1 Ω respectively.
    a. Calculate:
    b. 1. Brush voltage 2. Back emf
    c. 3. Power wasted in armature, and 4. Mechanical power developed

15. A series motor takes 20 A at 400 V to derive a load whose torque is proportional to square of the speed at 250 rpm. Determine the necessary applied voltage and current to derive the said load at 350 rpm. Assume straight line magnetising characteristic.
16. A 120 V dc shunt motor has an armature resistance of 0.2 Ω and a brush drop of 2 V. The rated full load armature current is 75 A. Calculate the current at the instant of starting and its value in terms of percentage of full load armature current. Assume field winding resistance of 120 Ω.
17. A 10 kW,250 V dc shunt motor with an armature resistance of 0.8 Ω and a field resistance of 275 Ω takes 3.91 A ,when running light at rated voltage and speed. Calculate the efficiency when the machine runs as a generator delivering an output of 10 kW at rated voltage and speed.

18. A 220 V d.c. shunt motor having an armature resistance of 0.25 ohm carries an armature current of 50 A and runs at 600 rpm. If the flux is reduced by 1% by field regulator, find the speed of motor, assuming the load torque to remain the same.
19. A 500 V, 10 HP dc shunt motor has a full load efficiency of 85% with same shunt field and armature current, it is derived to reduce the speed by 30 % on inserting a resistance in the armature circuit. Calculate the value of inserted resistance. The resistance of field and armature are 400 Ω and 0.25 Ω respectively.

UNIT-2

1. A 6 pole, 50 Hz three phase induction motor has rotor resistance of 0.4 ohm/phase; maximum torque is 200 N-m at 850rpm.Find:
2. Torque at 4% slip.
3. Additional rotor resistance to get (2/3) rd of maximum torque at starting.

4. A 400 V, 4 pole, 3phase, and 50 Hz induction motor has a rotor resistance and reactance per phase of 0.01 Ω and 0.1Ω respectively. Determine:
5. Maximum torque in N –m and the corresponding slip
6. The full load slip and power output in watts if maximum torque is twice the full load torque and the ratio of stator to rotor turns is 4.
7. The power supplies to a 3-phase 4 pole, 50 Hz induction motor is 40 kw .While motor is operating with 4% slip, the mechanical losses are 0.8 kW. Calculate efficiency of the motor and shaft torque.

8. The effective resistance of A 2200 V. 940 kVA, phase alternator is 0.5 Ω .On short circuit; a field current of 40A gives the full load current of 200A. The emf on open circuit with same field excitation is 1160V. Calculate synchronous impedance and reactance.
9. A three phase 8 pole 900 rpm star connected alternator has 72 slots on the armature and each slot has 10 conductors. The winding is short pitched by 1 slot. Assuming flux per pole 0.10 Wb , determine induced emf between lines.
10. A three phase, star connected, 1500 Kva , 13 kv alternator has an armature resistance of 0.9 ohm and synchronous reactance of 8.0 ohm per phase. When carrying rated load at rated voltage per phase for 0.8 leading power factor and calculate the percentage regulation for the same.

UNIT-3

1. Draw neat diagram of synchronous alternator and derive the EMF equation.
   Also define form factor, chording factor and breadth factor, coil span factor and distribution factor
2. Draw phasor diagram of a non-salient pole machine (synchronous machine) supplying full load at, 1. Lagging power factor 2. Leading power factor
3. Discuss the synchronous impedance method of calculating the voltage regulation of an alternator at different load power factors. Give phasor diagrams.

4. Explain the operation of synchronous motors. Also describe their industrial applications.
5. Draw and explain the phasor diagram of a synchronous motor operating at lagging power factor, leading power factor and unity power factor. What is a synchroronous condenser and where is it used?
6. Explain V-curves, their origin and significance with regard to synchronous motor.
7. Explain construction, starting and operation of synchronous motor. Also show the effect of excitation current on the motor armature current.
8. What is two phase servomotor? Describe its construction and operation and application.
9. Draw torque-speed characteristics of two phase servomotor for various control voltages. Also give the advantage of both types of servomotor.

DC MOTOR

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4. Describe power flow in a 3-phase induction motor. Also explain why it is advantageous to operate induction motor with a slip as small as possible?
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2. A series motor takes 20 A at 400 V to derive a load whose torque is proportional to square of the speed at 250 rpm. Determine the necessary applied voltage and current to derive the said load at 350 rpm. Assume straight line magnetising characteristic.
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3 phase induction motor

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   (ii) The full load slip and power output in watts if maximum torque is twice the full load torque and the ratio of stator to rotor turns is 4.
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carrying rated load at rated voltage per phase for 0.8 leading power factor and calculate the percentage regulation for the same.

ALTERNATORS

1. Draw neat diagram of synchronous alternator and derive the EMF equation. Also define form factor, chording factor and breadth factor, coil span factor and distribution factor
2. Draw phasor diagram of a non-salient pole machine (synchronous machine) supplying full load at, 1. Lagging power factor 2. Leading power factor
3. Discuss the synchronous impedance method of calculating the voltage regulation of an alternator at different load power factors. Give phasor diagrams.

SYNCHRONOUS MOTORS

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SERVOMOTORS

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