Department of Electrical Engineering

BEEG-0001 **Session:2021-22** **Tutorial sheet : 4**
Basic Electrical Engineering **Even Semester** **Module II**

DC/AC Machine

1. Explain the essential constructional features of a DC machine. State the material and function of each part.
2. What is the function of the commutator in a DC machine?
3. What is the principle of operation of a DC Machine? Derive the EMF equation for a DCmachine.
4. Why is induced EMF in a DC motor called the back or counter EMF?
5. Why should a DC series motor not be run without load?
6. Explain the effect of field current on the speed of a DC motor.
7. Discuss the necessity of starter for a DC motor.
8. Derive an expression for the torque developed in a DC motor.
9. With the help of neat sketch describe the construction and principle of operation of the 3- phase induction motor.
10. Define the term 'slip'. What is its value at instant of starting and at synchronous speed?
11. Discuss the important features of squirrel cage and phase wound rotor constructions in an induction motor.
12. Explain why rotor of an induction motor can never attain synchronous speed.
13. Show that when 3-phase AC supply is fed to the stator winding of a 3-phase induction motor, a rotating magnetic field that rotates in the air-gap at synchronous speed is produced.
14. Why is single-phase induction motor not self-starting? What are different methods to make it self-starting? Explain one of them.
15. An 8-poles DC machine has 500 armature conductors and useful flux of 0.05 Wb. What will be the EMF induced, if it is lap connected and runs at 1200 rpm? What must be the speed at which it is to be driven to produce the same EMF if it is wave- connected?
    [Ans: 500V, 300 rpm]
16. A 250 V DC shunt motor takes 30 A current while running at full load. The resistance of armature and field windings are 0.1Ω and 200 Ω respectively. Determine the back emf produced in the motor, when it runs on full load.
    [Ans: 247 V]

17. A 250 V DC shunt motor having an armature resistance of 0.25Ω carries an armature current of 50A and runs at 750 rpm. If the flux is reduced by 10%, find the new speed. Assume that the torque remains the same.
[Ans: 828 rpm]

18. A series motor has an armature resistance of 0.2 Ω and a series field resistance of 0.3Ω. It is connected to a 240 V supply and at a particular load runs at 24 rev/s when drawing 15 A from the supply.
(a) Determine the generated E.M.F. at this load.
(b) Calculate the speed of the motor when the load is changed such that the current is increased to 30 A. Assume that this causes a doubling of the flux.
[Ans: (a) 232.5 V, (b)11.6 rev/s]

19. A separately-excited generator develops a no-load E.M.F. of 150 V at an armature speed of 20 rev/s and a flux per pole of 0.10 Wb. Determine the generated E.M.F. when (a) the speed increases to 25 rev/s and the pole flux remains unchanged, (b) the speed remains at 20 rev/s and the pole flux is decreased to 0.08 Wb,and (c) thespeed increases to 24 rev/s and the pole flux is decreased to 0.07 Wb.
[Ans: 187.5 volts, 120 volts, 126 volts]

20. A three-phase 2-pole motor is to have a synchronous speed of 6000 rev/min. Calculate the frequency of the supply voltage.
[Ans: 100 Hz]

21. A 3-phase, 6-poles, 50 Hz induction motor has a slip of 1% at no load and 3% at full load. Find (a) the synchronous speed, (b) the no load speed, (c) the full-load speed, (d) the frequency of rotor current at standstill and (e) the frequency of rotor current atfull load.
[Ans: 1000 rpm, 990 rpm, 970rpm, 50Hz, 1.5 Hz]

22. If the electromagnetic force in the stator of an 8 poles induction motor has a frequency of 50Hz, and that in the rotor 3/2 Hz, at what speed is the motor running and what is the slip?
[Ans: 728 rpm, 3%]

23. When supply voltage to a 3-phase induction motor is reduced by 10%, find the reduction in torque.
[Ans: 19%]