March 2021

ELECTRICAL MACHINE – I

Time Allowed: 3 Hours *Full Marks: 70*

Answer to Question No.1 is compulsory and Answer any five questions from the rest.

1. Answer the following questions in one or two sentence(s) (any twenty): 1x20

   i) What type of dc motor is used in traction system?
   ii) Open circuit test of transformer normally performed in which side of transformer?
   iii) By which test we can find equivalent resistance and reactance of transformer?
   iv) Why transformers are rated in KVA instead of KW?
   v) Write down one application of an auto transformer?
   vi) The term all day efficiency is related to which transformer?
   vii) At what power factor, voltage regulation of transformer can be zero?
   viii) What is an ideal transformer?
   ix) By which rule we can find the direction of rotation of a dc motor?
   x) What is the function of commutator of a dc generator?
   xi) What do you mean by polarity of a transformer?
   xii) How could we reduce the hysteresis loss of a transformer?
   xiii) The wattmeter reading in open circuit test indicate what loss of transformer?
   xiv) What is the range of no load power factor of transformer?
   xv) What is the standard connection of pole mounted 3-phase distribution transformer?
   xvi) In which place oil gauge is fitted in a transformer cooling tank?
   xvii) Why armature of dc machine is laminated?
   xviii) Why interpoles are used in dc machine?
   xix) What is used to prevent high starting current in dc motor?
   xx) How many numbers of carbon brushes are there in a 6 pole wave wound dc machine?
   xxi) Write down the statement of speed regulation of a dc motor.
   xxii) Why carbon brush is used instead of copper brush in dc machine? Give at least two different reasons.

2. a) Draw and explain the speed-torque and torque-current characteristics of dc shunt motor.
   b) Explain rheostatic braking of dc series motor. 5+5

3. a) Draw the phasor diagram of a transformer under resistive-inductive load.
   b) What are different losses occurring in a transformer and state how can those be minimized? 5+5

4. a) Deduce the expression for the voltage regulation.
   b) A 25 KVA, 2000/200 V, 50 Hz transformer offers its maximum efficiency at 80% of full load. Its per unit resistance and impedances are 0.012 and 0.05 respectively. Determine its regulation and efficiency at full load at 0.8 pf lagging. 5+5

5. a) Briefly explain the principle of operation of a transformer.
   b) The test data obtain in a 5KVA, 200/400 V, 50 hz transformer is as follows,
   O.C. Test (on LV side): 200 V, 0.7 A, 70 W,
   S.C. Test (on HV side): 15 V, 10A, 85 W.
   Obtain the equivalent circuit parameters with respect to primary. 5+5

6. a) Show the vector diagram and connection diagram of three phase Dy1 connected transformer.
   b) Show how much copper savings are there in an auto transformer compared with two winding transformer for same KVA ratings. 5+5

7. a) State the two methods by which you can transform three phase power using two singlephase transformer.
   b) Explain any one of the above.
   c) What is tertiary winding of transformer? 2+5+3

8. a) Describe the working principle of dc motor.
   b) A 4 pole, 220 volt, lap wound shunt motor has 500 conductors. It takes 32 amps from supply mains. The field winding and armature resistance are 110 Ω and 1.0 Ω respectively. The flux per pole is 30 m Wb. Calculate the speed of the motor. 5+5

9. a) Briefly explain the building up of e.m.f. in shunt connected generator.
   b) A 4 pole, lap wound, long shunt, dc compound generator supplies 25 KW at a terminal voltage of 500 V. The armature resistance is 0.03 Ω, series field resistance is 0.04Ω and shunt field resistance is 200Ω. Determine the e.m.f. generated. 5+5

10. a) With the help of diagram explain the operation of 4 point starter.
    b) For which application 4 point starter is used instead of 3 point starter and why? 5+1+4
