Roll No. ..... Total Pages : 5

307302

December, 2019

B.Tech. EL/EEE 3rd SEMESTER

ELECTRICAL MACHINES 1 (ELPC 303)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume any missing Data.*

PART - A

1. (a) What parameters of the equivalent circuit of a transformer can be determined from short circuit test? (1.5) [CO3]

(b) A 10 kVA, 2000/200 V single-phase transformer has $r_1 = 3.6\ \Omega$ and $x_1 = 5.2\ \Omega$. Find the per-unit values of r_1 and x_1. (1.5) [CO3]

(c) Explain why a dc series motor not be run without load? (1.5) [CO3]

(d) What is linear commutation? (1.5) [CO2]

(e) List various methods of three-phase to six-phase conversion. (1.5) [CO3]

(f) What is the function of Commutator in dc machine? (1.5) [CO2]

(g) Identify suitable dc motor for the following applications (i) Electric traction (ii) Vaccum cleaners (iii) Paper making (iv) Shearing and punching (1.5) [CO3]

(h) Calculate the flux per pole required for a 4-pole dc generator with 360 conductors generating 250 V at 1000 rpm when armature is lap wound. (1.5) [CO3]

(i) For a singly excited magnetic system, write the relation for magnetic energy stored. (1.5) [CO1]

(j) Define the terms MMF and reluctance related to magnetic circuits. (1.5) [CO1]

PART - B

2. (a) Derive the expression for force as a partial derivative of stored energy w.r.t. position of the moving element (6) [CO1]

(b) Describe the classification of magnetic materials. Give examples for each class. (4) [CO1]

(c) The armature of an 8-pole dc generator has 960 conductors and runs at 400 rpm. The flux per pole is 40 mWb. (i) Calculate the induced emf if the armature is lap wound (ii) At what speed should it be driven to generate 400 V, if the armature were wave connected? (5) [CO2]

3. (a) Describe the Hopkinson's test for obtaining the efficiency of two similar shunt motors. (8)[CO3]

(b) Explain with neat sketches how the speed control of a dc shunt motor is done by Ward Leonard control system. (7) [CO3]

4. (a) Draw and explain speed-current, torque-current and speed-torque characteristics of dc series motor. Also, mention the industrial application of the same motor. (8) [CO3]

(b) What would be the causes for the failure of voltage build-up of dc self-excited dc generator? How can the problem be remedied? (7) [CO3]

5. (a) Draw and explain the phasor diagram of single-phase transformer supplying a leading power factor loads. (5) [CO3]

(b) Explain with suitable circuit and phasor diagram, the double-star connection of three-phase to six-phase conversion. (5) [CO3]

(c) Define voltage regulation and derive the condition for zero and maximum voltage regulation. (5) [CO3]

6. (a) A 200 kVA, 11000/400 V, delta-star distribution transformer gave the following test results:

Open circuit test 400 V, 9 A, 1.50 kW

Short circuit test 350 V, rated current, 2.1 kW

Calculate the equivalent circuit parameters referred to the h.v. side and its efficiency at half full load of unity power factor. (7) [CO3]

(b) Describe a test on a 1-phase transformer that gives the core losses. Discuss the determination of the equivalent circuit parameters which can be obtained from this test. (4) [CO3]

(c) Discuss the various advantages and disadvantages of an auto-transformer over two winding transformer. (4) [CO3]

7. (a) What is armature reaction? Explain briefly the four bad effects of armature reaction. Also, discuss how the effect of armature reaction can be minimized in the inter-polar zone using Interpoles. (8) [CO2]

(b) A 5 kW, 230 V, shunt motor has an armature resistance of 0.5 Ω and a field resistance of 230 Ω. At no load the motor runs at a speed of 1000 rpm and draws a current of 3 A. At full load and rated voltage, the current drawn is 23 A and the armature reaction causes a drop of 2% in flux. Determine (i) full-load speed (ii) full-load torque. (7) [CO2]
