

Code No: 153AQ

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B.Tech II Year I Semester Examinations, March - 2022****ELECTRICAL MACHINES - I****(Electrical and Electronics Engineering)****Time: 3 Hours****Max. Marks: 75****Answer any five questions****All questions carry equal marks**

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- 1.a) Derive the expression for generated e.m.f in a DC generator. Discuss the factors affecting the generated e.m.f.?
- b) A short-shunt dc compound generator supplies 150 A at 100 V. The resistance of armature, series field and shunt field windings are 0.04, 0.03 and 60  $\Omega$  respectively. Find the e.m.f generated. Also find the e.m.f generated, if same machine is connected as a long shunt machine. [8+7]
- 2.a) Sketch and explain the load characteristics of the shunt and series generator.
- b) A 4-pole generator has a wave-wound armature with 722 conductors, and it delivers 100 A on full load. If the brush lead is  $0.8$  Calculate the armature demagnetizing and cross magnetizing ampere turns per pole. [7+8]
- 3.a) Write a short notes on speed control of DC Motors.
- b) A 4-pole, 250 V d.c series motor has a wave-connected armature with 1254 conductors. The flux per pole is 22 mWb when the motor is taking 50 A. Iron and friction losses amount to 1.0 Kw. Armature resistance is 0.2 ohm and series field resistance is 1 ohm. Calculate: i) the speed ii) the shaft torque and iii) the efficiency at this load. [8+7]
- 4.a) Derive the condition for maximum efficiency of DC Motor.
- b) A DC series motor is driving a fan load, whose torque varies a cube of speed. The total armature and series field resistance is 1  $\Omega$ . It takes 10 Amp from 200 V mains and runs at 1000 RPM. Find the resistance to be connected in series with the motor to make it run at 800 RPM. [7+8]
- 5.a) Explain with diagram how Hopkinson's test is performed on dc machines. What are the advantages and disadvantages of this test?
- b) A 200 V d.c. shunt motor takes 5 A at no-load.  $R_a=0.5 \Omega$  and  $R_{sh}=200 \Omega$ . Estimate the kW output and efficiency when the motor takes 25 A on full loads. [8+7]
- 6.a) Explain the procedure to separate the stray losses in a DC Motor.
- b) Two identical DC machines when tested by Back-to-back method gave the following test results: Field currents are 2.5 A and 2 A. Line voltage is 220 V. Line current including both field current is 10 A. Motor armature current is 73A. The armature resistance of each machine is 0.05 $\Omega$ . Calculate the efficiency of both machines. [8+7]

- 7.a) Draw the exact equivalent circuit of a transformer and derive the equivalent circuits referred to primary and secondary. Describe the various parameters involved in it.
- b) A 25 kVA, 440/110 V, 50 Hz single-phase step-down transformer is designed to work with 1.5 V per turn with a flux density not exceeding 1.35 T. Determine: (i) the required number of turns on the primary and secondary windings respectively, (ii) the cross-sectional area of the iron core, and (iii) the secondary current. [9+6]
- 8.a) A 400/100 V, 5 kVA, single-phase two winding transformer is to be used as an auto-transformer to supply 400 V from a 500 V voltage source. When tested as a two winding transformer at rated load and 0.8 p.f. lagging, its efficiency was found to be 0.95.
- i) Determine its kVA rating as an Auto-transformer.
- ii) Find its efficiency as an auto-transformer at rated load and at 0.8 p.f. lagging.
- b) Draw the connection diagrams and explain the features of Y-Y, Y- $\Delta$  three-phase connections. [7+8]

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