MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY

(Autonomous Institution – UGC, Govt. of India)

UG Model question paper

ELECTRICAL MACHINES-I

Time: 3hours Max Marks: 70M

Note: This question of 5 sections. Answer five questions, choosing one question from each section and each question paper contains carries 14 marks.

Section-I

1 a) Describe the principle of energy conversion and apply it to an electric motor as electro mechanical conversion device. [7M]

b) All energy conversion devices use magnetic field as a coupling medium rather than electrical field. Explain why? [7M]

OR

2a) Draw and explain with block diagram, the various energies involved in an electro mechanical energy conversion device. [7M]

b) Show that the reaction of coupling magnetic field on the electrical or mechanical system is essential for the electromechanical energy conversion process. [7M]

Section-II

3 a) Explain the basic principle of operation of a D.C. generator [7M]

b) With neat diagram give the constructional features of D.C. machine. [7M]

OR

4a) Describe the constructional details of the armature of a D.C. machine giving suitable diagrams. [7M]

b) Give the materials and functions of the following parts of a D.C. machine. (i) Field poles, (ii) Yoke, (iii) Commutator, (iv) Commutating poles and (v) Armature. [7M]

Section-III

5a) Draw the schematic diagram of separately excited D.C. generator. Also write the current and voltage equations. [7M]

b) Draw the schematic diagram of D.C. series generator. Also write the current and voltage equation. [7M]

OR

6a) In a 110 V D.C. compound generator, the resistance of the armature, shunt field and series field are 0.06 Ω, 25 Ω and 0.04 Ω respectively. The load consists of 200 lamps each rated at 55 W, 110V. Find the total emf. generated and the armature current when the machine is connected in, (a) Long shunt and (b) Short shunt. [7M]

b) Draw the schematic diagram of D.C. short shunt generator and also write the current and voltage equation. [7M]

Section-IV

7a) Write the principle of working of D.C. motor [7M]

b) A 250 V D.C. motor takes 41 amps at full load. Its armature and shunt field resistance are 0.1 Ω and 250 Ω. Find back emf. On full load. [7M]

OR

8 a) Draw the schematic diagram of D.C. series motor. Also write the back emf. Current and voltage equations. [7M]

b) A D.C. series motor working on 200 V supply draws a current of 50 A, its armature and series field resistance are 0.03 Ω and 0.02 Ω respectively. Calculate back emf. [7M]

Section-V

9 a) List the different methods of speed control of D.C. shunt motor. [7M]

b) In a Hopkinson's test on 220 V, 100 kW generators the circulating current is equal to the full load current and in addition, 90 A are taken from the supply. Obtain the efficiency of each machine. [7M]

OR

10 a) what is Swinburne's test? List the advantages and the disadvantages of Swinburne's test Conducted on D.C. motor. [7M]

b) Write about Hopkinson's test and give its limitations. What are the advantages of Hopkinson's test?

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Section-I

1a) Derive expression for the magnetic force developed in linear electromagnetic system. [7M]

b) What is the expression for electromagnetic torque develop in a linear electromagnetic system? [7M]

OR

2 a) what is energy balance equation? Explain the importance of it in electromechanical energy conversion devices. [7M]

b) Give applications of singly excited system and explain their working. [7M]

Section-II

3 a) Derive the EMF equation of a D.C. generator. [7M]

b) An 8-pole D.C. generator has per pole flux of 40 m wb and winding is connected in lap with 960 conductors. Calculate the generated emf. on open circuit when it runs at 400 r.p.m. If the armature if wave wound at what speed must the machine be driven to generate the same voltage.

OR

4a) the armature of a 6-pole generator has a wave winding containing 664 conductors. Calculate the generated emf. When flux per pole is 60 m wb and the speed is 250 r.p.m. Find the speed at which the armature must be driven to generate an emf. of 550 V if the flux per pole is reduced to 58 m wb. [7M]

b) Derive the expression for calculating the demagnetizing and cross magnetizing ampere turns per pole in a D.C. generator with usual notation. [7M]

Section-III

5a) Draw the external and internal characteristics of a separately excited D.C. generator[7M]

b) What is critical speed? Explain the significance of critical speed [7M]

OR

6) In a 110 V compound generator, the resistance of the armature, shunt and series windings is 0.06, 25 and 0.04 Ω respectively. The load consists of 200 lamps each rated at 55 W, 110 V. Find the emf. generated and armature current when the machine is connected, (a) Long shunt, (b) Short shunt and (c) How will the ampere-turns of series winding be changed if in, (i) A diverter of resistance Ω be connected in parallel with the series winding? Ignore armature reaction and

brush contact drop. [14M]

Section-IV

7a) in a 4-pole lap wound D.C. compound motor develops back emf. of 200 V. The field produces a flux of 0.025 wb and the armature contains 400 conductors. Calculate the speed developed.
b) Why is starter necessary for D.C. motor? [7M]

OR

8) A 4-pole, 500 V, shunt motor has a total of 720 armature conductors which are wave wound. The full-load armature current is 60 A, and the flux per pole is 0.03 m wb. The armature resistance is Ω. The voltage drop across a brush is 1 volt. Calculate the full-load speed of the motor. [14M]

Section-V

9 a) what are the different methods of speed control of a D.C. motor? Explain? [7M]
b) Explain with neat diagram, how can you find efficiency of small D.C. motor with brake test. [7M]

OR

10) Describe a method of determining the efficiency of D.C. shunt motor at various loads, without actually putting the load on the motor. State the assumptions made in the method described. [14M]

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Section-I

1a) with the help of neat diagram obtain the expression for the energy stored in a magnetic system for a simple attracted armature type relay. Explain the operation of system. [7M]

b) Explain the mechanical energy and work done in singly excited system when actual displacement occurs. [7M]

OR

2 a) Derive an expression for the mechanical force developed for singly excited magnetic field system. [7M]

b) Define expressions of field energy and co-energy in a singly-excited electromechanical unit. [7M]

Section-II

3 a) what is armature reaction? Describe the effects of armature reaction on the operation of a D.C. machine. How the armature reaction is minimized. [7M]

b) The armature of a 2-pole, 200 V generator has 400 conductors and runs at 300 r.p.m. Calculate the useful flux per pole. If the number of turns in each field coils is1200, what is the average value of the emf? induced in each coil on breaking the field, if the flux dies away completely in 0.1 (Ø = 0.1 wb E_{ave} = 1200). [7M]

OR

4 a) A 4-pole lap connected D.C. generator having 50 slots on its armature with 6 conductors per slot, the flux per pole 30 m wb and generates an open circuit voltage of 180 V (i) Find the speed at which the motor will run for the above condition, (ii) Keeping the speed constant, suggest a changein the armature of the generator such that the generator is capable to generate at no load a voltage of 90 V, with the same rated flux. [7M]

b) What is the fundamental difference between a simple lap winding and a simplex wave winding? Draw simple diagrams to show the above windings**.** [7M]

Section-III

5 a) what are the requirements of voltage build up in self-excited D.C Generator. [7M]

b) Draw the load characteristics of shunt, series and compound generators. Describe these characteristics nature and applications. [7M]

OR

6 a) Mention the reasons for the compounding D.C. generator. Neatly sketch and explain the external characteristics of a D.C. compound generator. [7M]

b) Distinguish between internal and external characteristic of a D.C. generator. How can the internal characteristic are derived from the external characteristic of a separately excited generator. [7M]

Section-IV

7 a) Explain the principle of operation of a D.C. motor. Derive the equation for thetorque developed by a D.C. motor. [7M]

b) A 12-pole lap connected 230 V shunt motor has 410 conductors. It takes 41 A on full-loads.