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Code No: R21025





II B. Tech I Semester Supplementary Examinations, Jan - 2015 ELECTRICAL MACHINES - I

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions All Questions carry **Equal** Marks

- 1. Define co-energy. Give the significance of co-energy in the derivation of torque or force in an electromechanical energy conversion system. (15M)
- 2. a) Distinguish between self excited and separately excited DC generators. How the self excited generators are classified? Give their circuit diagrams.
 - b) Draw up the winding table for a 4 pole, wave connected armature having 30 coil sides and give the developed diagram of the winding showing the polarity and position of the brushes, the main poles and the direction of motion of the armature for a dc motor. (8M+7M)
- 3. a) Explain about the armature reaction in a DC machine by drawing necessary diagrams?
 - b) A 6 pole lap wound DC generator has 600 conductors and the armature current is 610A. It is given a brush lead of 7.5 angular degrees (mechanical) from the GNA. Calculate the cross and demagnetizing ampere turns per pole? (8M+7M)
- 4. a) Explain about the open circuit characteristics of a DC generator. Write the necessary equations?
 - b) Explain about importance of critical field resistance and how it is determined from open circuit characteristics of DC generator? (8M+7M)
- 5. a) A 150KW, 220V shunt generator is operating in parallel with a 415KW, 220V generator. Both are connected to a common load of 1000A and they have same regulation characteristics. Generator one is supplying 250A and two is supplying 750A. If an additional load of 500A is added, how would they share the current?
 - b) What are the advantages of parallel operation of two generators? (8M+7M)
- 6. a) Discuss in detail about the significance of back e.m.f that is produced in a DC motor?
 - b) DC motor connected to a 460V supply has an armature resistance of 0.25 ohm. Calculate the value of back e.m.f when the armature current is 120A and the value of armature current when the back e.m.f is 447.4V? (8M+7M)
- 7. a) Describe in detail about the methods of speed control of for D.C motors?
 - b) A 230V D.C shunt motor runs at 800 r.p.m and take an armature current of 55A. Find the resistance to be added to the field circuit to increase speed to 1000 r.p.m at an armature current of 80A. Assume the flux is proportional to field current. Armature resistance is 0.25 ohm and the field winding resistance is 215 ohms? (8M+7M)
- 8. a) Explain the brake test to determine the efficiency of a DC motor?
 - b) A 220V D.C shunt motor at no load takes a current of 2.5A. The resistances of armature and the shunt field are 0.6 ohm & 210 ohm respectively. Estimate the efficiency of the motor when the input current is 20 A. State the assumptions made? (8M+7M)



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SET - 2

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Time: 3 hours

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Answer any **FIVE** Questions All Questions carry **Equal** Marks

- 1. Show that the reaction of coupling magnetic field on the electrical or mechanical system is essential for the electromechanical energy-conversion process. (15M)
- 2. a) Describe the construction and principle of operation of a DC generator
 - b) A long shunt compound generator delivers a load current of 50A at 500V, and has armature, series field resistance of 0.05 ohm and 0.03 ohm, 250 ohm respectively. Calculate generated voltage and the armature current, allow 1 volt per brush for contact drop. (8M+7M)
- 3. a) Explain about the cross magnetization and demagnetization effects in DC generators?b) Explain about the method of improving the commutation by using inter poles? (8M+7M)
- 4. a) Discuss the causes for failure to excite a DC shunt motor. Explain the remedial methods.
 b) Explain the external characteristics of shunt and compound generators. (7M+8M)
- 5. a) Explain the working of equalizer bar in parallel operation of dc series generator.
 - b) Two shunt generators with straight line characteristics are operated in parallel, their no load voltages being 240 V and 245 V respectively. The rating of the above generators are 500 kW at 230 V and 250 kW at 220 V. if the total load supplied is 650 kW, calculate (i) the terminal voltage (ii) Power supplied by each machine in kW.
- 6. a) Derive the torque equation of a D.C motor?
 - b) A D.C motor takes an armature current of 120A at 480V. The armature circuit resistance is 0.3 ohm. The machine has 6 poles and the armature is lap connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate the speed and gross torque developed by the armature? (7M+8M)
- 7. a) Explain in detail about the Ward Leonard system of speed control with neat sketch?
 - b) A D.C series motor drives a load the torque of which varies as the square of the speed. The motor takes a current of 15 A when the speed is 600 r.p.m. calculate the speed and the current when the motor field current is shunted by a diverter of the same resistance as that of the field winding? Mention the assumptions made. (7M+8M)
- 8. a) Explain the Swinburne's test to determine the efficiency of a DC machine.
 - b) In a brake test the effective load on the brush pulley was 39.2 kg. The effective diameter of the pulley is 63.5cm and the speed is 12 r.p.s. The motor took 49A at 220V. Calculate the output power and efficiency at this load? (7M+8M)

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II B. Tech I Semester Supplementary Examinations, Jan - 2015 **ELECTRICAL MACHINES - I**

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Time: 3 hours

Max. Marks: 75 Answer any FIVE Questions All Questions carry Equal Marks With the help of neat diagram obtain the expression for the energy stored in a magnetic system 1. for a simple attracted armature type relay. Explain the operation of system. (15 M) 2. a) Derive the e.m.f equation of a DC generator. b) Draw the winding table for a 4-pole, wave connected armature having 30 coil sides and give the developed winding diagram showing the polarity of induced e.m.f, positions of brushes and direction of motion. (8M+7M)3. a) A 4 pole lap wound DC generator has 492 conductors and 82 commutator segments. The armature current is 156A. It is given a brush lead of 5 commutator segments from the GNA. Calculate the cross and demagnetizing ampere-turns per pole and find the extra field turns required on the field magnet to compensate the demagnetization if the field winding carries a current of 13A. b) Describe the effects of armature reaction on the operation of DC machines. Describe also the remedies employed for decreasing the effects of armature reaction. (8M + 7M)4. a) Explain about the voltage buildup in a DC shunt generator with necessary characteristics? b) What is critical speed? Explain the significance of critical speed. (8M + 7M)a) Explain how the load sharing is done by the shunt generators with equal no load generated 5. e.m.f? b) Two DC shunt generators are operating in parallel with the following straight line external characteristics* Source No load voltage Full load voltage Full load current Generator A 250V 220V 50A 230V 220V 40A Generator B Find: i) the current supplied by the individual machines when the total current is 80A. ii) Bus bar voltage iii) output of each machine? (8M + 7M)

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- 6. a) Describe about the characteristics of D.C series motor with necessary equations?
 - b) A 4 pole, 240V, wave connected shunt motor gives 1118 kw when running at 1000 r.p.m and drawing armature and field currents of 50A and 1 A respectively. It has 540 conductors. Its resistance is 0.1 ohm. Assuming a drop of 1V per brush, find total torque, useful torque, useful flux per pole, rotational losses and efficiency? (8M+7M)
- 7. a) Explain in detail about the operation of three point starter with neat sketch?
 - b) Find the value of the step resistance in a 6 stud starter for a 5 H.P, 200V shunt motor. The maximum current in the line is limited to twice the full load value. The total copper loss is 55% of the total loss. The normal field current is 0.4A and the full load efficiency is found to be 88%?
- 8. a) Explain the Field's test to determine the efficiency of a series machines.
 - b) The no load test of a 45.79 kW, 220V D.C shunt motor gave the following value: the input current is 13.25A; field current is 2.55A; the armature resistance at 75 degrees is 0.032 ohm and the brush drop is 2V. Determine the full load current and efficiency? (8M+7M)

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SET - 4

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Max. Marks: 75

Answer any **FIVE** Questions All Questions carry **Equal** Marks

- 1. The magnetic flux density on the surface of an iron face is 1.6 Tesla. What is the typical saturation value for a ferromagnetic material? Find the density on the iron face. Derive the formula used. (15M)
- 2. a) Explain the action of commutation in a DC generator.
 - b) A 4 pole wave wound DC shunt generator has use full flux per pole of 0.05Wb. The total conductors in the machine are 500, each having a resistance of 0.01 ohm. Calculate the terminal voltage when running at 1000 rpm, if the armature current is 60A. Neglect the brush drop. (8M+7M)
- 3. a) Explain about demagnetizing ampere-turn per pole and cross magnetizing ampere-turn per pole.
 - b) A 6 pole wave wound DC generator has 720 conductors. The current in each conductor is 215A. Find the ampere turns per pole required for providing compensation to improve mmf pattern in the machine, demagnetizing ampere- turns per pole if the brushes have an angular lead of 10 degrees, and cross magnetizing ampere- turns per pole. Assume the ratio of pole arc to pole pitch as 0.7. (8M+7M)
- 4. a) Explain about the internal and external characteristics of a DC compound generator?b) Explain about the magnetization characteristics of a DC generator. (8M+7M)
- 5. a) Explain about the parallel operation of DC compound generators with neat sketch?
 b) Explain how load sharing is done by the shunt generators with unequal no load generated e.m.fs? (8M+7M)
- 6. a) Explain the armature reaction in DC motors.
 - b) A 220V shunt motor has an armature resistance of 0.4 ohm and field resistance of 110 ohms. The motor draws 5A at 1500 r.p.m at no load. Calculate the speed and shaft torque if motor draws 52 A at rated voltage? (8M+7M)
- 7. a) Explain in detail about the operation of four point starter with neat sketch?

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b) Discuss in the applications of DC series, shunt and compound motors? (8M+7M)

- 8. a) Explain in detail about the retardation test with necessary circuit diagrams?
 - b) In a retardation test on a D.C motor, with its field normally excited, the speed fell from 1525 to 1475 in 25 seconds. With an average load of 1 kW supplied by the armature, the same speed drop occurred in 20 seconds. Find the moment of inertia of the rotating parts in kg.m²? (8M+7M)

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