Code No: RT21026 **R13** SET - 1

II B. Tech I Semester Regular/Supplementary Examinations, Dec - 2015
ELECTRICAL MACHIENS-I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Explain about co-energy. (3M)
   b) Define the simplex lap winding and wave winding. (3M)
   c) A 1500 kw, 600V, 16-pole separately excited DC generator runs at 200 RPM. It has 2,500 lap connected conductors and full – load copper losses are 25 KW. Calculate the useful flux per pole. (4M)
   d) Draw the different characteristics of shunt motor and explain them. (4M)
   e) A 220 V DC shunt motor at No-load takes a current of 2.5 A. the resistance of the armature and shunt field are 0.8W and 200W respectively. Estimate the efficiency of the motor when the input current is 32 A. (4M)
   f) Derive the output equation of DC machine. (4M)

PART -B

2. a) Explain the energy flow in electromechanical systems with energy flow diagrams. (8M)
   b) Derive an expression for co-energy density of an electromechanical energy conversion device. (8M)

3. a) Develop the winding table, winding diagram, sequence diagram and then fix up the brushes for a DC machine with 4 – pole, 24 slot single layer Lap winding. (8M)
   b) A 4-pole generator has wave wound armature with 722 conductors, and it delivers 100A on full load. If the brush lead is 8 degrees calculate the armature demagnetizing and cross-magnetizing ampere turns per pole. (8M)

4. a) Draw the OCC characteristics of DC shunt generator and explain how to find critical resistance of DC Generators. (8M)
   b) Draw the internal and external characteristics of different types of DC generators and explain them. (8M)

5. a) Draw different characteristics of shunt, series and compound motors. (8M)
   b) What is the necessity of starter and explain three point starter. (8M)

6. In a Hopkinson's test on a pair of 500 V, 100 kW shunt generator. The following data was obtained: Auxiliary supply 30 A at 500 V; Generator output current 200 A; Field current 3.5 A and 1.8 A; ra = 0.075 Ω for each machine; voltage drop at brushes = 2 V/machine; calculate the efficiency of the machine as a generator. (16M)

7. Calculate the armature diameter and core length for a 7.5kW, 4pole, 1000rpm, and 220V shunt motor. Assume: Full load efficiency = 0.83, field current is 2.5% of rated current. The maximum efficiency occurs at full load. (16M)
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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Mention the advantages of analyzing energy conversion devices by field – energy concept. (3M)
   b) Explain commutation with respect to DC generators and write the function of commutator. (3M)
   c) Compare separately excited DC generator with self excited DC generator. (4M)
   d) Draw the different characteristics of shunt motor and explain them. (4M)
   e) Write the advantages and disadvantages of hopkinson's test. (4M)
   f) Write different factors to consider for choice of number of poles in DC Machine. (4M)

PART –B

2. a) i) Explain the concept of rotating magnetic field.
      ii) Derive the torque equation in round rotor machines. (8M)
   b) Two parallel plates of each of area $2m^2$ are separated by a distance "g". The electric field intensity between plates is $5X10^6$ V/m, a value equal to break down strength of the air. Find the force between two plates using both energy and co-energy methods. (8M)

3. a) Explain armature reaction in a DC generator and what the methods to reduce its effects are. (8M)
   b) A 6 pole DC armature with 16 slots having two coil sides/slot and single turn coils. Calculate the winding pitches then develop the winding table, winding diagram and then fix up the brushes for a wave winding. (8M)
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4. a) The open-circuit characteristics of a separately excited D.C. generator driven at 1000 r.p.m.is as follows:

Field Current	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6
E.M.F. volts	30.0	55.0	75.0	90.0	100.0	110.0	115.0	120.0

If the machine is connected as a shunt generator and driven at 1000 r.p.m. and has a field resistance of 100 ohm, find i) open circuit voltage and exciting current ii) the critical resistance and iii) resistance to induce 115 volts on open circuit. (8M)

b) Explain the different methods of excitation and characteristics of DC generators with suitable diagrams. (8M)

5. a) Explain principle of operation of DC motor and write the significance of back EMF in DC motors. (8M)

b) Explain different types of losses occurred in DC motors. (8M)

6. a) Explain filed's test on DC series motors. (8M)

b) In a retardation test on a separately motor, the induced emf in the armature falls from 220V to 190V in 30 seconds on disconnecting the armature from the supply. The same fall takes place in 20 seconds if, immediately after disconnection, armature is connected to a resistance which takes 10A (average) during this fall, find the stray losses of motor. (8M)

7. Calculate the armature diameter and core length for a 7.5 kW, 4 pole, 1000 rpm, and 220V shunt motor. Assume: Full load efficiency = 0.83, field current is 2.5% of rated current. The maximum efficiency occurs at full load. (16M)

Code No: RT21026 **R13** SET - 3

II B. Tech I Semester Regular/Supplementary Examinations, Dec - 2015
ELECTRICAL MACHIENS-I
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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Predominant energy storage does not occur in the air – gap of an electromechanical energy conversion device. Is this statement correct? Give reason in support of your answer. (3M)
   b) What is the necessity of laminating the armature core of a DC generator and explain different types f windings of armature. (3M)
   c) Draw internal and external characteristics of shunt, series and compound generator. (4M)
   d) Draw the characteristics of series motor. (4M)
   e) Explain regenerative breaking. (4M)
   f) Derive the output equation of DC Machine. (4M)

PART -B

2. a) Briefly explain the various phenomena useful for electromechanical energy conversion in rotating machines. (8M)
   b) Derive an expression for co-energy density of an electromechanical energy conversion device. (8M)

3. a) Explain armature reaction in detail. (8M)
   b) Explain about compensating windings and inter poles. (8M)

4. a) What are the reasons for a shunt generator not to build up voltage. Explain the remedial measures. (8M)
   b) A 100 kW DC hunt generator driven by a belt from an engine runs at 750 rpm and is connected to 230 V dc mains. When the belt breaks, it continues to run as a motor drawing 9kW from the mains. At what speed would it run? Given: Armature resistance= 0.018 Ω and field resistance = 115Ω. (8M)

5. a) A 440V DC shunt motor is running at 1500rpm and it takes a line current of 30A. The output is 15HP. The load torque varies as the square of speed. Calculate the resistance to be connected in series with the armature for reducing the motor speed to 1300rpm. (8M)
   b) Draw and Explain the operation of 4 – point starter. (8M)

6. a) Explain Field test for series motor. (8M)
   b) Explain swinburn's test on DC machine when the machine act as motor. (8M)

7. For a preliminary design of a 1500kW, 275V, 300rpm, dc shunt generator determine the number of poles, armature diameter and core length, number of slots and number of conductors per slot. Assume: Average flux density over the pole arc as 0.85T, Output coefficient 276, Efficiency 0.91.Slot loading should not exceed 1500A. (16M)
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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) On what factors, the EMF induced in a coil rotating in a magnetic field is depending and derive the expression for torque in DC machines. (3M)
   b) What do you mean by "back emf" in DC Machine and write the significance of back emf. (3M)
   c) Draw internal and external characteristics of shunt, series and compound generator. (4M)
   d) What is a starter? Write significance of starter. (4M)
   e) Explain break test on shunt motor. (4M)
   f) Write different factors to consider for choice of number of poles in DC Machine. (4M)

PART -B

2. a) Draw and explain schematic diagram of flow of energy in the conversion of electrical energy into mechanical term. (8M)
   b) For a linear magnetic circuit, derive the expression for stored energy and Co-energy. (8M)

3. a) Explain lap and wave windings of DC machines. (8M)
   b) Derive the expressions for Ampere turns per pole for demagnetizing and cross magnetizing effect. (8M)

4. a) Explain open circuit characteristics of DC generator and also explain how to find critical field resistance-critical speed of DC generator. (8M)
   b) Draw the internal and external characteristics of different types of DC generators and explain them. (8M)

5. a) Draw different characteristics of shunt, series and compound motors. (8M)
   b) With a neat sketch explain the construction and working of a 3 point starter. What are the limitations of 3 point starter. (8M)

6. a) Explain Break test on DC shunt motor by drawing circuit diagram. (8M)
   b) Explain hopkinson's test on DC machines. (8M)

7. For a preliminary design of a 50hp, 230V, 1400 rpm dc motor, calculate the armature diameter and core length, number of poles and peripheral speed. Assume specific magnetic loading 0.5T, specific electric loading 25000 ampere-conductors per meter, efficiency 0.9. (16M)
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