

II B.Tech I Semester Supplementary Examinations, February 2008**ELECTRO MECHANICS-I****(Electrical & Electronic Engineering)****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

1. (a) Derive the force in a singly excited relay in the linear case.
- (b) The magnetizing curve of the iron portion of a cylindrical ironclad solenoid magnet is given in the following table. The exciting coil has 1100 turns and carries a steady current of 2.5 A. Find direction and magnitude of electrical energy flow if plunger is made to move from a gap of 0.2 to 1 cm.

Flux, Wb	0.001	0.00175	0.0023	0.0025	0.0026	0.00265
MMF, AT	60	120	210	300	390	510

[8+8]

2. Design a lap winding for 32 conductor, 4 pole d. c. machine. Show also the brush positions. [12+4]
3. (a) Explain the purpose of laminating the armature core of a d. c. machine.
- (b) The diameter of a commutator ring of a lap wound d. c. motor is 25 cms. The brush width is 1.8 cm and width of mica insulation is 0.2 cm. If the speed of the motor is 200 rpm, determine the time of commutation. [6+10]
4. (a) What is critical field resistance? How do you calculate the critical field resistance practically.
- (b) When a shunt generator fails to build up voltage, then how to rectify the fault. [8+8]
5. A 4-pole 250V DC shunt motor has lap connected 960 conductors. The flux per pole is 20mWb. Determine the torque developed by the armature and the useful torque in Nm when current drawn by the motor is 32A. The armature resistance is 0.1Ω and shunt field resistance is 125Ω . The rotational losses of the machine amount to 825W. Derive the formula used. [10+6]
6. (a) A 220V shunt motor takes 60A when running at 800rpm. It has an armature resistance of 0.1Ω . Find the speed and armature current if the magnetic flux is weakened by 20%, contact drop per brush = 1V. Total torque developed remains constant.
- (b) A 220V series motor runs at 800 rpm, when taking a current of 15A. The motor has $R_a = 0.3\Omega$ and $R_f = 0.2\Omega$. Find the resistance to be connected in series with armature if it has to take the same current at the same voltage at 600 rpm. Assume flux is proportional to current. [8+8]

7. (a) Explain, with a neat circuit diagram, why no load test is considered convenient and economical for testing d.c. shunt machines. Is it possible to conduct the same on series machines? Why?
- (b) In a brake test, on a shunt motor, the tensions of the two sides of the brake were 3.1 and 0.2. The radius of the pulley was 8 cm. The input current was 2.5A at 220V. The motor speed was 1150 rpm. Calculate
- i. the torque
 - ii. the h.p. output &
 - iii. the efficiency. [8+8]
8. (a) How are large series machines tested, explain?
- (b) The Hopkinson's test on two DC shunt machines gave the following results for full load. Line voltage 250V, line current 45A excluding field currents; motor armature current 385A; field current 5A and 4A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.015 Ω . [8+8]

II B.Tech I Semester Supplementary Examinations, February 2008
ELECTRO MECHANICS-I

(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Derive expression for the forces developed in linear electromagnetic system.
(b) All energy conversion devices use magnetic field as a coupling medium rather than electrical field. Explain Why? [10+6]
2. Design a lap winding for 32 conductor, 4 pole d. c. machine. Show also the brush positions. [12+4]
3. A 4-pole lap wound d. c. generator delivers a full load current of 400 A. It has shunt field current of 12 A and 123 commutator segments in the commutator ring of the machine. If the brushes are advanced by 3 commutator segments on full load, find
 - (a) The demagnetizing AT/pole;
 - (b) The cross-magnetizing AT/pole. [8+8]
4. (a) What is critical field resistance? How do you calculate the critical field resistance practically.
(b) When a shunt generator fails to build up voltage, then how to rectify the fault. [8+8]
5. (a) Derive an expression for the torque of a DC motor.
(b) Explain the armature reaction in dc motors. [8+8]
6. (a) Explain about series-parallel method of Speed Control of D.C. Series Motors.
(b) A 500V, d.c. shunt motor takes a current of 5 A on no-load. The resistances of the armature and the field circuits are 0.22 ohm and 250 ohm respectively. Find
 - i. The efficiency when loaded and taking a current of 100A.
 - ii. The percentage change of speed. State precisely the assumptions made. [6+10]
7. (a) Enumerate the principal losses that occur in a DC generator and where appropriate, state the general form of the physical law upon which each loss depends?
(b) Calculate the efficiency of a self excited DC shunt generator from the following data.
Rating : 10 KW, 250 V, 1000 rpm. Armature resistance = 0.35 Ω , voltage

drop at brushes = 2V. Winding and frictional losses = 150 W, Iron loss at 250 V = 180 W Open circuit characteristic:

EMF (V) :	11	140	227	285	300	312	
Field current (A) :	0	1.0	1.5	2.0	2.2	2.4	[8+8]

8. (a) Outline the steps to estimate the efficiency of given two d.c. machines by conducting Hopkinson's test. Draw schematic diagram to illustrate the method.
- (b) In a Hopkinson's test on a pair of 500V, 100KW, shunt generators, the following data was obtained. Auxiliary supply 30A at 500V
Generator output Current 200 A
Field currents 3.5 A and 1.8A
Armature circuit resistances of each machine 0.075 Ω
Voltage drop at brushes (each machine) : 2 V
Calculate the efficiency of each machine acting as a generator. [8+8]

II B.Tech I Semester Supplementary Examinations, February 2008

ELECTRO MECHANICS-I

(Electrical & Electronic Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. (a) What are the significances of energy and co-energy of Energy conversion system?
(b) Derive expression for the magnetic force developed in linear electromagnetic system. [8+8]
2. A 4-pole wave connected armature has 51 slots. Draw a developed winding diagram and show the brush positions. Assume any other data required. [12+4]
3. (a) Explain the purpose of laminating the armature core of a d. c. machine.
(b) The diameter of a commutator ring of a lap wound d. c. motor is 25 cms. The brush width is 1.8 cm and width of mica insulation is 0.2 cm. If the speed of the motor is 200 rpm, determine the time of commutation. [6+10]
4. What is the procedure to connect two series generators parallel? [16]
5. (a) How does a DC motor automatically adjust input to match the mechanical load on the motor?
(b) Explain the armature reaction in D.C shunt motors, indicating also a few remedies to its adverse effects. [8+8]
6. (a) A 220V shunt motor takes 60A when running at 800rpm. It has an armature resistance of 0.1Ω . Find the speed and armature current if the magnetic flux is weakened by 20%, contact drop per brush = 1V. Total torque developed remains constant.
(b) A 220V series motor runs at 800 rpm, when taking a current of 15A. The motor has $R_a = 0.3\Omega$ and $R_f = 0.2\Omega$. Find the resistance to be connected in series with armature if it has to take the same current at the same voltage at 600 rpm. Assume flux is proportional to current. [8+8]
7. (a) The following readings were obtained in a brake test conducted on a DC shunt motor, supply volts = 240V, armature current = 35A, shunt field current = 4A, load on one band = 60 Kgf and load on the other band is 15 Kgf. Diameter of brake pulley = 0.35m, speed = 1000 rpm. Determine
 - i. Output torque
 - ii. Horse power output.
 - iii. Efficiency.

- (b) A 200V shunt motor has a 5-step starter. The maximum current during starting should not exceed 40A. Armature resistance is 0.5Ω . Find the resistance of different steps. [8+8]
8. (a) What are the various methods of finding inertia of a motor? Explain any one method to calculate inertia experimentally?
- (b) A retardation test is carried out on a 1000 rpm DC machine. The time taken for the speed to fall from 1030 rpm to 970 rpm is
- 36 seconds with no excitation.
 - 15 seconds with full excitation and
 - 9 seconds with full excitation and armature supplying an extra load of 10A at 219 V. [6+10]

II B.Tech I Semester Supplementary Examinations, February 2008
ELECTRO MECHANICS-I
(Electrical & Electronic Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

★ ★ ★ ★ ★

1. (a) Derive the force in a doubly excited system in the linear magnetic system.
- (b) The magnetizing curve of the iron portion of a cylindrical ironclad solenoid magnet is given in the following table. The exciting coil has 1200 turns and carries a steady current of 2.25 A. Calculate magnetic field energy and co-energy for an air-gap of 0.3 cm for the linear case.

Flux, Wb	0.001	0.00175	0.0023	0.0025	0.0026	0.00265
MMF, AT	60	120	210	300	390	510

[8+8]

2. Give the developed view of a 13 slot, 2 coil sides/slot, 4-pole, D.C. wave winding.
[16]
3. (a) Explain the purpose of laminating the armature core of a d. c. machine.
- (b) The diameter of a commutator ring of a lap wound d. c. motor is 25 cms. The brush width is 1.8 cm and width of mica insulation is 0.2 cm. If the speed of the motor is 200 rpm, determine the time of commutation.
[6+10]
4. The load characteristics of two shunt generators are as follows:

Machine: I Armature current In amperes	0	283	566	850
Machine: II Armature current In amperes	0	200	400	600
Terminal voltage	500	490	480	470

If the above machine works in parallel to supply a total load of 400 KW, determine

- (a) The load taken by each machine and
- (b) The amount by which the open circuit emf of the machine must be raised by field regulation so that the two machines share the 400 KW load equally?
[8+8]
5. (a) Develop the general expression for the speed of a motor in terms of supply voltage, armature resistance and flux per pole.
- (b) Discuss the applications of series motors and compound motors.
[8+8]
6. (a) What are the different methods of speed control of DC motor? Explain.
- (b) A 220V DC shunt motor draws a no load armature current of 2.5A when running at 1400rpm. Determine its speed when taking an armature current of 60A if armature reaction weakens the flux by 3%. (Assume $R_a = 0.2\Omega$) [8+8]

7. (a) Enumerate the principal losses that occur in a DC generator and where appropriate, state the general form of the physical law upon which each loss depends?
- (b) Calculate the efficiency of a self excited DC shunt generator from the following data.
 Rating : 10 KW, 250 V, 1000 rpm. Armature resistance = $0.35\ \Omega$, voltage drop at brushes = 2V. Winding and frictional losses = 150 W, Iron loss at 250 V = 180 W Open circuit characteristic:
- | | | | | | | | |
|---------------------|----|-----|-----|-----|-----|-----|-------|
| EMF (V) : | 11 | 140 | 227 | 285 | 300 | 312 | |
| Field current (A) : | 0 | 1.0 | 1.5 | 2.0 | 2.2 | 2.4 | [8+8] |
8. (a) Outline the steps to estimate the efficiency of given two d.c. machines by conducting Hopkinson's test. Draw schematic diagram to illustrate the method.
- (b) In a Hopkinson's test on a pair of 500V, 100KW, shunt generators, the following data was obtained. Auxiliary supply 30A at 500V
 Generator output Current 200 A
 Field currents 3.5 A and 1.8A
 Armature circuit resistances of each machine $0.075\ \Omega$
 Voltage drop at brushes (each machine) : 2 V
 Calculate the efficiency of each machine acting as a generator. [8+8]
