Module 1 & 2 [Basics of Magnetism + Electromechanical Energy Conversion]

(1) Derive expression for torque developed in doubly excited m/c. ******(with schematic) (10M)

(2) Explain the principle of electromechanical energy conversion from considerations of various energies involved. Develop the model for an electromechanical energy conversion device ***** (5M)

(3) Explain hysteresis & Eddy current loss* (5M)

(4) Derive equation for torque of singly excited magnetic system * (10M)

(5) Explain eddy current loss & various factors affecting it (5M)

(6) Explain hysteresis loss and factors affecting it. (5M)

(7) How can Eddy current loss be minimised? (5M)

(8) What do you mean by leakage flux & how do you minimize it? (5M)

(9) Explain faraday's laws? (5M)

Numericals:

(1) A conductor of 3m length moves under a magnetic field of flux density $1.3\,Wb/m^2$ with a velocity of 1.3m/s Calculate magnitude of induced emf if conductor moves
(i) At an angle of 60 degree to the direction of field
(ii) At right angles to axis of fields.

(2) Find the value of induced emf and current flowing through coil, if an electromagnet is wound with 900turns If it is moved so that magnetic field is changed from 1.2mWb to 0.3mWb in 0.2sec. The resistance of coil is 230Ω.

(3) A conductor of 4m length moves under magnetic field of flux density of $1.3\,wb/m^2$ with velocity of 1.3 m/s. Calculate the magnitude of induced emf if conductor moves (i) At angle 50° direction of field and (ii) At 90° to axis of field

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Module 3 : DC Machines :

(1) Derive torque equation for dc motor.** (5M)

(2) Explain armature reaction in DC m/c **** (10M)

(3) Explain significance of back emf (5M)

(4) Define commutation. Explain process of commutation in dc m/c **** (10M)

(5) Methods of limiting armature reaction in dc machine **** (10M)

(6) What is compensating winding & its use in d.c m/c * (5M)

(7) Explain methods to improve commutation process **** (10M)

(8) Explain the importance of commutator & Brushes in D.C machine (5M)

(9) Derive expression for calculating demagnetising ampere turns/pole & cross magnetising ampere turns/pole ** (10 M)

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Module 4: DC Motors

(1) Explain necessity of starter in dc motor. *** (5M)
(2) Draw & explain characteristics of DC series motor (10M)
(3) Explain field test on DC series motor (10M)
(4) Explain construction & working of 4pt starter. State its advantages over 3pt starter. **** (10M)
(5) What is the difference between 3pt starter & 4pt starter? (5M)
(6) Explain torque-current, Speed-current & speed-torque characteristics of dc shunt & series motor. * (10M)
(7) Explain construction & working of 3pt starter *** (10M)
(8) Explain the Rheostatic braking of D.C seperately excited motor with diagram. (5M)
(9) Explain speed control methods of D.C shunt motor in detail. * (10M)
(10) Draw & explain all characteristics of DC series motor. (10M)
(11) Explain the different Electrical braking methods for seperately excited DC motor. (10M)
(12) Explain various characteristics of DC series motor & shunt motor. ** (10M)
(13) Explain why DC series motor is never started on No-load. (5M)
(14) List out dis-advantages of 3pt starter. (10M)
(15) Methods of speed control of DC machines
(16) Which speed control methods are used to get the speed above normal & below normal in case of DC motor. (5M)
(17) Explain different electrical braking methods for seperately excited DC Motor. * (10M)

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Numericals :

(1) A dc series motor runs at 800rpm with a line ckt of 100A from 230V mains. Its armature ckt resistance is 0.15 Ω & its series field resistance is 0.1 Ω. [B L Tharja pg 1010] Find the speed when motor takes 25A from mains. Assume drop in flux is 45% that of flux at 100A

(2) A 250V dc shunt motor on no load runs at 1000rpm and takes a current of 5A. Armature & shunt field resistances are 0.2 Ω and 250 Ω respectively. [Ashfaq Hussain 536pg] Calculate the speed when loaded and taking current of 50A if armature weakens the field by 3%

(3) A 250V, 15KW shunt motor has max efficiency of 88% and a speed of 700rpm when delivering 80% of its rated output. The resistance of its shunt field is 100 Ω. Determine the efficiency and speed when the motor draws a current of 75A from mains. [Bhimra pg 491]

~~(4) A load of 200kW at 0.86 power factor lagging is to be shared by two~~

(4) A 250 volt, shunt motor has an armature current of 20Amp. when running at 1000rpm against full load torque. The armature resistance is 0.5 Ω What resistance must be inserted in series with the armature to reduce the speed to 500rpm at the same torque and what will be the speed if the load torque is halved with this resistance in the circuit? Assume the flux to remain constant throughout & neglect brush drop. [My notes]

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(5) A 220V, 4 Pole, shunt motor has wave winding with 500 conductors. The armature circuit resistances is 0.25Ω, field resistance is 125Ω and the flux per pole is 0.02Wb. Armature reaction is neglected. If the motor draws 14 Ampere from the mains, then calculate; [same type, Bhimra 436pg]

1) Speed 2) Internal torque developed 3) Shaft power
4) Shaft torque when rotational losses are 300W.

(6) A shunt generator delivers 50kW at 250V when running at 400rpm. The armature & field resistances are 0.02Ω and 50Ω respectively. Calculate the speed of the machine when running as a shunt motor and taking 50kW input at 250V. Consider 1 volt per brush for contact drop. [Ashfaq Hussain pg 537].

(7) A 200V shunt motor having armature resistance of 0.4Ω and shunt field resistance of 100Ω drives a load at 500rpm taking 27 Amps. It is desired to run the motor at 700rpm. Assuming the load torque constant, find the value of resistance to be added in field ckt.

(8) A 500V, shunt motor takes 4Amp on no load. The armature resistance including that of brushes is 0.2Ω and field current is 1A. Estimate the o/p and the efficiency when the i/p current is (a) 20Amp (b) 100Amp. [Ashfaq Hussain 545pg]

(9) A 4pole, 220V, DC series motor has wave wound armature with 960 conductors. Flux/pole is 20 mwb When motor is drawing 50A, iron & friction losses amount to 1KW. Armature & series field resistances are 0.2Ω each. Calculate speed, shaft torque, and o/p at the shaft. Also find efficiency if the rotational losses equal 300Watt.

Module 5: Testing of DC Motor

(1) Explain field test on DC series motor * (10M)

(2) Explain swinburn's test on DC machine (10M)

(3) Give advantages of swinburn's test of DC m/c & explain how it is used to find η of m/c (10M)

(4) Explain Hopkinson's test with neat diagram (10M) Give its advantages.

Numericals: [BR Gupta 211]

(1) * The hopkinson's test on two identical shunt machines gave following results.

i/p voltage = 500V   i/p current = 15A

o/p current of generator = 120 A

field current of generator = 4A.

field current of motor = 3A

Armature resistance of each m/c = 0.06 Ω

• Find efficiency of both machines

(2) * A field test on two similar series machine gave following data- [Bhimra pg 503]

			Another * sum
Motor :	Armature current	- 60 A	56 Amp
	Voltage across Armature	- 500V	590 Volts
	Voltage across field	- 40V	40V
Generator :	Terminal voltage	- 450V	400 V
	o/p current	- 46A	44A
	Voltage across field	- 40V	40V.

/0.3Ω

Armature resistance of each m/c is 0.25Ω. Calculate efficiency of both m/c.

(3) The hopkinson's test on two shunt machines gave the following result for full load.

* (a) Line voltage – 250V
  (b) current taken from supply system excluding field currents = 50 Amp
  (c) Motor Armature currents – 380 Amp.
  (d) Field currents 5 Amp and 4.2 Amp.

Calculate the efficiency of the machine working as a generator and motor. Assume armature resistance of each machine is 0.02Ω.

(4) A dc m/c is tested for swinburns test. The m/c is rated for 230V, 50 Amp. The load current is 5 Amp. Armature resistance is 1Ω and shunt field resistance is 200Ω. find full load η if the m/c was tested as D.C Motor.