B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2013

ELECTRICAL AND ELECTRONICS ENGINEERING BRANCH

FOURTH SEMESTER

EE 9253 ELECTRICAL MACHINES – I

REGULATIONS 2008

Duration: 3 Hr Max. Marks: 100

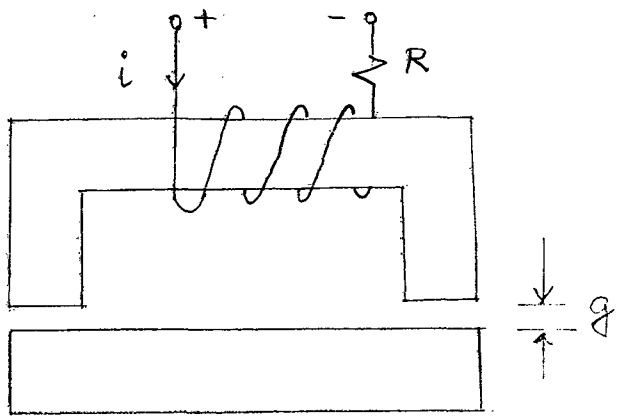
Answer All Questions

PART – A (10 x 2 = 20 Marks)

1. In an electrical machine self inductance of the stator is found to be varying as function of rotor position whereas mutual inductance is absent. Comment on the nature of torque developed.
2. Where does eddy current loss occur in an electrical machine and how can it be reduced?
3. A 1000 VA, 230/115 V single phase transformer has constant loss = 25 W and full load copper loss = 30 W. Compute the efficiency at 50% full load and 0.8 power factor lagging.
4. If a 10 kVA, 11000/440 V, 50 Hz three phase transformer is operated as open delta bank then what would be its available power output at full load?
5. Why armature winding is kept in the rotating part of the d.c. machine?
6. What is the distinction between full pitch and short pitch coils in an electrical machine?
7. Why equalizer connection is required in a d.c. machine?
8. What is called critical field resistance in a d.c shunt generator?
9. A 220 V, 5kW, 26A, 1460 RPM d.c separately excited motor runs at rated load conditions. The armature resistance is 0.5 Ω. Calculate the value of its developed torque?
10. A d.c. shunt motor needs to drive a constant load torque. What happens if the flux is progressively weakened?

PART – B (5 x 16 = 80 Marks)

11 (a). The electromagnet shown in figure can be used to lift a sheet of steel. The coil has 400 turns and a resistance of 5 ohms. The reluctance of the magnetic material is negligible. The magnetic core has a square cross section of 5 cm by 5 cm. Air gap length between the sheet steel and the electromagnet is g = 1 mm and the average force required to lift the steel is 550 newtons. Determine the d.c. source voltage and the energy stored in the magnetic field. [8]



1 (b). Deduce the average torque equation for a reluctance motor. [8]

12 (a) (i). A single phase, 10 kVA, 220/110 V, 60 Hz, transformer is connected to a 220 V supply. It draws rated current at 0.8 power factor leading. The transformer may be considered ideal. Determine the kVA rating of the load and the impedance of the load. [8]

12 (a) (ii). A single phase, 25 kVA, 220/440 V, 60 Hz, transformer gave the following test results. Open circuit test (440 V side open): 220 V, 9.5 A, 650 W;

Short circuit test (220 V side shorted): 37.5 V, 55 A, 950 W . Determine the voltage regulation at full load and 0.8 power factor lagging. Draw the respective phasor diagram also. [8]

[Or]

12 (b) (i). A 100 VA, 120/12 V transformer will be connected to form a step-up autotransformer with the primary voltage of 120 V. What will be the (a) secondary voltage, (b) the maximum power rating and (c) the power rating advantage? [8]

12 (b) (ii). Write short notes on Y / Δ three-phase transformer connection. [8]

13 (a) (i) Draw the air gap MMF of a two pole field winding of a d.c. machine and obtain the fundamental value of this MMF component. If the flux of this MMF saturates how this will affect the average value of induced emf in the armature winding? [8]

13 (a) (ii) A four pole d.c. machine has a wave winding of 300 turns. The flux per pole is 0.025 Wb and the d.c. machine rotates at 1000 rpm. Determine the generated voltage and kW rating of the generator if the rated current through the turn is 25 A. [8]

[Or]

13 (b) (i). Show that two oppositely rotating magnetic fields are produced in the air gap of a single phase motor excited with single phase supply. [8]

13 (b) (ii) A 10 kW, 4 pole, lap connected separately excited d.c. generator is suddenly switched into a 2 pole wave connected generator with load being constant at full load. Comment on the change in the average induced emf and induced torque. Justify your answer. [8]

14 (a). A separately excited d.c. generator has the following magnetization characteristics at 1200 rpm.

I_f (A)	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0	1.2
E_a (V)	5	20	40	60	79	93	102	114	120	125

The machine parameters are r_a = 0.2 Ω, R_{fw} = 100Ω. The field winding is separately excited with 120 V and the field current is adjusted at I_f = 0.8 A. A load resistance R_L = 2 Ω is connected to the terminals. Neglect armature reaction effect.

If the generator is made to run at 1500 rpm and delivers rated current at rated voltage then determine the corresponding field current and external field circuit resistance. [16]

(Or)

14 (b) Write short notes on (i) armature reaction and (ii) commutation in a d.c. motor. [16]

15 (a) (i) A permanent magnet d.c. motor drives a mechanical load requiring a constant torque of 25 Nm. The motor produces 10 Nm with an armature current of 10 A. The resistance of the armature circuit is 0.2 Ω. A 200 V d.c. supply is applied to the armature terminals. Determine the speed of the motor. [8]

15 (a) (ii) Discuss the constant torque and constant power operation of dc shunt motor. [8]

(Or)

15 (b) Why starters are required to start a d.c. motor. Discuss the operation of it with help of a three point starter. Derive the necessary relationship that shows how the starting current varies between a maximum and minimum value. [16]