B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2012

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. A coil of 300 turns wound on a ferro-magnetic material has an inductance of 10 mH. Calculate the flux produced by the current of 5 A.
2. Draw the B-H curve of a permanent magnet and identify the operating point of it.
3. Why the magnetizing circuit branch is connected as a parallel branch in the equivalent circuit of a transformer.
4. What is the source for third harmonic voltage in transformers?
5. Draw the air gap MMF pattern of a concentrated coil excited with d.c. supply.
6. Why armature winding needs to be distributed in a.c. machines?
7. Identify the d.c. compound generator that generates rated voltage under rated load conditions.
8. Two generators are connected parallel across infinite bus bars of voltage 220 V. Under parallel operation machine -1 and machine – 2 possess 230 V and 210 V as internal induced emf's. Comment on the nature of function of these d.c. machines which are connected to bus bars.
9. A 220 V d.c. shunt motor draws 10 A in the armature circuit and runs at 1440 RPM under rated load conditions. What must be the value of external resistance that is to be added in the armature circuit to reduce the speed to 1200 RPM. The armature winding resistance is 1.0 Ω.
10. What is the need for a four point d.c. motor starter?

PART – B (5 x 16 = 80 Marks)

11 (a). A simple relay has an air gap of length 1.0 mm and effective cross-sectional area 1000 mm^2. The magnetizing coil consists of 1000 turns of wire carrying a current of 200 mA. Calculate the energy stored in the air gap. The reluctance of the ferro-magnetic part of the magnetic circuit may be neglected. [8]

11 (b). From the principle of coenergy deduce the expression for developed torque in a singly excited system. [8]

12 (a) (i). Explain the principle of operation of transformers. [8]

12 (a) (ii). A single-phase transformer has a turns ratio of 1000/200. The no-load current is 3A at a power factor of 0.2 lagging, whereas the secondary load current is 280 A at a power factor of 0.6

lagging. Obtain the primary current and power factor using phasor diagram approach. Assume the voltage drop in the windings to be negligible. [8]

[Or]

12 (b) (i). Prove that an autotransformer has higher apparent power rating compared to a two winding transformer. [8]

12 (b) (ii). Write short notes on three-phase transformer connections. [8]

13 (a) Draw the winding diagram in developed form for a simplex lap wound 24 slot, 4 pole d.c. armature with 24 commutator segments. [16]

[Or]

13 (b) (i). An eight pole armature is wound with 480 conductors. The average emf generated per conductor is 2.2 V. The conductors in each parallel path can carry a full load current of 100 A. Calculate the generated emf and output current at full load and output power when the machine is lap connected. Assume that the armature resistance is negligible. [8]

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

14. (a) (i). Explain the principle of operation of the d.c self excited generator and explain at least two different conditions for failure of buildup of voltage. [8]

14 (a) (ii). A separately excited d.c. motor has the following name plate data: 100 HP, 440 V, 2000 rpm. Determine the torque and current at rated load if the efficiency of the motor is 90%. [8]

[Or]

14 (b) (i). Explain the armature reaction in d.c. machines. [8]

14 (b) (ii). A 10 kW, 250 V, 1500 RPM d.c. shunt machine has $R_a = 0.1\ \Omega$. The machine is connected to a 250 V supply, draws rated armature current and runs at 1200 RPM. Determine the generated voltage, electromagnetic power developed and torque developed at full load. [8]

15 (a). Explain the speed control strategies of d.c. shunt motor with regard to constant torque operation and constant power operation. [16]

[Or]

15 (b). Write short notes on (i) Swinburne's test (ii) Electrical braking of d.c machines. [16]