B. Tech Degree IV Semester Examination April 2011

EE 405 ELECTRICAL MECHANICS I

(*2002 Scheme*)

Time : 3 Hours Maximum Marks : 100

(All questions carry ***EQUAL*** marks)

I. (a) Derive the emf equation of a D.C generator.

(b) The armature of 6 a pole DC generator has a wave winding containing 650 conductors. Calculate the generated emf when the flux per pole is 0.055 Wb and the speed is 300 rpm. Also calculate the speed at which the armature must be driven to generate an emf of 550V if the flux per pole is reduced to 0.05 Wb.

OR

II. (a) Explain the different types of compound generators.

(b) A 6 pole, 40 kW, 500V, wave connected DC generator has 480 conductors on its armature. The brushes are shifted by an angle of 9 mechanical degrees to eliminate sparking on the commutator when delivering full load current. Calculate

(i) Demagnetising ampere turns/pole

(ii) Cross magnetising ampere turns/pole

III. (a) Explain the different methods for improving commutation in D.C machines.

(b) A DC shunt generator running at 1000 rpm has the following O.C.C.

Field current	1	2	3	4	5	6	7	8
O.C. Volts	52.5	107.5	155	196.5	231	256.5	275	287.5

Calculate the voltage to which the machine will build up if the speed is 800 rpm and the field circuit resistance is 30 ohms.

OR

IV. (a) Explain the conditions for parallel operation of two D.C shunt generators.

(b) Two shunt generators are operating in parallel. The emf induced in one machine is 260V and that induced in the other machine is 270V. They supply together a load current of 1800A. If each machine has an armature resistance of 0.04 ohm and field resistance 50 ohms. Determine

(i) Thermal voltage

(ii) Output of each machine

V. (a) Derive the Torque equation of a D.C motor.

(b) A 6 pole lap connected 230V shunt motor has 410 armature conductors. It takes 41A on full load. The flux per pole is 0.05Wb. The armature and field resistances are 0.1 Ω and 230 Ω respectively. Contact drop per brush = 1V.
Determine the speed of motor at full load.

OR

VI. (a) Explain the different methods of speed control for D.C. series motors.

(b) A 250 V series motor in which the total armature and field resistance is 0.15 Ω is working with unsaturated field, taking 120A and running at 750 rpm. Calculate at what speed the motor will run when developing half the torque.

(P.T.O)

VII. (a) Derive the emf equation of a single phase transformer.

(b) The primary and secondary winding resistances of a 30KVA, 6600/250V single phase transformer are $8\,\Omega$ and $0.015\,\Omega$ respectively. The equivalent leakage reactance as referred to the primary winding is $30\,\Omega$. Find the full load regulation for load power factors of

(i) unity
(ii) 0.8 lagging
(iii) 0.8 leading

OR

VIII. (a) Derive the condition for maximum efficiency of a transformer.

(b) The efficiency of a 250 KVA, single phase transformer is 96% when delivering full load at 0.8 pf lagging and 97.2% when delivering half full load at unity power factor. Determine the efficiency at 75% of full load at 0.8pf lagging.

IX. (a) Explain the open delta connection in transformers.

(b) A 1000KVA transformer having a percentage impedance of $(1+j4)$ and a 500KVA transformer having percentage impedance of $(2+j6)$ are connected in parallel. The no load secondary voltage of each transformer is 550 V. Find the load shared by each transformer and its power factor if the total load is 750KVA at 0.8 pf lagging.

OR

X. (a) Explain the all day efficiency of a transformer.

(b) Two single phase electric furnaces A and B are supplied at 220V from a 3 phase 1100V supply by means of a Scott connected transformer combination. If the total output is 600KW at 0.6pf lagging, determine the currents in the winding and transformation ratio of each transformer.

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