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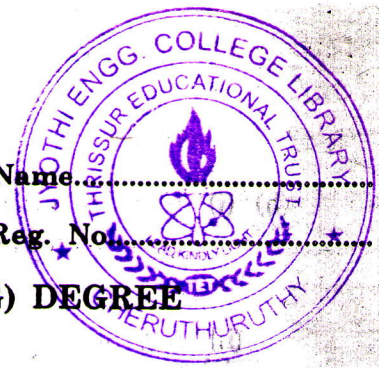
THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2007

AI/PT/EC 2K 306—ELECTRICAL ENGINEERING

Time : Three Hours   Maximum : 100 Marks

Answer all questions.
Graph sheet may be issued on request.

I. (a) A 4-pole dc generator generates 500 V on open circuit at 600 r.p.m. The armature has 144 slots with 2 coil sides per slot. Calculate the flux per pole when armature winding is (i) Lap-connected and (ii) Wave-connected.

(b) Describe the process of self-excitation in a d.c. shunt generator.

(c) Explain the principle of operation of auto-transformer.

(d) A 3000/400 V single-phase transformer takes a no-load current of 1 A at 0.2 p.f. Estimate the current taken by the primary when the secondary supplies a current of 60 A at 0.8 p.f. lagging. Find also t he power factor in the primary circuit.

(e) Explain the term 'pitch factor' and derive an expression for it.

(f) A 4-pole, 3-phase induction motor runs at 1440 r.p.m. on a 50 Hz supply. Find the slip and frequency of rotor emf. Also find the rotor speed if the motor operates with a slip of 6%.

(g) Explain the methods of providing damping torque in indicating instruments.

(h) A balanced 3-phase, star-connected load draws power from a 440 V supply. The two wattmeters connected indicate W_1 = 4.2 kW and W_2 = 0.8 kW. Calculate the power, power factor and current in the circuit.

(8 × 5 = 40 marks)

II. (a) The open circuit characteristic of a d.c. shunt generator driven at 600 r.p.m. is given by :

I_f, A ...	0	2	4	6	8	10	12	14	16
E_0, V ...	4	58	110	150	180	200	218	230	240

   (i) Determine the field circuit resistance setting in order to produce an open circuit voltage of 220 V.

  (ii) What is the critical speed of the generator for this setting of the field resistance ?

 (iii) What is the critical field resistance at the original speed ?

Or

Turn over

(b) (i) How are d.c. motors started ? Draw a neat diagram of the 3-point starter used for d.c. shunt motor and explain.

(8 marks)

(ii) A 4-role d.c. series motor has 944 wave connected armature conductors. At a particular load, the flux per pole is 0.04 Wb and the total torque developed is 260 Nm. Calculate the line current taken by the motor and the speed at which it will run with an applied voltage of 500 V. The total armature and field resistance is 2 Ω.

(7 marks)

III. (a) Draw and explain the phasor diagrams for a single-phase transformer supplying ; (i) lagging p.f. load (ii) leading p.f. load and (iii) unity power factor load.

Or

(b) Draw the circuit diagrams for conducting OC and SC tests on a single-phase transformer and explain. Also explain how the equivalent circuit parameters are determined from this test and draw an approximate equivalent.

(15 marks)

IV. (a) Explain the principle of operation of a 3-phase synchronous motor, with suitable diagrams. Also explain how the synchronous motor is made self-starting.

Or

(b) Draw the exact equivalent circuit for a 3-phase induction motor and explain how its parameters can be obtained from suitable tests.

(15 marks)

V. (a) Draw a neat diagram and explain the working of a moving coil voltmeter. Show the scheme of connection for the meter range is to be extended.

Or

(b) Draw the circuit diagram of a Kelvin double bridge. Explain its principle of operation and derive the equations of balance for this bridge.

(15 marks)

[4 × 15 = 60 marks]