3E1484

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B.Tech. (Sem. III) (Main/Back) Examination, January - 2012
Electrical Engg.
3EE4 Electrical Machines - I

Time : **3** Hours] [Total Marks : **80**
[Min. Passing Marks : **24**

Instructions to Candidates :

*Attempt any **five questions** selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Graph Paper (cm) 2. Nil

UNIT – I

1 (a) Show that in a singly excited system the mechanical work done is equal to the area enclosed by two flux-linkage versus current characteristics in initial and final position and vertical flux-linkage current locus during the slow movement of rotor.

(b) A singly excited system has a linear relationship between flux linkage and current. The inductance varies as $L_1 + L_2 \, Cos 2\theta$. Derive an expression for torque and find its average value for direct current.

8+8

OR

1 (a) Derive equations for dynamically induced emf and statically induced emf. Discuss the factors on which these depend.

(b) A circular coil of 500 turns with a mean diameter of 50 cms is rotated about a vertical axis in the earth's field at 40 revolutions per second. Find the instantaneous value of emf induced in the coil, when its plane is

(i) parallel and

(ii) inclined at 30° degree to the magnetic meridian. Take value of H as 14.3 AT/m..

8+8

UNIT – II

2 (a) Discuss the load characteristics of d.c. compound generators. Explain how the level compounding is obtained.

(b) When running at normal speed a d.c. shunt generator has a magnetising characteristics given by the following figures :

E.M.F.(V)	45	85	140	175	195	210	220	225
Shunt Current (A)	0.25	0.5	1.0	1.5	2.0	2.5	3.0	3.5

On open circuit the shunt regulator is adjusted to give 210 V. Calculate the total resistance in the shunt circuit. If the armature resistance is 0.095 Ω, calculate the terminal p.d. on load when the machine is delivering a current of 250 A.

8+8

OR

2 (a) Explain the term commutation related to d.c. machines. Discuss the methods of improving commutation.

(b) Draw a developed winding diagram of a lap-connected armature having 24 slots and 12 commutator segments and is used for 4-pole d.c. machine. Indicate the position of brushes.

8+8

UNIT – III

3 (a) Establish an expression for the speed of d.c. motors. With the help from a neat connection diagram, explain the method of controlling the speed of d.c. motors below and above the rated speed. Justify the statement that d.c. series motors are never started at no load.

(b) A 250 V d.c. shunt motor runs at 1000 r.p.m. at no load and takes 5A. The total armature and shunt field resistances are 0.2 Ω and 250 Ω respectively. Calculate the speed under loaded condition taking 50 A. The armature reaction weakens the field by 3%.

8+8

OR

3 (a) Why indirect tests are performed on d.c. machines ? Explain clearly with the help from a neat connection diagram and explain the Sainburn's test.

(b) Discuss the mechanical characteristics of d.c. compound motors. Give the applications of each type.

8+8

UNIT – IV

4 (a) Draw the vector/phasor diagram of a transformer, carrying lagging power factor load, assuming the load voltage as the reference phasor.

(b) Calculate the regulation of a transformer in which the ohmic loss is 1% of the output and the reactance drop is 5% of the voltatge, when the load power factor is

(i) 0.8 lagging

(ii) unity and

(c) 0.8 leading.

8+8

OR

4 (a) Establish an expression for saving of copper or conductor material by using an autotransformer in place of two winding transformer. State the assumptions made.

(b) Two similar 250 kVA single phase transformers gave the following results when tested by back-to-back method. Mains watt meter reading 5.0 kW secondary series circuit watt meter reading 7.5 kW at full load current. Calculate the efficiency of individual transformer at 75% full load and 0.8 p.f. leading.

8+8

UNIT – V

5 (a) (i) Explain the phase shift related with the connections of 3 phase transformers. State the method to represent it.

(ii) Why the no load current of a transformer contains harmonic component ?

(b) With the help of connection diagram and phasor diagram, discuss the delta-star connection of 3-phase transformers.

8+8

OR

5 (a) (i) Discuss open delta connection of 3 phase transformers.

(ii) Explain the use of tertiary winding in transformers.

(b) Explain in detail the double star connections for obtaining 6-phase supply from 3-phase supply.

8+8
