G 567 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2014

Fourth Semester

Branch : Electrical and Electronics Engineering

ELECTRICAL MACHINES—I (E)

(Old Scheme—Supplementary/Mercy Chance)

[Prior to 2010 Admissions]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Derive the e.m.f. equation of a D.C. machine.
2. What is back e.m.f. ? Explain its significance ?
3. A d.c. generator fails to build up voltage, when it is run at rated speed. What may be the possible reasons ?
4. What are the conditions for self excitation in a D.C. shunt generator ?
5. Why D.C. series motors are suitable for electric traction, and cranes ?
6. Neatly sketch the speed-load, torque-load and speed-torque characteristics of a d.c. compound motor.
7. Draw the phaser diagram of transformer on no-load.
8. What are the various losses present in a transformer ?
9. Define an autotransformer ? Indicate how does the current flow in different parts of its windings ?
10. Explain the advantages of using a tertiary winding in a bank of star-star transformers.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Define and explain (i) front pitch, (ii) resistant pitch ; and (iii) commutator pitch.

(3 × 2 = 6 marks)

Turn over

(b) A d.c. shunt machine, connected to 250 V mains, has an armature resistance (including brush) of 0.12 Ω, and the resistance of the field circuit is 125 Ω. Find the ratio of the speed as generator to the speed as a motor, the line current in each case being 75 A.

(6 marks)

Or

12. (a) Explain the effect of brush shift. (4 marks)

(b) Find the flux per pole of a 50 kW d.c. generator having 4 poles, and a lap-wound armature with 380 conductors. The machine is run at a speed of 800 r.p.m., and generates 460 V. Resistance of the armature, and shunt field are 0.5 Ω, and 300 Ω respectively. Also find the current flowing in the armature at full-load, and the terminal voltage.

(8 marks)

13. (a) With neat sketches, explain the constructional details, and working principle of a d.c. generator ? List the parts, and materials used in practice. (7 marks)

(b) A 400 V shunt generator has full-load current of 200 A. Its armature resistance is 0.06 Ω, and field resistance losses together are 2 kW. Find its efficiency.

(5 marks)

Or

14. (a) What is the critical field resistance of a d.c. shunt generator ? What is its significance ?

(4 marks)

(b) The field winding of a 4-pole generator consists of 4 coils connected in series, each coil being wound with 1200 turns. If a current of 2A produces a magnetic flux of 400 μWb, calculate : (i) inductance of the field circuit, (ii) the average value of e.m.f. induced, if the field switch is opened at such a speed that the flux falls to the residual value of 20 μWb in 0.01 second.

(8 marks)

15. The Hopkinson test on two shunt machines gave the following results for full-load : Line voltage : 250 V ; line current excluding field currents : 50 A ; motor armature current : 380 A ; field currents : 5 A and 4.2A ; calculate the efficiency of each machine. Armature resistance of each machine is 0.02 Ω.

Or

16. (a) Draw the power flow diagrams of a d.c. generator and a d.c. motor. (6 marks)

(b) When running on no-load, a 400 V shunt motor takes 5A. Armature resistance is 0.5 Ω and field resistance is 200 Ω. Find the output of the motor and efficiency when running on full- load and taking a current of 50 A. Also, find the percentage change is speed from no-load to full-load.

(6 marks)

17. (a) Derive the expressions for the r.m.s. values of the induced voltages in the two-windings of a single-phase transformer connected to a sinusoidal supply.

(4 marks)

(b) A 40 KVA single-phase transformer has iron losses of 800 W and copper loss of 1140 W when supplying its full-load at unity power factor. Calculate the efficiency of the transformer at upf at full-load and half load.

(8 marks)

Or

18. A commercial 400 Hz, 220V/20V transformer has 50 turns on its low-voltage side. Calculate :

(a) the number of turns on its high voltage side.

(b) ratio of transformation, when used as step down transformer.

(c) ratio of transformation, when used as a step-up transformer.

(d) volts/turns ratio of high voltage side.

(e) volts/turns ratio of low voltage side.

19. (a) Explain why it is essential to have one three-phase winding in delta for the transformers used in 3-phase systems.

(4 marks)

(b) A 2-phase 240 V supply is to be obtained from a 3-phase, 3-wire 440 V supply by means of a pair of scott-connected single-phase transformers. Determine the turns ratio of the main and teaser transformers. Find the input current in each of the three-phase lines when each of the 2-phase currents is 10 A lagging behind the respective phase voltage by 36.9°.

(8 marks)

Or

20. A 3300/400/100 star/star/delta transformer taking a magnetising currents of 6A, has respective primary, secondary and tertiary per unit resistances of 0.005, 0.006 and 0.008 and per unit reactances of 0.03, 0.025 and 0.035 with 1000 kVA as base KVA. If the secondary and tertiary windings supply balanced loads of 700 kVA at 0.8 p.f. lagging and 250 KVA at 0.6 p.f. leading, respectively, determine the primary current, power factor, primary load and various regulations at the given loads.

(5 × 12 = 60 marks)