



C09-EE-304

3242

BOARD DIPLOMA EXAMINATION, (C-09)

APRIL/MAY—2015

DEEE—THIRD SEMESTER EXAMINATION

DC MACHINES AND BATTERIES

Time : 3 hours]

[Total Marks : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

1. List different losses that occur in a DC machine. 3
2. Classify the DC generators based on field excitation. 3
3. List the applications of DC series motors. 3
4. State the purpose of equalizer bar in parallel operation of DC generators. 3
5. Draw the following curves : $1\frac{1}{2}+1\frac{1}{2}=3$
 - (a) Torque vs. Current
 - (b) Torque vs. Speed of DC series motor
6. State Fleming's left-hand rule. 3
7. List the speed control methods of DC shunt motor. 3
8. What is the necessity of starter for a DC motor? 3
9. What is trickle charging? 3
10. State the indications of fully charged lead-acid cell. 3

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PART—B

10×5=50

Instructions : (1) Answer *any five* questions.

(2) Each question carries **ten** marks.

- 11.** A short shunt compound DC generator supplies a current of 100 A at a voltage of 220 V. If the resistance of shunt field is 50 ohm, the series field is 0.025 ohm, the armature is 0.05 ohm, total brush drop is 2 V and iron and friction losses amount to 1 kW, find (a) the generated e.m.f., (b) the copper losses and (c) the generator efficiency. 3+3+4
- 12.** (a) A 4-pole DC generator having a wave wound armature conductors has 51 slots with each slot containing 20 conductors. Find the e.m.f. generated when the machine is driven at 1500 r.p.m. assuming flux per pole to be 7 mwb. 5
- (b) Write the chemical reactions during charging and discharging of lead-acid cell. 5
- 13.** Explain the internal and external characteristics of a separately excited DC generator. 10
- 14.** A 250-V, 25-kW, 4-pole DC generator has 328 wave connected armature conductors when the machine is delivering full load, the brushes are given a lead of 7.2 electrical degrees. Calculate (a) the demagnetizing AT/pole and (b) cross-magnetizing AT/pole. 5+5
- 15.** A 4-pole 220-V shunt motor has 540 lap wound conductors. It takes 32 A from the supply mains and develops output power of 5.595 kW. The field winding takes 1 A. The armature resistance is 0.9 and flux per pole is 30 mwb. Calculate (a) the speed and (b) the torque developed in N-m. 10

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- 16.** (a) Explain the field control and armature control methods of DC shunt motor. 4
- (b) A 500-V shunt motor runs at its normal speed of 250 r.p.m. when the armature current is 200 A. The resistance of armature is 0.12 ohm. Calculate the speed when a resistance is inserted in the field reducing the shunt field flux to 80% of normal value and the armature current is 100 A. 6
- 17.** Explain how the efficiency of a DC machine is determined using the Swinburne's test with a neat circuit diagram and necessary equations. What are the merits and demerits of the test? 10
- 18.** (a) Define ampere-hour and watt-hour efficiencies. 4
- (b) An alkaline cell is discharged at a steady-state current of 5 A for 10 hours, the average terminal voltage being 1.2 V. To restore it to its original state of charge, a steady-state current of 4 A for 15 hours is required. The average terminal voltage being 1.44 V. Calculate the ampere-hour efficiency and watt-hour efficiency. 6
