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GOVT. ENGINEERING COLLEGE

WAZIRPUR, DELHI-110028

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**B.Tech. 3<sup>rd</sup> Semester End-Term Examination**

**ELECTRICAL TECHNOLOGY**

**(New Regulations & New Syllabus)**

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* question from questions to 2 to 7.

1. Answer *all* questions : (10 × 1 = 10)

- (i) The direction of a D.C motor can be reversed
- (a) By reversing the connections of the armature and field windings with supply
  - (b) By reversing the connections of either the armature or field windings with the supply
  - (c) By reducing the field flux.
  - (d) By introducing an extra resistance in the armature circuit
- (ii) A DC generator may lose residual magnetism due to
- (a) Heating
  - (b) Vibrations
  - (c) Over excitation
  - (d) Any of the above
- (iii) Field coils of D. C. machine are usually made of
- (a) Mica
  - (b) Copper
  - (c) Carbon
  - (d) Cast iron

[Turn over

- (iv) During the open circuit test of a transformer
- (a) The H.V. side is supplied rated current
  - (b) L.V. side is supplied with no-load current
  - (c) L.V. side is supplied with rated current
  - (d) L.V. side is supplied rated voltage
- (v) A transformer has a primary coil with 1600 turns and a secondary coil with 1200 turns. If the current in the primary coil is 6 Ampere, then what is the current in the secondary coil of a transformer?
- (a) 78 Ampere
  - (b) 98 Ampere
  - (c) 68 Ampere
  - (d) 58 Ampere
- (vi) It is advisable to avoid line starting of the induction motor and use a starter because, otherwise
- (a) It will run in a reverse direction
  - (b) It will pick up very high speed and may go out of step
  - (c) Motor takes five to seven times its full load current
  - (d) Starting torque is very high
- (vii) What will happen if the relative speed between the rotating flux of the stator and rotor of the induction motor is zero?
- (a) The slip of the motor will be 5%
  - (b) The rotor will not run
  - (c) The rotor will run at a very high speed
  - (d) The torque produced will be very large
- (viii) The V-curves of a synchronous motor show the relationship between
- (a) Applied voltage and back emf
  - (b) Back emf and armature current
  - (c) Armature current and rotor field current
  - (d) Back emf and power factor
- (ix) A 4 pole, 1200 R.P.M. alternator will generate E.M.F at
- (a) 50Hz
  - (b) 40 Hz
  - (c) 60 Hz
  - (d) 25 Hz

- (x) The one "unit" of energy measured in an AC circuit is equivalent to
- (a) One watt-hour (b) One kilowatt-hour  
(c) One watt (d) One kilowatt  
(e) One joule
2. (a) What are the main parts of a d.c. machine? State the function of each part and the materials used for each part. (7)
- (b) Explain the terms critical resistance and critical speed as applied to a dc generator. (3)
- (c) A long shunt compound generator has an armature winding resistance of  $0.05 \Omega$ . The series field winding resistance of  $0.03 \Omega$  and the shunt field winding of  $75 \Omega$ . The generator supplies a load of 20 kW at 300 V. Calculate induced emf in the generator if the voltage drop per brush is 1 v. (5)
3. (a) Draw and explain the torque-speed characteristics for the different types of d.c. motors. (6)
- (b) What are the conditions for self-excitation in a D.C shunt generator? (4)
- (c) A d.c. series motor with series field and armature resistance of 0.06 ohm and 0.04 ohm respectively is connected across 220 V mains. The armature takes 40 A, and its speed is 900 rpm. Determine its speed when the armature takes 75A and excitation is increased by 15% due to saturation. (5)
4. (a) A 600/230 V, 50 Hz, single phase transformer on test gave the following results as referred to high voltage side. (7)

O.C. test : 600 v 1A 120 W

S.C. test : 12 v 10 A 90 W

Draw the equivalent circuit of a transformer showing different parameters in it showing their value.

- (b) Discuss the various losses present in a transformer. (4)
- (c) Draw and explain the complete phasor diagram for the transformer on inductive load. (4)

5. (a) Why are 1-phase induction motors not self-starting? How it can be made self-starting? (3 + 1 = 4)
- (b) Define the slip of a three-phase induction motor. Why does a 3-phase induction motor always run at a speed less than the synchronous speed? (5)
- (c) A 12-pole, 3-phase, 600-V, 50-Hz, star-connected, induction motor has rotor resistance and stand-still reactance of 0.03 and 0.5 ohms per phase respectively.
- Calculate :
- (i) Synchronous speed
- (ii) Slip and speed at maximum torque
- (iii) The ratio of full-load torque to maximum torque, if the full-load speed is 495 rpm. (6)
6. (a) Calculate the speed and open circuit line and phase voltage of a 4-pole, 3-phase, 50 Hz star-connected alternator with 36 slots and 30 conductors per slot. The flux per pole is 0.05 Wb sinusoidally distributed. (6)
- (b) What are the types of alternators? Explain the term synchronous impedance? (4)
- (c) Explain the working principle of a synchronous motor. (5)
7. Write short notes on the following : (5 + 5 + 5 = 15)
- (a) Open circuit and short circuit test of a transformer
- (b) Universal motor
- (c) Dynamometer – type wattmeter.