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EE 181302

Roll No. of candidate

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22/2/22 2021

B.Tech. 3rd Semester End-Term Examination

ME, IPE

ELECTRICAL TECHNOLOGY

(New Regulation & New Syllabus)

Full Marks – 70

Time – Three hours

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

SECTION – A

1. Answer all:

(10 × 1 = 10)

- (i) Which of the following rule is used to determine the direction of rotation of the D.C motor?
- (a) Columb's Law (b) Lenz's Law
(c) Fleming's Right-hand Rule (d) Fleming's Left-hand Rule
- (ii) A DC generator may lose a residual magnetism due to
- (a) Heating (b) Vibrations
(c) Over excitation (d) Any of the above
- (iii) Because of its high starting torque, a series motor is used for
- (a) Machine tools (b) Centrifugal pumps
(c) Electric trains (d) Large presses
- (iv) The open-circuit test in a transformer is used to measure
- (a) Copper loss (b) Winding loss
(c) Total loss (d) Core loss
- (v) A 200/400 V single-phase transformer draws a primary current of 25A at 0.8 p.f lag. The secondary KVA developed by it is
- (a) 5 kVA (b) 4 kVA
(c) 10 kVA (d) 8 kVA
- (vi) The frame of an induction motor is usually made of
- (a) Silicon steel (b) Cast iron
(c) Aluminum (d) Bronze

[Turn over

- (vii) The frequency of rotor current in a 6-pole, 50 Hz, 3-phase induction motor running at 950rpm is _____ Hz
- (a) 2.5 (b) 1.5
(c) 5.0 (d) 0.05
- (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) In a dynamometer wattmeter, the fixed coil is
- (a) current coil (b) voltage coil
(c) current or voltage coil (d) none of the above

SECTION – B

[Answer any five]

(5 × 2 = 10)

2. (a) What is the magnetization curve in reference to a DC shunt generator?
- (b) What is a starter? What is the function of no-volt release in a three-point starter?
- (c) What is the all-day efficiency of a transformer?
- (d) Can the direction of the revolving magnetic field in an induction motor be reversed? Explain how?
- (e) Why is synchronous motor speed not self-starting?
- (f) Why is an ac generator commonly called a synchronous generator?

SECTION – C

[Answer any five]

(5 × 10 = 50)

3. (a) What is meant by the excitation of a dc generator? Differentiate between the separately excited and self-excited dc generators. (1+4=5)
- (b) A series generator supplies a current of 5A to a resistive load at 220v. The armature resistance is 2.5 Ω and the series field resistance is 2.0 Ω. Calculate the induced emf and copper loss in both windings and generators.

(5)

4. (a) Explain the construction of a dc motor. (5)
- (b) The resistance of the armature of a 250-V shunt motor is 0.3Ω and its full-load speed is 1000 r.p.m. Calculate the resistance to be inserted in series with the armature to reduce the speed with full-load torque to 800 r.p.m., the full-load armature current being 5A. If the load torque is then halved, at what speed will the motor run? (5)
5. (a) An 11,000/230-V, 150-kVA, 50-Hz, a 1-phase transformer has a core loss of 1.4 kW and full-load Cu loss of 1.6 kW. Determine
- (i) the kVA load for maximum efficiency and the minimum efficiency.
- (ii) the efficiency at half full-load at 0.8 power factor lagging. (4)
- (b) Voltage regulation of a transformer varies with power factor. Validate this statement. At what power factor will the regulation be (i) maximum and (ii) zero? Derive the conditions. (6)
6. (a) Explain the construction of squirrel cage and phase wound induction motors. Give two industrial uses of 3 phase induction motor. (4+1=5)
- (b) 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 ohm per phase respectively. Calculate: (5)
- (i) Synchronous speed
- (ii) Slip and Speed of maximum torque
- (iii) The ratio of full-load torque to maximum torque, if the full-load speed is 495 rpm.
7. (a) A 3-phase, 16-pole alternator has the following data
- Number of slots: 192
- Conductor/slot: 8
- Coil span: 160° electrical
- Speed of the alternator: 375 rpm
- Flux/pole: 55 mwb
- Calculate the phase and line voltage. (5)
- (b) What is a universal motor? Why it is called so? Describe the construction and operation of a universal motor. (5)

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8. (a) With a neat sketch explain the principle of working of a single-phase induction type energy meter. (5)
- (b) Draw and explain slip torque characteristics of 3 phase I.M. (5)
9. Write short notes on the following (5+5 =10)
- (a) Autotransformer
- (b) Pitch factor and distribution factor as referred to as an alternator.

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