Total No. of printed pages = 6

EE 131405

Roll No. of candidate | | | | | | | | | | |

2017

B. Tech 4th Semester End-Term Examination

ELECTROTECHNOLOGY

Full Marks–100 Pass Marks–35 Time–Three hours

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

GROUP – A

1. Answer any *ten* questions : 3×10=30

(a) What is 'critical resistance' as referred to DC shunt generators ? Explain.

(b) What are the necessary conditions for voltage build-up in a DC shunt generator ?

(c) A 6-pole lap wound DC generator has 600 conductors on its armature. The flux per pole is 0.02 Wb. Calculate the speed at which the generator must be run to generate 300V.

(d) A DC series motor should never be started without some load on it. Why ?

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(e) What is the necessity of a starter for a DC motor ?

(f) Differentiate between lap and wave windings.

(g) Calculate the distribution factor for a 36-slot, 4-pole, single layer, 3-phase winding of an alternator.

(h) Explain the terms as referred to alternator :
  (i) Pitch factor
  (ii) Distribution factor.

(i) What are the conditions that need to be satisfied for paralleling two alternators ?

(j) A 6-pole, 3-phase, 50 Hz induction motor is running at 940 rpm, calculate the slip and the frequency of rotor currents.

(k) Why does rotor rotate in the same direction as the rotating magnetic field in a 3-phase induction motor ?

(l) Draw the equivalent circuit of a polyphase induction motor.

(m) What are V-curves ?

(n) What is the use of damper windings in synchronous motors ?

GROUP – B

2. Answer any *eight* questions : 5×8=40

(a) Derive the condition for maximum efficiency in a DC generator.

(b) Discuss about the various losses present in a DC machine.

(c) What are the different methods of decreasing the effects of armature reaction in a DC machine ?

(d) Develop an expression for induced emf for an alternator.

(e) Draw and explain the slip-torque characteristics of a 3-phase induction motor.

(f) What are the different methods of starting a squirrel-cage induction motor ?

(g) A single-phase induction motor is not self-starting. Why ?

(h) Discuss about the various applications of synchronous motors.

(i) A 50 Hz, 8-pole induction motor has full-load slip of 4%. The rotor resistance/phase is 0.01Ω and standstill reactance/phase of 0.1Ω. Find the ratio of maximum to full load torque and the speed at which the maximum torque occurs.

(j) An 4-pole wave-wound DC motor armature has 880 conductors and delivers 120A. The brushes have been displaced through 3 angular degrees from the geometrical axis. Calculate :

(i) Demagnetising amp-turns/pole

(ii) Cross-Magnetising amp-turns/pole.

GROUP – C

3. Answer any *three* questions : 10×3=30

(a) A 25kW, 250V DC shunt generator has armature and field resistances of 0.06Ω and 100Ω respectively. Determine the total armature power developed when working as a :

(i) generator delivering 25kW output and

(ii) motor taking 25kW as input.

(b) A 500V DC shunt motor takes a current of 5A on no-load. The resistances of the armature and field circuit are 0.22Ω and 250Ω respectively. Find the efficiency when loaded and taking a current of 100A.

(c) The Hopkinson's test on two similar shunt machines gave the following full-load data : Line voltage = 110V, Line current = 48A, Motor armature current = 230A. Field currents are 3A and 3.5A; armature resistance of each machine is 0.035Ω. Calculate the efficiency of each machine assuming a brush contact drop of 1 volt per brush.

(d) The power input to a 500V, 50 Hz, 6-pole, 3-phase induction motor running at 975 rpm is 40kW. The stator losses are 1kW and the friction and windage losses total 2kW. Calculate :

(i) the slip,

(ii) the rotor copper loss,

(iii) shaft power and

(iv) the efficiency.

(e) From the following test results, determine the voltage regulation of a 2000V, 1-phase alternator delivering a current of 100A at :

(i) unity power factor

(ii) 0.71 lagging power factor.

Test results : Full-load current of 100A is produced on short-circuit by a field excitation of 12.5A. An emf of 1100V is produced on open-circuit by the same excitation. The armature resistance is 0.8Ω.

(f) Write short notes on any *two* of the following :

(i) Commutation process

(ii) Testing of DC machines

(iii) AC Servo motors

(iv) Stepper motors.