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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination; June/July - 2015

Electrical Machines - II

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.*
ii) Assume suitable missing data if any.

UNIT - I

1. a. With a neat diagram, Classify different types of DC Generator. 5

   b. Describe different methods to improve commutation in DC Generator. 8

   c. A short shunt compound DC generator delivers 100 A to a load at 250 V. The generator has shunt field, series field and armature resistance of 130 Ω, 0.1 Ω and 0.1 Ω respectively. Calculate the voltage generated in armature winding. Assume 1V drop per brush. 7

2. a. From the fundamental, derive the expressions for Torque developed by the DC motors. 6

   b. Draw and explain characteristics of a DC series motor. 8

   c. A 4 pole, 250 V, wave-connected shunt motor gives 10 kW when running at 1000 rpm and drawing armature and field current of 60 A and 1 A respectively. It has 560 conductors. Its armature resistance is 0.2 Ω. Assuming drop of 1V per brush, determine; (i) Total torque (ii) useful Torque (iii) useful flux per pole (iv) rotational losses (v) Efficiency 6

UNIT – II

3. a. Explain how efficiency of a series motor can be computed by conducting field test. 7

   b. Describe Hopkinson's test on two similar DC shunt machines to find the efficiency. 8

   c. Summarize the advantages and disadvantages of Swinburne's test. 5

4. a. Summarize the advantages and disadvantages of retardation test. 5

   b. The Hopkinson's test on two shunt machine gave following results for full load:
   Line Voltage 250 V; Line current excluding field current 50 A; Motor Armature current, 380 A; field current, 5 A and 4.2 A. Calculate the efficiency of each machine. Armature resistance of each machine is 0.02 Ω. 10

   c. List the merits and demerits of Hopkinson's Test. 5

UNIT - III

5. a. With neat sketches, explain the constructional features of smooth cylindrical rotor and salient pole alternators. 8

   b. Derive the expression for emf equation of an alternator. 6

Contd…2

c. A 3-phase, 16 pole synchronous generator has a resultant air-gap flux of 0.06 wb per pole. The flux is distributed sinusoidally over the pole. The stator has 2 slots per pole per phase and 4 conductors per slot are accommodated in two layers. The coil span is 150º electrical. Calculate the phase and line induced voltages when the machine runs at 375 rpm. 6

6. a. Summarize the advantages of connecting alternators in parallel. 4

b. A 6600 V, 1200 kVA, 3-phase alternator is delivering full-load at 0.8 power factor lagging. Its reactance is 25% and resistance negligible. By changing the excitation, the emf is increased by 30% at this load. Calculate the new values of current and power factor. The machine is connected to infinite busbars. 10

c. Define; (i) pitch factor and (ii) Distribution factor. Derive an expression for distribution factor. 6

UNIT - IV

7. a. Explain Blondel's two reaction theory of a salient pole alternator with necessary phasor diagram to find the voltage regulation. 10

b. A 3-phase star connected 1000 kVA, 2000 V, 50 Hz alternator gave the following open-circuit and short circuit test readings.

Field current	10	20	25	30	40	50
O.C. Voltage	800	1500	1760	2000	2350	2600
S.C. Current	-	200	250	300	-	-

10

The armature effective resistance per phase is 0.2 Ω. Determine the full load percentage regulation at 0.8 pf lagging.

8. a. Explain the slip test on salient pole synchronous machines with a neat circuit diagram and indicate how X_d and X_q can be determined from the test. 10

b. Derive an expression for active power and reactive power developed in synchronous generator as a function of rotor angle 'δ'. 10

UNIT - V

9. a. Explain the principle of operation of synchronous motor. 6

b. Describe V and inverted V curves for different loading condition of synchronous motor. 8

c. A 3000 V, 3-phase synchronous motor running at 1500 rpm, has its excitation kept constant corresponding to no-load terminal voltage of 3000 V. Determine the power input, power factor and torque developed for an armature current of 250 A if the synchronous reactance is 5 Ω per phase and armature resistance is neglected. 6

10 a. Describe the constructional features and principle operation of hysteresis Motors. 10

b. Write short notes on: 10

(i) Reluctance Motor (ii) Servomotor.

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