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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 - 2016

Electric 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. Explain armature reaction of DC generator and list the effects of armature reaction. 8

c. A 460 V series motor runs at 500 rpm, taking a current of 40 A. Calculate the speed and percentage change in torque if the load is reduced so that motor is taking 30 A. Total Resistance of the armature and field circuits is 0.8 Ω. Assume flux and field current to be proportional. 7

2 a. From the fundamental, derive the expression for Torque developed by the DC motor. 7

b. Why starter is required to start a DC motor and with a neat diagram explain 3-point shorter. 6

c. A short-shunt compound generator supplies a current of 100 A at a voltage of 220 V. The resistance of shunt field, series field and armature are 50 Ω, 0.025 Ω and 0.05 Ω respectively. The total brush drop is 2 V and total iron and friction losses are 1000 W. Determine; 7

(i) Generated voltage (ii) The copper loss

(iii) Output of the prime mover driving the generator (iv) Generator efficiency.

UNIT - II

3 a. What are the losses that occur in DC machines? Derive the conditions for maximum efficiency of a DC generator. 7

b. Describe Swinburne's test with the help of a neat diagram to find out the efficiency of a DC machine. 8

c. Summarize the advantages and limitations of Hopkinson's test. 5

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

b. Draw the power flow diagram of DC generator and DC motor indicating losses. 5

c. The Hopkinson test on two shunt machines gave the following results for full load :

Line voltage -250 V; Line current excluding field current -50 A;

Motor armature current-380 A ; Field currents-5 A and 4.2 A

Calculate the efficiency of each machine. Assume resistance of each machine is 0.02 Ω. 10

UNIT - III

5 a. List the advantages of rotating magnetic field. 4

b. With neat sketches, explain the constructional features of smooth cylindrical rotor and salient pole alternator. 8

Contd……2

c. Two identical, three-phase alternators, operating in parallel share equally a load of 1000 kW at 6600 V and 0.8 lag power factor. The field excitation of first machine is adjusted so that armature current is 50 A at logging power factor. Determine; 8

(i) The armature current of the second alternator and

(ii) The power factor at which each machine operates.

6 a. Summarize the advantages of connecting alternators in parallel. 5

b. What is the meaning of synchronizing of alternators? Describe any one method of synchronizing. 7

c. A 3-phase, 50 Hz, 2-pole, star-connected turbo alternator has 54 slots with 4 conductors per slot. The pitch of the coils is 2 slots. Less than the pole pitch. If the machine gives 3300 V between lines on open circuit with sinusoidal flux distribution, determine the useful flux per pole. 8

UNIT - IV

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

b. In a 50 kVA, star connected, 440 A, 3-phase, 50 Hz alternator, the effective armature resistance is 0.25 Ω per phase. The synchronous reactance is 3.2 Ω per phase and leakage reactance is 0.5 Ω per phase. Determine at rated load and unity power factor : 10

(i) Internal emf (ii) No-load emf (iii) Percentage voltage regulation at full load

(iv) Value of the synchronous reactance which replaces armature reaction.

8 a. A 3-phase star connected 1000 kVA, 2000 V, 50 Hz alternator five 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	-	-

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The armature effective resistance per phase is 0.2 Ω. Determine the full load percentage regulation at 0.8 pf logging and 0.6 pf leading.

b. Explain 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. 8

UNIT - V

9 a. Explain the principle of operation of synchronous motor. 4

b. Describe V and inverted V curves for different loading condition of synchronous motor. 6

c. Write short notes on : (i) Stepper motor (ii) Brushless motor. 10

10 a. A 2000 V, 3-phase star connected synchronous motor has an effective resistance and synchronous reactance of 0.2 Ω and 2.2 Ω per phase respectively. The input is 800 kW at normal voltage and the induced line emf is 2500 V. Calculate the line current and power factor. 10

b. Describe the constructional features and principle operation of permanent magnet motor. 10

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