CBCS Scheme

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15EE33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Transformers and Generators

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain operation of a practical transformer on load. Also draw the phasor diagram. **(06 Marks)**

b. Show that open delta connection has a kVA rating of 58% of the rating of the normal delta-delta connection. Also list the limitations of open-delta connection. **(06 Marks)**

c. A 20 kVA single phase transformer has voltage rating of 1100/110 V. During short circuit test it gives the following readings: 60V, 18 A, 560 W, LV side shorted. Find the power factor at which the regulation is (i) maximum, (ii) zero. **(04 Marks)**

OR

2 a. Define regulation of a transformer and obtain regulation of transformer by OC and SC tests. **(06 Marks)**

b. With the help of phasor diagram, explain how 2 phase supply can be obtained from 3 phase supply using Scott connection. **(06 Marks)**

c. A three phase step down transformer with per phase turns ratio 47.6:1 connected in delta/star and is supplying a load of 400 KW, 0.8 power factor lagging at 400 V. Sketch the connection diagram and show in it, the line voltages, phase currents and line currents. **(04 Marks)**

Module-2

3 a. List the conditions to be satisfied for satisfactory parallel operation of both single phase and three phase transformers. **(05 Marks)**

b. A 10 KVA 230/110 V transformer is to be used as a step up transformer to step up 230 V to 340 volts what will be the output rating of the autotransformer. **(04 Marks)**

c. What is the necessity of tertiary winding and explain its operation in star/star transformers. **(07 Marks)**

OR

4 a. Derive an expression for copper saving in autotransformer. **(05 Marks)**

b. Two transformers each of 80 kVA are connected in parallel. One has a resistance and reactance of 1% and 4% respectively and the other has resistance and reactance of 1.5% and 6% respectively. Calculate the load shared by each transformer and the corresponding power factor when the total load shared is 100 kVA at 0.8 power factor lagging. **(06 Marks)**

c. How do you obtain the equivalent circuit of a three winding transformer? Explain. **(05 Marks)**

Module-3

5 a. Explain in rush current phenomenon in transformers. **(05 Marks)**

b. A four pole lap wound armature running at 1400 rpm delivers a current of 100 A and has 64 commutator segments. The brush width is equal to 1.4 segments and inductance of each coil is 0.05 mH. Calculate the value of reactance voltage assuming (i) linear commutation, (ii) sinusoidal commutation. **(05 Marks)**

c. Explain any one method used to reduce the armature reaction effects in a dc machine. **(06 Marks)**

OR

6 a. What are the causes and effects of harmonics in a transformer? Explain. **(05 Marks)**

b. An 8 pole wave connected dc generator has 480 armature conductors. The armature current is 200 A. Find the armature reaction demagnetizing and cross magnetizing ampere turns per pole if the brushes are shifted 6° electric from geometric neutral axis. Also calculate compensating turns per pole if the pole arc to pole pitch ratio is 0.75. **(05 Marks)**

c. Derive an expressions for distribution factor K_d and pitch factor K_p. **(06 Marks)**

Module-4

7 a. Explain slip tests on salient pole synchronous machine. **(05 Marks)**

b. Discuss the effect of change of excitation at constant load. **(05 Marks)**

c. Two identical 2000 kVA alternators operate in parallel. The governor of the prime mover of the first machine is such that the frequency drops uniformly from 50 Hz on no load to 48 Hz on full load. The corresponding uniform speed drop of the second machine is 50 Hz to 47.5 Hz. Find how will the two machines share a load of 3000 KW. **(06 Marks)**

OR

8 a. Derive an expression for synchronizing power. **(05 Marks)**

b. A 3 phase star connected synchronous generator supplies current of 10 A having phase angle of 20° lagging at 400 V. Find the load angle and components of armature current I_d and I_q, if $X_d = 10\ \Omega$ and $X_q = 6.5\ \Omega$. Assume armature resistance to be negligible. **(06 Marks)**

c. Derive an expression for the output power of cylindrical rotor altenator connected to infinite bus. Neglect armature resistance. **(05 Marks)**

Module-5

9 a. Differentiate between synchronous reactance, adjusted synchronous reactance and potier reactance. **(06 Marks)**

b. A 2300 V, 50 Hz, 3 phase star connected alternator has an effective armature resistance of 0.2 ohm. A field current of 35 A produces a current of 150 A on short circuit and an open circuit emf 780 V (line value). Calculate the voltage regulation at 0.8 pf lagging. The full load current is 25 A. **(06 Marks)**

c. Describe Hunting in alternator. **(04 Marks)**

OR

10 a. A 3.5 MVA, star connected altenator rated at 4160 volts at 50 Hz has open circuit characteristics as given by the following data:

I_f Amp	50	100	150	200	250	300	350
V_{oc} Volts	1620	3150	4160	4750	5130	5370	5550

A field current of 200 A is found necessary to circulate full load current on short circuit. Calculate by Ampere turn method full load voltage regulation at 0.8 pf lagging. **(08 Marks)**

b. Define short circuit ratio. What is the relation between short circuit ratio and synchronous reactance? **(04 Marks)**

c. List the advantages and disadvantages of synchronous impedance method of computing the regulation. **(04 Marks)**

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