

# CBCS SCHEME



18EE33

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020

## Transformers and Generators

Max. Marks: 100

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

### Module-1

- 1 a. Develop an exact equivalent circuit diagrams of a single phase transformer referred to both primary and secondary sides indicating all the parameters. (08 Marks)
- b. A 5 KVA, 500/250V, 50Hz, 1  $\phi$  transformer gave the following readings :  
O.C. Test : 500V, 1A, 50W (HV side)  
S.C. Test : 25V, 10A, 60W (LV side shorted)  
Determine : i) Circuit constants ii) The efficiency on full load, 0.8 lagging p.f  
iii) The voltage regulation on full load, 0.8 leading p.f  
iv) Draw the equivalent circuit. (08 Marks)
- c. Mention the advantages of single 3  $\phi$  transformers over bank of single phase transformers. (04 Marks)

OR

- 2 a. Explain with the help of connection and phasor diagrams, how Scott connections are used to obtain two phase supply from three – phase supply mains. (08 Marks)
- b. A 3 phase, 1000 KVA, 6600/1100V, transformer is delta connected on the primary and star connected on the secondary, the primary resistance per phase is  $1.8\Omega$  and secondary resistance per phase is  $0.025\Omega$ . Determine the efficiency when the secondary is supplying full load at 0.8 p.f. and the iron loss is 15KW. Also determine the efficiency on full load unity p.f. (08 Marks)
- c. Write a note on voltage regulation and its significance of a single phase transformer. (04 Marks)

### Module-2

- 3 a. Analyze the performance of transformers by conducting Sumpner's test with relevant circuit diagram. (07 Marks)
- b. Derive an expression for the currents and load shared by two transformers connected in parallel supplying a common load, when no load voltages are unequal. (07 Marks)
- c. Two single phase transformers A and B are connected in parallel. They have same KVA ratings but their resistances are respectively 0.05 and 0.1 per unit and their leakage reactance 0.05 and 0.04 per unit. If A is operated on full load at a p.f. of 0.8 lagging, what will be the load and p.f. of B. (06 Marks)

OR

- 4 a. What is an Auto Transformer? Derive an expression for saving of copper in auto transformer compared to two windings transformer also write its applications. (10 Marks)
- b. With the help of neat sketches, explain the working ON load tap changer and OFF load tap changer. (10 Marks)

### Module-3

- 5 a. Draw and explain the equivalent circuit of tertiary transformer. (06 Marks)

- b. Discuss the armature reaction in D.C. machines and derive the equations for  $AT_d/\text{pole}$  and  $AT_f/\text{pole}$ . (08 Marks)
- c. A 6 pole, 148 A, dc shunt generator has 480 conductors and is wave wound. Its field current is 2 A. Find the demagnetising and cross magnetising amper – turns / pole at full load if
- The brushes are at the GNA.
  - The brushes are shifted from GNA by  $5^\circ$  electrical.
  - The brushes are shifted from GNA by  $5^\circ$  mechanical. (06 Marks)

OR

- 6 a. Explain in detail cooling of transformers. (06 Marks)
- b. Derive EMF equation of synchronous generator and give the expression for pitch factor and distribution factor. (08 Marks)
- c. A,  $3\phi$ , 8 pole, star connected alternator has the armature coils short chorded by one slot. The coil span is  $165^\circ$  electrical. The alternator is driven at the speed of 750 rpm. If there are 12 conductors per slot and flux per pole is 50 mwb. Calculate the value of induced phase and line voltages. (06 Marks)

Module-4

- 7 a. Explain the short circuit ratio and its significance of an alternator. (08 Marks)
- b. Enumerate the various methods available for determining the voltage regulation. Explain in details EMF and MMF methods. (12 Marks)

OR

- 8 a. Explain Zpf method of predetermination of voltage regulation of alternator. Mention the advantages of this method. (08 Marks)
- b. The open circuit and short circuit test results for  $3\phi$ , star connected, 1000 KVA, 1905V, 50Hz alternators are

$I_f$ in Amps	10	20	25	30	40	50
$V_{oc}$ line volts	760	1500	1700	1905	2300	2600
$I_{sc}$ in Amps	-	220	-	335	-	-

The armature reactance per phase is  $0.2\Omega$ . Draw the O.C and S.C characteristics and find the voltage regulation on full load 0.8 lagging p.f. by

- Amper \_turn method
- Synchronous impedance method. (12 Marks)

Module-5

- 9 a. With a neat circuit diagram, explain the slip test on salient pole synchronous machine to determine  $X_d$  and  $X_q$  from the slip – test. (10 Marks)
- b. The single phase alternators operating in parallel have induced emfs on open circuit of  $230\angle 0^\circ$  and  $230\angle 10^\circ$  volts and respective reactances of  $j2\Omega$  and  $j3\Omega$ . Calculate
- Terminal voltage
  - Current
  - Power delivered by each of the alternators to a load of impedance  $6\Omega$  (reactive). (10 Marks)

OR

- 10 a. Discuss the concept of two – reaction theory in a salient pole synchronous machine with the help of phasor diagram. (08 Marks)
- b. Write a note on capability curves of synchronous generator. (06 Marks)
- c. Discuss about hunting in synchronous machines. Also explain the role of damper windings. (06 Marks)

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