



# CBCS SCHEME

18EE33

Third Semester B.E. Degree Examination, Jan./Feb. 2023

## Transformers and Generators

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Draw and explain the full load phasor diagrams of single phase transformer for lagging, leading and unity power factor loads. (08 Marks)
- b. Develop an exact equivalent circuit diagrams of a single phase transformer referred to primary side indicating all the parameters. (06 Marks)
- c. A 4 KVA, 200/400V, single phase transformer has the following OC/SC test results.  
O.C Test : 200V, 0.7A, 65W  
S.C Test : 15V, 10A, 75W  
Determine : i) Full load efficiency at UPF  
ii) Voltage regulation at 0.8 pf lagging. (06 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. With the help of a neat circuit diagram and phasor diagram, explain the operation of a 3-phase delta-star transformer. (06 Marks)
- c. A balanced 3-phase load of 150 KW at 1000V, 0.866 lagging power factor is supplied from 2000V, 3-phase mains through single phase transformers connected in delta-delta and V-V connection. Find the current in the windings of each transformer. (06 Marks)

### Module-2

- 3 a. Derive an expression for the currents and load shared by two transformers connected in parallel supplying a common load, when no load voltages are equal. Also draw the phasor diagram. (08 Marks)
- b. Analyze the performance of transformers by conducting Sumpner's test with relevant circuit diagram. (08 Marks)
- c. Two single phase transformers rated at 250KVA each are operated in parallel on both sides. Impedances of transformers are  $(1 + j6)\Omega$  and  $(1.2 + j4.8)\Omega$  respectively. Find the load shared by each when the total load is 500KVA at 0.8 pf lagging. (04 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. What is Communication? With a neat diagram, explain the process of communication in DC machines. (08 Marks)
- b. How stabilization is achieved due to tertiary winding. (06 Marks)
- c. A 6 pole generator has wave connected armature having 550 conductors. IT delivers 150A current at full load and the brush load is 12 degrees. Find the number of demagnetizing and crossing magnetizing ampere – turns per pole. (06 Marks)

OR

- 6 a. Derive EMF equation of synchronous generator and give the expression for pitch factor and distribution factor. (06 Marks)
- b. With necessary diagrams, explain armature reaction in alternator for lagging, leading and unity power factors. (08 Marks)
- c. A 4 pole, 50Hz, star connected alternator has 6 slots per pole per phase and a two – layer winding with 4 conductors per slot. If the coil span is  $150^\circ$ , calculate the value of induced phase and line voltages if the flux per pole is 300mwb. (06 Marks)

**Module-4**

- 7 a. Enumerate the various methods available for determining the voltage regulation. Explain in details EMF and MMF methods. (12 Marks)
- b. Discuss about short circuit ratio and its significance. (04 Marks)
- c. Compare synchronous impedance method and ampere turns method of predetermining of regulation. (04 Marks)

OR

- 8 a. Explain ZPF method of predetermination of voltage regulation of alternator. Mention the advantage of this method. (08 Marks)
- b. The following test results are obtained on a 6600V alternator.

Open circuit voltage	3100	5000	6600	7500	8300
Field current in Amps	16	25	37.5	50	70

A field current of 20A is found necessary to circulate full load current on short circuit of the armature. Determine the full load regulation at 0.8pf lagging by using :

- i) EMF method  
ii) Ampere – Turn method. (12 Marks)

**Module-5**

- 9 a. Discuss the concept of two reaction theory in a salient pole synchronous machine with the help of phasor diagram. (08 Marks)
- b. What are the conditions for proper synchronization of an alternator? Explain with the help of a neat sketch, synchroscope method of synchronization. (06 Marks)
- c. A 500V, 50HZ, delta connected synchronous generator has  $X_d = 0.2\Omega$  and  $X_q = 0.075\Omega$  per phase. The armature resistance is neglected. The alternator is supplying 1100A at 0.8pf lagging. Calculate the :  
i) Emf neglecting saliency and assuming  $X_s = X_d$   
ii) Emf considering saliency. (06 Marks)

OR

- 10 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. (08 Marks)
- b. Write short notes on capability curves of a synchronous generator. (06 Marks)
- c. Discuss about hunting in synchronous machines. Also explain the role of damper windings. (06 Marks)

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