

# CBCS SCHEME

21EE34

## 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. Discuss in detail how to perform OC and SC tests on single phase transformer with neat circuit diagram. (08 Marks)
- b. Explain with circuit diagram and phasor diagram how two transformers are connected in open delta can supply the power successfully. (06 Marks)
- c. The primary and secondary windings of a 40 KVA, 6600/250V single phase transformer have resistances of  $10\Omega$  and  $0.02\Omega$  respectively. The leakage reactance of transformer referred to primary side is  $35\Omega$ . Calculate the percentage voltage regulation of the at 0.8 p.f lagging. (06 Marks)

OR

- 2 a. Explain how SCOTT connections are used to obtain two phase from three phase mains with the help of connection and phase diagrams. (06 Marks)
- b. State the advantages of single three phase transformer over a bank of single phase transformers. (04 Marks)
- c. Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15KVA at UPF and loaded as follows :
  - i) 12 hours – 2 KW at 0.5 pf lagging
  - ii) 6 hours – 12 KW at 0.8 pf lagging
  - iii) 6 hours – No load. (10 Marks)

### Module-2

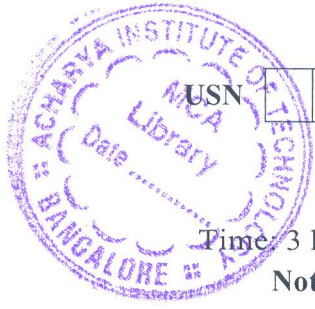
- 3 a. Derive an expression for saving of copper when an auto transformer is used. (07 Marks)
- b. What are the conditions to be satisfied for paralld operation of two transformers? Explain briefly. (04 Marks)
- c. Two single phase transformers with equal voltage ratios have impedances of  $(0.819 + j2.503)\Omega$  and  $(0.8 + j2.31)\Omega$  with respect to the secondary. If they operate in parallel, how they will share a total load of 2000 KW at p.f of 0.8 lagging. (09 Marks)

OR

- 4 a. Explain with diagram, the Sumpner's test on transformer. (07 Marks)
- b. What is tap changing transformer, explain with neat figure. (07 Marks)
- c. Two transformers A and B are joined in parallel to same load. Determine the current delivered by each transformer having given : Open circuit emf. 6600V for A and 6400V for B equivalent leakage impedance in terms of secondary is  $(0.3 + j3)\Omega$  for A and  $(0.2 + j1)\Omega$  for B. The load impedance is  $(8 + j6)\Omega$ . (06 Marks)

### Module-3

- 5 a. What is armature reaction? With a neat diagram, explain in detail. (08 Marks)
- b. What is cooling of transformer? List of different methods of cooling and explain any two of them. (06 Marks)
- c. A 4 – pole generator supplies a current of 143A. If has 492 conductors :
  - i) Wave connected ii) Lap connected. When delivering full load, the brushes are given an actual lead of  $10^\circ$ . Calculate the demagnetizing ampere-turns /pole. The field winding is shunt connected and takes 10A. Calculate the number of extra shunt field turns necessary to neutralize this demagnetization. (06 Marks)





OR

- 6 a. What is commutation? Explain different methods available for improving commutation. (08 Marks)
- b. Derive an E.M.F equation of synchronous generator. (06 Marks)
- c. A 3- phase, 16 pole synchronous generator has a star connected winding with 144 slots and 10 conductor per slot. The flux per pole is 0.03wb, sinusoidally distributed and the speed is 375rpm. Calculate : i) The frequency ii) Line induced emf. (06 Marks)

Module-4

- 7 a. Define voltage regulation of the alternator and explain the ampere – turn method of predetermination of regulation. (08 Marks)
- b. The effective resistance of a 2200V, 50Hz, 440KVA, I – phase alternator is  $0.5\Omega$  on short circuit a field current of 40A gives the full load current of 200A. The voltage on open circuit with same field excitation is 1160V. Calculate :  
i) Synchronous impedance ii) Synchronous reactance. (04 Marks)
- c. Explain the zero power factor method of predetermination of regulation of an alternator. (08 Marks)

OR

- 8 a. Enumerate the various methods available for determining the voltage regulation. Explain in detail emf method. (08 Marks)
- b. A 3.5MVA Y-connected alternator rated at 4160 volts at 50Hz has open circuit characteristics given by the following data :

|                      |      |      |      |      |      |      |      |      |
|----------------------|------|------|------|------|------|------|------|------|
| Field current (amps) | 50   | 100  | 150  | 200  | 250  | 300  | 350  | 400  |
| Line emf (volts)     | 1620 | 3150 | 4160 | 4750 | 5130 | 5370 | 5550 | 5650 |

A field current of 100A is found necessary to circulate full – load current on short circuit of the alternator. Calculate by : i) Synchronous impedance method ii) Ampereturn method the full-load voltage regulation at 0.8 pf lagging. Neglect armature resistance. (12 Marks)

Module-5

- 9 a. What is synchronization? Explain with the help of neat sketch the three lamps dark method of synchronization. (08 Marks)
- b. Explain about synchronizing power. (04 Marks)
- c. A 2MVA, 3 phase, 8 pole alternator is connected to 6000V, 50Hz bus bars and has a synchronous reactance of  $4\Omega$  per phase. Calculate the synchronizing power and synchronizing torque per mechanical degree of rotor displacement at no-load. Assume normal excitation. (08 Marks)

OR

- 10 a. What is hunting in synchronous machines? (06 Marks)
- b. Describe the parallel operation of alternators. (06 Marks)
- c. A three phase star connected synchronous generator supplies a current of 10A having phase angle of  $20^\circ$  lagging at 400V (phase voltage). Find : i) the load angle ii) components  $I_d$  and  $I_q$  of armature current iii) voltage regulation. Given  $X_d = 10\Omega$  and  $X_q = 6.5\Omega$ . Neglect armature resistance. (08 Marks)

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