CBCS SCHEME

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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 10Ω and 0.02Ω respectively. The leakage reactance of transformer referred to primary side is 35Ω. Calculate the percentage voltage regulation of the at 0.8p.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 paralled operation of two transformers? Explain briefly. **(04 Marks)**

c. Two single phase transformers with equal voltage ratios have impedances of (0.819 +j2.503)Ω and (0.8 + j2.31)Ω 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)Ω for A and (0.2 + j1)Ω for B. The load impedance is (8 + j6)Ω. **(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°. 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 0.5Ω on short circuit a field current of 40A gives he 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 4Ω 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° 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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