CBCS SCHEME

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18EE33

Third Semester B.E. Degree Examination, June/July 2025
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 1-ϕ transformers for lagging, leading and UDF load. **(10 Marks)**

b. A 20 KVA, 2000/200V, 1-ϕ transformers has the following parameters. HV winding $R_1 = 3\Omega$, $X_1 = 5.3\Omega$, $R_2 = 0.05\Omega$, $X_2 = 0.1\Omega$. Find the voltage regulation at 0.8 pf lagging. **(05 Marks)**

c. A 3-ϕ step down transformer is connected to 6600V and it takes 10A. Calculate the secondary line voltage, line current and output for : i) Y – Δ ii) Δ – Δ. **(05 Marks)**

OR

2 a. Write a short note on V – V connection. **(06 Marks)**

b. Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15 KVA at UPF and loaded as follows :
12 hours – 2kW at 0.5 p.f lagging
6 hours – 12kW at 0.8 p.f lagging
6 hours – No load. **(08 Marks)**

c. State the advantages of single three phase transformer over a bank of single phase transformers. **(06 Marks)**

Module-2

3 a. What are the conditions to be satisfied for parallel operation of two transformers? **(04 Marks)**

b. Derive an expression for the currents and loads shared by two transformers connected in parallel supplying a common load when no load of these are equal. **(08 Marks)**

c. Two 1-ϕ transformers rated at 250 KVA 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 500 KVA at 0.8 pf lagging. **(08 Marks)**

OR

4 a. With a neat circuit diagram. Explain in detail Sumpner's test for determining the efficiency and voltage regulation of transformer. **(08 Marks)**

b. What is an auto-transformer? Derive an expression for the saving of copper in auto-transformers as compared to an equivalent two winding transformer. What are the advantages and limitations? **(08 Marks)**

c. Explain the working of an load tap changer with neat sketches. **(04 Marks)**

Module-3

5 a. Explain armature reaction in DC machines. Draw neat sketches. **(06 Marks)**

b. Classify different methods of cooling adopted in transformer operation. Explain with neat diagrams. **(08 Marks)**

c. Discuss the methods of improving commutation in DC machines. **(06 Marks)**

OR

6 a. Derive an equation for the e.m.f induced in an alternator and also write equations for pitch factor and distribution factor. **(08 Marks)**

b. A 3-ϕ star connected alternator oh open circuit is required to generate a line voltage of 3.5KV, 50 HZ when driven at 500 rpm. The stator has 3 slots/pole/ph and 10 conductors/slot. The coils are short chorded by 1 slot. Calculate the number of poles and useful flux/pole. **(06 Marks)**

c. List out the causes of harmonics and the methods used to reduced harmonics in 3-ϕ alternator. **(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. Compare synchronous impedance method and ampere turns method of predeterming of regulation. **(04 Marks)**

c. Discuss about short circuit ratio and its significance. **(04 Marks)**

OR

8 a. Explain ZPF method of predetermination of voltage regulation of alternator. Mention the advantages of this method. **(08 Marks)**

b. The following test results are obtained on a 6600V alternator open circuit

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. Derive the expression for synchronizing power. **(06 Marks)**

b. With a neat circuit diagram, explain the slip test to determine direct axis reactance and quadrature axis reactance of an salient pole synchronous generator. **(08 Marks)**

c. A 3-ϕ star connected synchronous generator supplies current of 10A having phase angle of 20 degree lagging at 400V. Find the load angle and components of armature current I_d and I_q. If $X_d = 10\Omega$ and $X_q = 6.5\Omega$. Armature resistance to be negligible. Also find voltage regulation. **(06 Marks)**

OR

10 a. What is hunting in synchronous machines? Explain the role of damper winding. **(06 Marks)**

b. Write a note on capability curve of synchronous generator. **(06 Marks)**

c. Two identical 2000 KVA alternators operate in parallel. The governor of 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.
i) How will the two machines share a load of 3000 kW?
ii) What is the maximum load at UPF that can be delivered without overloading either machine? **(08 Marks)**

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