CBCS SCHEME

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21EE34

Third Semester B.E. Degree Examination, June/July 2024
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. Explain the operation of 1-ph transformer under no-load condition. **(06 Marks)**

b. Draw the equivalent circuit of 1-phase transformer referred to primary side. **(06 Marks)**

c. A transformer has its maximum efficiency of 0.98 at 15 KVA at unity p.f. During a day it is loaded as follows:
12 Hours 2 kW at 0.8 p.f
6 Hours 12 kW at 0.8 p.f
6 Hours 18 kW at 0.9 p.f
Find the all-day efficiency. **(08 Marks)**

OR

2 a. With neat schematic diagram, explain the construction of three phase transformer. **(06 Marks)**

b. With circuit diagram, explain the working principle of scott connection for three to two phase conversion. **(06 Marks)**

c. Consider a 4 KVA, 200/400 V single phase transformer supplying full load current at 0.8 lagging power factor. The OC/SC Tests results are as follows :
OC Test : 200 V, 0.8 A, 70 W (LV side)
SC Test : 20 V, 10 A, 60 W (HV side)
(i) Calculate efficiency, secondary voltage and current into primary at the above load.
(ii) Calculate the load at unity power factor corresponding to maximum efficiency. **(08 Marks)**

Module-2

3 a. Explain the necessity and conditions for parallel operation of 1-phase transformers. **(06 Marks)**

b. Show that how two transformers will share the load with equal ratios. **(06 Marks)**

c. Two 100-KW, single phase transformers are connected in parallel both on the primary and secondary. One transformer has an ohmic drop of 0.5% at full load and an inductive drop of 8% at full load current. The other has an ohmic drop of 0.75% and inductive drop of 2%. Show how will they share a load of 180 kW at 0.9 power factor. **(08 Marks)**

OR

4 a. Discuss the necessary conditions for parallel operation of 3-phase transformers. **(06 Marks)**

b. With neat circuit connection, explain the working principle of Auto Transformer. **(06 Marks)**

c. A two winding transformer is rated at 2400/240 V, 50 KVA. It is re-connected as a step-up auto-transformer, with 2400 V input. Calculate the rating of auto-transformer and the inductively and conductively transferred powers while delivering the rated output at unity power factor. **(08 Marks)**

Module-3

5 a. Discuss the advantages of three winding transformer. **(06 Marks)**

b. Explain the process of Armature reaction in D.C. Generators. **(06 Marks)**

c. Determine per pole the number, (i) of cross-magnetising ampere-turns (ii) of back ampere turns and (iii) of series turns to balance the back ampere-turns in the case of a dc generator having the following data:
500 conductors, total current 200 A, 6 poles, 2-circuit wave winding, angle of load = 10°, leakage coefficient = 1.3 **(08 Marks)**

OR

6 a. Explain the following terms :
(i) Demagnetising Ampere-turns
(ii) Cross magnetizing Ampere-turns. **(06 Marks)**

b. Explain the following terms :
(i) Distribution or Breadth factor
(ii) Winding factor or Spread factors. **(06 Marks)**

c. Calculate the RMS value of the induced e.m.f per phase of a 10-pole 3-ph 50 Hz alternator with 2 slots per pole per phase and 4-conductors per slot in two layers. The coil span is 150°. The flux per pole has a fundamental component of 0.12 wb and a 20% third component. **(08 Marks)**

Module-4

7 a. Explain the method determining the Regulation by synchronous impedance method. **(10 Marks)**

b. In a 50 KVA, star connected, 440 V, 3-phase, 50 Hz alternator, the effective armature resistance is 0.25 ohm per phase, the synchronous reactance is 3.2 Ω per phase and leakage reactance is 0.5 Ω per phase. Determine at rated load and unity power factor.
(i) Internal emf
(ii) No-load emf E_O.
(iii) Percentage Regulation on full load.
(iv) Value of synchronous reactance which replaces armature reaction. **(10 Marks)**

OR

8 a. Explain the method finding the voltage regulation by zero-power factor or Potier method. **(10 Marks)**

b. The open and short circuit test readings for a 3-d star-connected, 1000 KVA, 2000 V, 50 Hz synchronous generators are,

Field amps :	10	20	25	30	40	50
OC Testinal :	800	1500	1760	2000	2350	2600
SC armature current :	-	200	250	300	-	-

The armature effective resistance is 0.2 Ω per phase. Draw the characteristic curves and estimate the full-load percentage regulation at,
(i) 0.8 pf lagging
(ii) 0.8 pf leading **(10 Marks)**

Module-5

9 a. Explain the necessity and advantages of parallel operation and explain the condition for proper synchronization of alternators. **(10 Marks)**

b. A 3-phase, 50 Hz, 2 pole alternator is excited to generate the bus bar voltage of 11 KV at no-load. Calculate synchronizing power per degree of mechanical displacement of the rotor. The machine in star connected and the short circuit current for this excitation is 1200 A. Neglect armature winding resistance. **(10 Marks)**

OR

10 a. Explain the method of finding X_d and X_q of synchronous machine (slip test). **(10 Marks)**

b. Explain the power angle characteristics of salient pole synchronous machines under loaded condition. **(10 Marks)**

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