CBCS SCHEME

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18EE33

Third Semester B.E. Degree Examination, Dec.2023/Jan.2024
Transformers and Generators

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Develop an equivalent circuit of a single phase transformer and show that the parameters of the primary and secondary may be combined to give approximate equivalent circuit referred to primary side. **(06 Marks)**

b. A 20 KVA, 2000/200V single phase transformer has the following parameters.
HV winding : $R_1 = 3\Omega$, $X_1 = 5.3\Omega$; LV winding : $R_2 = 0.05\Omega$, $X_2 = 0.1\Omega$.
Find the voltage regulation at i) Pf of 0.8 lagging ii) 0.707 pf leading. **(06 Marks)**

c. Define All day efficiency. A 2300/230V , 500KVA , 50Hz distribution transformer has core loss of 1600W at rated voltage and copper loss of 7.5 kW at full load.
During day it is loaded as follows :

% load	0 %	20 %	50 %	80 %	100 %	125 %
pf	-	0.7 lag	0.8 lag	0.9 lag	1	0.85 lag
Hours	2	4	4	5	7	2

Determine the all day efficiency of the transformer. **(08 Marks)**

OR

2 a. With the help of connection and phasor diagram, explain how SCOTT connections are used to obtain two phase supply from three phase supply mains. **(08 Marks)**

b. With circuit diagram and phasor diagram, explain how two transformer connected in open delta can supply the power. **(04 Marks)**

c. A three phase step down transformer with per phase turns ratio 47.6 : 1 connected in delta/star and is supplying a load of 400kW, 0.8 pf lagging at 400V. Sketch the connection diagram and indicate line voltages and currents. **(08 Marks)**

Module-2

3 a. List out the necessary conditions for parallel operation of transformers. **(05 Marks)**

b. An auto transformer is used to supply a load of 2kW at 230V from a 400V AC supply. Find the currents in 230V winding and also the copper saving assuming the resistive load. **(05 Marks)**

c. Derive an expression for copper saving in an autotransformer as compared to an equivalent two wdg transformer. Mention the advantages and limitations. **(10 Marks)**

OR

4 a. Explain the reason for tap changing in transformer and also the operation of on load tap changer. **(06 Marks)**

b. Two single phase transformers share a load of 400KVA at 0.8 pf lag. Their equivalent impedances referred to secondary winding are $(1 + j2.5)\Omega$ and $(1.5 + j3)\Omega$ respectively. Calculate load shared by each transformer. **(06 Marks)**

c. With neat circuit diagram, explain heat run test conducted on two single phase transformers. **(08 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 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. List out the causes of harmonics and the methods used to reduce harmonics in three phase alternator. **(06 Marks)**

c. A 3 ϕ star connected alternator an open circuit is required to generate a line voltage of 3.5kV, 50Hz 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)**

Module-4

7 a. Draw the vector diagram of an alternator supplying lagging power factor load and hence derive the expression for E_{ph} in terms of armature resistance , reactance and load current. **(06 Marks)**

b. Define SCR and explain its significance. **(04 Marks)**

c. With necessary circuit diagram, explain the method of voltage regulation using Zero Power Factor method by conducting ZPF test on alternator. **(10 Marks)**

OR

8 a. A 3 ϕ , 1500 KVA , Y connected 50 Hz , 230V alternator has a resistance (effective) of 0.12Ω/ph. A field current of 70A produces a short circuit current equal to full load current of 376 Amp in each line. The same field current produces an emf of 700V on open circuit. Determine synchronous reactance of the machine and its full load regulation at 0.8 pf lag. **(08 Marks)**

b. Mention the various methods for determining the voltage regulation of a 3 ϕ alternator. Describe synchronous impedance method with neat circuit diagram. **(12 Marks)**

Module-5

9 a. Define X_d and X_q. With neat circuit diagram, explain the test conducted on alternator to obtain X_d abd X_q. **(10 Marks)**

b. Two similar three phase, 400V alternators share equal kW power delivered to a balanced load of 50kW, 0.8 pf lag. The pf of one machine is 0.9 lag. Find the current supplied and the pf of the second machine. **(10 Marks)**

OR

10 a. Write short notes on :

i) Capability curves for large turbo generators.

ii) Hunting and damper windings. **(10 Marks)**

b. With operating characteristics and power angle diagram, derive the expression of power – angle of cylindrical pole synchronous generator. **(10 Marks)**

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