CBCS SCHEME

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18EE33

Third Semester B.E. Degree Examination, July/August 2022
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. Develop the equivalent circuit of transformer referred to secondary and explain.   **(06 Marks)**
   b. A 3 = phase, 500 KVA, 11/0.43 kV, delta / star connected transformer has on rated load an HV copper loss of 2.5 kW and an LV loss of 2KW. The total leakage reactance is 4.56Ω / phase as referred to secondary. Find the ohmic values of the equivalent resistance and leakage reactance on the delta side.   **(08 Marks)**
   c. Draw the complete phasor diagram of a single phase transformer under full load condition connected to a lagging load and explain.   **(06 Marks)**

OR

2 a. Explain how all day efficiency is different from conventional efficiency of a transformer.   **(06 Marks)**
   b. Explain with circuit diagram and phasor diagram how two transformers connected in open delta can supply three phase power.   **(06 Marks)**
   c. The following readings are obtained from O.C and S.C tests on 8KVA, 400 / 120V, 50Hz single phase transformer.
       O. C. Test (LV side) : 120V , 4A , 75W
       S. C. Test (HV side) : 9.5V , 20A , 110W, calculate
       i)   The equivalent circuit parameters.
       ii) Voltage regulation and efficiency for 0.8 lagging p.f. loading.
       iii) The efficiency at half full load and 0.8 leading p.f. load.   **(08 Marks)**

Module-2

3 a. Justify the need for parallel operation of transformers and list the conditions to be satisfied for parallel operation of transformers.   **(08 Marks)**
   b. Two transformers A & B are working in parallel. 'A' has an open circuit EMF of 6600V, while 'B' has 6400V. Equivalent leakage impedances referring to secondary are (0.3 + j3)Ω and (0.2 + j1) Ω respectively. The load impedance is (8 + j6) Ω. Determine the current delivered by each transformer to the load.   **(06 Marks)**
   c. Derive the expression for copper saving in auto - transformer.   **(06 Marks)**

OR

4 a. Explain with a circuit diagram how hysteresis and eddy current losses are seperated.   **(08 Marks)**
   b. With the help of sketches, explain the working of on load tap changer.   **(06 Marks)**
   c. A 440/110V, 10 KVA, 2 winding transformer is to be employed as an auto transformer to supply a 440V circuit from a 500V source. When tested as a two winding transformer at rated load and 0.8 p.f lagging , its efficiency is 0.98.
       i) Determine its KVA rating as an autotransformer.
       ii) Find its efficiency as an autotransformer.   **(06 Marks)**

Module-3

5 a. Why is cooling necessary for transformer? List the cooling methods used to dissipate heat in transformers.   **(04 Marks)**

b. What is Armature Reaction? What are their effects? Derive the equations for
   i) Demagnetizing ampere-turns / Pole and   ii) Cross – magnetizing ampere – turns/pole.
   (08 Marks)

c. A 3ϕ, 8 pole, 50Hz, star connected alternator has 96 slots with 4 conductors / slot. The coil span is 10 slots and the flux / pole is 0.06 wb. Determine the line EMF generated. If each phase is capable of carrying 650A, what is the KVA rating of the machine?   **(08 Marks)**

OR

6 a. Explain the process of commutation in DC machine and list the difficulties and remedies.
   (08 Marks)

b. Define Pitch factor and distribution factor. Derive the expressions for these factors.
   (06 Marks)

c. The brushes of a lap connected 400 KW, 6 pole dc generators are given a lead of 21 electrical degrees. From the data given, calculate the demagnetizing and cross magnetizing ampere – turns. The full load current is 750A and total number of conductors in the armature is 900.   **(06 Marks)**

Module-4

7 a. With the help of neat sketches, explain how the voltage regulation can be determined using EMF method from the O.C and S.C test results.   **(10 Marks)**

b. A 5 MVA, 6.6 KV, 3 ϕ, star connected alternator has a resistance of 0.075Ω / phase. Estimate the regulation for a load of 500A and i) UPF   ii) 0.9 p.f leading from the following open circuit and full load ZPF curve.   **(10 Marks)**

Field current (A)	O.C Terminal voltage (V)	ZPF Curve
32	3100	0
50	4900	1850
75	6600	4250
100	7500	5800
140	8300	7000

OR

8 a. Explain the effect of variable excitation of an alternator supplying constant load.   **(10 Marks)**

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

O.C voltage :	3100	4900	6600	7500	8300
Field current :	16	25	37.5	50	70

A field current of 20A is found necessary to circulate full load current. Calculate by MMF method. The full load regulate at 0.8 pf lag. Neglect armature resistance and leakage reactance.   **(10 Marks)**

Module-5

9 a. With a neat phasor diagram, derive an expression for the power output of a salient pole alternator. Draw the variation of power Vs load angle δ.   **(10 Marks)**

b. Explain Capability curve of an alternator.   **(06 Marks)**

c. What is Hunting in synchronous generator? Explain.   **(04 Marks)**

OR

10 a. With a neat circuit diagram, explain slip test to determine direct axis reactance and quadrature axis reactance of a salient pole synchronous generator.   **(07 Marks)**

b. What are the conditions to be satisfied when two alternators are connected in parallel? Derive the expressions for synchronizing power and torque neglecting the effect of Ra.   **(10 Marks)**

c. Explain Reluctance Power.   **(03 Marks)**

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