USN | | | | | | | | | |

Third Semester B.E. Degree Examination, July/August 2022
Transformers and Generators

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1   a. State the advantages of single 3 phase unit transformer over bank of single phase transformers. **(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 – 2 KW at 0.5 PF lagging
    6 hours – 2 KW at 0.8 PF lagging
    6 hours – no load **(06 Marks)**

    c. Write a short note on all day efficiency. **(04 Marks)**

OR

2   a. Explain star zig-zag-star and open delta connection with the help of connection diagram and phasor diagram. Mention its advantages applications. **(10 Marks)**

    b. The following results were obtained on a 50 KVA, 2400/120 V transformer:
    OC test : 396 W, 9.65 A, 120 V
    SC test : 810 W, 20.8 A, 92 V
    Determine:
    (i)   The circuit constants
    (ii) The efficiency at F.L., 0.8 pf lagging
    (iii) The appropriate voltage regulation **(06 Marks)**

Module-2

3   a. How stabilization is achieved due to tertiary winding? **(05 Marks)**

    b. Derive expression for saving of copper in auto transformer compared to 2 winding transformers. **(07 Marks)**

    c. Explain why tertiary winding is used. **(04 Marks)**

OR

4   a. Two transformers gave the following test results with the LV side shorted, transformer 'A' takes current of 10 A at 200 V, power input is 1000 W. Similarly transformer 'B' takes 30 A at 200 V. The power input is 1500 W. On open circuit both transformers gave a secondary voltage of 2200 V when 11 KV is applied to the primary terminals. These terminals of the two transformers are connected in parallel. Calculate the load shared by each transformer. **(08 Marks)**

    b. The primary and secondary voltages of an auto transformer are 230 V and 75 V respectively. Calculate the currents in the different parts of the winding when load current is 200 A. Also calculate the saving of copper. **(08 Marks)**

Module-3

5   a. Write a short note on noise in transformer. **(04 Marks)**

    b. With a circuit diagram, explain in detail Sumpner's test for determining the efficiency and voltage regulations of transformer. **(06 Marks)**

c. A 4 pole 3 phase 50 Hz star connected alternator has 60 slots with 4 conductors per slot. The coils are short pitched by 3 slots. If the phase spread is 60°. Find the line voltage induced for a flux per pole of 0.943 wh. Sinusoidally distributed in space. All the turns per phase are in series. **(06 Marks)**

OR

6 a. Describe EMF equation of synchronous generator. **(05 Marks)**
   b. A 4 pole lap wound armature running at 1400 rpm delivers a current of 100 A and has 64 commutator segments. The brush width is equal to 1.4 commutator segments and inductance of each armature coil is 0.05 mH. Calculate the value of the reactance voltage assuming linear commutation. **(06 Marks)**
   c. What are the methods used to reduce the harmonics in alternator? **(05 Marks)**

Module-4

7 a. With a neat circuit diagram, explain the slip test on salient pole synchronous machine to determine X_d and X_q from slip test. **(08 Marks)**
   b. With phasor diagram, explain the concept of two reaction theory in a salient pole synchronous machine. **(08 Marks)**

OR

8 a. A synchronous generator has a direct axis synchronous reactance of 0.8 PU and a quadrature axis synchronous reactance of 0.5 PU. It is supplying full load at rated voltage at 0.8 p.f. lag. Find the open circuit voltage. **(08 Marks)**
   b. With a phasor diagram, explain the concept of two reaction theory in a salient pole synchronous machine. **(08 Marks)**

Module-5

9 a. A 50 KVA, 500 V, single phase alternator gave following test results:
   OC test : A field current of 12 A produced an emf of 300 volts
   SC test : A field current of 12 A caused a current of 175 A to flow in the short circuited armature.
   The effective armature resistance is 0.2 Ω.
   (i)   Calculate the synchronous impedance and synchronous reactance.
   (ii) If alternator is supplying full load current of 100 A at 0.8 pf lagging, to what value would the terminal voltage rise if the load were removed? Also find the voltage regulation for this load and pf. **(10 Marks)**
   b. Write a note on capability curves of synchronous generator. **(06 Marks)**

OR

10 a. Explain potier reactance method. **(08 Marks)**
   b. A 2300 V, 50 Hz, 3 phase star connected alternator has an armature resistance of 0.2 Ω. A field current of 35 A produces a current of 150 A on short circuit and an open circuit emf 780 V (line). Calculate the voltage regulation at 0.8 pf lagging and 0.8 pf leading for the full load current of 25A. **(08 Marks)**

* * * * *