**CBCS SCHEME**

5F26

**17EE33**

USN

## Third Semester B.E. Degree Examination, Feb./Mar. 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. Draw the phasor diagram of a practical transformer on no-load and explain. **(06 Marks)**
   b. Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15kVA at unity power factor and loaded as follows:
      12 hours – 2kW at 0.5p.f lagging
      6 hours – 12kW at 0.8 power factor logging
      6 hours – No load. **(08 Marks)**
   c. With a proper connection and phasor diagram describe the star-delta connection of 3-phase transformer. **(06 Marks)**

### OR

2  a. Explain the behavior of practical transformer with inductive load. **(06 Marks)**
   b. State the advantages of single 3-$\phi$ transformer over bank of three single phase transformers. **(04 Marks)**
   c. Two 110V single phase electric furnaces take loads of 500kW and 800kW respectively at a power factor of 0.71 lagging and are supplied from 6600V, 3-phase, 50Hz mains through a scott-connected transformer combination. Calculate the currents in the 3-phase lines neglecting transformer losses. Draw the phasor diagram. **(10 Marks)**

### Module-2

3  a. Discuss the necessary conditions for parallel operation of 2 transformers. **(06 Marks)**
   b. A 500kVA transformer with 0.01 per unit resistance and 0.05 per unit reactance is connected in parallel with a 250kVA transformer with 0.015p.u resistance and 0.04p.u reactance. The secondary voltage of each transformer is 400V on no load. Find how they share a load of 750KVA at power factor 0.8 lagging. **(10 Marks)**
   c. Briefly explain the polarity test. **(04 Marks)**

### OR

4  a. 2 single phase transformers are operating in parallel. Derive an expression for the current drawn by each, sharing a common load, when no-load voltages of these are equal. **(06 Marks)**
   b. Compare autotransformer with two winding transformers. **(06 Marks)**
   c. In a Sumpner's test on two identical transforms rated 500kVA, 11/0.4 KV, 50Hz, the wattmeter reading on H.V side is 6000W and on L.V side is 15000W. Find the efficiency of each transformer on half full load at 0.8p.f what ill be maximum efficiency? **(08 Marks)**

### Module-3

5  a. Discuss the necessity of testairy winding transformers. **(05 Marks)**
   b. With a neat diagram, explain the process of commutation in D.C. machine. **(05 Marks)**
   c. A 3-phase, 16 pole, star connected alternates has 144 slots having 10 conductors in each slot. The flux per pole is 30MWb and distributed sinusoidally and the speed is 375r.p.m. Find the induced emf for i) Full pitch winding    ii) Coils short pitched by 1 slot    iii) Coils short chorded by 2 slots. **(10 Marks)**

**OR**

6  a. List the advantages and disadvantages of 3 winding transformers. **(06 Marks)**
   b. An 8 pole wave wound d.c generators has 480 armature conductors. The armature current is 200A. Find the armature current is 200A. Find the armature reaction demagnetizing and cross magnetizing ampere turns per pole if  i) Brushes are on GNA    ii) Brushes are shifted 6° electrical from G.N.A. **(06 Marks)**
   c. What are harmonics? What are the methods used to reduce harmonics? **(08 Marks)**

## Module-4

7  a. Draw the vector diagram of an alternator supplying lagging power factor load and hence derive an expression for no load e.m.f in terms of terminal voltage, load current, armature resistance and synchronous reactance. **(04 Marks)**
   b. Two similar three phase, 400V alternators share equal kW power delivered to a balanced load of 50kW, 0.8p.f lag. The p.f. of one machine is 0.9 lag. Find the current supplied and p.f of the 2$^{nd}$ machine. **(08 Marks)**
   c. Derive the expression for the synchronizing power and torque when an alternator is connected to infinite bus bar. **(08 Marks)**

**OR**

8  a. A 3-phase star connected alternator is rated at 1600kVA, 13500V. The armature resistance and synchronous reactances are 1.5Ω and 30Ω respectively per phase. Calculate the percentage regulation for a load of 1280 kW at a p.f of 0.8 lag. U.P.F and 0.8 lead. **(08 Marks)**
   b. Briefly discuss necessity and conditions for parallel operation of two alternators. **(06 Marks)**
   c. Explain the determination of direct and quadrature axis reactance's of an alternator using slip test. **(06 Marks)**

## Module-5

9  a. Discuss the procedure to determine regulation of an alternator by E.M.F. method. **(10 Marks)**
   b. What is hurting in synchronous machine? Explain role of damper winding to prevent hunting. **(05 Marks)**
   c. What is capability curve? Discuss about capability curve for large turbo generator. **(05 Marks)**

**OR**

10  a. Explain the Potier's triangle method to determine the regulation of an alternator. **(10 Marks)**
    b. A 220V, 50Hz, 6 pole star connected alternator with armature resistance 0.06Ω/ph gave the following data for open circuit and short circuit characteristic. Find the % voltage regulation at full load current of 40A at a power factor of 0.8 lag by M.M.f method.

| Field current in A | 0.2 | 0.4 | 0.6 | 0.8 | 1 | 1.2 | 1.4 | 1.8 | 2.2 | 2.6 | 3 | 3.4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O.C voltage in volt | 16.7 | 33.5 | 50.2 | 67 | 84.3 | 99.3 | 112 | 134 | 151 | 164 | 173 | 179 |
| S.C current in Amps. | 6.6 | 13.2 | 20 | 26.5 | 32.4 | 40 | 46.3 | 59 | - | - | - | - |

**(10 Marks)**

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