

CBCS SCHEME

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Third Semester B.E. Degree Examination, July/August 2021

Transformers and Generators

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

- 1 a. Write short notes on V – V connection. (06 Marks)
b. State the advantages of single three phase transformer over bank of single phase transformers. (06 Marks)
c. Find the all day efficiency of single phase transformer having maximum efficiency of 98% at 15KVA at UPF and loaded as follows :
12 hours – 2 KW at 0.5 pf lagging
6 hours – 12 KW at 0.8 pf lagging
6 hours – No load. (08 Marks)
- 2 a. Draw and explain the full load phasor diagrams of 1 ϕ transformers for lagging, leading and UPF load. (10 Marks)
b. A 20 KVA, 2000/200V single phase transformer has the following parameters. HV winding $R_1 = 3\Omega$, $X_1 = 5.3\Omega$, $R_2 = 0.05\Omega$, $X_2 = 0.1\Omega$. Find the voltage regulation at 0.8pf lagging. (05 Marks)
c. A 3 ϕ step down transformer is connected to 6600V and it takes 10A. Calculate the secondary line voltage, line current and output for : i) star – delta ii) Delta – Delta. (05 Marks)
- 3 a. Derive the expression for load shared between two transformers connected in parallel when voltage ratios are different with phasor diagram. (10 Marks)
b. In a Sumpner's test on two identical single phase transformers rated 500KVA. 11/0.4KV, 50Hz, the wattmeter reading on HV side is 6000W and on LV side is 15000W. Find the efficiency of each transformer on half full load of 0.8pF. What will be its maximum efficiency? (10 Marks)
- 4 a. What are the conditions to be satisfied for parallel operation of two transformers? Explain briefly. (06 Marks)
b. Derive an expression for saving of copper when an auto transformer is used. (08 Marks)
c. Compare auto transformer with two winding transformer. (06 Marks)
- 5 a. Derive EMF equation of a 3 ϕ alternator. (06 Marks)
b. What are the methods used to reduce harmonics in 3 ϕ alternators? Explain. (06 Marks)
c. What is armature reaction? With neat figures explain in detail. (08 Marks)
- 6 a. A 3 ϕ , 50Hz, 10 pole alternator has 90 slots. The flux per pole is 0.15Wb. If the winding is to be star connected to give a line voltage of 11000V. Find the number of armature conductors to be connected in series/phase. Assume $K_p = 1$. (06 Marks)
b. Write short notes on synchronous reactance. (06 Marks)
c. What is commutation? What are the methods available for improving commutation? Explain briefly. (08 Marks)

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

- 7 a. Enumerate the methods available for determining the voltage regulation of an alternator. Explain ZPF method in detail. (10 Marks)
- b. A 2300V, 50Hz, 3 ϕ star connected alternator has an effective armature resistance of 0.2 Ω . A field current of 35A produces a current of 150A on short circuit and an open circuit emf 780V(line). Calculate the voltage regulation at 0.8pF lagging and 0.8pF loading for the full load current of 25A. (10 Marks)
- 8 a. Show that the short circuit ratio of an alternator is the reciprocal of the per unit value of the synchronous reactance at rated value. Explain its significance. (10 Marks)
- b. A 10 KVA, 440V, 50Hz, 3 ϕ star connected alternator has the OCC as given below :

J_f (A)	1.5	3	5	8	11	15
V_{oc} (line) (Volts)	150	300	440	550	600	635

With full load zero pF, the applied excitation required is 14A to produce 500V of terminal voltage. On short circuit, 4A excitation is required to give full load current. Determine the voltage, regulation for full load, 0.8pF lagging and leading. (10 Marks)

- 9 a. Write a short note on capability curves of synchronous generator. (06 Marks)
- b. What is hunting in synchronous machines? Explain the role of damper windings. (06 Marks)
- c. What is synchroscope? How it is used for synchronization of alternators? (08 Marks)
- 10 a. With a phasor diagram, explain the concept of two reaction theory in a salient pole synchronous machine. (07 Marks)
- b. With a neat circuit diagram, explain the slip test on salient pole synchronous machines and indicate how X_d and X_q can be determined. (07 Marks)
- c. An alternator has a direct axis synchronous reactance of 0.7 per unit and a quadrature axis synchronous reactance of 0.4 per unit. It is used to supply full load at rated voltage at 0.8pF. Find the total induced emf on open circuit. (06 Marks)

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