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17EE33

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. Explain the operation of practical transformer on No-load and on-load condition with the help of phasor diagrams. (10 Marks)
- b. With a neat circuit diagram, explain the conversion of 3- ϕ AC supply to 2- ϕ AC supply and draw the phasor diagram. Also obtain the expression for line currents drawn by the primary when a balanced load is connected. (10 Marks)

OR

- 2 a. Why a bank of 3 single phase transformers is used as 3 ϕ transformer rather than single unit. (04 Marks)
- b. With a neat circuit diagram and phasor diagram, explain the operation of 3 ϕ transformers connected in (i) $Y-Y$ and (ii) $Y-\Delta$ (08 Marks)
- c. A 5 KVA, 500/250 V, 50 Hz SPh transformer gave the following readings:
OC Test : 500 V, 1A, 50 W [LV open]
SC Test : 25V, 10A, 60W [LV short]
Determine:
(i) Efficiency on full load, 0.8 pf lagging
(ii) Voltage regulation on full load, 0.8 pf leading
Also draw the equivalent circuit referred to primary. (08 Marks)

Module-2

- 3 a. Mention the necessity of parallel operation of two transformers and the conditions that needs to be satisfied. (06 Marks)
- b. Explain the operation of two similar transformers having same voltage ratios and obtain the expression for load shared by both transformers. (08 Marks)
- c. Explain the operation of no-load tap changing transformers with a neat circuit diagram. (06 Marks)

OR

- 4 a. What is an autotransformer? Derive an expression for the saving of copper in an auto transformer compared to two winding transformers. Mention the advantages and disadvantages of auto transformers. (10 Marks)
- b. Explain the operation of on-load tap changing transformers with a neat diagram. (05 Marks)
- c. Explain the conduction of Sumpner's test with a neat circuit diagram and show how the efficiency at any load can be predetermined. (05 Marks)

Module-3

- 5 a. What is armature reaction? Explain how armature reaction produces cross magnetizing and demagnetizing effect. Also derive the expression for them. (12 Marks)
- b. Draw the equivalent circuit diagram of tertiary transformer and explain how equivalent circuit parameters can be calculated. (08 Marks)

OR

- 6 a. Derive the emf equation of a synchronous generator. Also derive the expression for pitch factor and distribution factor. (08 Marks)
- b. With neat diagram, explain the process of commutation in DC machines. (06 Marks)
- c. A 3 phase, 16 pole, star connected alternator has 144 slots having 10 conductors in each slot. The flux/pole is 30 mWb and distributed sinusoidally and the speed is 375 rpm. Find the line value of induced emf if the coil is full pitched. (06 Marks)

Module-4

- 7 a. Define the voltage regulation of a synchronous generator and draw the load characteristic. (05 Marks)
- b. State the necessary conditions for synchronization and explain briefly. (05 Marks)
- c. With the phasor, explain the concept of two-reaction theory in a salient pole synchronous machine. Also obtain expression for direct and quadratic axis reactance. (10 Marks)

OR

- 8 a. 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 from the test. (08 Marks)
- b. Explain the V-curves of a synchronous generator. (06 Marks)
- c. Explain the effect of variation of excitation of an alternator supplying constant load. (06 Marks)

Module-5

- 9 a. Explain the ampere turns method of predetermining the regulation of an alternator. (10 Marks)
- b. What is hunting in synchronous machines? Explain the role of damper windings. (05 Marks)
- c. Write a short note on capability curves of a synchronous generator. (05 Marks)

OR

- 10 a. Explain the ZPF method of predetermining the voltage regulation of an alternator. (10 Marks)
- b. The OC and SC test is conducted on a 3 phase, star connected, 866 V, 100 KVA alternator. The OC test results are

I_f in amps	1	2	3	4	5	6
V_{OC} in line volts	173	310	485	605	728	790

The field current of 1A, produces a short circuit current of 25A. The armature resistance is $0.15 \Omega/ph$. Calculate the full load regulation at 0.8 pf lagging condition. (06 Marks)

- c. Explain the significance of short circuit ratio. (04 Marks)
