phase are in series and flux per pole is 30 mWb. Which is sinusoidally distributed ? If the winding is star connected, determine the value of induced emf available across the terminals. 7½

6. (a) Explain construction, excitation and principle system of synchronous Generator. 7½

(b) A 3-phase star connected alternator is rated at 1500 KVA, 11 KV. The armature effective resistance and synchronous reactance are 1.2 Ω and 24 Ω respectively per phase. Calculate the percentage regulation of a load of 1200 KW at power factor of :

(i) 0.8 Lagging

(ii) Unity and

(iii) 0.8 Leading. 7½

Section D

7. (a) Describe the power factors control of synchronous motor under : 7½

(i) Under excitation

(ii) Normal excitation

(iii) Over excitation.

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B. Tech. EXAMINATION, 2021

Semester IV (CBCS)

ELECTRICAL MACHINE-II

EE-401

Time : 2 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.

Note : Attempt *Four* questions in all, selecting *one* question from any of the Sections A, B, C and D. Q. No. **9** is compulsory.

Section A

1. (a) Explain with the help of suitable diagram, how rotating magnetic field is developed in a 3-phase induction motor when 3-phase AC supply is given to it. 7½

(b) A three-phase 460 V, 60 Hz, six pole wound rotor induction motor drives a constant load of 100 N-m at a speed of 1140 rpm when the rotor terminals are short circuited. It is required to reduce the speed of the motor to 1000 rpm by inserting resistances in the rotor circuit. Determine the value of the resistance if the rotor winding resistance per phase is 0.2 ohms. Neglect rotational losses. The stator-to-rotor turns ratio is unity. **7½**

2. (a) A 3-phase 4-pole stars connected AC machine has 54 slots with 4 conductors per slot. The coils are short pitched by two slots. If the machine gives 3300 V line voltage than calculate flux per pole. **7½**

(b) Show how the circuit elements of the equivalent circuit of an induction motor can be determined from the readings of no-load and blocked-rotor tests. **7½**

Section B

3. (a) Describe the construction and working of a capacitor start capacitor run 1-ϕ induction motor. **7½**

(b) The gross power absorbed by the forward and backward field of a 230 V, 4-pole, 50 Hz, single-phase induction motor is 180 W and 30 W respectively at a motor speed of 1425 rpm. Find the shaft torque if the no-load friction losses are 50 W. **7½**

4. (a) Draw the equivalent circuit of single-phase induction motor and explain its working principle. **7½**

(b) Explain the construction and working principle of a permanent-split single value capacitor-type single-phase induction motor. Mention its applications. **7½**

Section C

5. (a) What is Short Circuit Ratio (SCR) ? Why modern alternators are designed with high SCR ? **7½**

(b) An alternator runs at 250 rpm and generates an emf of 50 Hz. The winding distribution factor (kd) is 0.9597 and coil span factor or pitch factor (kc) is 1. All the conductors of each

(b) A three-phase 3.3 kV, 50 Hz, star connected synchronous motor has a synchronous impedance of $(0.3 + j4.9)$ Ω/phase. Calculate the line current and the power factor for an induced emf of 4 kV and an input power of 900 kW at rated voltage. **7½**

8. (a) Explain function of damper winding in a synchronous motor. **7½**

(b) A 5000 V, 3-phase circuit takes 20 A at a lagging power factor of 0.8. A synchronous motor is used to raise the power factor to unity. Calculate the KVA input to the motor, and its power factor when driving a mechanical load of 7.5 kW. The motor has an efficiency of 8.5%. **7½**

(Compulsory Question)

9. (a) What do you mean by pole pitch, conductor, coil, coil pitch and front pitch and back pitch ?

(b) State the difference between single-layer and double-layer windings.

(c) What is the difference between a squirrel-cage type rotor and phase-wound rotor ?

(d) Why are rotor slots made skewed by a small angle to the shaft axis ?

(e) State the advantages and the disadvantages of decreasing the air gap length of a three-phase induction motor.

(f) What will be the rotor frequency at the time of starting and at running condition ?

(g) Which motor, capacitor-start or resistance-start motor has a larger starting torque ?

(h) Why dampers are used in a synchronous motor ?

(i) What happens when the field current of a synchronous motor is increased beyond the normal value at constant input ?

(j) The outer frame of a sychronous machine may not be made of magnetic material (cast iron), state why ? **10×1½=15**