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Code No: 154AU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February - 2024

ELECTRICAL MACHINES – II

(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	What is the significance of slip in a 3-phase Induction Motor?	[2]
b)	Why 3-phase Induction motor never attains synchronous speed?	[3]
c)	What is crawling?	[2]
d)	Sketch and explain torque-slip characteristic of an induction motor working at rated Voltage and frequency.	[3]
e)	What is winding factor?	[2]
f)	How harmonics in a generated e.m.f. of an alternator?	[3]
g)	What is hunting phenomenon in a synchronous motor?	[2]
h)	What are "V" and Inverted "V" curves of a synchronous motor?	[3]
i)	State the applications of shaded pole motor.	[2]
j)	What is split type motor? Explain its working principle.	[3]

PART – B

(50 Marks)

2.a) Explain the constructional details of both squirrel cage and slip ring induction motor.
b) Obtain an expression for rotor current and power factor at the time of starting and running conditions of 3-phase Induction Motor. [5+5]

OR

3.a) Explain the production of rotating magnetic field in a 3-phase Induction Motor.
b) A 3 phase induction motor is wound for 4 poles and is supplied from 50 Hz system. Calculate (i) the speed at which magnetic field of the stator is rotating (ii) the rotor speed when slip is 3 % and (iii) the frequency of the rotor currents when the slip is 0.04 and (iv) the frequency of the rotor currents when at stand still. [5+5]

4.a) Derive an expression for torque developed by 3-phase Induction motor.
b) A 3 phase, 6pole, 400V, 50 Hz induction motor takes a power input of 30KW at its full load speed of 970 rpm. The total stator losses are 900 W and the friction and windage losses are 1.2 KW. Calculate (i) slip (ii) rotor ohmic losses (iii) shaft power (iv) shaft torque and (v) efficiency. [5+5]

OR

5.a) Obtain the relationship between rotor input, rotor copper loss and rotor gross output of 3-phase Induction Motor.

b) A 3-phase Squirrel cage Induction motor takes a line current of 50A and starting torque of 100 N-m when started by direct switching. If an auto transformer with 40% tapping is used, Find the starting current from the mains and starting torque developed by the motor. [5+5]

6.a) What is armature reaction? Explain the effect of armature reaction on the terminal voltage of alternator at (i) unity power factor load (ii) Zero lagging power factor load.

b) A 25 kVA, 440V, 3phase, 50 Hz, star connected alternator gave the following test data:

I_f in Amp	2	4	6	7	8	10	12	14
Terminal voltage (V) on Open circuit	155	287	395	440	475	530	570	592
S.C current (A)	11	22	34	40	46	57	69	80

Resistance between any two terminals is 0.25 ohm. Find the regulation at full load 0.85 p.f lagging by E.M.F method. [5+5]

OR

7.a) Explain the two reaction theory applicable to salient pole synchronous machine.

b) The stator of a 3-phase, 8-pole, and 750-rpm alternator has 62 slots, each of which contains 8 conductors. Calculate the r.m.s value of the e.m.f per phase if the flux per pole is 0.2 Wb sinusoidally distributed. Assume full pitch coils and a winding distribution factor of 0.96? [5+5]

8.a) What is an infinite bus? State the characteristics of an infinite bus. What are the operating characteristics of an alternator connected to an infinite bus?

b) What conditions must be fulfilled before an alternator can be connected to an infinite bus? Explain. [5+5]

OR

9.a) Draw the phasor diagram of 3-phase synchronous motor under lagging power factor load.

b) The synchronous reactance per phase of a 3-phase star connected 6600 V synchronous motor is 10 Ω. For certain load, the input is 900 KW and the induced line e.m.f is 8900 V. determine the line current. Neglect resistance. [5+5]

10.a) Prove that a single phase motor winding when excited by a single phase supply produces two equal and opposite revolving fields.

b) Explain the operation of shaded pole type motor. [5+5]

OR

11. Draw the circuit diagram of a capacitor start and run single phase induction motor and explain its working. Draw its performance characteristics. [10]

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