



B.E DEGREE EXAMINATIONS: MAY 2017

(Regulation 2015)

Fourth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U15EET401: AC Machines

(Ordinary Graph sheet is to be provided)

COURSE OUTCOMES

- CO1:** Explain the construction, principle of operation of synchronous machines and asynchronous machines.
CO2: Determine the performance of synchronous machine under various excitation conditions.
CO3: Choose a suitable starter for the given AC Machine.
CO4: Describe the speed control methods of induction motors.
CO5: Analyze speed torque characteristics of induction motors.
CO6: Explain the principle of operation and characteristics of special machines.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code

CO2 [K₄]

List I		List II	
A. Speed remains constant (ie N_s) from no load to full load		1. Single phase Induction motor	
B. Operates at lagging power factor.		2. Synchronous motor	
C. Holding Torque related to		3. Three phase Induction Motor	
D. Double field revolving theory		4. Stepper Motor	

	A	B	C	D
a)	2	3	4	1
b)	3	4	1	2
c)	4	1	3	2
d)	2	3	1	4

2. When a number of alternators are operating in parallel, the power factor at which each operates is determined by _____ CO1 [K₂]
- a) power factor of the load b) driving torque of the prime mover
c) its field excitation d) speed of the prime mover.
3. An Under excited synchronous motor behaves as _____ and overexcited synchronous motor behaves as _____. CO2 [K₂]
- 1)Inductor 2) resistor 3) Capacitor 4)Conductor
- a) 1,3 b) 1,4
c) 3,1 d) 2,3
4. The speed at which a 6 pole alternator should be driven to generate 50 cycles per second is _____. CO1 [K₁]
- a) 1500 rpm b) 1000rpm
c) 500rpm d) 1250rpm
5. Assertion (A) : A squirrel cage induction motor is preferred to the slip ring induction motor. CO5 [K₃]
Reason (R): Higher starting torque is the main consideration.
- a) Both A and R are true and R is the correct explanation of A b) Both A and R are true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
6. Which of the following equation is true for three phase induction motor, where f =supply frequency, s =slip, and f' =rotor current frequency. CO5 [K₂]
- a) $s = f' / f$ b) $s = f / f'$
c) $f = f' \times s$ d) $f' = s / f$
7. For starting a three phase Induction motor using a Auto- Transformer Starter the proper sequence is : CO3 [K₃]
1. The auto-transformer automatically gets disconnected from the circuit as the switch goes to "run" position.
2. The motor gets started on a 65% tap, the applied voltage to the motor will be 65% of the line voltage.
3. The motor gathers an appropriate speed, say upto 80% of its rated speed.
- a) 1-2-3 b) 3-2-1
c) 2-3-1 d) 2-1-3

8. The condition of an induction motor on no-load resemble those of a transformer whose secondary is CO3 [K₄]
- a) Short circuited b) open circuited
 c) supplying a variable resistive load d) supplying a variable inductive load.
9. Assertion (A): A single-phase induction motor is not self-starting. CO6 [K₃]
 Reason (R): A three-phase induction motor is self-starting.
- a) Both A and R are true and R is the correct explanation of A b) Both A and R are true but R is NOT the correct explanation of A
 c) A is true but R is false d) A is false but R is true
10. The purpose of starting winding in a single phase induction motor is to CO6 [K₂]
- a) reduce loss b) improve efficiency
 c) limit temperature rise d) Produce rotating flux conjunction with main winding.

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. Demonstrate the principal advantages of rotating field system type of construction in synchronous machines. CO1 [K₂]
12. Describe the conditions for synchronization. CO2 [K₂]
13. Differentiate the 'V' and 'inverted V' curves. CO2 [K₂]
14. What does hunting of synchronous motor mean? CO2 [K₂]
15. List the salient characteristics of double squirrel cage motor. CO3 [K₁]
16. Induction motor can run at synchronous speed? True or false? Explain. CO3 [K₄]
17. State two advantages of speed control of IM of injecting an emf in the rotor Circuit. CO4 [K₂]
18. Illustrate cascading of motors? CO4 [K₃]
19. Why single phase induction motor is not self starting? CO6 [K₂]
20. What is a Hysteresis motor? List the applications of Hysteresis motor. CO6 [K₁]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. Draw the circle diagram of a 7.46kW, 200V, 50Hz, 3 phase, slipring induction motor with a star connected stator and rotor, a winding ratio of unity, a stator resistance of 0.38ohm/phase and a rotor resistance of 0.24ohm/phase. The following are the test readings: CO2 [K₄]

No-load test: 200V, 7.7A; $\cos \phi_0 = 0.195$

Blocked rotor test: 100V, 47.6A; $\cos \phi_s = 0.454$

Find (i) starting torque (ii) maximum torque (iii) the maximum power factor (iv) the slip for maximum torque (v) the maximum output.

22. The following test results are obtained on a 6600V alternator: CO2 [K₄]
Open circuit voltage: 3100 5000 6600 7500 8300
Field current(amp) : 16 25 37.5 50 70
A field current of 20A is found necessary to circulate full load current on short circuit of the armature. Using ampere-turn method. Find the full load regulation at 0.8 p.f lagging.
23. i. Write note on synchronous Condenser. (7) CO1 [K₁]
ii. Show that the synchronous motor is a variable power factor motor. (7) CO2 [K₃]
24. Derive the expression for starting torque of 3 phase induction motor. What is the condition for maximum starting torque? Mention the ratio between the maximum torque and starting torque. CO5 [K₄]
25. What are the methods available for starting the 3 phase induction motors? Explain any two methods. CO3 [K₂]
26. Explain the operation of single phase repulsion motor and its characteristics. CO6 [K₂]
27. Explain the methods available for controlling the speed of the Induction type motors. CO4 [K₂]
