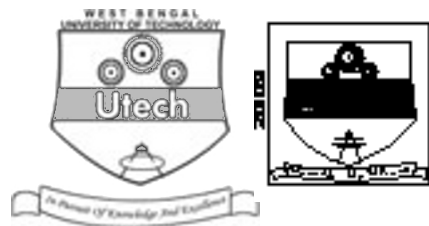


## ELECTRICAL MACHINES-II ( SEMESTER - 6 )

CS/B.TECH (EEE)/SEM-6/EEE-601/09



1. ....  
Signature of Invigilator

2. ....  
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the  
Candidate

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CS/B.TECH (EEE)/SEM-6/EEE-601/09  
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009  
ELECTRICAL MACHINES-II ( SEMESTER - 6 )

Time : 3 Hours ]

[ Full Marks : 70

### INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.  
b) For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

**No additional sheets are to be used and no loose paper will be provided**

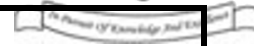
### FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B					Group – C					Total Marks	Examiner's Signature
Question Number																						
Marks Obtained																						

.....  
Head-Examiner/Co-Ordinator/Scrutineer

6610 (03/06)



**DO NOT WRITE ON THIS PAGE**



## ENGINEERING &amp; MANAGEMENT EXAMINATIONS, JUNE – 2009

## ELECTRICAL MACHINES-II

## SEMESTER - 6



Time : 3 Hours ]

[ Full Marks : 70

## GROUP – A

## ( Multiple Choice Type Questions )

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10
- i) The starting torque of a 3-phase induction motor can be increased by increasing
- a) the rotor resistance                      b) rotor reactance
- c) stator resistance                      d) the stator reactance. ☐
- ii) In a 3-phase induction motor, torque  $T$  is related with supply voltage  $V$  as
- a)  $T \propto V^{1/2}$                       b)  $T \propto \frac{1}{V}$
- c)  $T \propto V$                       d)  $T \propto V^2$  . ☐
- iii) For high starting torque, the most suited induction motor is
- a) squirrel cage                      b) slip ring
- c) deep bar squirrel cage                      d) double cage induction motor. ☐
- iv) In a 3-phase induction motor, the mechanical power developed, in terms of air gap power ( $P_g$ ) is
- a)  $(S - 1) P_g$                       b)  $P_g / 1 - S$
- c)  $\frac{1}{S}$                       d)  $(1 - S) P_g$  . ☐
- v) Pole changing method of speed control is used in
- a) slip ring induction motor                      b) d.c. shunt motor
- c) d.c. series motor                      d) squirrel cage induction motor. ☐



vi) For parallel operation, a.c. polyphase alternators must have the

- |               |                   |
|---------------|-------------------|
| a) same speed | b) voltage rating |
| c) kVA rating | d) excitation.    |



vii) A 3-phase synchronous motor has

- |                         |                          |
|-------------------------|--------------------------|
| a) high starting torque | b) low starting torque   |
| c) no starting torque   | d) low starting current. |

viii) A ceiling fan uses

- a) split phase motor
- b) capacitor start capacitor run motor
- c) capacitor start motor
- d) universal motor
- e) none of these.

ix) The torque speed characteristics of a repulsion motor resembles the characteristics of which of the following d.c. motors ?

- |                       |              |
|-----------------------|--------------|
| a) Separately excited | b) Shunt     |
| c) Series             | d) Compound. |

x) A.C. series motors are built with as few field turns as possible to reduce

- |              |                      |
|--------------|----------------------|
| a) flux      | b) eddy current loss |
| c) reactance | d) speed.            |

xi) Armature reaction in a synchronous motor at rated voltage and zero power factor is

- |                     |                      |
|---------------------|----------------------|
| a) magnetising      | b) cross-magnetising |
| c) both (a) and (b) | d) de-magnetising    |
| e) none of these.   |                      |



5

**GROUP – B****( Short Answer Type Questions )**Answer any *three* of the following questions.

3 × 5 = 15



2. Explain why single phase induction motors are not self starting. State the techniques adopted to make the single phase induction motor self starting.
3. Draw the equivalent circuit of a slip ring type 3-phase induction motor and explain the different components of the circuit.
4. Explain the phenomenon of hunting in a synchronous motor. State the remedial measures.
5. What is the difference between salient pole and cylindrical rotor of synchronous machine ? Mention the sphere of their applications.
6. Derive an expression for the average torque developed in a universal motor in terms of the armature current.

**GROUP – C****( Long Answer Type Questions )**Answer any *three* of the following questions.

3 × 15 = 45

7. a) Define the terms 'synchronous reactance' and 'voltage regulation' of alternator. Explain synchronous impedance method of determining voltage regulation of an alternator.
- b) A 1200 kVA, 3300 V, 50 Hz three phase star connected alternator has armature resistance of 0.25 ohms per phase. A field current of 40 A produces a short circuit current of 200 A and open circuit e.m.f. of 1100 V line to line for the same field current.

Find the voltage regulation on the following :

- i) Full load 0.8 p.f. lagging
- ii) Full load 0.8 p.f. leading.

Draw also the phasor diagram.



8. a) Derive an expression of the rotating magnetic field produced in a 3-phase induction motor.
- b) Prove that the rotating magnetic field rotates at synchronous speed.
- c) Which mechanism is responsible for development of flux in the rotor ?
- d) Why the rotor does not rotate at synchronous speed ?
- e) Show that the rotating magnetic field is a sinusoid with constant magnitude.
9. a) Explain the techniques adopted for speed control of induction motor.
- b) A 50 Hz, 440 V, 3-phase, 4 pole induction motor develops half the rated torque at 1490 r.p.m. with the applied voltage magnitude remaining at the rated value. What should be its frequency if the motor has to develop the same torque at 1600 r.p.m. ? Neglect stator and rotor winding resistances, leakage reactance and iron losses.

10. The equivalent circuit parameters of 230 V, 50 Hz, single phase induction motor having friction loss windage loss and core loss of 50 W are given below :

$$R_{1m} = 2.4 \, \Omega, \quad R_2' = 4.7 \, \Omega, \quad X_{1m} = 3.2 \, \Omega, \quad X_2' = 2.8 \, \Omega \quad \text{and} \quad X_m = 90 \, \Omega, \quad \text{where}$$

$R_{1m}$  = resistance of main rotor winding

$X_{1m}$  = leakage reactance of the main stator winding

$X_m$  = magnetising reactance

$R_2'$  = standstill rotor resistance to main stator winding.

$X_2'$  = standstill leakage reactance to main stator winding.

Calculate

- i) input current
- ii) power factor
- iii) developed power
- iv) output power
- v) efficiency.



$2 \times 7 \frac{1}{2}$

11. Write short notes on any *two* of the following :

- a) Parallel operation of 3-phase alternators
- b) Stepper motor
- c) Double cage rotor motor
- d) Armature reaction in synchronous generator.



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END