

Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.TECH(EEE(N))/SEM-5/EEE-501/2012-13**

**2012**

**ELECTRICAL MACHINE - II**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words  
as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

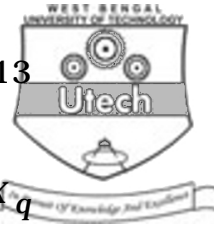
1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

- i) With usual notations, the angle of synchronous impedance  $Z_s$  is expressed as
- a)  $\tan^{-1} ( Z_s / R )$       b)  $\tan^{-1} ( R / X_s )$   
c)  $\sin^{-1} ( X_s / R )$       d)  $\sin^{-1} ( R / X_s )$ .
- ii) In a synchronous generator operating at zero power factor lagging, the effect of armature reaction is
- a) Magnetising  
b) Demagnetising  
c) Cross-Magnetising  
d) Both magnetising and cross-magnetising.

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- iii) For salient pole synchronous machine
- a)  $X_d > X_q$                       b)  $X_d = X_q$   
c)  $X_d < X_q$                       d)  $X_q = Z_d$
- iv) Damper winding is provided to
- a) Suppress hunting  
b) Develop reactance torque  
c) Improve the p.f.  
d) Improve the efficiency.
- v) Capacitor start and run induction motor is basically a
- a) Single phase induction motor  
b) Two phase induction motor  
c) Three phase induction motor  
d) Single phase reluctance motor.
- vi) The speed torque characteristic of a repulsion motor resembles the speed torque characteristic of which of the following dc motors ?
- a) Separately excited              b) Series  
c) Shunt                                d) Compound.
- vii) The motor generally used in a tape recorder is
- a) Universal motor                  b) Reluctance motor  
c) Split phase motor                d) Hysteresis motor.



viii) What happens when a stationary alternator is connected in parallel to live bus-bars

- a) run as a synchronous motor
- b) get short circuited
- c) momentarily the voltage drops
- d) no change in circuit condition.

ix) Winding of a four pole alternator having 36 slots and coil span 1-8 is short pitched by

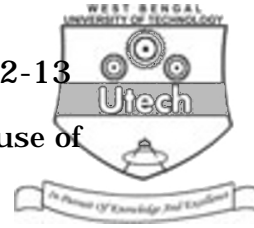
- a)  $140^\circ$
- b)  $80^\circ$
- c)  $20^\circ$
- d)  $40^\circ$ .

x) The rotor of the following motors has no teeth or winding

- a) Split phase
- b) Reluctance
- c) Hysteresis
- d) Shaded pole.

xi) If the prime mover of an alternator supplying load to an infinite bus bar is suddenly shut down, then it will

- a) Stop
- b) Continue to run as an altrenator
- c) Continue to run as a synchronous motor in the reverse direction
- d) Continue to run as a synchronous motor in the same direction.



- xii) Stepper motors are widely used because of
- Wide speed range
  - Large rating
  - No need of field control
  - Compatibility to digital system.

**GROUP - B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

- A single phase induction motor, when excited by a single phase supply produces two equal and opposite revolving fields. Justify the statement.
- Define voltage regulation of an alternator. State different methods for determination of voltage regulation.
  - What are the reasons for variation in terminal voltage of a loaded alternator ?
- Explain the operating principle of a stepper motor.
  - Why the alternators of a power plant are synchronized ?
- Why synchronous motors are not self-starting ?
  - Mention different methods of starting a synchronous motor.
- What is distribution factor ? What are the advantages of distributing a winding in slots ?



**GROUP - C**

**( Long Answer Type Questions )**

Answer any *three* of the following.  $3 \times 15 = 45$

7. a) Explain the working principle of a 1-phase induction motor.
- b) Draw and explain the equivalent circuit of a 1-phase induction motor.
- c) The test results of 230 V, 1-ph induction motor are given below :

Blocked rotor test : 110 V, 9.5 A, 450W

No load test : 230 V, 4.4 A, 120 W

The starting winding is kept open during blocked rotor test and the stator winding resistance is  $1.4 \Omega$ .

Find the equivalent circuit parameters and the core, friction and windage losses.  $4 + 5 + 6$

8. a) What is hunting in a Synchronous machine ? Explain its cause and effect. How it is minimized ?
- b) A 3-ph, 440 V, 50 Hz, delta connected alternator has a direct axis reactance of  $0.12 \Omega$  and a quadrature axis reactance of  $0.09 \Omega$  per phase. If the alternator supplies 900 A at 0.8 p.f. lagging, calculate the following :

i) the excitation emf neglecting saliency.

ii) the excitation emf taking into account the saliency.

In the first case, assume  $X_s = X_d$ . Neglect armature resistance.  $7 + 8$

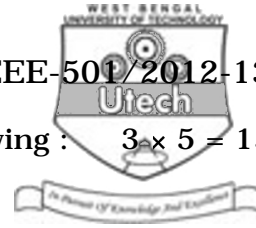


9. a) What is hunting in synchronous motor ?
- b) How the hunting can be prevented ?
- c) A 3000 V 3-phase synchronous motor running at 1500 r.p.m. has its excitation kept constant corresponding to a no load terminal voltage of 3000 V. Determine the power input, power factor and torque developed for an armature current of 250 A if the synchronous reactants is 5 ohm / phase and armature resistance is neglected. 4 + 4 + 7

10. a) Derive the *e.m.f.* equation of an alternator indicating pitch factor and distribution factor.

- b) A three phase, star connected alternator has the following data :

Voltage required to be generated on O.C. is 4000 V at 50 Hz speed is 500 r.p.m. Stator slots / pole / phase is three, conductor / slot is 12. Calculate the number of poles and useful flux / pole. Assume all conductors / phase to be connected in series and coils to be full pitched. 6 + 9



11. Write short notes of any *three* of the following :  $3 \times 5 = 15$

- a) 3-phase induction generator
- b) Repulsion motor
- c) Stepper motor
- d) Linear induction motor
- e) A.C. servo motor.

