

CS/B.Tech/EE/Odd/Sem-5th/EE-501/2015-16

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**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY,  
WEST BENGAL**

**EE-501**

**ELECTRIC MACHINES-II**

Time Allotted: 3 Hours

Full Marks: 70

*The questions are of equal value.*

*The figures in the margin indicate full marks.*

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

*All symbols are of usual significance.*

**GROUP A  
(Multiple Choice Type Questions)**

1. Answer any *ten* questions. 10 × 1 = 10
- (i) The synchronous-impedance method of finding the voltage regulation by a cylindrical rotor alternator is generally considered as
- (A) a pessimistic method because saturation is not considered  
(B) an optimistic method because saturation is not considered  
(C) a fairly accurate method even if power factor is not taken into account while determining synchronous impedance  
(D) a fairly accurate method even if power factor is taken into account while determining synchronous impedance
- (ii) A salient pole synchronous machine has maximum power output when power angle  $\delta$  is
- (A)  $90^\circ$  (B) either  $90^\circ$  or more  
(C) less than  $90^\circ$  (D) more than  $90^\circ$

- (iii) If the power factor of an alternator is zero lagging the armature reaction is
- (A) demagnetizing  
(B) magnetizing  
(C) cross magnetizing  
(D) both demagnetizing and cross magnetizing
- (iv) Cylindrical rotor synchronous machines are mainly used in
- (A) Hydel power plants  
(B) Steam power plants  
(C) In both hydel and steam power plants  
(D) None of these
- (v) When a 3-phase synchronous motor is running at synchronous speed, the damper winding produces
- (A) damping torque  
(B) eddy current torque  
(C) torque aiding the developed torque  
(D) no torque
- (vi) In a salient pole synchronous machine, where  $X_d = d$ -axis synchronous reactance,  $X_q = q$ -axis synchronous reactance
- (A)  $X_q = X_d$  (B)  $X_q > X_d$  (C)  $X_q = 0$  (D)  $X_q < X_d$
- (vii) Which motor has the starting torque proportional to iron loss?
- (A) Permanent magnet motor (B) Switch reluctance motor  
(C) Hysteresis motor (D) Stepping motor
- (viii) The function of compensating winding in a single phase series motor is to
- (A) improve the commutation  
(B) reduce the reactance drop and degrade the commutation  
(C) reduce the reactance drop and improve commutation  
(D) none of these
- (ix) 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
- (x) The motor generally used in a tape recorder is
- (A) reluctance motor (B) universal motor  
(C) hysteresis motor (D) split-phase motor

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- (xi) In a double revolving field theory, the slip of the forward motor is  $S$ , then the slip of the backward motor is  
 (A)  $2S$  (B)  $S$  (C)  $2 - S$  (D)  $S - 2$
- (xii) Induction generator runs at  
 (A) super synchronous speed (B) sub-synchronous speed  
 (C) synchronous speed (D) none of these

### GROUP B

#### (Short Answer Type Questions)

Answer any three questions.

$3 \times 5 = 15$

2. What is a synchronous condenser? Explain its operation and utility with phasor diagram.
3. What is hunting in an alternator? Discuss the measures to be taken to minimize such hunting.
4. Explain why cylindrical rotor alternators have small diameter and large core length while salient pole alternators have large diameter and small core length.
5. Why is a single phase induction motor not self starting? Name the various methods of starting and mention which mode of starting will provide high starting as well as running torque.
6. For an universal motor, the performance of the machine is better under d.c. operation than under a.c. operation-justify.

### GROUP C

#### (Long Answer Type Questions)

Answer any three questions.

$3 \times 15 = 45$

7. (a) Discuss the nature of armature reaction of an alternator for zero p.f. lagging, zero p.f. leading and unit power factor load. 8+7  
 (b) Describe the effect of change of excitation and mechanical input of an alternator.

8. (a) Explain two reaction field theory for a salient pole synchronous machine. Using this theory, draw the phasor diagram for lagging current for (i) salient pole generator (ii) salient pole motor. 8+7  
 (b) A 3-phase star connected 400 V synchronous motor takes a power input of 5472 Watts at rated voltage. Its synchronous reactance is 10 ohms per phase and resistance is negligible. If the excitation voltage is adjusted equal to the rated voltage 400 V, compute the load angle, power factor and armature current.
9. (a) For a single phase induction motor, derive the condition for maximum starting torque during capacitive starting. 7  
 (b) A 220 V, 4 - pole, 50 Hz single phase induction motor gave the following test results: 4+4  
 Blocked Rotor test: 110 V, 10 A, 400 W  
 No-load test: 220 V, 4 A, 100 W  
 (i) Find the parameters to develop equivalent circuit. State necessary assumptions.  
 (ii) Considering the speed of the motor as 1440 rpm, determine (a) line current, (b) power factor.
- 10 (a) Explain with reasons why compensating winding is provided in a universal motor for AC operation. 5+5+5  
 (b) What are the modifications that should be done in a dc series motor so that it will run satisfactorily with ac supply?  
 (c) What may happen if one of the 3 - lines of a 3 - phase cage rotor induction motor suddenly gets disconnected? Justify your answer.
11. Write short notes on any three of the following: 3×5  
 (a) Hysteresis motor  
 (b) Servomotor  
 (c) Brushless dc motor  
 (d) Linear Induction Motor  
 (e) Stepping motor.