17511

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3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory*.

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. (A) Attempt any THREE of the following : **12**

(a) State the effects of change in supply voltage on torque-slip characteristics of 3-phase induction motor.

(b) State the function of following parts of an induction motor (i) Slip-rings, (ii) Fan, (iii) Brushes and (iv) Frame.

(c) (i) State the necessity of starter for three-phase induction motor.

(ii) Write the names of starters used for 3-phase squirrel cage induction motor.

(d) Define the following terms and write their mathematical expression :

(i) Pitch Factor and

(ii) Distribution Factor related to the winding of alternators

(B) Attempt any ONE of the following : **6**

(a) Draw and explain how star-delta starter is used for reducing the starting current of a 3-phase induction motor.

(b) Describe the principle of operation of an induction generator. Draw its torque-speed characteristic.

2. Attempt any FOUR of the following : 16

(a) Compare squirrel cage and slip-ring induction motor on the basis of :
(i) Starting torque (ii) Power factor (iii) Speed control and (iv) Applications.

(b) Explain why three phase induction motor is called as asynchronous motor. Also give the formulae for rotor induced emf and frequency of rotor currents.

(c) Compare salient pole rotor and smooth cylindrical rotor alternator on the basis of : (i) Operating speed (ii) Rotor construction (iii) Ratio of core length to bore diameter and (iv) Applications.

(d) Draw the phasor diagram of loaded alternator when load is capacitive and also write the equation of no load, induced emf.

(e) A motor is to be operated from 230 V, 50 Hz single phase A.C. and 220 V D.C. supply. Identify the above motor and describe its working principle with neat sketch.

(f) Practically if D.C. series motor has to be supplied with single phase A.C., what modification and refinements will have to be done on D.C. series motor ?

3. Attempt any FOUR of the following : 16

(a) Draw and explain torque-slip characteristics of three phase induction motor.

(b) Describe with the help of curves the effect of variation of a rotor circuit resistance on the torque-slip characteristics of an induction motor.

(c) Derive the e.m.f. equation of a three phase alternator from first principle.

(d) An 400 V, 125 kVA, 3-phase, star connected alternator has open-circuit characteristics as under :

Field Current (A)	0	10	20	30	40	50	60
Open Circuit emf (V)	0	140	250	340	400	460	520

Short circuit characteristics of the alternator is a straight line passing through origin and it is found that the S.C. current is equal to the full load current when I_f is 20 A. Determine full load regulation of the alternator by Z_s method at the following p.f. : (i) 0.8 lagging and (ii) 0.8 leading. Assume R_a is 0.15 Ω.

(e) "Single phase induction motor is not self starting." Justify the statement by double field revolving theory.

4. (A) Attempt any THREE of the following : 12

(a) A 440 V, 6-pole, 3-phase, 50 Hz induction motor develops an output of 15 kW at 950 r.p.m. If the input power factor is 0.86 lagging, mechanical losses are 730 W and the stator losses 1500 W. Find (i) The Slip (ii) The rotor copper losses (iii) The motor input and (iv) The line current.

(b) Write any four significances of a rotor resistance starter.

(c) Find the no-load line voltage of a star connected 3-phase, 6-pole alternator which runs at 1200 rpm, having flux per pole of 0.1 Wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by one slot.

(d) Explain the need of parallel operation of Alternators.

(B) Attempt any ONE of the following : 6

(a) Describe with the help of necessary graphs and phasor diagram, the procedure to calculate voltage regulation of a 3-phase alternator by synchronous impedance method.

(b) (i) Write the formulae for X_s, Z_s of an alternator.

(ii) Explain the effect of armature reaction at various p.f. of loads of an alternator. Draw suitable wave-forms showing the effects.

5. Attempt any FOUR of the following : 16

(a) Draw and explain power flow diagram of three phase induction motor.

(b) Prove that rotor copper loss in induction motor is slip times rotor input.

(c) Describe three-lamp method of synchronising an alternator with the bus-bar.

(d) What are the conditions to be fulfilled when two alternators are to be connected in parallel ?

(e) Describe the construction and working principle of Line as Induction Motor. (LIM)

(f) Describe the working principle of permanent magnet stepper motor.

P.T.O.

6. Attempt any FOUR of the following : 16

(a) Discuss about the split-phasing principle used in the starting of single phase induction motor. Explain the construction and working of resistance split phase induction motor in detail.

(b) State one application of the following special machines :

(i) Universal motor

(ii) Linear Induction motor

(iii) Induction Generator and

(iv) Stepper motor

(c) State four advantages of rotating field over rotating armature of a 3-phase alternator.

(d) Describe with neat sketch, the principle of operation of single phase shaded pole induction motor.

(e) Compare resistance split phase motor with capacitor split phase motor on the basis of (i) Output, (ii) Starting torque, (iii) Power factor and (iv) Applications.

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