Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III(New) • EXAMINATION – WINTER 2016

Subject Code:2131005 Date:09/01/2017

Subject Name:Electrical Machines

Time:10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 Choose the correct answer for the following multiple choice questions. 14

1 With increase in load of a transformer, core flux will …
(a) increase. (b) decrease.
(c) remain constant. (d) depends on type of load.

2 What is the current drawn by an actual transformer, when primary is supplied rated voltage and secondary is kept open.
(a) No-load current. (b) Full-load current.
(c) Zero current. (d) Magnetizing current.

3 The maximum e.m.f. will induce in the rotor of a 3-phase induction motor, when it …
(a) is blocked. (b) runs at synchronous speed.
(c) runs at no-load. (d) runs at full-load.

4 What is the purpose of starting winding in 1-phase induction motor?
(a) To limit temperature rise of the machine.
(b) To reduce losses.
(c) To produce rotating magnetic field in conjunction with main winding.
(d) Both (a) and (b).

5 When 3-phase a.c. supply of 50 Hz is given to stator of a 4-pole, 3-phase induction motor, in standstill condition the rotor frequency will be ...
(a) 25 Hz. (b) 50 Hz.
(c) 0 Hz. (d) 12.5 Hz.

6 The current from the stator of an alternator is taken out to the external load circuit through …
(a) carbon brushes. (b) solid connections.
(c) slip rings. (d) commutator segments.

7 Which type of alternator is used in hydro-electric power stations?
(a) Salient pole alternator. (b) Non-salient pole alternator.
(c) Turbo generator. (d) Steam turbine alternator.

8 While starting a synchronous motor its field winding should be ….
(a) kept open. (b) connected to a d.c. source.
(c) short-circuited. (d) connected to a a.c. source.

9 In a d.c. generator, the effect of armature reaction on the main flux is to …
(a) reduce it. (b) distort it.
(c) both, reduce and distort it. (d) reverse it.

10 In d.c. generators, the polarity of interpoles is ...
(a) same as that of the main pole behind.
(b) same as that of the main pole ahead.
(c) opposite to that of the main pole ahead.
(d) None of the above.

11 What is the function of brush and commutator in a d.c. motor.
(a) To convert a.c. into d.c.
(b) To reduce demagnetizing effect of armature reaction.
(c) To produce unidirectional current in the armature.
(d) To produce unidirectional torque.

12 The economisers are used to heat …
(a) air. (b) feed water.
(c) steam. (d) None of the above.

13 The skin effect in stranded conductor compared to solid conductor is ...
(a) less. (b) more.
(c) equal. (d) None of the above.

14 The main consideration in the design of a feeder is the ...
(a) current carrying capacity. (b) voltage drop.
(c) power handling capacity. (d) None of the above.

Q.2 **(a)** Draw a complete phasor diagram for a step-down transformer when the load power factor is lagging. **03**

(b) Draw the torque-speed characteristics of 3-phase induction motor and explain the effect of change in rotor resistance. **04**

(c) Explain the back-to-back test with necessary diagram for separation of losses in two identical 1-phase transformers. **07**

OR

(c) A 746 kW, 3-phase 50 Hz, 16-pole induction motor has a rotor impedance of (0.02 + j0.15) Ω at standstill. Full-load torque is obtained at 360 RPM. Calculate (i) the ratio of maximum to full-load torque, (ii) the speed for maximum torque and (iii) the rotor resistance to be added to get maximum starting torque. **07**

Q.3 **(a)** Explain power stages in 3-phase induction motor. **03**

(b) Derive e.m.f. equation of an alternator. **04**

(c) Describe, with neat sketches, the constructional details of salient pole and non-salient pole type of rotors in an alternator. **07**

OR

Q.3 **(a)** State the advantages of stationary armature in an alternator. **03**

(b) Explain diversity factor and plant utilization factor. **04**

(c) Explain the synchronous impedance method of voltage regulation in an alternator with neat diagrams. **07**

Q.4 **(a)** Derive e.m.f. equation of a d.c. generator. **03**

(b) Explain commutator action in d.c. generator with necessary diagrams. **04**

(c) A d.c. shunt generator supplies 96 A at a terminal voltage of 200 V. The armature and shunt field resistances are 0.1 Ω and 50 Ω respectively. The iron and frictional losses are 2500 W. Find (i) generated e.m.f., (ii) copper losses and (iii) commercial efficiency. **07**

OR

Q.4 **(a)** Explain critical resistance for a d.c. series generator. **03**

(b) Explain the characteristics of d.c. shunt motor. **04**

(c) What is the necessity of d.c. motor starter? Explain three-point starter. **07**

Q.5 **(a)** Define power factor. What is the need of improving power factor? **03**

(b) What is Ferranti effect? How is it effect the voltage of transmission line? **04**

(c) Derive the equitation of starting torque and running torque of 3-phase induction motor. **07**

OR

Q.5 **(a)** Why 1-phase induction motor is not self-starting? **03**

(b) Explain the types of d.c. distributors. **04**

(c) A 3-phase induction motor has a 4-pole star-connected stator winding. The motor runs on a 50 Hz supply with 200 V between lines. The rotor **07**

resistance and standstill reactance per phase are 0.1 Ω and 0.9 Ω respectively. The ratio of rotor to stator turns is 0.67. Calculate (i) torque at 4 % slip, (ii) maximum torque and (iii) speed at maximum torque.

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