

AMIETE – ET (Current Scheme)

Time: 3 Hours

December - 2017

Max. Marks: 100

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

- a. The full voltage regulation of an alternator is 6% at 0.8 power factor lagging and at rated speed of 1200 rpm. Its full load regulation at 0.8 pf lagging and at 1000 rpm would be (assuming negligible armature resistance)
- (A) less than 6% (B) more than 6%
(C) 6% (D) 5.5%
- b. Function of damper bars in a synchronous machine is to
- (A) prevent rotor from running at subsynchronous speed
(B) prevent rotor from running at supersynchronous speed
(C) prevent rotor from running at synchronous speed
(D) reduce the rotor oscillations about the operating point
- c. In a dc machine, the demagnetizing effect of armature reaction is owing to
- (A) uneven air gap length
(B) magnetic saturation in half of the field pole
(C) non sinusoidal nature of armature mmf
(D) component of armature mmf along field axis
- d. The function of a starter in dc motor is to
- (A) start the dc motor (B) limit the starting current
(C) increase the starting torque (D) avoid dip in supply voltage
- e. The primary (220V) of a 220/6V, 50 Hz transformer is connected to 110V, 60Hz source. The secondary output voltage will be
- (A) 3.6V (B) 3.0V
(C) 2.5V (D) 1.667V

- f. A single phase transformer has a maximum efficiency of 90% at full load and unity power factor. Efficiency at half load at the same power factor is
 (A) 86.7% (B) 88.26%
 (C) 88.9% (D) 87.8%
- g. The main reason for using a hysteresis motor for high quality tape recorder and record player is that
 (A) its speed is constant (synchronous)
 (B) it develops extremely steady state torque
 (C) it needs no centrifugal switch
 (D) its operation is not affected by mechanical vibration
- h. Induction generators deliver power at
 (A) unity pf (B) zero pf lagging
 (C) leading pf (D) lagging pf
- i. If a dc series motor is connected to an ac supply
 (A) the motor will not start
 (B) the motor will start but come to stop
 (C) the motor will start and run but will have poor performance
 (D) None of these
- j. A 3- phase 50Hz, 400V, 15HP induction motor needs a starter
 (A) because there is no back emf induced in the stator during starting
 (B) because the motor does not possess an inherent starting torque
 (C) to increase the starting torque
 (D) because the induced secondary voltage and hence the currents in the windings are abnormally high during starting

Answer any FIVE Questions out of EIGHT Questions.

Each question carries 16 marks.

- Q.2** a. Why all electrical machines are made of magnetic circuits? Elucidate MMF, Flux, Reluctance and Eddy current Loss. (8)
- b. A rectangular magnetic circuit has three limbs. A coil of 1000 turns wound on the central limb which has an air gap of 1mm. The magnetic path from top of the central limb to the bottom of the central limb is 50cm (air gap length excluded) and via each outer limb is 200cm. The cross sectional area is $5 \times 3 \text{cm}^2$ and that of outer limb is $2.5 \times 3 \text{cm}^2$. A current of 1A in coil produces an air gap flux of 0.4 mWb. Find the relative permeability of core. Draw magnetic circuit and corresponding magnetic analog circuit. (8)
- Q.3** a. What are the major functions of a transformer? Prove that in two winding transformer $V_1/V_2 = N_1/N_2$ (8)
- b. A short circuit test on a single phase 10 kVA, 400/100V transformer has been conducted. It has taken 20A, 120W at 10V when instruments have been kept on HV side. Find voltage regulation at full load 0.8 power factor lagging. Draw equivalent circuit and phasor diagram. (8)

- Q.4** a. Draw cross sectional view of an elementary 2- pole dc generator, Labelling its major parts. Derive expression for its generated emf. (4+4)
- b. A 200V DC series motor runs at 1000 rpm and takes 20 A. It has $R_a + R_{se} = 0.4\Omega$. Calculate the resistance to be inserted in series so as to reduce the speed to 800rpm. Assume torque to vary square of speed and linear magnetization curve. Draw the circuit also. (8)
- Q.5** a. Compare between cylindrical and salient pole synchronous machines with a neat sketch. The stator of three phase, star connected, 6 pole, 50 Hz has 54 slots. It consists of sinusoidally distributed winding. The coil pitch is shorted by two slots Find pole pitch, slot angle and winding factor. (4+4)
- b. Prove that for a synchronous motor $P_e = (V_t E_f / X_s) \sin\alpha$ where α is power angle with circuit and phasor diagram. Highlight significance of Power –Angle Curve. (8)
- Q.6** a. Why a three phase induction motor always rotates at subsynchronous speed in steady-state? A three phase induction motor has full load slip of 4% and slip at maximum torque of 30%. Find the value of Maximum torque/Full load torque. (4+4)
- b. Describe different starting methods of three phase induction motor. Why star-delta starter is popular? (6+2)
- Q.7** a. Why a single phase induction motor has no starting torque? Draw a neat rotating field equivalent circuit of single phase induction motor under load. (4+4)
- b. Describe working of permanent capacitor single phase induction motor with power circuit, phasor diagram and torque–speed curve. In what direction shaded -pole motor rotates? (6+2)
- Q.8** a. What do you mean by green energy? With the help of a neat diagram, explain how MHD generates voltage. (4+4)
- b. Draw the block diagram of wind power interfacing grid. Why solar power is becoming more popular in modern world? (4+4)
- Q.9** a. Draw one line diagram of power system grid. Why power is transmitted at high voltage? (4+4)
- b. What are the pros and cons of HVDC power transmission scheme? Compare between batteries and fuel cell. (4+4)