Code: AE55   **Subject: PRINCIPLES OF ELECTRICAL ENGINEERING**

AMIETE – ET

Time: 3 Hours   JUNE 2013   **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. An electric charge in uniform motion produces

      (A) An electrical field only   **(B)** A magnetic field only
      (C) Both **(A)** and **(B)**   **(D)** No such field at all

    b. Cooling of transformer is required so as

      (A) to increase the efficiency
      (B) to reduce the losses
      (C) to reduce lumming
      (D) to dissipate the heat generated in the windings

    c. If the full load copper loss of a transformer is 100 W, what will be its copper loss at half-load?

      (A) 100 W   **(B)** 200 W
      (C) 50 W   **(D)** 25 W

    d. The armature of a DC machine is made up of laminated sheets in order to

      (A) reduce armature copper loss
      (B) reduce eddy-current loss
      (C) reduce hysteresis loss
      (D) increase the dissipation of heat from the armature surface

    e. The purpose of having a commutator and brush arrangement in a DC motor is

      (A) to produce an unidirectional torque
      (B) to produce an unidirectional current in armature
      (C) to help in changing the direction of rotation of the armature
      (D) None of these

f. Which of the following equations doesn't apply to a shunt wound DC generator?

    (A) $I_{sh} = \dfrac{V}{R_{sh}}$ **(B)** $I_L = I_a - I_{sh}$

    (C) $E = V + I_a R_a$ **(D)** $V = E + I_a R_a$

g. Under full load running conditions, the slip of a synchronous motor is

    (A) zero   **(B)** about 0.01

    (C) about 0.1   **(D)** unity

h. A 4-pole, 1200 rpm alternator will generate emf at a frequency of

    (A) 60 Hz   **(B)** 50 Hz

    (C) 40 Hz   **(D)** 25 Hz

i. The main reason why three-phase induction motors are widely used in industries is that

    (A) they are rugged in construction, require less maintenance and are less expensive than other motors.

    (B) their operating characteristics are superior over other motors

    (C) their speed can be controlled very smoothly over a wide range

    (D) They can be manufactured easily for any HP rating

j. In a three phase induction motor

    (A) three-phase supply is connected to the stator winding and a DC supply is connected to the rotor winding

    (B) three-phase supply is connected to both stator and rotor windings

    (C) three-phase supply is connected to the rotor winding only

    (D) three-phase supply is connected to the stator winding only

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Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. State and explain Faraday's laws of electromagnetic induction.   **(8)**

    b. A conducting circular loop is placed in an uniform magnetic field B=0.020 T with its plane perpendicular to the field. Somehow, the radius of the loop starts shrinking at a constant rate of 1.0 mm/s. Find the induced emf in the loop at an instant when the radius is 2 cm.   **(8)**

Q.3 a. Explain the principle of working of transformer.   **(8)**

     b. A 230/110 V, single-phase transformer takes an input of 350 volt-amperes at no-load while working at rated voltage. The core loss is 100 W. Find the iron-loss component of no-load current, the magnetising component of no-load current and the no-load power factor. **(8)**

Q.4   a. Draw and explain the power flow diagram for a DC generator. **(8)**

     b. A shunt wound DC generator delivers 496 A at 440 V to a load. The resistance of the shunt field coil is $110\,\Omega$ and that of the armature winding is $0.02\,\Omega$. Calculate the emf induced in the armature winding. **(8)**

Q.5   Discuss in detail the operation of a synchronous motor at constant load with variable excitation. **(16)**

Q.6   a. Explain why a three-phase induction motor rotates always with a speed less than the synchronous speed. **(8)**

     b. A 6-pole induction motor is fed from 50 Hz supply. If the frequency of a rotor emf at full load is 2 Hz, find the full-load slip and speed. **(8)**

Q.7   a. Explain the principle of operation of a capacitor start single-phase AC motor. **(8)**

     b. Explain the principle of operation of a capacitor-start capacitor-run single phase AC motor. **(8)**

Q.8   a. Discuss the advantages and limitations of utilizing wind energy for electricity generation. **(8)**

     b. Draw the block diagram representation of a thermal power generation unit. Write the function of its main components. **(8)**

Q.9   Explain the need for energy storage. What are various methods of energy storage? Explain the compressed air storage and heat storage methods of storing energy. **(16)**