Code: AE105   Subject: PRINCIPLES OF ELECTRICAL ENGINEERING

AMIETE – ET *{NEW SCHEME}*

| Time: 3 Hours | JUNE 2015 - SPECIAL | 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 d.c. series motor should always be started with load because
   (A) at no load, it will rotate at dangerously high speed.
   (B) it will fail to start.
   (C) it will not develop high starting torque.
   (D) all are true.

b. In a 3 – phase induction motor the maximum torque
   (A) is proportional to rotor resistance r_2
   (B) does not depend on r_2
   (C) is proportional to $\sqrt{r_2}$
   (D) is proportional to r_2^2

c. The stator of an alternator is laminated to reduce
   (A) Hysteresis loss   **(B)** Copper losses
   (C) Mechanical loss   **(D)** Eddy current loss

d. The sole purpose of a commutator in a dc generator is to
   (A) Increase output voltage   **(B)** Reduce sparking at brushes
   (C) Convert the induced ac into dc **(D)** Provide smoother output

e. A balanced three-phase, 50 Hz voltage is applied to a 3 phase, 4 pole, induction motor. When the motor is delivering rated output, the slip is found to be 0.05. The speed of the rotor m.m.f. relative to the rotor structure is
   (A) 1500   **(B)** 1400
   (C) 25   **(D)** 75

f. In a 3-phase synchronous motor
    (A) the speed of stator MMF is always more than that of rotor MMF.
    (B) the speed of stator MMF is always less than that of rotor MMF.
    (C) the speed of stator MMF is synchronous speed while that of rotor MMF is zero.
    (D) rotor and stator MMF are stationary with respect to each other.

g. A universal motor is one which
    (A) is available universally
    (B) with no maintainence
    (C) can be operated both on dc & ac supply
    (D) runs at dangerously high speed on no-load
.

h. Transmission efficiency increases as
    (A) Voltage and power factor both increase
    (B) Voltage and power factor both decrease
    (C) Voltage increases but power factor decreases
    (D) Voltage decreases but power factor increases

i. In a circuit model of transformer, the core loss is represented by,
    (A) shunt resistance   **(B)** series resistance
    (C) shunt inductance   **(D)** series inductance

j. The magnetising force (H) and magnetic flux density (B) are connected by the relation
    (A) $B = \mu_r H/\mu_0$ **(B)** $B = \mu H$
    (C) $B = H/\mu_0\mu_r$ **(D)** $B = \mu_0 H/\mu_r$

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

Q.2 a. A magnetic circuit of cross-sectional area 0.4 cm^2 consists of one part 3 cm long, of material having a relative permeability 1200, and a second part 2 cm long of material having a relative permeability 750. With a 100 turn coil carrying 2 A, find the value of flux existing in the circuit.   **(8)**

b. What is magnetic circuit? Compare electric and magnetic circuits.   **(8)**

Q.3 a. Explain the construction and working of Single phase transformer.   **(8)**

b. The parameters of the equivalent circuit of a 150-kVA, 2400/240V transformer are: **(8)**
    R_1=0.2ohm, R_2=2 x 10^{-3} ohm, X_1=0.45 ohm, X_2= 4.5 x 10^{-3} ohm,
    R_i =10 kohm, X_m = 1.6 kohm as seen from 2400 volts side.
    Calculate: open circuit current, power and power factor when LV side is excited at rated voltage

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Q.4 a. A shunt generator has an induced emf of 254 V. When the generator is loaded, the terminal voltage is 240 V. Neglecting armature reaction, find the load current if the armature resistance is 0.04 ohm and the field circuit resistance is 24 ohms. **(8)**

  b. Draw the characteristic curves and state two applications for   **(4×2)**
  (i) A dc shunt motor
  (ii) A dc series motor

Q.5 a. What are starters in DC machines? Give reasons, why, starters are required for starting a motor. Name different type of starters. **(6)**

  b. Explain construction and working of Synchronous machine. Also state its applications. **(10)**

Q.6 a. A 400V, 4-pole, 50 Hz, 3-phase, 10 hp, star connected induction motor has a no load slip of 1% and full load slip of 4%. Find the following: **(5×2)**
  (i) synchronous Speed   (ii) no-load speed
  (iii) full-load speed.   (iv) frequency of rotor current at full-load
  (v) full-load torque.

  b. Explain the working principle of induction generator. **(6)**

Q.7 a. Name different types of 1-phase A.C motors. Give some important application of these motors. **(8)**

  b. Explain the construction, working principle & applications of a single-phase induction motor. **(8)**

Q.8 a. Discuss the criterion for choice of voltage for transmission and distribution. **(8)**

  b. With the help of neat sketches explain different types of distribution systems. **(8)**

Q.9 a. Explain what is earthing and why it is necessary? **(8)**

  b. Classify instruments and clearly differentiate between absolute and secondary instruments. **(8)**