ROLL NO. _____

Code: AE55 Subject: PRINCIPLES OF ELECTRICAL ENGINEERING

AMIETE – ET

Time: 3 Hours **DECEMBER 2014** **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. When a small element of conductor of length ℓ, carrying current i is placed in a magnetic field B at an angle θ with respect to B, then the force F that it experiences is

(A) Zero **(B)** Biℓ
(C) Biℓ 2sinθ **(D)** Biℓ cosθ

b. A vertical wire carries a current in upward direction. An electron beam sent horizontally towards wire will be deflected

(A) towards right **(B)** towards left
(C) upwards **(D)** down wards

c. The core of a transformer is made of

(A) Annealed copper **(B)** Silicon steel
(C) Seasoned wood **(D)** Aluminium

d. The core of a transformer is assembled with laminated sheets so as to reduce

(A) hysteresis loss **(B)** copper loss
(C) magnetic noise **(D)** eddy-current loss

e. The emf induced in a coil rotating in a uniform magnetic field is maximum when

(A) the flux linkage by the coil is minimum
(B) the flux linkage by the coil is maximum
(C) the rate of change of flux linkage by the coil is minimum
(D) the coil is at right angles to the magnetic field

f. The number of parallel paths in the armature winding of a four- pole wave connected dc machine having 28 coil-sides is

(A) 28 **(B)** 14
(C) 4 **(D)** 2

g. A 4-pole, 1500 rpm alternator will generate emf at a frequency of

(A) 60 Hz **(B)** 50 Hz
(C) 40 Hz **(D)** 25 Hz

h. A three phase, 8-pole alternator having 72 slots will have the distribution factor of

(A) 0.96 **(B)** 0.88
(C) 0.72 **(D)** 0.64

i. The slip of an induction motor under full load condition is about

(A) 0.03 **(B)** 0.1
(C) 0.2 **(D)** zero

j. In 50Hz, three phase induction motor running at 4% slip, the frequency of the rotor current is about

(A) 50 Hz **(B)** 10 Hz
(C) 2 Hz **(D)** zero

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

Q.2 a. What is hysteresis? Sketch hysteresis loop and indicate on it the coercive force and residual flux density. **(8)**

b. The flux in a magnetic core is varying sinusoidally at a frequency of 500 Hz. The maximum flux density is 0.5Tesla. The eddy- current loss then is 14 watts. Find the eddy-current loss in this core, when the frequency is 750 Hz, and flux density is 0.4Tesla. **(8)**

Q.3 a. Explain how can you determine the parameters of circuit model of a transformer, experimentally. **(8)**

b. The primary and secondary windings resistances of a 40 KVA, 6600/250V, single-phase transformer are 10 ohm and 0.02 ohm respectively. The equivalent leakage reactance as referred to the primary winding is 35 ohm. Find the full load regulation for load power factor of 0.8 lagging. **(8)**

Q.4 a. Explain the terms “critical resistance” and critical speed’ of a DC shunt generator with reference to its relevant characteristics. **(8)**

b. A 50kW, 230V dc shunt motor takes a current of 14.5 A when running at 1640 rpm. The armature and field resistances are 0.15Ω and 120Ω respectively. Estimate the motor efficiency when the motor is drawing 215A. What would be the maximum efficiency of the motor and the load current at which it would occur? **(8)**

Q.5 a. Write short note on V-curves for a synchronous motor. **(8)**

b. A 3 phase, 50Hz, star connected synchronous generator with double layer winding runs at 500 rpm. It has 12 turns / coil and 5 slots / pole / phase and coil pitch of 13 slots. If the flux per pole is 0.025 wb. Find phase emf induced. **(8)**

Q.6 a. Explain how a rotating magnetic field is produced by applying 3-phase currents to 3-phase windings of a 3-phase induction motor. **(8)**

b. A three-phase, 6-pole, 50Hz induction motor develops maximum torque at a speed of 940 rpm. If the rotor resistance per phase is 0.1Ω, determine the standstill rotor reactance. **(8)**

Q.7 a. Explain the construction and principle of operation of split phase AC motor. **(8)**

b. Explain the construction and principle of operation of a single-phase universal motor. **(8)**

Q.8 Draw the block diagram representation of a thermal power generation unit. Explain the functions of its main components. **(16)**

Q.9 Write notes on any **TWO** of the following: **(2×8)**

(i) Batteries
(ii) Energy storage
(iii) HVDC Transmission