ROLL NO. _____

Code: AE55 Subject: PRINCIPLES OF ELECTRICAL ENGINEERING

AMIETE – ET

Time: 3 Hours **DECEMBER 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. The relative permeability of ferromagnetic materials is

(A) Less than one **(B)** More than one
(C) More than 10 **(D)** More than 100 or 1000

b. Which of the following distribution systems is most economical?

(A) DC System **(B)** Single phase ac system
(C) Three phase, 3-wire system **(D)** Three phase, 4-wire system

c. Which of the following does not change in a transformer?

(A) Current **(B)** Voltage
(C) Frequency **(D)** All of these

d. No load test on a transformer is carried out to determine

(A) Copper loss **(B)** Magnetising Current
(C) Core loss **(D)** Efficiency of the transformer

e. In D.C machines, the armature reaction m.m.f is

(A) Stationary with respect to armature
(B) Rotating with respect to stator
(C) Stationary with respect to stator
(D) Rotating with respect to brushes

f. When the speed becomes more than the synchronous speed during hunting, the damper bars develop

(A) Synchronous motor torque **(B)** Single phase induction motor torque
(C) Induction motor torque **(D)** Induction generator torque

g. In a 3 phase, 4 pole 50 Hz induction motor runs at a speed of 1440 r.p.m then the slip is

(A) 0.03 **(B)** 0.10
(C) 0.04 **(D)** 0.05

h. A single phase induction motor is

(A) Self Starting
(B) Not self Starting
(C) Self starting with the help of an auxiliary winding
(D) None of these

i. In case of 3-phase induction motor, shaft power is 2700W and mechanical losses are 180W. At a slip of 4%, the rotor ohmic losses are

(A) 115.2W **(B)** 120 W
(C) 108W **(D)** 105W

j. The rating of battery is expressed in

(A) Volt-ampere **(B)** Kilovolt-ampere
(C) Ampere-hour **(D)** Watt-hour

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

Q.2 a. Explain the power losses in magnetic material. **(8)**

b. A coil of 300 turns and of resistance 10 Ω is wound uniformly over a steel ring of mean circumference 30 cm and cross-sectional area 9 cm^2. It is connected to a supply at 20 V D.C. If the relative permeability of the ring is 1500, Calculate
(i) The Magnetising Force (ii) Reluctance
(iii) M.M.F (iv) Flux **(8)**

Q.3 a. Draw the schematic diagram of ideal transformer. Derive an expression for e.m.f. of an ideal transformer. **(8)**

b. The primary and secondary windings of a 40KVA, 6600/250V single phase transformer have resistance of 10 ohms and 0.02 ohms respectively. The total

leakage reactance is 35 Ω as referred to the primary winding. Find full load regulation at power factor of 0.8 lagging. **(8)**

Q.4 a. What is meant by commutation process in D.C machines? Explain in detail, the commutation process in D.C machines. **(8)**

b. A 4-pole, 220V shunt motor has 540 lap-wound conductor. It takes 32 A from the supply mains and develops output power of 5.59 KW. The field winding takes 1 A. The armature resistance is 0.9 Ω and the flux per pole is 30 mWb. Calculate
(i) the speed
(ii) the torque developed in Newton meters. **(8)**

Q.5 a. Explain the constructional details of a salient pole synchronous machine. **(8)**

b. A 3300V star-connected synchronous motor has synchronous impedance of 0.4+j5 Ω per phase. For an excitation e.m.f. of 4000V and motor input power of 1000KW at rated voltage. Compute the line current and Power factor. **(8)**

Q.6 a. Explain the construction and working of a 3-phase induction motor. **(8)**

b. In a 6-pole, 3-phase, 50 Hz induction motor with star connected rotor, the rotor resistance per phase is 0.3 Ω, the reactance at standstill is 1.5 Ω per phase and an e.m.f. between the slip-rings on open-circuit is 175V. Calculate
(i) Slip at a speed of 950 rpm
(ii) Rotor e.m.f. per phase
(iii) Rotor frequency and reactance at a speed of 950 rpm **(8)**

Q.7 Write short notes on any **TWO**:

(i) Split-Phase Motor
(ii) Reluctance Motor
(iii) Two value Capacitor Motor **(8×2)**

Q.8 a. With the help of a neat diagram explain the function of various components of a Nuclear power plant. **(8)**

b. Explain how direct sunlight can be converted into electricity. **(8)**

Q.9 Write technical short notes on any **TWO** of the followings:

(i) Hydrogen Energy Systems
(ii) Fuel Cell
(iii) Renewable Energy Resources

(16)