ROLL NO. _____

Code: AE55 Subject: PRINCIPLES OF ELECTRICAL ENGINEERING

AMIETE – ET

Time: 3 Hours **DECEMBER 2012** **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 two windings of a transformer are

(A) conductively linked **(B)** inductively linked
(C) not linked at all **(D)** electrically linked

b. The generation voltage is usually

(A) between 11 KV and 33 KV **(B)** between 132 KV and 400 KV
(C) between 400 KV and 700 KV **(D)** None of these

c. The type of DC motor which is preferred for constant speed is:

(A) series motor **(B)** shunt motor
(C) cumulatively compound motor **(D)** any of these

d. 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

e. Specific heat of nickel-chrome is____

(A) 0.112 **(B)** 0.106
(C) 0.108 **(D)** None of these

f. The drive used in ceiling fan is

(A) self start **(B)** inductive start
(C) capacitive start **(D)** resistive start

g. The stator winding of an alternator is laminated to reduce

(A) Hysteresis loss **(B)** Copper losses
(C) Mechanical loss **(D)** Eddy current loss

h. Maximum efficiency of a DC machine take place when

(A) variable loss > constant loss **(B)** variable loss < constant loss
(C) variable loss = constant loss **(D)** variable loss = twice of constant loss

i. The Electric motor used in a mixer-grinder is a

(A) DC motor **(B)** induction motor
(C) synchronous motor **(D)** universal motor

j. 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

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

Q.2 a. Compare the effects of electric and magnetic circuits. **(4)**

b. Derive an expression for the energy stored in a magnetic field. **(4)**

c. A ring of magnetic material has rectangular cross section. The inner diameter of the ring is 20 cm and the outer diameter 25 cm, its thickness being 2 cm. An air gap of 1 mm length is cut across the ring. The ring is wound with 500 turns carrying a current of 2 A. The permeability of the magnetic material is 6000. Find
(i) flux density in the air gap
(ii) inductance of the coil
(iii) energy stored in the magnetic material and in the air-gap. **(8)**

Q.3 a. Define all day efficiency of a transformer. Derive the expression for maximum efficiency at any fraction *n* of full-load of a transformer in terms of its losses. **(8)**

b. The maximum efficiency of 50 kVA transformer is 97.4% and occurs at 90% of the full load. Calculate the efficiency of the transformer at
(i) Full load, 0.8 pf (ii) Half load at 0.9 pf **(8)**

Q.4 a. Explain armature reaction in association with D.C. Machines. Also explain the various methods for reducing armature reaction. **(8)**

b. A 240V dc shunt motor has an armature resistance of 0.4 ohm and is running at the full-load speed of 600 r.p.m. with a full load current of 25A. The field current is constant; and a resistance of 1 ohm is added in series with the armature. Find the speed
(i) at the full-load torque
(ii) at twice the full-load torque **(8)**

Q.5 a. How does salient–pole rotor differs from a cylindrical rotor in 3 phase synchronous machines. Discuss the application area of salient pole Synchronous Machines. **(8)**

b. A 3300Volts, delta connected synchronous motor has a synchronous reactance per phase (delta) of 18 ohm. It operates at a leading power factor of 0.707 when drawing 800 kW from the mains. Calculate its excitation emf. **(8)**

Q.6 a. Draw the torque speed characteristics of a 3-phase induction machine and clearly indicate the effect of change in rotor resistance. **(8)**

b. A 3-phase induction motor has a starting torque of 100% and a maximum torque of 200% of full load torque. Find
(i) Slip at maximum torque
(ii) Full load slip (neglect the stator impedance) **(8)**

Q.7 a. With a neat sketch explain the working of an universal motor. Draw its torque-speed characteristics which is feed by both AC & DC sources. **(8)**

b. What is the difference between Reluctance Motor and Universal Motor? **(8)**

Q.8 a. With the help of a neat diagram explain the various components of a Nuclear Power Plant. **(8)**

b. Explain a Method to convert Solar Energy into Electrical Energy. **(8)**

Q.9 a. With the help of neat sketches explain the principle of HVDC transmission. Write its advantages & disadvantages. **(8)**

b. Classify different types of Batteries and explain the operating characteristics of any one of them. **(8)**