Code: AE105   Subject: PRINCIPLES OF ELECTRICAL ENGINEERING

AMIETE – ET (New Scheme)

Time: 3 Hours   **December 2016**   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. Those materials are well-suited for making permanent magnets which have _____ retentivity and _____ coercivity.
   (A) High, High   **(B)** High, Low
   (C) Low, Low   **(D)** Low, High

b. Energy stored by a coil is double when its current is increased by _____ percent
   (A) 100   **(B)** 41.4
   (C) 50   **(D)** 25

c. When a 400 Hz transformer is operated at 50Hz its KVA rating
   (A) Reduces to 1/8   **(B)** Increases 8 times
   (C) Unaffected   **(D)** Increases 64 times

d. If the impedance triangles of two transformers operating in parallel are not identical in shape and size, the two transformers will
   (A) Share the load unequally
   (B) Get heated unequally
   (C) Have a circulatory current secondary even when unloaded
   (D) Run with different power factor

e. The maximum torque of D.C Motor is limited by
   (A) Commutation   **(B)** Heating
   (C) Speed   **(D)** Armature Current

f. A 6 pole, 50 Hz three phase induction motor is running at 950 rpm and has rotor cu loss of 5 kW. Its rotor input is
   (A) 100 kW   **(B)** 10 kW
   (C) 95 kW   **(D)** 5.3 kW

g. The direction of rotation of a synchronous motor can be reversed by reversing
    (A) Current to Field winding   **(B)** Supply phase sequence
    (C) Polarity of rotor pole   **(D)** None of these

h. One of the characteristics of a single phase induction motor is that it is
    (A) Self starting
    (B) Not self starting
    (C) Require only one winding
    (D) Direction of rotation cannot change

i. The power consumption in PMMC instrument is typically about:
    (A) 0.25 W to 2 W   **(B)** 0.25 mW to 2 mW
    (C) 25 µW to 200 µW   **(D)** None of these

j. When applied rated voltage per phase is reduced by one-half, the starting torque
    of a squirrel cage induction motor becomes_____ of the starting torque
    with full voltage.
    (A) 1/2   **(B)** 1/4
    (C) 1/√2   **(D)** √3/2

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

Q.2 a. What is self inductance and mutual inductance? Derive the equation of energy
            stored in Inductor.   **(8)**

        b. A mild steel ring of 30 cm mean circumference has a cross sectional area of 6
            cm^2 and has a winding of 500 turns on it. The ring is cut through at a point so
            as to provide an air-gap of 1 mm in the magnetic circuit. It is found that a
            current of 4A in the winding produces flux density of 1 T in the air-gap. Find:
            (i) the relative permeability of mild steel and   (ii) Inductance of the winding. **(8)**

Q.3 a. Explain the equivalent circuit of single phase transformer. How can we obtain
            different parameters of equivalent circuit?   **(8)**

        b. A transformer has a primary winding of 800 turns and a secondary winding of
            200 turns. When the load current on the secondary is 80A at point 0.8 power
            factor lagging, primary current is 25A at 0.707 power factor lagging.
            Determine the No-load current of the transformer and its phase angle with
            respect to the voltage.   **(8)**

Q.4 a. Explain how the rotating magnetic field is produced in three phase Induction
            motor?   **(8)**

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    b. A three phase slip-ring induction motor having a star connected rotor has an induced e.m.f of 80 volts between slip-ring at standstill on open circuit. The rotor has a resistance and reactance per phase of 1 ohm and 4 ohm respectively. Calculate current per phase and power factor when:
(i) slip rings are short circuited
(ii) slip-rings are connected to a star connected rheostat of 3 ohm per phase. **(8)**

Q.5 a. Explain working and construction of single phase A.C. Series motor. **(8)**

    b. Why single phase induction motor is not self started? Explain it by double filled revolving theory. **(8)**

Q.6 a. Explain different methods of speed control of D.C. Shunt motor. **(8)**

    b. The input to 220V D.C shunt motor is 11kW. Calculate:
(i) The torque developed   (ii) The efficiency   (iii) The speed at this load.
The particulars of the motor are as follows.
No load current is 5A.
No load speed is 1150 rpm.
Arm. Resistance is 0.5 ohm
Shunt field resistance is 110 ohm. **(8)**

Q.7 a. Explain advantages of HVDC system. Explain HVDC system with the help of block diagram. **(8)**

    b. Draw the model of short transmission line. Derive the relationship between receiving end and sending end voltage. Derive equation of voltage regulation. **(8)**

Q.8 a. Explain the need of Earthing in power system. Explain pipe Earthing and plate earthing. **(8)**

    b. Explain working and construction of PMMC type instruments. What are the merits and demerits of it? **(8)**

Q.9 a. Derive the equitation of power developed by synchronous motor. Explain its working under different power factors. **(8)**

    b. A 75 kW, three phase, star connected, 50 Hz 440V cylindrical rotor synchronous motor operated at rated condition with 0.8 p.f leading. The motor efficiency excluding field and stator losses is 95% and Xs=2.5 ohm. Calculate
(i) Mechanical power developed   (ii) Armature current   (iii) Back e.m.f
(iv) power angle   (v) Maximum or pull out torque of the motor. **(8)**