AMIETE – ET (NEW SCHEME) – Code: AE55

Subject: PRINCIPLES OF ELECTRICAL ENGINEERING

Time: 3 Hours   Max. Marks: 100

DECEMBER 2010

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 half an hour 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. Two free parallel wires carrying currents in the opposite directions

   (**A**) attract each other   (**B**) repel each other
   (**C**) do not affect each other   (**D**) get rotated to be perpendicular to each
                                                        other

   b. If the full load iron loss of a transformer is 100 W, what will be its iron loss at half load?

   (**A**) 25 W   (**B**) 400 W
   (**C**) 50 W   (**D**) 100 W

   c. Primary winding of a 110 V / 220 V transformer is supplied with 12 V dc, and a voltmeter is connected across the secondary winding. What would be the reading in the voltmeter?

   (**A**)   Zero
   (**B**)   The reading will fluctuate very fast
   (**C**)   It will show a reading at the time of switching on and then show a zero reading
   (**D**)   It will show full scale deflection permanently

   d. The purpose of having a commutator and brush arrangement in a dc motor is

   (**A**) to produce a unidirectional torque
   (**B**) to produce unidirectional current in the armature
   (**C**) to help in charging the direction of rotation of the armature
   (**D**) None of the above.

   e. Under full load running condition, the slip of a synchronous motor is

   (**A**) 0   (**B**) about 0.01
   (**C**) about 0.1   (**D**) unity

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f. The speed of a 50-Hz, three phase induction motor under full load conditions 720 rpm. The number of poles of the motor is

(A) 4   (B) 6
(C) 8   (D) 12

g. The direction of rotation of an ordinary shaded pole single-phase induction motor

(A) can be reversed by reversing the supply terminal connections to the stator winding.
(B) cannot be reversed
(C) can be reversed by open-circuiting the shaded rings
(D) can be reversed by short-circuiting the shaded rings

h. The motor used in a ceiling fan is

(A) split-phase motor   (B) capacitor start motor
(C) shaded pole motor   (D) ac series motor

i. The most commonly used generation voltage in India is

(A) 11 kV   (B) 66 kV
(C) 33 kV   (D) 132 kV

j. The conductor connecting consumer's terminals to the distributor is called the

(A) feeder   (B) distributor
(C) service mains   (D) none of these

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

Q.2   a.   What is meant by electromagnetic induction? State and explain Faraday's laws of electromagnetic induction.   **(8)**

b.   The total core loss of a specimen of silicon steel is found to be 1500W at 50 Hz. Keeping the flux density constant, the loss becomes 3000W when the frequency is raised to 75Hz. Calculate separately the hysteresis and eddy-current loss at each of these frequencies.   **(8)**

Q.3   a.   Explain how various losses in a transformer can be found from practical tests without actually loading the transformer.   **(8)**

b.   A 50 kVA, 2200/220 V transformer when tested gave the following results
OC test measurements on LV side: 405W, 5A, 220V
SC test measurement on HV side: 805W, 20.2A, 95V
Determine the efficiency of the transformer
(i)   Under O.C. test conditions.
(ii) Under S.C. test conditions.   **(8)**

Q.4 a. Explain a method for speed control of dc motor by which you can achieve the speeds even higher than the rated speed of the motor. **(8)**

b. A 230V dc shunt motor has an armature resistance of 0.1Ω and a shunt field resistance of 275Ω. It runs at a speed of 1000 rpm when drawing an armature current of 75A. Calculate the additional resistance to be inserted in the field to raise motor speed to 1200 rpm at an armature current of 125A. Assume linear magnetization characteristics. **(8)**

Q.5 a. Explain the effect of change of excitation of a synchronous motor on its armature current. **(8)**

b. Explain what do you understand by voltage regulation of an alternator. Describe how it can be determined experimentally. **(8)**

Q.6 a. Explain the principle of operation of a 3-phase induction motor. **(8)**

b. Prove that in a 3-phase induction motor the ratio of maximum to starting torque is $\left[\dfrac{\left(1+k^2\right)}{2k}\right]$ where k is the ratio of rotor resistance to rotor reactance. Neglect stator impedance. **(8)**

Q.7 a. Explain, with a schematic diagram, the operation of single-phase induction motor. **(8)**

b. In what ways does a capacitor start motor differ from a capacitor-start capacitor-run motor. **(8)**

Q.8 With the help of a neat diagram explain the various components of a Nuclear Power station. **(16)**

Q.9 Write notes on any **<u>TWO</u>** of the following:- **(16)**

    (i) Interconnection of Electric power stations
    (ii) HVDC
    (iii) Fuel cell