AMIETE – ET (OLD SCHEME)

Code: AE10   **Subject: ELECTRICAL ENGINEERING**
Time: 3 Hours   **Max. Marks: 100**

JUNE 2010

NOTE: There are 9 Questions in ...

- 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.
- 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.   Copper losses at full load operation are 1600 W. If the load on the transformer is reduced to 75% of full load, the copper losses will be

    (A) 1600 W   **(B)** 1200 W
    (C) 900 W   **(D)** 800 W

b.   At the instant of starting, the per unit slip of the 3-phase induction motor is

    (A) 0.05   **(B)** 0.1
    (C) 1.0   **(D)** 0.5

c.   The commutator of dc motor serves the purpose of

    (A) Changing ac into dc   **(B)** Converting dc into ac
    (C) Reducing friction   **(D)** Avoiding arc at the brushes

d.   In an ordinary transformer which of the following does not change

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

e.   A 220 V dc shunt motor develops a torque of 54 Nm at an armature current of 10 A. The torque developed for the armature current of 20 A is

    (A) 54 Nm   **(B)** 81 Nm
    (C) 108 Nm   **(D)** None of the above

f.   For a 3-phase 4 pole 50 Hz synchronous motor, the frequency, no. of poles and the load torque are all halved. The motor speed will be

    (A) 375 rpm   **(B)** 75 rpm
    (C) 1500 rpm   **(D)** 3000 rpm

g.   While starting a synchronous motor its field winding should be kept

   (A) Short circuit   **(B)** Open
   (C) Connected to dc source   **(D)** None of these

h.   A wound rotor induction motor can be distinguished from squirrel cage
      induction motor by

   (A) Presence of slip-rings   **(B)** Size of frame
   (C) Shaft diameter   **(D)** None of these

i.   Control rods used in nuclear reactor made of

   (A) Zirconium   **(B)** Boron
   (C) Beryllium   **(D)** Lead

j.   In comparison with diesel power plant the gas turbine power plant has

   (A) Lower overall thermal efficiency **(B)** Higher overall thermal efficiency
   (C) Same overall thermal efficiency   **(D)** Unpredictable

---

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

Q.2   a.   Draw an approximate equivalent circuit of a transformer. Based upon it derive the expression for its regulation.   **(8)**

   b.   The efficiency of a 400 kVA single phase transformer is 98.77% when delivering full load at 0.8 p.f. and 99.13% at half load and unity p.f. Calculate (i) iron losses and (ii) full load copper losses.   **(8)**

Q.3   a.   Explain with suitable diagram the construction details of a salient pole alternator.   **(8)**

   b.   A 2800 V, 3-phase, star connected motor has a synchronous reactance of 5π per phase. The motor input is 1000 kW at rated voltage and an excitation emf of 3600 V (line). Calculate the line current and power factor.
                                                        (8)

Q.4   a.   Draw and explain load characteristics curve for various types of dc generator.   **(8)**

   b.   A 200 V dc series motor runs at 500 rpm when taking a current of 25 A. The resistance of the armature is 0.5 Ω and that of field is 0.3 Ω. If the current remains constant, calculate the resistance necessary to reduce the speed to 250 rpm.   **(8)**

Q.5   a.   Explain with the help of a diagram how a rotating magnetic field is produced in the air gap of 3-phase induction motor.   **(8)**

   b.   Write short notes on

(i) Torque-speed characteristics of 3-phase induction motor.
(ii) Application of 1-phase induction motors.   **(8)**

Q.6   a.   Explain the construction and working principle of a universal motor and mention its applications.
(8)

   b.   Describe the construction of hysteresis motor and show that it develops a running torque both at synchronous and asynchronous speed of the rotor.   **(8)**

Q.7   a.   Draw neat sketch of a thermal electric power plant station and explain the function of major components in it.   **(8)**

   b.   What is wind energy? How can wind energy be converted into electric energy?   **(8)**

Q.8   a.   Design precisely the 'Voltage Regulation' of a transmission line and discuss qualitatively its dependence on the load power factor. Can the regulation be negative? If so, under what conditions?   **(8)**

   b.   What do you understand by carrier current protection? Explain.   **(8)**

Q.9   a.   What are the advantages of electric heating? Give classification of various electric heating methods along with brief account of their working principles.   **(8)**

   b.   Write short technical notes on any **TWO** of the following:

   (i)   Lead Acid cell.
   (ii)   Nickel Cadmium cell.
   (iii) Button cell.   **(4 × 2)**