AMIETE – ET (OLD SCHEME)

Code: AE10   **Subject: 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.   A 25 KVA transformer has a voltage ratio of 3300/400 V, the primary current is

   (A) 6.2 A   **(B)** 75.8 A
   (C) 62.5 A   **(D)** 7.58 A

b.   Commutation in DC generators causes

   (A) DC changes to AC   **(B)** AC changes to DC
   (C) DC changes to DC   **(D)** AC changes to high voltage DC

c.   If the supply of a shunt motor is increased, which of the following will decreases

   (A) Full load current   **(B)** starting torque
   (C) Full load speed   **(D)** None of the above.

d.   At low slip, torque slip characteristics of a three phase induction motor is

   (A) $T \alpha S$ **(B)** $T \alpha S^2$
   (C) $T \alpha \dfrac{1}{S}$ **(D)** $T \alpha \dfrac{1}{S^2}$

e.   If stator impedence in neglected the maximum torque of an induction motor Occurs at a slip of

   (A) $S = 1$ **(B)** $S = \dfrac{r_2}{x_2}$

   (C) $S = \sqrt{\dfrac{r^2}{x^2}}$ **(D)** Torque-slip does not exhibit a maximum

f. If the excitation current of a synchronous motor be increased, the P.F. of the motor will

(A) Improve   **(B)** Decrease
(C) Remains constant   **(D)** Depend on other factors.

g. The average thermal efficiency of a nuclear power plant in around

(A) 30%   **(B)** 50%
(C) 70%   **(D)** 80%

h. Which of the following methods of heating is independent of supply frequency

(A) Electric arc heating   **(B)** Induction heating
(C) electric resistance heating   **(D)** Dielectric heating

i. Which of the two synchros are used for torque transmission over a long distance with the help of electric wires only.

(A) CX and CT   **(B)** CX and CR
(C) CX and CD   **(D)** CT and CD

j. A 66 KV is suitable for transmission of power over a distance of

(A) 30km   **(B)** 66km
(C) 120km   **(D)** 200km

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

Q.2 a. Define a transformer. Draw its approximate, equivalent circuit and describe briefly the various parameters involved in it.   **(8)**

b. In a 25kVA, 2000/200V transformer the iron and full load copper losses are 350W and 400W respectively. Find the efficiency at unity P.F at (i) Full load (ii) half load. Determine the load for maximum efficiency.   **(8)**

Q.3 a. Explain various methods of starting of a synchronous motor. Explain hunting of a synchronous motor.   **(8)**

b. A three phase synchronous motor of 1000KW and 6.6KV has synchronous reactance of 10Ω per phase. The efficiency of the motor is 90%.Neglecting armature resistance determine the minimum current and the corresponding induced emf at full load.   **(8)**

Q.4 a. What is the necessity of a starter in a DC motor? Explain with the help of a neat sketch the principle of a three point starter.   **(8)**

b. A DC series motor has an armature resistance of $0.03\,\Omega$ and series field resistance of 0.04Ω. The motor is connected to a 400V supply. The line current is 20A when the speed of the machine is 1000rpm. Find the speed of the machine when the line current is 50A and excitation is increased by 20%. **(8)**

Q.5 a. Explain the principle of operation of a three phase induction motor. Analytically justify how a rotating field is created in a three phase induction motor when a balanced three phase AC supply is applied at the stator terminals. **(8)**

b. A three phase, 50 Hz 4-pole induction motor (slip ring) develops a maximum torque of 100 Nm at 1400 rpm. The resistance of the star connected rotor is 0.25Ω/ phase. Determine the value of resistance that must be inserted in series with each rotor phase to produce a starting torque equal to half the maximum torque. **(8)**

Q.6 a. Explain the principle of operation of two phase servo motor. Draw its torque slip characteristics. **(8)**

b. An AC operated universal motor has a 2 pole armature with 960 conductors. At a certain load the motor speed is 5000 rpm, and the armature current is 4.6A; the armature terminal voltage and input are respectively 100V and 300W. Assuming an armature resistance of $3.5\,\Omega$ compute: **(8)**
   (i) Effective armature reactance
   (ii) Maximum value of useful flux/ pole.

Q.7 a. Explain & draw the typical layout of a nuclear power plant indicating the function of each component. **(8)**

b. Explain the term cogeneration. Give its physical significance. **(4)**

c. Explain the factors involved for selecting a factory drives. **(4)**

Q.8 a. How inductive interference is caused? Give necessary steps to reduce its effect. **(6)**

b. Explain the principle of carrier current protection and communication. **(5)**

c. Explain the process of charging and discharging of a cell. **(5)**

Q.9 Write the short notes on the following **(4×4 = 16)**

   (i) Nickel-cadmium cell
   (ii) electrical heating
   (iii) wind energy
   (iv) HV DC transmission.