JUNE 2008

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

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.**
- **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 best alternative in the following: (2x10)

a.   No load current in a transformer:
   (A) lags the applied voltage by 90°

   (B) lags the applied voltage by somewhat less than 90°
   (C) leads the applied voltage by 90°
   (D) leads the applied voltage by somewhat less than 90°

b.   A transformer operates most efficiently at 3/4th full load. Its iron (   ) and copper loss (   ) are related as:

   (A) $P_i/P_{cu} = 16/9$ **(B)** $P_i/P_{cu} = 4/3$
   (C) $P_i/P_{cu} = 3/4$ **(D)** $P_i/P_{cu} = 9/16$

c.   In a salient pole synchronous machine (usual symbols are used):

   (A) $x_q > x_d$ **(B)** $x_q = x_d$
   (C) $x_q < x_d$ **(D)** $x_q = 0$

d.   The armature of a dc machine is laminated to reduce:
   (A) Eddy current loss   **(B)** Hysteresis loss
   (C) copper losses   **(D)** friction and windage losses

e.   The resistance representing mechanical output in the equivalent circuit of an induction motor as seen from the stator is:

   (A) $r_2'\left(\dfrac{1}{s}-1\right)$ **(B)** $\dfrac{r_2'}{s}$

   (C) $r_2^2\left(\dfrac{1}{s}-1\right)$ **(D)** $\dfrac{r_2}{s}$

f.   A single phase Hysteresis motor
   (A) can run at synchronous speed only
   (B) can run at sub synchronous speed only
   (C) can run at synchronous and super synchronous speed

   (D) can run at synchronous and sub synchronous speed

g. The temperature of resistance furnaces can be controlled by changing the:
   (A) applied voltage   (B) number of heating elements
   (C) circuit configuration   (D) All of the above

h. The line trap unit employed in carrier current relaying:
   (A) offers high impedance to 50 Hz power frequency signal
   (B) offers high impedance to carrier frequency signal
   (C) offers low impedance to carrier frequency signal
   (D) Both (A) & (C)

i. For a line voltage V and regulation of a transmission line R
   (A) $R \propto V$ (B) $R \propto 1/V$
   (C) $R \propto V^2$ (D) $R \propto 1/V^2$

j. The boundary of the protective zone is determined by the
   (A) Location of CT   (B) sensitivity of relay used
   (C) Location of PT   (D) None of these

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

Q.2 a. Define voltage regulation of a single phase transformer. The primary and
secondary winding of a 40kVA, 6600/250V, single phase transformer have resistance of 10 ohm and 0.02 ohm respectively. The total leakage reactance is 35 ohm as referred to the primary winding. Find full load regulation at a pf of 0.8 lagging.   **(8)**

   b. Write short notes on
   (i) three-phase connection of a transformer
   (ii) Variable frequency operation of transformer   **(8)**

Q.3 a. Explain the constructional features of synchronous generator. What are the two types of generators? Derive emf equation of a synchronous machine.   **(10)**

   b. A star connected synchronous motor at 187 kVA, 3-ϕ, 2300V, 47A, 50Hz, 187.5 rpm has an effective resistance of 1.5 ohm and a synchronous reactance of 20 ohm per phase. Determine internal power developed by the motor when it is operating at rated current and 0.8 power factor leading. **(6)**

Q.4 a. Draw and explain characteristics of dc series motor.   **(6)**

   b. A 220V dc shunt motor takes 22A at rated voltage and run at speed of 1,000 rpm. Its field resistance is 100 ohm and armature resistance is 0.1 ohm. Compute the value of additional resistance required in armature circuit to reduce the speed to 800 rpm when (i) load torque is proportional to speed and (ii) when load torque varies as the square of the speed.   **(10)**

Q.5 a. Give comparison between squirrel cage and slip ring induction machine? Discuss the working principle of three phase induction motor.   **(8)**

    b. State different methods of speed control of three phase induction motor. Explain any one of the method in detail. Also draw torque-speed characteristics. **(8)**

Q.6   a. Describe the construction of hystersis motor and show that it builds a running torque both at synchronous and asynchronous speed of the rotor.   **(8)**

     b. A 120V, 60 Hz, ¼ hp universal motor runs at 2000rpm and takes 0.6 Amp when connected to a 120V dc source. Determine speed, torque and power factor of the motor, when it is connected to a 120V, 60 Hz supply, and is loaded to take 0.6 Amp(rms). The resistance and inductance measured at terminals of the machine are 20 ohm and 0.25H respectively.   **(8)**

Q.7   a. What do you understand by the term cogeneration? Give its significance.   **(8)**

     b. Write short notes on following energy sources
     (i) Wind   (ii) Wave
                                     (iii) Bio fuels   **(3+3+2)**

Q.8   a. Discuss the criterion for choice of voltage for transmission and distribution.   **(8)**

     b. Explain principle of carrier current protection and communication.   **(8)**

Q.9   a. Explain the principle of induction heating.   **(8)**

     b. What is welding process and explain principle of electric welding.   **(8)**