Instructions:  
1. All questions are compulsory.
2. Illustrate your answers with neat sketches wherever necessary.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary.
5. Use of Non-programmable Electronic Pocket Calculator is permissible.
6. Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. A) Attempt any three of the following:
   b) Define the following terms:
      i) Colour Rendering Index  
      ii) Luminous Efficacy  
      iii) Luminous flux  
      iv) Illumination.
   c) Draw and explain power flow diagram of three phase induction motor.
   d) Explain the following energy conservation methods of electrical motor.
      i) Minimizing idle and redundant running of motor.
      ii) Matching motor rating with required load.

B) Attempt any one of the following:
   a) State the need of energy conservation in transformer. Explain the use of Epoxy Resin Cast/Encapsulated dry type transformer from energy conservation point of view.
   b) An illumination on the working plane of 75 lux is required in a room 72 m × 15 m size. The lamps are required to be hung 4 m above the work bench. Assuming a suitable space-height ratio, a utilization factor of 0.5, a lamp efficiency of 14 lumens per watt and a candle power depreciation of 20%. Estimate the number and rating of the lamps.

2. Attempt any four of the following:
   a) Explain the procedure for assessing existing lighting system in a facility.
   b) Explain the energy conservation techniques in lighting system by installation of separate transformer/servo stabilizer for lighting.
   c) Write any four comparison between energy efficient motor with conventional induction motor.
   d) State and explain any two energy conservation measures for T and D system related to administrative loss.
   e) State the opportunities for energy conservation techniques in transformer.
   f) Define both laws of illumination.

P.T.O.
3. Attempt any four of the following:
   a) State any four objectives of tariff systems.
   b) State any four causes of technical losses in transmission and distribution system. Also state techniques to reduce it.
   c) With an example explain how energy flow diagram helps in energy audit procedure.
   d) Explain energy conservation technique in induction motor by operating I.M. in star mode.
   e) Explain the need of co-generation plants helps for energy conservation.

4. A) Attempt any three of the following:
   a) State any four merits of co-generation system.
   b) What is ABC analysis? State its three advantages referred to energy audit projects.
   c) Why soft starter used for motor? State its two advantages.
   d) State the incentives and penalty related with P.F. tariff.

B) Attempt any one of the following:
   a) What is phase balancing system? Explain in detail how it is used to conserve energy in distribution system.
   b) Define energy conservation equipment. Draw block diagram of microprocessor based centralised control equipment of energy conservation and explain it in details.

5. Attempt any four of the following:
   a) Explain the working principle of automatic power factor controller.
   b) Explain energy conservation technique in induction motor by improving power quality method.
   c) Explain energy conservation in transmission and distribution system by using compensating reactive power. How?
   d) Define the following terms:
      i) Electricity tax  
      ii) Electricity duty  
      iii) Connected load  
      iv) Load factor tariff
   e) List name of eight industries suitable for cogeneration.
   f) Explain following energy audit instrument and their use.
      i) Lux meter  
      ii) Tri Vector meter

6. Attempt any four of the following:
   a) Draw layout of steam turbine cogeneration system and label it.
   b) A consumer requires $50 \times 10^6$ kWh per annum. The tariff is Rs. 100/kW of maximum demand per year plus 20 paise per unit. Calculate the annual cost of supply at load factor 50%. Also estimate the saving in annual cost if its load factor is improved to 100%.
   c) State any four advantages of energy audit.
   d) State two benefits and two applications of variable frequency drives.
   e) Explain two part tariff with its advantages and disadvantages.