CENTRE FOR ENERGY STUDIES
INDIAN INSTITUTE OF TECHNOLOGY
MAJOR TEST: ESL750 ECONOMICS AND PLANNING OF ENERGY SYSTEMS
Time: Two Hours   (2007 – 2008 batch)   Maximum Marks: 50
Note: Please answer all the questions. The marks assigned to each question are indicated at the end of the question within parenthesis.

1. A box type solar cooker costs Rs. 2500/- and on an average basis its use saves 150 ml of kerosene daily. For a discount rate of 8% and a useful life of 10 years determine the price of kerosene for which the present value of cumulative costs and cumulative benefits are equal. Assume the annual operation, maintenance and repair costs of the solar cooker negligibly small. [4]

2. The use of a domestic solar water heating system costing Rs. 25000/- is expected to result in uniform net annual savings of Rs. 4000/- to the user. Determine the difference between the discounted payback period and the simple payback period of the investment on the domestic solar water heating system if the discount rate is 12%. [4]

3. An industry in Punjab is looking for a substitute of coal (with a calorific value of 20 MJ/kg) for use in its boilers. While the pithead coal is priced at Rs. 2100 /- per tonne, an additional cost of Rs. 150/- per tonne is incurred in transporting coal to the end use location. A locally available agricultural residue with a calorific value of 12.5 MJ/kg is being considered for this purpose. Estimate the maximum acceptable price of the agricultural residue if the efficiency of utilization of coal and agricultural residues in the boiler are estimated at 90% and 80% respectively. [4]

4. A block development office is entrusted with the task of estimating the per capita annual average fuelwood consumption in the block. With a sample of 16 villages from the block the point estimate of the per capita annual average fuelwood consumption is 250 kg with a sample standard deviation of 40 kg. Determine the interval estimate for the per capita annual average fuelwood consumption in the block at 95% confidence level ($z = 1.96$ for 45% area under the standardized normal distribution curve on either side). [5]

5. The average primary energy consumption per capita (ECPC) of an economy can be expressed in terms of its GDP per capita (GDPPC) in the following form:
   $$\ln(ECPC) = \alpha + \beta \ln (GDPPC)$$
   Write the expression for estimating the energy consumption per capita five years later if the GDP per capita is expected to grow at an annual rate p (expressed as a fraction). [4]

6. An economy is divided into three sectors A, B, and C. The input-output flow of the economy (expressed in some specific units) is as given below:

Producing Sectors	Consuming sectors A	B	C	Final Demand
A	200	300	500	1000
B	700	400	400	2500
C	100	200	700	4000

Determine the corresponding input-output coefficient matrix. Show that it satisfies the first Hawkins Simon condition. [6]

P.T.O.

7. What is Clean Development Mechanism(CDM).What is the justification for such a mechanism? Briefly explain the steps involved in the CDM process. [5]

8. Briefly explain the meaning and/or implications of
   (a) end of the period cash flow convention
   (b) using a constant value of discount rate in financial evaluation of solar energy systems
   (c) a negative salvage value
   (d) determining the annualized cost of different components of PV system separately [4]

9. Determine the equivalent primary energy demand for pumping 500 m³ of water using an electric pump from a 30 m deep well with the following information.
   (a) the efficiency of the electric motor pump is 75%
   (b) electrical transmission and distribution losses are estimated at 20%.
   (c) electricity is generated in coal thermal power plants at an efficiency of 40%. [3]

10. Please explain difference(s) between
    (a) Behavioural reaction and Efficiency reaction (of consumers to change in the price of a commodity).
    (b) Availability of Renewable and Non-renewable energy resources.
    (c) Future trends in marginal cost of production of Renewable and Non-renewable energy sources.
    (d) Physical control and Pricing (as energy policy instruments) [6]

11. Please explain why

    (a) market prices of fossil fuels may include scarcity rent?
    (b) energy pricing often necessitates a compromise between mutually conflicting objectives?
    (c) pricing of petroleum fuels requires consideration/adjustment at different interfaces?
    (d) Electricity pricing should include time of use considerations?
    (e) users of coal located far off from the mines may prefer to use higher grade coals?
    [5]