

**End Semester Examinations - 2015-16 Even Semester - May 2016**

**14EE3017 Energy Modeling, Economics and Project Management**

**Set A**

**Time : 3 hrs**  
**Total Marks: 100**

1. (a) How to measure the GDP of an economy using different approaches? Explain each one of them. (6)
- (b) A Coal mining industry pays its workers Rs.75,000 to mine 1000 Kg of coal, which it sells to a crushing company for Rs.100/Kg. The crushing company crushes the large sized coal to small sized coal and sells it to a thermal power station for Rs.120/Kg. The thermal power station produces 100 MWh of energy from 1000 Kg of coal and sells it at Rs.10/KWh. Calculate GDP of the above energy economy using Output method and Income method. (8)
- (c) Classify the Energy Reserves according to the degree of uncertainty. (6)

**OR**

2. (a) Derive the steps by which final energy demand is calculated for Industry and Building sector in World Energy Model. (8)
- (b) Based on the following specification, suggest a proposal of 50MW capacity for implementation using LCOE method. (12)

	Combined Cycle Gas Turbine	Wind Power
Annual Investment cost (Rs./kW)	7	5
Returns on Investment(Rs./year)	25000	20000
Discount rate (%)	12%	7%
Technical lifetime of plant (years)	3	6
Fix operating cost (Rs./kW/year)	5	3
Fuel cost (Rs./MW)	23	0
CO <sub>2</sub> -Cost(Rs./tonnes of CO <sub>2</sub> )	11	0
CO <sub>2</sub> Emmission factor (tonnes of CO <sub>2</sub> /MW)	0.202	0
Salvage Value (% of initial cost)	20%	10%

3. (a) What is Energy Demand Forecasting? Explain the regression method of forecasting the Energy demand in detail. (8)
- (b) The following table gives the Average no. of inhabitants/100 sq.m. in a state and its corresponding energy demand. Find (a) the regression equation of energy demand on average no. of inhabitants/ 100 sq.m. (b) If the average no. of inhabitants increases by 20 in Uttar Pradesh, 10 in Tamil Nadu and 5 in New Delhi, find the corresponding Energy Demand. (12)

S.No	Name of the State	No. of inhabitants / 100 Sq.m	Energy Demand in MW
1	Tamil Nadu	36	158
2	Andhra Pradesh	34	156
3	Kerala	28	144
4	Karnataka	36	158
5	Maharashtra	34	160
6	Uttar Pradesh	30	162
7	Madhya	30	150

	Pradesh	50	150
8	New Delhi	28	138

**OR**

4. (a) Elucidate the step by step procedure in designing a standalone PV system. (10)
- (b) A 2-MW wind turbine costs approximately Rs.24 Crores installed. The O&M cost of a wind farm is approximately 25 %. The price of gas is about Rs.275 per thousand cubic feet. The price of a barrel of oil is Rs.5500. It takes about 7.7 cubic feet of natural gas to generate 1 kWh of electricity. It takes 0.00175 barrels of oil to generate 1 kWh of electricity. The capacity factor of a wind farm is about 30 percent. A higher capacity factor of 45 percent is assumed for Oil plant and 55% for Natural Gas plant. The average life of a wind turbine is 15 years. Interest costs for the wind farm are neglected. The cost of transmission lines is neglected. If a 1000MW plant is to be installed how much will be the cost of wind energy. Also find the savings compared to Oil and Natural gas plant.
5. (a) Enumerate the various techniques available to evaluate an energy project. (12)
- (b) Define the term budgetary control. What are the objectives of budgetary control system? (8)

**OR**

6. An industry has a gas turbine generator with the following specifications. (20)
- Capacity of gas turbine generator : 4000 kW
- Plant operating hours per annum : 8000 hrs.
- Plant load factor : 90 %
- Heat rate as per standard given
- by gas turbine supplier : 3049.77 kCal/kWh
- It also requires a steam output of 10 TPH for another application with the following specification
- Steam temperature : 200 °C
- Steam pressure : 8.5 kg /cm<sup>2</sup>
- Steam enthalpy : 676.44 kCal / Kg
- If the capital investment and operation charges per annum for total co-generation plant is Rs.300 Lakhs , find the cost of energy produced.
  - If the industry plans to buy electric power from state grid at Rs.3/KWh and generates steam from natural gas direct conventional fired boiler, determine the total cost per annum. The price of gas is Rs.3000/1000sm<sup>3</sup> and CV is 9500 KCal/sm<sup>3</sup>.
- Suggest a suitable option.

7. (a) Describe the Energy value chain for the Oil & Natural Gas resources in India. (10)
- (b) Discuss in detail about the various methods adopted in Energy Modelling. (10)

**OR**

8. Assume that a regional economy has two primary industries: A and B. In producing these two products it was observed last year that air pollution emissions associated with this industrial activity included 3 pounds of SO<sub>2</sub> and 1 pounds of NO<sub>x</sub> emitted per dollar's worth of output of industry A, and 5 pounds of SO<sub>2</sub> and 2 pounds of NO<sub>x</sub> emitted per dollar's worth of output of industry B. It was also observed that industries A and B consumed 1×10<sup>6</sup> tons and 6×10<sup>6</sup> tons of coal respectively during that year. Industry A also consumed 2× 10<sup>6</sup> barrels of oil. Total employment in the region was 100,000 (40 percent of which were employed by industry A and the rest by industry B). The regional planning agency has constructed the following input–output table of inter-industry activity in the region (in \$10<sup>6</sup>):

	A	B	Total Output
A	2	6	10
B	6	2	10

Assume that with growth in the region during the next year the new final-demand vector will be [15 25]. Using what you know about constructing a generalized input–output model, determine the following:

- a) the total consumption of each energy type (coal and oil) during the next year;
- b) the total pollution emission (of each type) during the next year; and
- c) the level of total employment during the next year.

9. (a) On what criteria will you appraise an financial investment? Explain each one of them. (10)
- (b) Determine Simple payback period for a continuous Deodorizer that costs Rs.60 lakhs to purchase and install, Rs.1.5 lakhs per year on an average to operate and maintain and is expected to save Rs. 20 lakhs by reducing steam consumption. (5)
- (c) Calculate the internal rate of return for a economizer that will cost Rs.500,000, will last 10 years, and will result in fuel savings of Rs.150,000 each year. (5)

---

**Wishing you All the Best**

---