Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May – 2017**

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| **Code** | **14EE3017** | **Duration :** | **3hrs** |
| **Sub. Name** | **ENERGY MODELING, ECONOMICS AND PROJECT MANAGEMENT** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Derive the steps by which final energy demand is calculated for Industry and Building sector in World Energy Model. | CO2 | 8 |
| b. | Based on the following specification, suggest a proposal of 50MW capacity for implementation using LCOE method.   |  |  |  | | --- | --- | --- | |  | 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 | | Fixed operating cost (Rs./kW/year) | 5 | 3 | | Fuel cost (Rs./MW) | 23 | 0 | | CO2-Cost(Rs./tones of CO2) | 11 | 0 | | CO2 Emmission factor (tones of CO2/MW) | 0.202 | 0 | | Salvage Value (% of initial cost) | 20% | 10% | | CO3 | 12 |
| (OR) | | | | |
| 2. | a. | How to measure the GDP of an economy using different approaches? Explain each one of them. | CO1 | 10 |
| 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. | CO1 | 6 |
| c. | Classify the different types of Reserves. | CO1 | 4 |
| 3. | a. | Construct an energy demand model for Household and industry/commercial sectors. | CO1 | 6 |
|  | b. | For a freight transport, following table gives the fuel consumed for the past 6 months. Forecast the fuel demand for the 7th month using   * + Simple average method   + 3-month moving average method   + 3-month weighted moving average method with weights 0.2,0.3,0.5   + Exponential smoothing method with α = 0.1  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Month** | **1** | **2** | **3** | **4** | **5** | **6** | | Fuel consumed in litres | 650 | 700 | 810 | 800 | 900 | 700 | | CO1 | 14 |
| (OR) | | | | |
| 4. | a. | Elucidate the step by step procedure in designing a standalone PV system. | CO2 | 6 |
|  | b. | A house has the following electrical appliance usage:   * One 18 Watt fluorescent lamp with electronic ballast used 4 hours per day. * One 60 Watt fan used for 2 hours per day. * One 75 Watt refrigerator that runs 24 hours per day with compressor run 12 hours and off 12 hours.   If the owner plans to install a solar PV plant for his house, what will be the cost of one unit of energy produced? The cost of 75W panel is Rs.2000, the cost of battery is Rs.500 per kilowatt-hour of storage and cost of inverter is Rs.1200 per KW. Assume the battery lifetime is 6 years and PV system lifetime is 25 years. Also find the annual energy savings if the cost of electricity is Rs.12 per unit. | CO2 | 14 |
| 5. | a. | Explain any two commercial Waste Heat recovery Devices with necessary diagrams. | CO2 | 12 |
|  | b. | 10000 kg/hr at 75◦C is being discharged as waste hot water from an industry. 10000 kg/hr of cold inlet water of 20⁰C has to be preheated in the same industry. If the heat recovery factor is 58% and the industry is operated for 5000 hours per year, (i) calculate the annual heat savings and (ii) Calculate the annual oil savings if the GCV of fuel oil is 10,200 kCal/kg and price is Rs.23 per Kg. | CO2 | 8 |
| (OR) | | | | |
| 6. | a. | Discuss about the Energy aggregation practice. Also analyze the influence of energy quality on energy aggregation  and the benefits of energy aggregation. | CO2 | 10 |
|  | b. | Explain the working of Gas turbine and steam turbine cogeneration system. | CO2 | 10 |
| 7. | a. | A house has the following lighting load:   * Five 40 Watt fluorescent lamp of 3200 lumens with electronic ballast used 4 hours per day to light a room. Life of 3 years. * Two 60 Watt incandescent lamp with 800 lumens used for 2 hours per day to light another room. Life of 1500 hours.   If the owner plans to replace all the lamps by LED lamps with the  following specification, find the annual energy savings. Find the  total cost for lighting the house assuming the life of the building  as 50 years and cost of electricity as Rs7/kwh.  **LED tube light LED bulb**  Cost – Rs.1600 Cost – Rs.210  Life – 14 years Life – 15000 hours  Lumens – 120 lumens/watts Lumens – 800 lumens  Wattage- 16W Wattage – 11 watts | CO1 | 8 |
|  | b. | Suggest some energy conservation techniques to be adopted in domestic, industry and commercial sector. | CO1 | 12 |
| (OR) | | | | |
| 8. |  | An industry has a gas turbine generator with the following specifications.  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 0C  Steam pressure : 8.5 kg /cm2  Steam enthalpy : 676.44 kCal / Kg   1. If the capital investment and operation charges per annum for total co-generation plant is Rs.300 Lakhs , find the cost of energy produced. 2. 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.3000/1000sm3 and CV is 9500 KCal/sm3. 3. Suggest a suitable option. | CO2 | 20 |
|  | | **Compulsory:** |  |  |
| 9. | a. | With illustrations for each technique, explain the three financial analysis techniques used in investment planning. | CO3 | 8 |
|  | b. | 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. | CO3 | 6 |
|  | c. | Determine Simple payback period for a standalone PV system 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 fuel consumption. | CO3 | 6 |

ALL THE BEST