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



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18EE3001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ENERGY ENGINEERING** | **Max. Marks :** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome** | **Marks** |
| **ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)** | | | | |
| 1. | a. | With relevant pictorial representation, draw and explain the energy flow diagram to the earth. | CO1 | 4 |
| b. | Describe the role of energy in economic development and social transformation. | CO1 | 8 |
| c. | A Commercial building has 200, 15W CFL lamps. It is proposed to replace them with LED lamps provided an equivalent light output. The following data are given.  Cost of 7W LED lamp=Rs.6/-  Average electricity price=16p/kWh  Lamps operate an average 5 hours per day  The building is occupied 250 days per year  Calculate the simple payback period of replacement. | CO1 | 4 |
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| 2. | a. | Assess the energy resources available in India with relevant data. | CO2 | 4 |
| b. | Construct a table showing the use of gas over the next 50 years if the rate of increase varies between 1% and 4% per year. The world wide use of gas as a primary energy source was 3×109 toe/year. | CO2 | 4 |
| c. | Discuss the energy consumption in various sectors and projected energy consumption for the future with relevant graph/chart. | CO2 | 8 |
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| 3. | a. | With relevant diagram, write short notes on solar radiation measurements. | CO3 | 5 |
| b. | Design a solar PV systems with base conditions of 2 CFLs (18 Watts each), 2 fans (60 Watts each) for 6 hours a day. Assume peak power rating of PV panel 40 Watts. Inverter Efficiency=90% and Battery Efficiency=90%. | CO3 | 6 |
| c. | With relevant diagram, explain the operation of parabolic trough solar thermal power station including thermal storage. | CO3 | 5 |
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| 4. | a. | With relevant diagram, explain the operation of geothermal power plant. | CO4 | 8 |
| b. | Describe the working of standalone solar photovoltaics power plant in detail with relevant block diagram. | CO4 | 8 |
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| 5. | a. | Kyoto protocol-Environmental degradation due to the energy production and utilization. Discuss its significance. | CO5 | 6 |
| b. | Tabulate the gaseous air pollutants. Also give their sources and effects. | CO5 | 5 |
| c. | Show the block diagram of pollutants and pollution control in nuclear power plants. | CO5 | 5 |
| 6. | a. | Derive the expression for the Betz Limit, Thrust co-efficient and torque co-efficient of a wind turbine. | CO3 | 10 |
| b. | Based on average speed data only, estimate the annual energy production from a horizontal axis wind turbine with a 12m diameter operating in a wind regime with an average wind speed of 8 m/s. Assume that the wind turbine is operating under standard atmosphere conditions (ρ=1.225 kg/m3). Assume a turbine efficiency of 0.4. | CO3 | 6 |
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| 7. |  | Discuss biomass as renewable energy resource as well as the ways and technologies involved in extracting electrical power from biomass energy. | CO4 | 16 |
| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | |
| 8. | a. | Draw and explain the smart grid architecture in detail. | CO6 | 10 |
| b. | Discuss the methods involved in smart grid metering in detail. | CO6 | 10 |