

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: BE  
BRANCH: CHEMICAL ENGG.**

**SEMESTER : V  
SESSION : MO/19**

**SUBJECT: CL5003 ENERGY ENGINEERING**

**TIME: 3 HOURS**

**FULL MARKS: 60**

**INSTRUCTIONS:**

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
  2. Candidates may attempt any 5 questions maximum of 60 marks.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) List the renewable energy resources and its application. [2]  
Q.1(b) Define heat recuperator and Describe working principle with neat diagram. [4]  
Q.1(c) Explain the working principle of heat pump with diagram and its application & advantages. [6]
- Q.2(a) Calculate the gross & net calorific values of a coal sample having following composition in percentage [2]  
are: C=80, H=7, O=3, S= 3.5, N= 2.5 & ash is 4.4%.  
Q.2(b) Describe the different properties of solid fuels & Briefly discuss the vertical gas retorts. [4]  
Q.2(c) Describe with neat diagram indirect and direct process coal liquefaction process. [6]
- Q.3(a) Describe the properties of liquid fuels and its importance in comparison with other fuels. [2]  
Q.3(b) What is Petroleum Crude? Give the composition and refining, naming different petroleum products [4]  
recovered from it.  
Q.3(c) Describe catalytic cracking and FCC with diagram and explain their uses. [6]
- Q.4(a) Calculate the minimum volume of air requirement for the complete combustion of one cubic meter [2]  
of a gaseous fuel containing the following combustion by volume percentages are: CO-23, Hydrogen-  
12, Methane-3, Carbon dioxide-5, nitrogen-55 & oxygen-2.  
Q.4(b) Explain the physico-chemical properties of gaseous fuels. [4]  
Q.4(c) Describe working and give important reaction of producer gas with the help of neat diagram and its [6]  
advantage over other fuels.
- Q.5(a) What is the extended application of nuclear power in today's world? [2]  
Q.5(b) List out the various type of nuclear reactor with neat diagram. [4]  
Q.5(c) Explain the principle and working of a BWR& GCR with neat diagram and its application. [6]
- Q.6(a) Classification of various wind energy conversion system (WECS). [2]  
Q.6(b) Explain electricity generation by Ocean thermal energy conversion. A tidal power plant of the simple [4]  
basin type, has area of 30Mm<sup>2</sup>. The tide has a range of 12m. The turbine, however, stop operating  
when the head on it falls below 3m. Calculate the energy generation filling (or emptying) process in  
kWh if the turbine efficiency is 0.73.  
Q.6(c) Discuss the construction and working of fixed dome digester biogas plant and Discuss its merits and [6]  
demerits.
- Q.7(a) Explain the working of solar furnace. [2]  
Q.7(b) What are fuel cells? Describe the alkaline fuel cell with neat diagram and applications in chemical [4]  
process industries.  
Q.7(c) Describe the working of production of hydrogen energy by steam reforming with neat diagram and its [6]  
application in chemical industries.

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