**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(END SEMESTER EXAMINATION SP2023)**

**CLASS:** BTECH — **SEMESTER : IV**
**BRANCH:** CIVIL/ECE/MECH — **SESSION : SP2023**

**SUBJECT: CL221 ENERGY ENGINEERING**

**TIME:** 3 Hours — **FULL MARKS: 50**

**INSTRUCTIONS:**
**1. The question paper contains 5 questions each of 5 marks and total 25 marks.**
**2. Attempt all questions.**
**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 handbook/Graph paper etc., if applicable, will be supplied to the candidates**

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| Q.1(a) | Explain the working of Heat Pumps and Heat pipes with figures | [5] | 1 | 2 |
| Q.1(b) | Estimate Power output & Fuel consumption of steam turbine cogen. System, if, steam enthalpy = 2500 kCal/kg; $H_2O$ enthalpy = 500 kCal/kg; steam mass flow rate = 2.5 kg/hr; overall plant heat rate = 6.25 kCal/kWh and overall plant fuel rate = 1.2 kg/kWh. | [2] | 1 | 5 |
| Q.1(c) | Illustrate (i) back-pressure steam turbine cogen. system (ii) Open cycle gas turbine cogen. system and (iii) Reciprocating Engine cogen. system, via figures | [3] | 1 | 2 |
| Q.2(a) | (i) Explain the working principles of Electrically heated retort with figure<br>(ii) Define Slip velocity and mention the values of fluidization velocity in **three** types of Fluidized Bed Combustion boilers | [5] | 2 | 2 |
| Q.2(b) | Detail the functions of various components of atmospheric distillation column with a diagram. Also list salient points of vacuum distillation unit | [5] | 2 | 4 |
| Q.3(a) | Solve for theoretical $CO_2$%, if, excess air = 60% and actual $CO_2$ = 10% | [2] | 2 | 3 |
| Q.3(b) | (i) Carburetted water gas is essentially a mixture of _____<br>(ii) LPG is a mixture of _____ & _____ and in winter more _____ and in summer more _____<br>(iii) Oil gas is obtained by _____ | [2] | 2 | 1 |
| Q.3(c) | List the functions of control rods & moderators in a nuclear fission reactor and outline typical nuclear fission and fusion reactions. Also, illustrate Nuclear Fuel Cycle | [6] | 4,5 | 4 |
| Q.4(a) | Outline short notes on the following: (i) equation for theoretical power & extractable power in ocean currents (ii) Figure of Flash steam Geothermal power plant (iii) objective of biomass Torrefaction (iv) Differentiate impulse & reaction turbines with examples | [5] | 3,4 | 2 |
| Q.4(b) | Prove that maximum possible efficiency of a wind turbine is 59.26% via derivation | [5] | 3 | 5 |
| Q.5(a) | Explain the working principle of solar photovoltaic cells | [2] | 3 | 2 |
| Q.5(b) | Distinguish PAFC & AFC fuel cells via figures and important salient points | [3] | 4 | 4 |
| Q.5(c) | Explain Iodine-Sulfur cycle for $H_2$ production with reactions and diagram. Also mention challenges of the process | [5] | 4,5 | 2 |

**:::::01/05/2023 M:::::**