BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: IVth Date: 02/05/2022 (MORNING)

Subject with Code: **CL221 ENERGY ENGINEERING**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

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

CLASS:BE **SEMESTER :IV**
BRANCH:CHEMICAL/P&P **SESSION :SP 22**

SUBJECT: CL 221 – Energy Engineering – Set 1

TIME: 2 Hrs **FULL MARKS:50**

Section A (MCQs, 15 x 2 = 30 marks)

1. **In a Lasagna producing food industry, the energy alternative suggested after energy auditing is _____. The suggestion is based on _____. This auditing can be referred as _____ type of audit**

a) HR + CHP turbine; % energy saving + economy; benchmarking

b) HR + CHP turbine; % energy saving + economy; investment grade/detailed audit

c) HR + CHP turbine + ST; % energy saving + economy; walk-through audit

2. **_____ is the cogen. system that uses rankine cycle and _____ system is controlled by thermal load and _____ system is independent of thermal load**

a) steam turbine cogen. system, back pressure cogen., extraction condensing cogen.

b) gas turbine cogen. system, open cycle cogen., closed cycle cogen.

c) steam turbine cogen. system, extraction condensing cogen., back pressure cogen.

3. Name the waste heat recovery devices associated with the following terns: (i) geometry like concentric pipes (ii) small dT with large air masses (iii) temporary heat storage

a) (i) Metallic/ceramic recuperators (ii) Heat Wheels (iii) Regenerator

b) (i) Metallic recuperators (ii) Regenerator (iii) Heat Pipes

c) (i) Metallic/ceramic recuperators (ii) Heat pipes (iii) Regenerator

4. Carbonisation of non-caking coals takes place in _____, clay/sulfite liquors are used in _____ retort and Joule's heating effect is used in _____ retort.

a) Didier-Werke retort, Petit , Electrically heated

b) Didier-Werke retort, Weber, Electrically heated

c) Petit retort, Weber, Electrically heated

5. **In an atmospheric distillation column state the functions of reflux and reboiler:**

a) to cool vapors @ top & to separate heavies mixed with vapors @ top; to provide necessary heat for distillation completion

b) to cool vapors @ top & to separate heavies mixed with vapors @ top; to cool

c) to heat vapors @ top & to separate mixed vapors @ top; to recylce

6. **Catalytic cracking uses _____ as catalyst, whereas catalyst reforming uses _____ as catalyst respectively. Also, in advanced FCC units max. cracking happens in _____ at _____ pressure. The product reformates contains _____ as major component**

a) SiO_2-Al_2O_3 ; Pt ; riser ; 0.7 - 2 bar ; BTX

b) SiO_2-Al2O_3 ; Pt-Rhe ; reactor ; 3 - 13 bar ; BTX

c) Al_2O_3 ; Pt ; reactor ; 0.7 - 2 bar ; petrol

7. **In a Tokamak, inner and outer poloidal coils create _____ magnetic field, the toroidal coils create _____ magnetic field and the resultant magnetic field is _____**

a) Vertical; horizontal; helical

b) Helical; vertical; horizontal

c) Horizontal; vertical; helical

8. Main component of both producer gas and water gas is _____, but the difference is **the first contains _____ whereas the latter contains _____**

a) CO + H_2 ; more non-combustible gases ; less non-combustible gases

b) CO + H_2 ; less non-combustible gases ; more non-combustible gases

c) CO_2 + H_2 ; more non-combustible gases ; less non-combustible gases

9. **In a nuclear fission reaction, U_{235} is broken to _____ as final products. _____ neutrons can produce controlled sustainable chain reaction**

a) Kr, Ba, 3 n^0 & energy; thermal

b) Kr, Ba, 3 n^0 & energy; fast

c) Kr, Ba, 3 n^0 & energy; epithermal

10. **An OTEC plant contains the following equipments in its setup. Identify them**

a) Evaporator, refrigerant, steam turbine, condenser

b) Evaporator, flywheel, Kaplan turbine, condenser

c) Evaporator, pumps, turbine, condenser

11. _____ and _____ Geothermal deposits contain hot water and _____ deposit contains no fluids in it

a) Vapor dominated hydrothermal; Geopressurised; EGS

b) Liquid dominated hydrothermal; Geopressurised; EGS

c) Liquid dominated hydrothermal; Magma; EGS

12. _____ process leads to dry biomass product with no bio-activity. Also, name the forces that are encountered by a wind turbine

a) Combustion; Drag & Lift forces

b) Torrefaction; Drag & shear forces

c) Torrefaction; Drag & Lift forces

13. **Devices converting solar energy directly to electricity are called _____. Name the 1st, 2nd & 3rd generation materials used in them.**

a) PV cell; crystalline Si, thin film SiO_2, CdTe

b) PV cell; crystalline SiO_2, amorphous SiO_2, CdTe

c) PV cell; crystalline Si, amorphous Si, polymer cells with quantum dots

14. **Solar concentrators using individual flat glass plates as reflectors are called _____ whereas concentrators using mirrors as reflectors are called _____ and concentrators that look like DTH dish are _____**

a) Fresnel, Central receiver, parabolic trough

b) Fresnel, Central receiver, parabolic dish

c) Parabolic trough, Central receiver, parabolic dish

15. **Identify the fuel cells that have similar type of electrolytes and name the fuel source in both fuel cells, also mention the anode materials in each of them.**

a) PEMFC/H2/Pt-Rhe ; DMFC/CH3OH/Pt

b) PEMFC/H2/Pt ; PAFC/CH3OH/Pt-Rhe

c) PEMFC/H2/Pt ; DMFC/CH3OH/Pt-Rhe

Section B (20 marks)

1. Identify and briefly describe the waste heat recovery device that can recover heat from baking ovens with a neat figure [3]

2. Draw a neat sketch of a petit retort [3]

3. Illustrate nuclear fuel cycle with a neat sketch [3]

4. Calculate actual power developed by a wind turbine, if, interference factor b=0.2; $A_T = 5\ m^2$; wind speed = 10 m/s. Use std. value of air density (1.225 kg/m^3) [3]

5. Explain the working of cells used in stationary power generators using schematic figures and also write very important salient points of these fuel cells [3]

6. Define Energy audit and mention the significances of water gas shift reaction [2]

7. Differentiate (i) Bee-hive & by-product coke ovens in terms of pressure, heat transfer, geometry, pollution and coke quality (ii) Reaction & Impulse turbines [3]