BUDDHA INSTITUTE OF TECHNOLOGY, GIDA, GORAKHPUR
DEPARTMENT OF MECHANICAL ENGINEERING
PRE AKTU EXAM (EVEN SEMESTER 2022-23)
JULY-2023

Course:	B.Tech		**Semester:**	4
Subject:	Applied Thermodynamics		**Subject Code:**	KME 401
M.M.	100	**Time:** 3:00 hrs	**Roll No.** _____	

SECTION-A

1. Attempt all questions. Each questions carry equal marks.   **Marks: 10*2=20**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	Define adiabatic flame temperature.	L2	C01
b.	Define the following: Brake power, Indicated power, Brake mean effective pressure, and Indicated mean effective pressure.	L2	C01
c.	What is enthalpy of formation?	L2	C02
d.	Write the difference between the Otto cycle and Diesel cycle.	L2	C02
e.	Differentiate between Boiler mountings and Boiler accessories.	L2	C03
f.	Differentiate between Impulse and Reaction Turbines.	L2	C03
g.	Explain Rocket Propulsion.	L2	C04
h.	Classify the jet propulsion engines	L2	C04
i.	Explain the significance of choked flow in a nozzle.	L2	C05
j.	Give limitations of Carnot vapour power cycle and explain how Rankine cycle helps in overcoming them.	L2	C05

SECTION-B

2. Attempt ALL questions. Each questions carry equal marks.   **Marks: 3*10= 30**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	A steam turbine plant operates on Rankine cycle with steam entering turbine at 40 bar, 350ºC and leaving at 0.05 bar. Steam leaving turbine condenses to saturated liquid inside condenser. Feed pump pumps saturated liquid into boiler. Determine the net work per kg of steam and the cycle efficiency. Assuming all processes to be ideal. Also show cycle on T-s diagram.	L2	C01
	or		
a.	Derive an expression for air standard efficiency of Otto cycle in terms of compression ratio.	L2	C01
b.	Draw any water tube boiler and explain the functioning of following mounting and accessories- safety valves, and Fusible plug, Feed check valve, Superheater, Economizer and Air-preheater	L2	C02
	or		
b.	Demonstrate the following - Equivalent evaporation, Effects of air leakage on condenser performance, Boiler Draught , Difference between Natural and Forced	L2	C02

c.	Write principle of (i) Jet Propulsion (ii) Turbojet Engine (iii) Turboprop Engine (iv) Rocket Propulsion	L2	C03

SECTION-C

3. Attempt ANY ONE questions. Each questions carry equal marks.   **Marks: 1*10=10**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	In an air standard diesel cycle with compression ratio 14, the conditions of air at the start of compression stroke are 1 bar 300K. After addition of heat at constant pressure, the temperature rises to 2775K. Determine the thermal efficiency of the cycle, net work done per kg of air and the mean effective pressure. (take: R= 287 J/kg K and γ=1.4)	L2	C01
b.	Determine thermal efficiency and mean effective pressure of thermodynamic cycle used by a 4-strokepetrol engine. Details of cycle are as follows. Compression ratio = 7 Initial state = 100 kPa and 90ºC Swept volume = 0.1 m3 Heat added to cycle at constant volume = 100 kJ/cycle. Consider air as working fluid.	L2	C01

4. Attempt ANY ONE questions. Each questions carry equal marks.   **Marks: 1*10=10**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	A steam engine working on Rankine cycle operates between 1.96 MPa, 250ºC and 13.7 kPa. If engine consumes steam at the rate of 0.086 kg per second, determine Rankine cycle efficiency, neglecting pump work. Also, find Rankine cycle efficiency considering pump work..	L2	C02
b.	Discuss the effects of Regeneration, Superheating, Reheating on Rankine cycle with the help of neat sketches	L2	C02

5. Attempt ANY ONE questions. Each questions carry equal marks.   **Marks: 1*10=10**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	Discuss the causes of air leakage and its effect on condenser	L2	C03
b.	What are the essentials of a good boiler? Distinguish between Fire tube & Water tube boilers. Give two names of each. Give a neat-labeled sketch of a Babcox and wilcox Boiler.	L2	C03

6. Attempt ANY ONE questions. Each questions carry equal marks.   **Marks: 1*10=10**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	A convergent divergent nozzle expands air at 6.89 bar and 427 0 C into a space at 1 bar. The throat area is 650mm2 and exit area is 975mm2 . The exit velocity is found to be 680 m/s when the inlet velocity is negligible. Assuming negligible friction. Calculate a) Mass flow through the nozzle. b) Nozzle efficiency and coefficient of velocity.	L2	C04
b.	Define critical pressure ratio for nozzle of the steam turbine. Obtain analytically its value in terms of the index of expansion. What do you understand by compounding of steam turbines? Describe different types of compounding of steam turbines with appropriate diagram	L2	C04

7. Attempt ANY ONE questions. Each questions carry equal marks.   **Marks: 1*10=10**

Q. No.	Question	Level of Taxonomy	Course Outcome
a.	A gas turbine plants consists of two stage compressor with perfect intercooler and a single stage turbine. If the plants work between the temperatures limits 300 K and 1000 K and 1 bar and 16 bar. Find the net power of the plant per kg of air. Take specific heat at constant pressure 1 kJ/kgK.	L2	C05
b.	What is the principle of jet propulsion? Classify the jet propulsion engines. Explain the working of turbo jet engines by making neat sketch	L2	C05