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

CLASS: PG **SEMESTER : SECOND**
BRANCH: HPE **SESSION : SP/22**

SUBJECT: ME 572 MODERN POWER PLANT ENGINEERING

TIME:
2:00 hrs

FULL MARKS: 50

INSTRUCTIONS:

1. **Attempt all the questions.**
2. **There are internal choices in some 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.**

Q.1 Discuss the site selection criterion of steam power plant. [5]

Q.2 Explain the boiler circulation theory. [5]

Q.3 a. With neat and suitable sketch, explain the construction and working of Benson boiler. [5]

or

b. With neat and suitable sketch, explain the construction and working of Loefler boiler. [5]

Q.4 Explain the concept of nuclear breeding. [2]

Q.5 Argue on why Natural uranium is used as a fuel for PHWR's. [3]

Q.6 a. Sketch the construction of Pressurized water reactor and explain it's working also list the drawbacks. [5]

or

b. Explain the major components used in the nuclear reactor. [5]

Q.7 With neat and suitable sketch explain the working of simple gas/ steam turbine cycle with single pressure HRSG. [5]

Q.8 A combined cycle power plant takes in air at 1 bar and 15℃. The compressor pressure ratio is 13 and the gas turbine inlet temperature is 1400℃. The exhaust gas pressure of gas Turbine is 1.08 bar. The stack temperature is 140℃. The HSRG is a single pressure system. The steam pressure and temperature are 50 bar and 500℃. The steam at 2 bar is bled from the steam turbine for heating the feed water in the deaerator and the feed after the deaerator is pumped to the boiler. The condenser pressure is 0.05 bar. For ideal conditions calculate the following: [10]

i. Compressor work, Gas turbine work and Steam turbine work.
ii. mass of fuel (natural gas having lower calorific value of 42MJ/kg)
iii. Gas turbine cycle and steam turbine cycle efficiency.
iv. Combine cycle specific work and combined power plant efficiency.

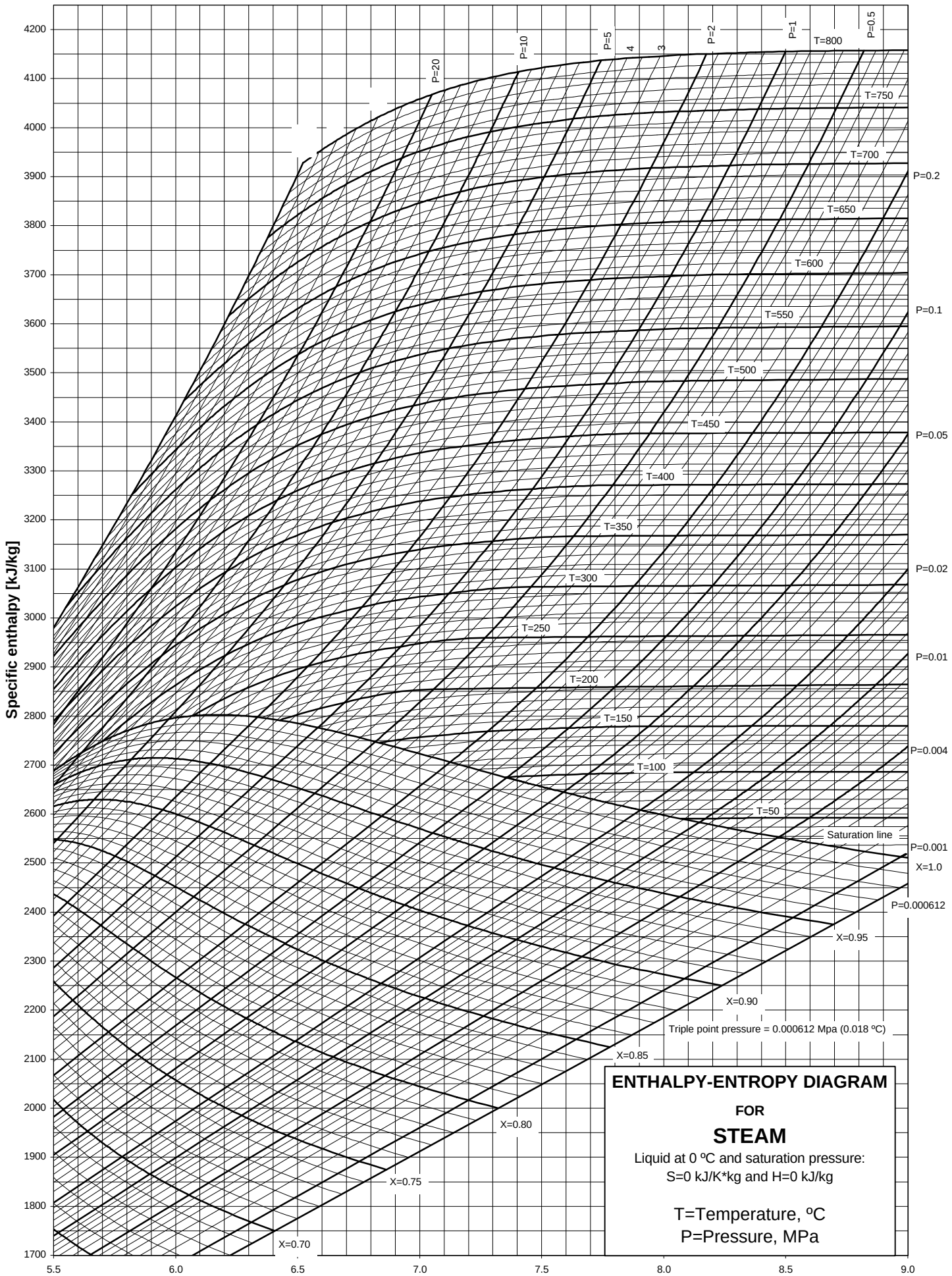
Take c_p = 1.11 kJ/kg K and γ =1.33 for combustion gases and c_p = 1.005 kJ/kg K and γ =1.4 for air. Neglect pump work. The properties can be taken from Table given below and Mollier chart.

Pressure, bar	Temperature, ℃	Specific Volume m^3/kg		Enthalpy kJ/kg			Entropy kJ/kg. K	
		Sat. Liq. v_f	Sat. vapour v_g	Sat. Liq. h_f	mixture h_{fg}	Sat. vapour h_g	Sat. Liq. s_f	Sat. vapour s_g
0.04	28.96	1.0040	34.800	121.46	2432.9	2554.4	0.4226	8.4746
0.06	36.16	1.0064	23.739	151.53	2415.9	2567.4	0.5210	8.3304
2.00	120.2	1.0605	0.8857	504.70	2201.9	2706.7	1.5301	7.1271
50.00	264.0	1.2859	0.03944	1154.2	1640.1	2794.3	2.9202	5.9734

Q.9 Explain the concept of thermoelectric power generation. [4]
or
Explain the concept of power generation through fuel cells. [4]

Q.10 Define the following: (Any 3) [6]

a. Economic efficiency and operational Efficiency.
b. Capacity factor and Load factor.
c. Base load and Peak load.
d. Power factor.



Produced by I. Aartun, NTNU 2001. Based on the program Allprops, Center for Applied Thermodynamic Studies, University of Idaho.