Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Course: **POWER PLANT ENGINEERING** **Semester: VI**

Program: **B. Tech Mechanical Engineering & Mechanical Engineering (Specialization)** **Time 03 hrs.**

Course Code: **MHEG 455** **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
1	Illustrate boiling water reactor with a line diagram and compare over pressurized water reactor.	**5 M**	**CO1**
2	Explain working procedure of Binary Cycle system with flow and T-S diagrams.	**5 M**	**CO4**
3	Describe characteristics, construction and working of Babcok and Wilcox high-pressure boiler.	**5 M**	**CO3**
4	Relate diesel power plants over thermal power plants	**5 M**	**CO1**

SECTION B

5	A gasoline engine working on four stroke develops a brake power of 20.9 Kw. A Morse test was conducted on this engine and the brake power (kW) obtained when each cylinder was made inoperative by short circuiting the spark plug are 14.9, 14.3, 14.8 and 14.5 respectively. The test was conducted at constant speed. Find the indicated power, mechanical efficiency and bmep when all the cylinders are firing. The bore of the engine is 75 mm and the stroke is 90 mm. The engine is running at 3000 rpm.	**10 M**	**CO4**
6	Draw layout of hydroelectric power plant and explain the basic elements of the plant.	**10 M**	**CO1**
7	**Explain the Following** (a) Electro static precipitator working principle (b) Liquid – dominated double flash system	**5 M** **5 M**	**CO3**
8	In a gas turbine, plant operating on a Joule cycle maximum and minimum temperature are 825^0 C and 25^0 C. The pressure ratio is 4.5. Calculate the specific work out put, cycle efficiency and work ratio. Assuming isentropic efficiencies of the com pressure and the turbine at 85 and 90 percent respectively. If the rating of the turbine is 1300 k W , what is the mass flow in kg/sec? Neglect the mass flow of fuel. Take C_P = 1.005 k J/ kg K. **OR** In a cogeneration plant, the power load is 5.6 MW and the heating load is 1.163 MW. Steam is generated at 40 bar and 500^0 C and is expanded isentropically through a turbine to a condenser at 0.06 bar. The heating load is supplied by extracting steam	**10 M** **10 M**	**CO2** **CO4**

	from the turbine at 2 bar, which condensed in the process heater to saturated liquid at 2 bar and then pumped back to the boiler. Compute (a) the steam generation capacity of the boiler in t/h, (b) the heat input to the boiler in kw, (c) the fuel burning rate of the boiler in t/h if a coal of calorific value 25 MJ/kg is burned and the boiler efficiency is 88%, (d) the heat rejected to the condenser, (e) the rate of flow of cooling water in the condenser if the temperature rise of water is 6^0 C. Neglect pump work.		

SECTION-C

Answer any two questions

9 The runoff data of a river at a particular site is tabulated below: (**20 M**, **CO5**)

Month	Mean discharge per month (millions of cu.m.)	Month	Mean discharge per month (millions of cu.m.)
January	40	July	75
February	25	August	100
March	20	September	110
April	10	October	60
May	0	November	50
June	50	December	40

(i) Draw a hydrograph and find the mean flow,

(ii) Also draw the flow duration curve,

(iii) Find the power in MW available at mean flow if the head available is 80 m and overall efficiency of generation is 85%.

Take each month of 30 days.

10 The following results were obtained in a test on a gas engine: (**20 M**, **CO4**)

Gas used	= 0.16 m^3/min at NTP
Calorific value of gas at NTP	= 14 MJ/m^3
Density of gas at NTP	= 0.65 kg/ m^3
Air used	= 1.50 kg/min
Specific heat of exhaust gas	= 1.0 kJ/kg K
Temperature of exhaust gas	= 400 ^{0}C
Room temperature	=20 ^{0}C
Cooling water per minute	= 6 kg
Specific heat of water	= 4.18 kJ/kg K
Rise in temperature of cooling water	= 30 ^{0}C
IP	=12.5 kW
BP	= 10.5 kW

Draw a heat balance sheet for the test on per hour basis in kJ.

11 Air is drawn in a gas turbine unit at 15^0C and 1.01bar, pressure ratio is 7:1 the compressor is driven by the H.P turbine, and L.P turbine drives a separate power shaft. (**20 M**, **CO5**)

	The isentropic efficiency of compressor and the H.P and L.P turbines are 0.82, 0.85 and 0.85 respectively. If the maximum cycle temperature is 610^0C, calculate: The pressure and the temperature of gases entering the power turbine, The net power developed by the unit per kg/s mass flow, The work ratio, Thermal efficiency of the unit, For compression C_{pa}=1.005kJ/kg k and γ=1.4 For combustion and expansion process C_p = 1.15kJ/kg k and γ=1.333		