Birla Institute of Technology and Science Pilani-K K Birla Goa Campus
FIRST SEMESTER 2019-2020
ME F420 Power Plant Engineering
Comprehensive Examination (Closed Book)
DATE: 10/12/2019 Time: 2:00 P.M. – 5:00 P.M. Maximum Marks: 100

Instructions:

- Write all steps while answering the problems.
- All the parts of a question must be answered together at a single place.
- Recheck will not be considered where pencil is used while answering.
- All symbols used in the question paper have their standard meaning.

Q.1. The input output curve of a 10 MW power station is expressed as $I = 10^6 (8+8L+0.4L^2)$ where I is in kcal per hour and L is in MW. **(i)** Determine the energy generated per kcal for a day if plant operates at its full capacity for 12 hours and is kept running at zero load for remaining 12 hours. **(ii)** Also calculate the coal's heat energy saving per Whr if the same amount of energy generated as in case (i) if plant operates for 24 hours. **[20]**

Q.2. What are the salient features of Geopressurized systems? **[06]**

Q.3. Match the items of columns A and B. (Two marks will be deducted for each wrongly answered pair). Write the content of option alongwith its option number otherwise rechecks will not be allowed. If you feel, answer is not available in Column B then you may write column A has "(option number say h) content "XYZ" → "NA i.e (Not Available)" in B. **[14]**

A	B
a. Toluene	i. Lower temperature Rankine cycle solar power plant
b. Efficiency 2.5%	ii. Petrothermal systems
c. 250^0C, 8 bar	iii. OTEC
d. Overall efficiency 10%	iv. $C_6H_{12}O_6$
e. Biomass	v. Hydrothermal Systems
f. Wind mill efficiency	vi. $C_{12}H_{12}O_8$
g. Wind	vii. High temperature Rankine cycle solar power plant
	viii. Medium temperature Rankine cycle solar power plant
	ix. Betz
	x. Moses

Q.4. It is desired to build a hydro-electric power station across a river having a discharge of 30 m^3/second at a head of 10 m. Assuming turbine efficiency 80% and speed ratio (Ku) as 0.83, determine the following

(i) Is it possible to use two turbines with a speed not less than 120 rpm and specific speed not more than 350?

(ii) Specify the type of the runner that can be used. Also calculate the diameter of the runner. **[15]**

Q.5. A Pelton wheel driven by two similar jets transmits 4000 kW to the shaft when running at 400 rpm. H = 200 m. Jets are tangential to a 1.50 m diameter circle. Jet is deflected by 165^0. (i) Find the efficiency of runner (ii) Diameter of each jet. **[15]**

Q.6. Propane gas is reacted with air in such a ratio that an analysis of the dry products of combustion gives CO_2 11.5%, O_2 2.7%, and CO 0.7 %. What is the percentage of excess air used? **[15]**

Q.7. An unknown hydrocarbon fuel, C_xH_y, was allowed to react with air. An Orsat analysis was made of a representative sample of the product gases with the following result: 12.1% CO_2, 3.8% O_2, and 0.9% CO. Determine (i) the combustion equation for the actual reaction, (ii) the excess or deficiency of air used, and (iv) the air fuel ratio during the test. **[15]**