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

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2019

Course: Thermal Utilities **Semester: I**

Program: M Tech Energy Systems (ES) **Time 03 hrs.**

Course Code: EPEC7027 **Max. Marks: 100**

Instructions: Read the question paper carefully before answering, Section B and C has one internal choice.

SECTION A

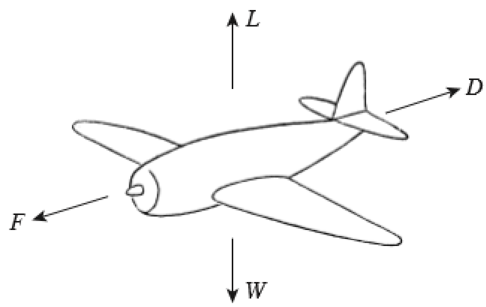
S. No.		Marks	CO
Q 1	What do you understand by Organic Rankine Cycle? Elaborate on some application areas for the same.	**5**	**CO2**
Q 2	In the filling of a tank, why (physically) is the final temperature in the tank higher than the initial temperature?	**5**	**CO1**
Q 3	Explain why Artificial Draught is more important in thermal power plant operation as compared to Natural Draught.	**5**	**CO3**
Q 4	Is heat transfer across a finite temperature difference only irreversible if no device is present between the two to harvest the potential difference?	**5**	**CO1**

SECTION B

Q 5	Draught produced by chimney is 2 cm of water column. Temperature of flue gas is 300°C and ambient temperature is 33°C. The flue gas formed per kg of fuel burnt is 24 kg. Neglect the losses and take the diameter of chimney as 1.75 m. Calculate: a. Height of Chimney in meters. b. Mass of flue gas flowing through the chimney in kg/min. Density of flue gases is given by: $\rho_g = \left\{\frac{m_a+1}{m_a}\right\} \frac{353}{T_g}$	**10**	**CO4**
Q 6	Explain the working of **Spreader Stoker Boiler** with a neat flow diagram. Also explain why such systems are preferred over other types of stokers in Industrial applications. **OR** A boiler system is to be controlled so the total dissolved solids in the blowdown does not exceed TDS_{BD} = 2000 mg/l for a feed water (makeup) that has TDS_F = 200 mg/l TDS. Steam consumption, Q_s is 1000 kg/day. Calculate Boiler Blowdown.	**10**	**CO2**

Q 7	Comment on Performance Evaluation for Furnaces, and elaborate on the major heat losses from a furnace, during a process operation. Use a neatly labelled concept diagram to explain the heat losses.	**10**	**CO3**

Q 8 — Consider an aircraft in level flight, with weight W. The rate of change of the gross weight of the vehicle is equal to the fuel weight flow:



For the given figure evaluate the following:

a. The Propulsion Energy Conversion Chain.
b. Operation of the gas turbine engine with block diagram.
c. Operation of Gas Turbines as applied to Thermal Power Generation Utilities

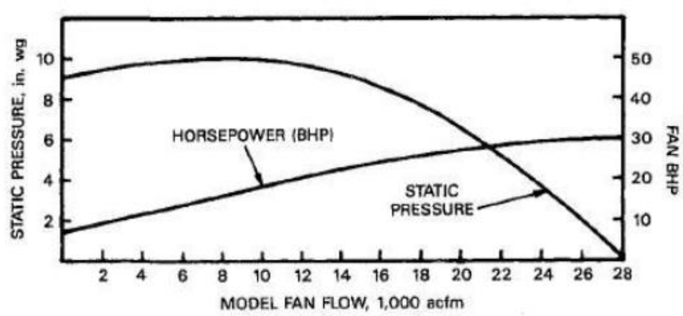
10 | **CO5**

SECTION-C

Q 9 — Convert model fan (b) performance to that of a full-size fan (a) with different speed and operating temperature as indicated below. Assume that the inlet pressure and gas molecular weight are the same for the model and full size fan.

Parameter	**Model Fan (b)**	**Full size Fan (a)**
Diameter, inches	20	80
RPM	1200	900
Temperature	60°F (520°R)	320°F (780°R)

The model fan performance curve is shown in the following figure:



The model fan performance data is given as:

Flow (acfm)	**ΔP, in w.g.**	**bhp**
3000	9	7
6000	10	16
12000	8.6	25

20 | **CO4**

		18000	5.2	28			
		24000	3.1	30			

Q 10	What do you understand by Energy Storage? Explain the working of Battery Storage systems and how it is critical to balance Power Plant Operations. In that context, explain how Demand Side Management (DSM) can be linked with such systems. **OR** What do you mean by a mechanical stoker? In that context, explain the working of Spreader Stoker Boiler with the help of a neat flow diagram. Further, keeping the above in mind, elaborate on DSM measures applied to Steam Boilers.	**20**	**CO5**