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

CLASS: MTECH **SEMESTER : III**
BRANCH: CSE/MECH **SESSION : MO/2024**

SUBJECT: SR511 FUNDAMENTALS OF FUELS AND COMBUSTION

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all 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.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	How is wind energy harnessed? Why is a three blade configuration used in wind turbine instead of a one or two blade configuration? Explain. What are the pros and cons of using wind energy?	[5]	CO1	L2
Q.1(b)	Illustrate and explain the complete process of fractional distillation of petroleum crude with proper schematic diagram.	[5]	CO	L2
Q.2(a)	What is calorific value? Calculate calorific value using Dulong's formula and further compare it with the experimental calorific value (8530 kcal/kg). The elemental analysis of a coal of Assam coalfield is as follows in percentage: C (87.52), H (7.27), S (0.84), N (2.7).	[5]	CO2	L4
Q.2(b)	Describe in detail the different stages of coke formation? What are the different types of coke formed?	[5]	CO2	L3
Q.3(a)	Differentiate between self-ignition and forced ignition? Discuss at least three factors/parameters which effect ignition energy?	[5]	CO3	L3
Q.3(b)	A gas turbine engine operates at an equivalence ratio of 0.286 with an air flow rate of 15.9Kg/s. The equivalent composition of the fuel (natural gas) is $C_{1.16}H_{4.32}$. Determine the fuel mass flow rate and the operating air-fuel ratio for the engine. MW_{air}=28.85gms.	[5]	CO3	L4
Q.4(a)	Demonstrate the various equilibrium criteria and their conditions at equilibrium condition.	[5]	CO4	L4
Q.4(b)	What is a zero order reaction? Explain with the help of an example. Derive the equation for rate constant and half-life of a zero order reaction.	[5]	CO4	L3
Q.5(a)	Demonstrate the change is flame shape and size on changing the nozzle velocity. Explain with diagrams.	[5]	CO5	L3
Q.5(b)	Describe in detail the various methods for determination of flame front.	[5]	CO5	L3

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