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

CLASS: BTECH **SEMESTER : VII**
BRANCH: ALL **SESSION : MO/2025**

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)	Why is a three blade configuration used in wind turbine instead of a one or two blade configuration? Explain with the help of diagrams. What are the advantages and disadvantages of using wind energy?	[5]	CO1	L3
Q.1(b)	What are the different types of sulphur present in coal? Explain in detail how sulphur is determined in coal.	[5]	CO	L2
Q.2(a)	Why is bio-diesel a preferred renewable fuel in the diesel engine? How is bio-diesel prepared? What are the applications of the byproduct glycerin obtained from bio-diesel production?	[5]	CO2	L2
Q.2(b)	What is calorific value? Calculate calorific value using Dulong's formula. 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	L3
Q.3(a)	Discuss the requirement of adiabatic flame temperature? How is adiabatic flame temperature determined? Discuss the effect of equivalence ratio and pressure on the adiabatic flame temperature?	[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)	What is a first order reaction? Explain with the help of an example. Derive the equation for rate constant and half-life of a first order reaction.	[5]	CO4	L3
Q.4(b)	Derive the Arrhenius equation. Explain the mechanism of chain reaction.	[5]	CO4	L2
Q.5(a)	Demonstrate the flame shape when a flame travels through a tube using a diagram. Discuss how the direction of flame travel affects the flame shape and velocity.	[5]	CO5	L3
Q.5(b)	Illustrate the various methods for determination of flame front.	[5]	CO5	L2

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