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

CLASS: B.TECH **SEMESTER : VII**
BRANCH: BT/CHEMICAL/IT **SESSION : MO/2023**

SUBJECT: SR511 FUNDAMENTALS OF FUELS & 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)	Demonstrate the different geothermal power plants used for harnessing energy? Describe in detail with diagram, enlightening their benefits. What are the pros and cons of using geothermal energy?	[5]	1	L2
Q.1(b)	The following data are available for Raniganj coal,	[5]	1	L3

Proximate Analysis, percent air-dried				Ultimate Analysis, percent dmmf			
Moisture	Ash	VM	Fc	C	H	S	N
2.3	14	29.1	54.6	84.52	6.27	0.64	3.37

Calculate calorific value using Dulong's formula and CFRI formula (b) Calculate the volatile matter, and fixed carbon on dmmf basis.

Q.2(a)	What are the different types of sulphur in coal? Explain in detail how is Nitrogen in coal is determined?	[5]	2	L2
Q.2(b)	Demonstrate in detail how producer gas is produced by the gasification of coal. Use diagram to highlight the different zones and reactions involved.	[5]	2	L3
Q.3(a)	How is adiabatic flame temperature determined? Discuss in detail the effect of equivalence ratio, initial temperature, and pressure on the adiabatic flame temperature?	[5]	3	L3
Q.3(b)	The gasoline (represented by C8H18) is burnt with dry air. The volumetric analysis of products on dry basis is CO_2=10.02%, O_2=5.62%, CO=0.88% and N_2=83.48%. Determine (a) A/F ratio, (b) The mole fraction of H_2O in the products (c) equivalence ratio, (d) % stoichiometric air used.	[5]	3	L4
Q.4(a)	Explain second order reactions with the help of examples. Derive the equation for rate constant and half-life of a zero-order reaction.	[5]	4	L3
Q.4(b)	Derive a relation for equilibrium constant in terms of mole fractions. Describe the three equilibrium criteria used to describe the equilibrium state.	[5]	4	L3
Q.5(a)	Illustrate in detail the various methods used for the determination of flame front.	[5]	5	L2
Q.5(b)	What happens to the flame shape when the flame travels in a horizontal direction? What would happen to the flame shape if the tube wall was heated? Illustrate with the help of diagrams.	[5]	5	L3

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