

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

CLASS: BTECH
BRANCH: MECH

SEMESTER : VI
SESSION : SP/2025

SUBJECT: ME361 COMBUSTION PROCESS

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.
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			CO	BL
Q.1(a)	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]	CO1	L4
Q.1(b)	What are the various methods used for determining adiabatic flame temperature? Explain with the help of a process diagram. What is the effect of the change in equivalence ratio on adiabatic flame temperature? Describe the various equilibrium criteria with the help of diagrams.	[2+1+2]	CO1	L3
Q.2(a)	How is inflammability of a gaseous mixture determined experimentally? Calculate the limits of inflammability of a gas mixture containing 40% methane, 20% butane and 40% hydrogen. Limits of inflammability for methane (5.3 and 14), butane (1.9 & 8.5) and hydrogen (4.0 & 75).	[3+2]	CO2	L3
Q.2(b)	Differentiate between order of a reaction and molecularity of a reaction? Derive a relation for rate constant and half-life of a first order reaction.	[2+3]	CO2	L4
Q.3(a)	Explain in detail the Constant pressure soap bubble method of measurement of burning velocity in a combustible mixture. What are its merits and demerits?	[5]	CO3	L3
Q.3(b)	Derive Rankine Hugoniot equation for a shock wave, and equations for particle velocity and velocity of propagation for the shock wave.	[5]	CO3	L3
Q.4(a)	Describe the any one method of forced ignition and discuss the factors affecting this type of ignition.	[5]	CO1	L4
Q.4(b)	Demonstrate in detail with the help of examples how the various factors affect the ignition energy.	[5]	CO1	L2, L3
Q.5(a)	What are the various combustion methods for NO _x emission control? Describe any two methods of NO _x emission control.	[1+2+2]	CO5	L2
Q.5(b)	What are the various methods for SO _x emission control? Describe any two methods of SO _x emission control.	[1+2+2]	CO5	L2

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