

Model Question Paper-1

USN

--	--	--	--	--	--	--	--	--	--

Fourth Semester B.E. Degree Examination Introduction to Combustion

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02.
03.

Module -1			*Bloom's Taxonomy Level	Marks
Q.01	a	Discuss about the laws of thermodynamics.	L2	6
	b	Derive the simple thermo chemical equation.	L3	7
	c	Explain the Rankine Hugoniot curves with the help of P -V diagram.	L2	7
OR				
Q.02	a	Estimate the constant-pressure adiabatic flame temperature for the combustion of a stoichiometric CH ₄ –air mixture. The pressure is 1 atm and the initial reactant temperature is 298 K. Use the following assumptions: 1. “Complete combustion” (no dissociation), i.e., the product mixture consists of only CO ₂ , H ₂ O, and N ₂ . 2. The product mixture enthalpy is estimated using constant specific heats evaluated at 1200 K ($\approx 0.5(T_i + T_{ad})$, where T_{ad} is guessed to be about 2100 K).	L4	8
	b	In their survey of experimental determinations of rate coefficients for the N–H–O system, Hanson and Salimian [10] recommend the following rate coefficient for the reaction $\text{NO} + \text{O} \rightarrow \text{N} + \text{O}_2$: $k_f = 3.80 \times 10^9 T^{1.0} \exp(-20,820/T) = \text{cm}^3/\text{gmol}\cdot\text{s}$. Determine the rate coefficient k_r for the reverse reaction, i.e., $\text{N} + \text{O}_2 \rightarrow \text{NO} + \text{O}$, at 2300 K.	L4	8
	c	Define the following (i) Unimolecular reaction, (ii) Termolecular reaction	L1	4
Module-2				
Q. 03	a	Define stoichiometric. Write their applications in thermodynamic combustion.	L2	4
	b	A small, low-emission, stationary gas turbine engine operates at full load (3950 kW) at an equivalence ratio of 0.286 with an air flow rate of 15.9 kg/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.	L4	6
	c	A natural gas–fired industrial boiler operates with an oxygen concentration of 3 mole percent in the flue gases. Determine the operating air–fuel ratio and the equivalence ratio. Treat the natural gas as methane.	L4	10
OR				
Q.04	a	Explicate standardized enthalpy and enthalpy of formation	L2	8
	b	Expound enthalpy and internal energy of combustion	L2	8
	c	Estimate the constant-volume adiabatic flame temperature for a stoichiometric CH ₄ –air mixture Use the following assumptions: 1. “Complete combustion” (no dissociation), i.e., the product mixture consists of only CO ₂ , H ₂ O, and N ₂ . 2. The product mixture enthalpy is estimated using constant specific heats evaluated at 1200 K ($\approx 0.5(T_i + T_{ad})$, where T_{ad} is guessed to be about 2100	L3	4

		K). Initial conditions are $T_i = 298 \text{ K}$, $P = 1 \text{ atm} (= 101,325 \text{ Pa})$.		
Module-3				
Q. 05	a	Explain the experimental methods of measuring burning velocity.	L2	8
	b	Discuss about the factors influencing flame velocity and flame thickness.	L2	6
	c	Elucidate about the flame stabilization.	L1	6
OR				
Q. 06	a	Illustrate the physical description of jet flame with the help of neat diagram.	L2	10
	b	Describe in detail about Burke Schumann flames.	L2	10
Module-4				
Q. 07	a	Explain the working of reciprocating engine with the neat sketch and write the factors affecting the combustion efficiency.	L3	10
	b	Explicate detonation in reciprocating engines and preventive methods.	L2	10
OR				
Q. 08	a	Expound the different types of combustion chambers in gas turbine engines with the neat diagram write their merits and demerits.	L2	10
	b	What is meant by afterburner? Explain the working and components of the afterburner with the neat sketch.	L1	10
Module-5				
Q. 09	a	Narrate the basic principles of combustion of solid propellant.	L2	10
	b	Outline the extension of droplet combustion to liquid propellant rockets	L2	10
OR				
Q. 10	a	Explain the unburned hydrocarbon and carbon monoxide in non-premixed combustion.	L2	10
	b	Elucidate the methods of reducing pollutants.	L2	10

Model Question Paper-1

USN

--	--	--	--	--	--	--	--	--	--

Fourth Semester B.E. Degree Examination Subject Title: Aircraft Systems and Instrumentations

TIME: 03 Hours

Max. Marks: 100

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

Module -1			*Bloom's Taxonomy Level	Marks
Q.1	a	With a neat diagram explain digital fly by wire system.	L2	06
	b	Explain power assisted and power operated system.	L2	08
	c	Describe the advantages and disadvantages of autopilot system	L1	06
OR				
Q.2	a	Describe about the primary & secondary flight controls with relevant diagrams.	L2	12
	b	With the help of neat sketch explain about auto pilot system.	L2	08
Module-2				
Q.3	a	With a neat sketch, explain about typical high pressure pneumatic system.	L2	10
	b	Explain basic brake control system with neat labelled diagram.	L2	10
OR				
Q.4	a.	Explain simple hydraulic system with neat sketch & briefly explain about simplified B767 aircraft.	L2	15
	b.	Write a short note on hydraulic fluid	L1	05
Module-3				
Q.5	a	What is the purpose of an aircraft fuel system? With a neat sketch explain the generalized fuel system for large transport aircraft.	L1,2	12
	b	What are some of the factors that influence the choice of the starting system?	L1	08
OR				
Q.6	a	Distinguish between fuel system of piston engine and jet engine.	L4	10
	b	How do you select ignition system in aircraft	L1	10
Module-4				
Q.7	a	With relevant sketch, briefly explain regarding air cycle cooling system.	L2	08
	b	Explain the most common types of fire detection system used on aircraft. Explain any one type with neat sketch	L1,2	12
OR				
Q.8	a	With relevant sketch, briefly explain regarding vapor cycle cooling system.	L2	08
	b	Write a short note on: i. Electrical anti icing ii. Pneumatic impulse de-icing system	L2	12
Module-5				
Q.9		With a neat sketch, explain the working operations of the following instruments. i. Thermocouple ii. Machmeter iii. Pitot static system iv. Gyroscope	L1,2	20

OR				
Q. 10		Explain the principle and operation for the following with neat labelled diagram: i. Accelerometer ii. Altimeters iii. Airspeed Indicator iv. Electrical tachometer	L1,2	20