CBCS SCHEME

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BME401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Applied Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Thermodynamics Data hand book and Steam tables are permitted.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Derive an expression for the air standard efficiency of an Otto cycle. Represent the processes of the cycle on P – V and T – S diagrams. List the assumptions.	**12**	**L3**	**CO1**
	b.	The compression ratio of a Diesel cycle is 14 and the cut off ratio is 2.2. At the beginning of the cycle, air is at 0.98 bar and 100°C. Find : i) Temperature and pressure at all the salient points. ii) Air standard efficiency.	**8**	**L3**	**CO1**
		OR			
Q.2	**a.**	Explain the Willan's line method of determining the frictional power of an IC engine.	**8**	**L2**	**CO1**
	b.	In a test on three cylinder, 4 – stroke IC engine with 22cm bore and 26cm stroke, the following were the observations during a trial period of one hour Fuel consumption = 8kg , Calorific value = 45,000 kJ/kg , Total revolutions of the crank shaft = 12,000 , MEP = 6 bar , Net load on brake = 1500N , Brake drum diameter = 1.8m , Rope diameter = 3cm , Mass of cooling water = 550kg , Inlet temperature of water = 27°C , Exit temperature of water = 55°C , Air used = 300kg , Ambient temperature = 30°C , Exhaust gas temperature = 310°C , Specific heat of exhaust gases = 1.1 kJ/kg K , Calculate : i) Mechanical efficiency ii) Indicated thermal efficiency. Also draw a heat balance sheet in kJ/min.	**12**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Derive an expression for the optimum pressure ratio for maximum work output in case of an ideal Brayton cycle in terms of maximum and minimum temperature of the cycle.	**10**	**L3**	**CO2**
	b.	In an open cycle gas turbine plant, air enters the compressor at 1 bar and 20°C. The pressure after compression is 4 bar. The isentropic efficiency of turbine and compressor are 85% and 80% respectively. The air – fuel ratio is 90 : 1. Calorific value of fuel used to 42,000 kJ/kg. Mass flow rate of air is 3kg/s. Determine the power output from the plant and the cycle efficiency. Assume that Cp = 1kJ/kg K and r = 1.4 for air and gases.	**10**	**L3**	**CO2**
		OR			

			Marks	Level	CO
Q.4	a.	With a neat sketch, explain the following methods used to improve the performance of an open cycle gas turbine plant : i) Reheating ii) Inter cooling.	12	L2	CO2
	b.	With a neat sketch, explain the working of a Ramjet and a Turbo propeller engine.	8	L2	CO2
Module – 3					
Q.5	a.	With a neat schematic diagram and T – S diagram, derive an expression for the thermal efficiency of the Rankine cycle.	8	L3	CO3
	b.	Explain the effect of the following on Rankine cycle efficiency : i) Boiler pressure ii) Condenser pressure.	4	L2	CO3
	c.	A simple ideal Rankine cycle works between the pressure of 30 bar and 0.04 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency and work ratio.	8	L3	CO3
OR					
Q.6	a.	With a neat schematic diagram and T – S diagram, briefly explain the regenerative vapour power cycle with single open feed water heater. Derive and expression for its thermal efficiency.	10	L3	CO3
	b.	A steam power plant operates on a reheat cycle. Steam in boiler at 150 bar, 550°C expands through high pressure turbine. It is reheated at constant pressure of 40 bat to 550°C and expands through low pressure turbine to a condenser at 0.1 bar. Find i) Quality of steam at turbine exist ii) Cycle efficiency iii) Steam rate in kg/Kw hr.	10	L3	CO3
Module – 4					
Q.7	a.	With a neat sketch, explain the working principle of an Ammonia vapour absorption refrigeration system.	8	L2	CO4
	b.	A 10 ton Ammonia ice plant operates between an evaporator temperature of -15°C and condenser temperature of 35°C. The Ammonia enters the compressor as dry saturated vapour. Assuming isentropic compression, determine i) mass flow rate or Ammonia ii) COP iii) Power input in KW iv) Tons of ice at -10°C produced from water at 25°C in a day. Enthalpy of fusion of ice = 334 kJ/kg, Cp = 4.187 kJ/kg K for water and Cp = 2.1 kJ/kg K for ice.	12	L3	CO4
OR					
Q.8	a.	With a neat sketch, explain the working principle of a winter air conditioning system. Represent the processes of the system on a psychrometric chart.	10	L2	CO4

	b.	It is required to design an air conditioning plant for an office room with the following conditions : Outdoor conditions = 14°C DBT , 10°C WDT , Required conditions = 20°C DBT , 60% RH , Amount of air circulation = 0.3m^3/min/person , Seating capacity of office = 60. The required condition is achieved first by heating and then by adiabatic humidifying. Determine : i) heating capacity of the coil in kW and the surface temperature required if the bypass factor of the coil is 0.4 ii) Capacity of the humidifier.	10	L3	CO4
		Module – 5			
Q.9	a.	Derive an expression for the volumetric efficiency of a reciprocating air compressor.	10	L3	CO5
	b.	Air at 1 bar and 27°C is compressed to 7 bar by a single stage reciprocating compressor according to the law $PV^{1.3} = C$. The free air delivered was 1m3/min. Speed of the compressor is 300rpm , Stroke to bore ratio is 1.5:1. Mechanical efficiency is 85% and motor transmission efficiency is 90%. Determine i) Indicated power and Isothermal efficiency. ii) Cylinder dimensions and power of the motor required to drive the compressor.	10	L3	CO5
		OR			
Q.10	a.	Derive an expression for condition of maximum discharge through a nozzle.	10	L3	CO5
	b.	A convergent – divergent nozzle is required to discharge 360 kg/hr of steam. The nozzle is supplied with steam and 10 bar and 0.97 dry and discharges against a back pressure of 0.5 bar. Neglecting the effect of friction, find the throat and exit diameters. Assume the condition for maximum discharge.	10	L3	CO5

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BME402

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Machining Science and Metrology

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With a neat sketch, explain single point cutting tool geometry.	07	L2	CO1
	b.	Explain the merchant circle diagram for the analysis of power requirement for the machine tool.	08	L2	CO1
	c.	Describe the orthogonal and oblique cutting.	05	L2	CO1
		OR			
Q.2	a.	With neat sketches, explain the tool layout for producing a hexagonal bolt on a capstan lathe.	07	L2	CO1
	b.	Briefly discuss the broad classification of lathes.	07	L2	CO1
	c.	Explain any two operations of the lathe.	06	L2	CO1
		Module – 2			
Q.3	a.	With a neat diagram, explain column and knee type milling machine.	07	L2	CO2
	b.	Explain with neat sketches up milling and down milling methods of milling operations. Discuss the significance of both.	08	L2	CO2
	c.	Use compound indexing method for calculating the index crank movement to divide the peripheral of a job into 87 divisions.	05	L3	CO2
		OR			
Q.4	a.	Explain with neat sketch constructional features of radial drilling machine.	08	L2	CO2
	b.	Explain driving mechanisms of shaper.	06	L2	CO2
	c.	Briefly explain the classification of grinding machines.	06	L2	CO2
		Module – 3			
Q.5	a.	Define tool life. Discuss the parameters which influences the tool life.	08	L2	CO3
	b.	With a neat sketch, explain the different heat zones that are present during the metal cutting process.	06	L2	CO3
	c.	Discuss the different wear mechanisms.	06	L2	CO3
		OR			
Q.6	a.	List the different types of cutting tool materials and explain them.	08	L2	CO3
	b.	Explain different properties of cutting fluids.	06	L2	CO3
	c.	Define machinability and discuss the factors affecting machinability.	06	L2	CO3
		Module – 4			
Q.7	a.	Discuss the following standards of measurement: (i) Line standard (ii) Wavelength standard (iii) End standard	07	L2	CO4
	b.	With a neat sketch, explain international prototype meter.	07	L2	CO4
	c.	Explain wringing phenomenon.	06	L2	CO4
		OR			
Q.8	a.	Define fit. Describe the types of fit and their designation.	08	L2	CO4
	b.	What is the purpose of limit system?	06	L2	CO4
	c.	With a neat sketch, explain snap gauges.	06	L2	CO4

		Module – 5			
Q.9	**a.**	With a neat sketch explain Taylor's principle in the design of limit gauges.	**08**	**L2**	**CO5**
	b.	Sketch and explain two types of plug and ring gauges.	**08**	**L2**	**CO5**
	c.	Explain briefly the different gauge tolerances.	**04**	**L2**	**CO5**
		OR			
Q.10	**a.**	Explain the basic characteristics and classification of comparators.	**06**	**L2**	**CO5**
	b.	With a neat sketch, explain sigma comparator.	**08**	**L2**	**CO5**
	c.	Explain the principle and working of a sine bar.	**06**	**L2**	**CO5**

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BME403

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following properties of fluids and write their SI units. i) Density ii) Specific weight iii) Specific volume iv) Kinematic viscosity.	8	L1	CO1
	b.	If the velocity distribution over a plate is given by $u = \frac{2}{3}y - y^2$ in which 'u' is the velocity in meter per second at a distance 'y' meter above the plate, Determine the shear stress at y = 0 and y = 0.15m. Take dynamic viscosity of fluid as 8.63 poises.	6	L3	CO1
	c.	Define capillarity. Derive an expression for capillary rise.	6	L2	CO1
		OR			
Q.2	a.	State and prove Pascal's law.	6	L2	CO2
	b.	Define the following and indicate their relative position on a chart: i) Absolute pressure ii) Gauge pressure iii) Vacuum pressure iv) Atmospheric pressure.	6	L1	CO2
	c.	The right limb of a simple u-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp. gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.	8	L3	CO2
		Module – 2			
Q.3	a.	Define the following types of fluid flows: i) Steady and unsteady flow ii) Uniform and non-uniform flow iii) Compressible and incompressible flow.	6	L1	CO2
	b.	Derive the continuity equation in three dimensional Cartesian co-ordinates for a steady, incompressible fluid flow.	8	L2	CO2
	c.	Explain stream function and velocity potential function.	6	L2	CO2

		OR			
Q.4	**a.**	Derive Hagen-Poiseuille's equation for laminar flow through a circular pipe.	**10**	**L2**	**CO2**
	b.	A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds. Assume laminar flow.	**6**	**L3**	**CO2**
	c.	Define Reynolds number. Explain its significance in fluid flow.	**4**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Derive Euler's equation of motion along a stream line. Deduce Bernoulli's equation from Euler's equation. State the assumptions made.	**10**	**L2**	**CO3**
	b.	A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position 'A' to 500 mm diameter at a position 'B' which is 4 m at a higher level. If the pressures at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 lit/s, determine the loss of head and direction of flow.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Derive Darcy – Weisbach equation for loss of head due to friction in pipe.	**10**	**L2**	**CO3**
	b.	A horizontal pipe line 40 m long is connected to a water tank at one end and discharge freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take f = 0.01 for both sections of pipe.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the following terms: i) Drag ii) Lift iii) Friction drag iv) Pressure drag.	**8**	**L2**	**CO4**
	b.	Briefly explain what is meant by boundary layer and hence define the following: i) Boundary layer thickness ii) Displacement thickness.	**6**	**L2**	**CO4**
	c.	State and explain Buckingham's π theorem.	**6**	**L2**	**CO4**
		OR			
Q.8	**a.**	What is similitude? Explain the different types of similitude.	**7**	**L2**	**CO4**
	b.	Explain the dimentional homogeneity with examples.	**3**	**L2**	**CO4**

	c.	The frictional torque (T) of a disc of diameter (D) rotating at a speed (N) in a fluid of viscosity (μ) and density (ρ) in a turbulent flow is given by $T = D5N^2\rho\phi\left[\frac{\mu}{D^2N\rho}\right]$. Prove this by Buckingham's - π theorem.	10	L3	CO4
		Module – 5			
Q.9	a.	Define Mach number. Explain the significance of Mach number in compressible fluid flow.	6	L2	CO5
	b.	Derive an expression for velocity of sound wave in a fluid.	8	L2	CO5
	c.	Find the velocity of bullet fired in standard air if Mach angle is 30°. Take R = 287.14 J/kg K and $\gamma = 1.4$ for air and temperature of air is 15°C.	6	L3	CO5
		OR			
Q.10	a.	An air plane is flying at an altitude of 15 km where the temperature is -50°C. The speed of plane corresponds to Mach number 1.6. Assume $\gamma = 1.4$ and R = 287 J/kg K for air. Find speed of plane and Mach angle.	8	L3	CO5
	b.	Define: i) Mach Number ii) Sub-Sonic flow iii) Sonic flow iv) Super-Sonic flow	4	L1	CO5
	c.	Mention the advantages and disadvantages of CFD.	8	L2	CO5

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BBOK407

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Biology for Engineers

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	**a.**	Define cell. Explain the structure and function of plant cell with neat diagram.	**08**	**L2**	**CO1**
	b.	Define Stem Cell. Discuss the types and application of stem cells.	**06**	**L2**	**CO1**
	c.	Describe the properties and functions of hormones.	**06**	**L2**	**CO1**
		OR			
Q.2	**a.**	Discuss the properties and functions of nucleic acids in cellular processes.	**07**	**L2**	**CO1**
	b.	Discuss the properties and functions of enzymes.	**07**	**L2**	**CO1**
	c.	Discuss the properties of vitamins and its supplies.	**06**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	Apply the knowledge of nucleic acid in DNA finger printing in forensic applications.	**08**	**L3**	**CO1**
	b.	Discuss whey protein and plant based protein as protein based food.	**06**	**L2**	**CO1**
	c.	Write a note on PLA as bioplastic.	**06**	**L1**	**CO1**
		OR			
Q.4	**a.**	Apply your knowledge of lipids and outline the process of obtaining biodiesel from lipids.	**07**	**L3**	**CO1**
	b.	Define vaccine. Discuss the mechanism of RNA vaccine for COVID-19.	**07**	**L2**	**CO1**
	c.	Write a note on enzyme based biosensors.	**06**	**L1**	**CO1**
		Module – 3			
Q.5	**a.**	Compare human brain with computer's CPU.	**07**	**L3**	**CO2**
	b.	Explain lungs as a purification system.	**07**	**L2**	**CO2**
	c.	Write a note on dialysis systems of kidney.	**06**	**L1**	**CO2**
		OR			

Q.6	a.	Illustrate the engineering solutions available for Parkinson's disease.	07	L3	CO2
	b.	Explain heart as a pumping system.	07	L2	CO2
	c.	Write a note on optical correction and materials used for lens.	06	L1	CO2
		Module – 4			
Q.7	a.	Illustrate the HBOCs and PFCs as human substituents.	07	L3	CO3
	b.	Explain how the structure of shark skin reduces drag and how these properties have been applied to improve swim suit.	07	L2	CO3
	c.	Explain the term GPS and aircrafts technology as bio inspired by bird fly.	06	L2	CO3
		OR			
Q.8	a.	Compare the uses of ultrasonography and sonars.	07	L3	CO3
	b.	Discuss the king fisher beak shaped bullet train to the reduction of noise and improve the stability.	06	L2	CO3
	c.	Explain the term superhydrophobic and self-cleaning in lotus leaf effect.	07	L2	CO3
		Module – 5			
Q.9	a.	Explain bioimaging and artificial intelligence technique in disease diagnosis.	08	L2	CO4
	b.	Explain the working principles of electrical tongue and electrical nose in food industry.	06	L2	CO4
	c.	Write a note on bioengineering of Muscular dystrophy and oseteoporosis.	06	L1	CO4
		OR			
Q.10	a.	Explain the process of biomining via microbial surface adsorption.	07	L2	CO4
	b.	Describe the concept of DNA origami and its role in bio-computing.	06	L2	CO4
	c.	Write a note on self healing bio-concrete and bio-mineralization processes.	07	L1	CO4

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