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B.TECH (ME)

II YEAR, III SEMESTER EXAMINATION

MATHEMATICS – III (PDE, PROBABILITY & STATISTICS)

[Time : 03:00 Hours]

[Max. Marks : 70]

NOTE: - ATTEMPT ALL THE QUESTIONS AS PER GIVEN INSTRUCTIONS. NON – PROGRAMMABLE SCIENTIFIC CALCULATORS ARE ALLOWED.

QUESTION NO.-1: ATTEMPT ANY *FOUR* PARTS.

(4×3=12)

a)	Form PDE from the equation $z = ax + by + ab$ by eliminating the arbitrary constants.
b)	Classify the following differential equation- $u_{xx} - 2u_{xy} + u_{yy} = 0$.
c)	The first four moments about mean of a distribution are 0, 1.5, 0 and 6. Discuss the skewness of the distribution.
d)	Write a short note on correlation.
e)	If 5 coins are tossed, what is the probability that all will show a head?
f)	Given that $P(A) = 3/8$, $P(B) = 5/8$ and $P(A \cap B) = 1/4$, find $P(A/B)$ and $P(B/A)$.

QUESTION NO.-2: ATTEMPT ANY *THREE* PARTS.

(3×4=12)

QUESTIONS: 2. ATTEMPT ANY THREE PARTS.							(3×4=12)
a)	Solve the following PDE:- $yzp - xzq = xy$.						
b)	Fit a straight line to the following data treating y as the dependent variable:						
	X	1	2	3	4	5	
	Y	5	7	9	10	11	
c)	In a random throw of 2 dice what is the expectation of the sum of the points on them?						
d)	Using the formula for binomial distribution, find the probability of rolling at most 2 sixes in 5 rolls of a die.						

QUESTION NO.-3: ATTEMPT ANY *THREE* PARTS.

(3×6=18)

a)	Solve:- $(D^2 + 3DD' - 4D'^2)z = x + \sin y$.
b)	Write a short note on moments.
c)	Write a short note on correlation and regression.
d)	The number of arrivals of customers during any day follows Poisson distribution with a mean of 5. What is the probability that the total number of customers on two days selected at random is less than 2? (Given: $e^{-10} = 4.54 \times 10^{-5}$)

QUESTION NO.-4: ATTEMPT ANY *TWO* PARTS.

(2×7=14)

a)	Solve:- $(D^2 - DD' - 2D)z = \sin(3x+4y) - e^{2x+y}$.
b)	The first four moments of a distribution about the value 4 of the variable are -1.5, 17, -30 and 108. Find the moments about mean and moments about origin. Also find β_1 and β_2 .
c)	Show that the area under the normal curve is unity.

QUESTION NO.-5: ATTEMPT ANY *TWO* PARTS.

(2×7=14)

a)	Solve by the method of separation of variables- $3u_x + 2u_y = 0$; $u(x, 0) = 4e^{-x}$.
b)	Find the two lines of regression and coefficient of correlation for the data given below: $n = 18$, $\sum x = 12$, $\sum y = 18$, $\sum x^2 = 60$, $\sum y^2 = 96$, $\sum xy = 48$
c)	There are 4 boys and 2 girl in room A and 5 boys and 3 girls in room B. A girl from one of the two rooms laughed loudly. What is the probability that the girl who laughed was from room B.

Enrollment No.[illegible]

B.TECH (ME)
II YEAR, III SEMESTER EXAMINATION
THERMODYNAMICS

[Time : 03:00 Hours]

[Max. Marks : 70]

NOTE:- ATTEMPT ALL THE QUESTIONS AS PER GIVEN INSTRUCTIONS. STEAM TABLE, MOILER CHART AND PSYCHROMETRIC CHART IS ALLOWED.

QUESTION NO.-1: ATTEMPT ANY FOUR PARTS.

(4*3=12)

- What is steady flow energy equation (SFEE)? What are the assumptions made for it?
- Explain the reversible and irreversible processes.
- Distinguish between high grade energy and low-grade energy.
- Difference between Point Function and Path Function
- Define work and heat with their sign convention.

QUESTION NO.-2: ATTEMPT ANY THREE PARTS.

(3*4=12)

- Write short notes on i) Heat pump and ii) Heat engine.
- What is heat reservoir? Also discuss about PMM-I.
- What is an unsteady flow process?
- Show that the Kelvin-Planck and the Clausius statement of the second law of thermodynamics are equivalent.
- What do you understand by cyclic and quasi-static process? Differentiate between point functions and path functions.

QUESTION NO.-3: ATTEMPT ANY THREE PARTS.

(3*6=18)

- A mass of 8 kg gas expands within a flexible container so that the $p-v$ relationship is of the form $pv^{1.2} = \text{constant}$. The initial pressure is 1000 KPa and the initial volume is 1 m^3 . The final pressure is 5 KPa. If specific internal energy of the gas decreases by 40 KJ/Kg, find the heat transfer in magnitude and direction.
- Demonstrate Carnot theorem. An engine manufacturer claims to have developed a heat engine with following specifications: Power developed 75KW, fuel burnt 5KJ/hr, heating value of fuel 75000KJ/Kg, and temperature limits 1000 K and 400K. Is the claim of the manufacturer true or false? Give reasons for your answer.
- Derive the relation of Vander Waal's equation in terms of critical properties. Explain compressibility factor.
- State Zeroth law of thermodynamics. Explain how the Zeroth law of thermodynamics can be used for temperature measurement.
- Steam enters an engine at a pressure 10 bar absolute and 400°C . It is exhausted at 0.2 bars. The steam at exhaust is 0.9 dry. Find: (i) Drop in enthalpy; (ii) Change in entropy.

QUESTION NO.-4: ATTEMPT ANY TWO PARTS.

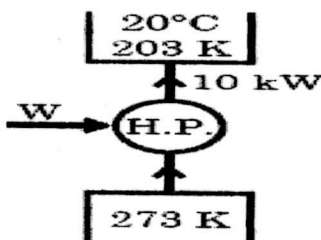
(2*7=14)

- Define entropy. Prove that entropy is a point function.
- Define Specific volume of a fluid. How volume of dry, wet and superheated steam is determined.
- Draw the P-T diagram of pure substances and explain its various regions of the diagram in details.
- Derive the Carnot cycle derivation

QUESTION NO.-5: ATTEMPT ANY TWO PARTS.

(2*7=14)

- a) It takes 10 kW to keep the interior of a certain house at 20°C when the outside temperature is 0°C . This heat flow is usually obtained directly by burning gas or oil. Calculate the power required if the 10 kW heat flow were supplied by operating a reversible engine with the house as the upper reservoir and the outside surroundings as the lower reservoir, so that the power were used only to perform work needed to operate the engine.



- b) Derive the expression of work done for various non-flow processes.
- c) What is Clausius inequality ? Explain it with T-V diagram.
- d) An ice-making plant produces ice at atmospheric pressure and at 0°C from water. The mean temperature of the cooling water circulating through the condenser of the refrigerating machine is 18°C . Evaluate the minimum electrical work in kWh required to produce 1 ton of ice (The enthalpy of fusion of ice at atmospheric pressure is 333.5 kJ/kg).
- e) Find the entropy of 1 kg of superheated steam at a pressure of 12 bars and a temperature of 250°C . Take specific heat of superheated steam as 2.1 kJ/kg K .

Printing Pages : 2

Paper Code : - BAS-303

(B) (SVSU) : 2023-2024/R

Enrollment No.

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B.Tech (ME)
II YEAR, III SEMESTER EXAMINATION
PHYSICS –II (OPTICS & WAVES)

[Time : 03:00 Hours]

[Max. Marks : 70]

NOTE:- ATTEMPT ALL THE QUESTIONS AS PER GIVEN INSTRUCTIONS.

1.	Multiple Choice Questions (MCQs)	[01×15=15]
I	Question: What is the time period of a simple harmonic oscillator dependent on? A) Mass B) Amplitude C) Spring constant D) All of the above	
II	Question: The potential energy of a simple harmonic oscillator is maximum at: A) Amplitude B) Equilibrium position C) Half of the amplitude D) None of the above	
III	Question: What is the relationship between the frequency and the mass of an object in simple harmonic motion? A) Inverse proportionality B) Direct proportionality C) Square root relationship D) No relationship	
IV	Constructive interfere providesrings in Newton's ring experiment– (a) Bright (b) Dark (c) Both (d) None	
V	LASER is a- (a) Highly coherent light (b) Highly incoherent light (c) Both (None)	
VI	Question: LASER stands for: A) Light Amplification by Stimulated Emission of Radiation B) Laser Amplification by Spontaneous Emission of Radiation C) Light Absorption by Stimulated Emission of Radiation D) Laser Absorption by Spontaneous Emission of Radiation	
VII	Question: In a laser, the term "coherent" refers to: A) In-phase and consistent frequencies B) Random frequencies C) Absence of light amplification D) Incoherent emission	
VIII	Question: What is the active medium in a laser? A) Crystal B) Gas C) Liquid D) All of the above	

[P.T.O.]

IX	In a complex number $z=6x+6i$, the real part is- (a) 3 (b) 4(c) 6(d) None
X	Question: Which of the following waves require a medium for propagation? A) Electromagnetic waves B) Sound waves C) Light waves D) Both B and C
XI	Question: The phenomenon of bending of light as it passes from one medium to another is known as: A) Reflection B) Refraction C) Diffraction D) Dispersion
XII	In newton's ring experiment, we use- (a) LASER (b) White light (c) Monochromatic light (None)
XIII	In Newton's Ring's experiment, dark fringes happen because of- (a) Destructive Interference (b) Constructive interference (c) Both (d) None
XIV	Question: In the context of waves, what is the relationship between frequency and wavelength? A) Inverse proportionality B) Direct proportionality C) Square root relationship D) No relationship
XV	What type of lens is used to correct far sightedness? a) Convex lens b) Concave lens c) Plano-concave lens d) Plano-convex lens
2.	Answer in long (any three) [10×3=30]
I	Explain Newton's rings experiment in detail. Also draw the ray diagram.
II	Explain Population inversion in detail with the help of a ray diagram.
III	What you mean by LASER. Define its properties and explain population inversion.
IV	Explain total internal reflection, Brewster's angle and Huygens's principle.
3.	Answer in short (any five) [5x5=25]
I	Define simple harmonic motion
II	What is the amplitude of an oscillating object?
III	Differentiate between spontaneous emission and stimulated emission in the context of lasers
IV	Provide relation between Einstein's coefficients
V	What is population inversion in the context of laser operation?
VI	Define refraction.
VII	Describe the function of a convex lens.
