

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(First Semester)

Branch - MATHEMATICS

CALCULUS – I

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	$\vec{r}(t) = (1 + t^3)\vec{i} + te^{-t}\vec{j} + \frac{\sin t}{t}\vec{k}$, then $\lim_{t \rightarrow 0} \vec{r}(t) = \underline{\hspace{2cm}}$. a) $\vec{i}$ b) $\vec{i} + \vec{j}$ c) $\vec{i} + \vec{k}$ d) $\vec{i} - \vec{k}$	K1	CO1
	2	$\vec{r}(t) = \langle t, t^2, t^3 \rangle$ is the vector equation of ____. a) helix b) spiral c) knot d) twisted cube	K2	CO1
2	3	If $f(x, y) = x \ln(y^2 - x)$ then $f(3, 2) = \underline{\hspace{2cm}}$. a) 3 b) 0 c) ∞ d) -3	K1	CO2
	4	The equation $\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$ is called ____ equation a) Laplace b) Wave c) Euler d) Heat	K2	CO2
3	5	If $f(x, y) = \sin x + e^{xy}$ then $\nabla f(0, 1) = \underline{\hspace{2cm}}$. a) $\langle 0, 0 \rangle$ b) $\langle 2, 2 \rangle$ c) $\langle 0, 2 \rangle$ d) $\langle 2, 0 \rangle$	K1	CO3
	6	If $f(a, b)$ is neither a maximum nor minimum then (a, b) is a ____ point. a) maximum b) minimum c) saddle d) extreme	K2	CO3
4	7	If $f(x, y) \geq g(x, y)$ for all x in R then which of the following property holds: a) $\iint_R f(x, y) dA \geq \iint_R g(x, y) dxdy$ b) $\iint_R f(x, y) dA \leq \iint_R g(x, y) dxdy$ c) $\iint_R f(x, y) dA = \iint_R g(x, y) dxdy$ d) $\iint_R f(x, y) dA = - \iint_R g(x, y) dxdy$	K1	CO4
	8	The mass of a triangular lamina with vertices $(0, 0)$, $(1, 0)$ and $(0, 2)$ is ____. a) $\frac{11}{16}$ b) $\frac{16}{11}$ c) $\frac{3}{8}$ d) $\frac{8}{3}$	K2	CO4

Cont...

5	9	The equation of the surface $z^2 = x^2 + y^2$ in cylindrical coordinates is _____ a) $z = r^2$ b) $z^2 = r$ c) $z = r$ d) $z = \sqrt{r}$	K1	CO5
	10	The cylindrical coordinates of the point with rectangular coordinates $(3, -3, -7)$ is _____. a) $(-3\sqrt{2}, 7\pi/4, 7)$ b) $(3\sqrt{2}, 7\pi/4, -7)$ c) $(3\sqrt{2}, -7\pi/4, 7)$ d) $(-3\sqrt{2}, 7\pi/4, -7)$	K2	CO5

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Identify a vector function that represents the curve of intersection of the cylinder $x^2 + y^2 = 1$ and the plane $y + z = 2$.	K3	CO1
	(OR)			
	11.b.	Calculate the curvature of the parabola $y = x^2$ at the points $(0,0)$, $(1,1)$ and $(2,4)$		
2	12.a.	Examine whether $\lim_{(x,y) \rightarrow (0,0)} f(x,y)$ exists if $f(x,y) = \frac{x^2 - y^2}{x^2 + y^2}$.	K4	CO2
	(OR)			
	12.b.	a) Inspect if $u(x,y) = e^x \sin y$ satisfies Laplace equation. b) Analyze if $u(x,t) = \sin(x - at)$ satisfies wave equation.		
3	13.a.	The pressure P (in kilopascals), volume V (in liters), and temperature T (in kelvins) of a mole of an ideal gas are related by the equation $PV = 8.31T$. Discuss the rate at which the pressure is changing when the temperature is $300K$ and increasing at a rate of $0.1K/s$ and the volume is $100 L$ and increasing at a rate of $0.2K/s$.	K2	CO3
	(OR)			
	13.b.	Describe the equations of the tangent plane and normal line at the point $(-2,1,-3)$ to the ellipsoid $\frac{x^2}{4} + y^2 + \frac{z^2}{9} = 3$.		
4	14.a.	Calculate $\iint_D xy dA$ where D is the region bounded by the line $y = x - 1$ and the parabola $y^2 = 2x + 6$.	K3	CO4
	(OR)			
	14.b.	Apply multiple integrals to find the volume of the solid that lies under the paraboloid $z = x^2 + y^2$ above the xy -plane and inside the cylinder $x^2 + y^2 = 2x$.		

Cont...

5	15.a.	Simplify the iterated integral $\int_0^1 \int_0^{x^2} \int_0^y f(x, y, z) dz dy dx$ in the following order integrating first with respect to x , then z and then y .	K4	CO5
	(OR)			
	15.b.	Deduce the centre of mass of a solid of constant density that is bounded by the parabolic cylinder $x = y^2$ and the planes $x = z$; $z = 0$; $x = 1$.		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Detect the unit normal and the binormal vectors for the circular helix $\vec{r}(t) = \cos t \vec{i} + \sin t \vec{j} + t \vec{k}$.	K4	CO1
2	17	The dimensions of a rectangular box are measured to be 75cm, 60cm and 40cm and each measurement is correct to within 0.2cm. Use differentials to examine the largest possible error when the volume of the box is calculated from these measurements.	K4	CO2
3	18	Test for the absolute maximum and minimum values of the function $f(x, y) = x^2 - 2xy + 2y$ on the rectangle $D = \{(x, y) / 0 \leq x \leq 3, 0 \leq y \leq 2\}$	K4	CO3
4	19	The density at any point on a semi-circular lamina is proportional to the distance from the centre of the circle. List the coordinates of the centre of mass of the lamina.	K4	CO4
5	20	Simplify the triple integral to find the volume of the tetrahedron T bounded by the planes $x + 2y + z = 2$; $x = 2y$; $x = 0$; $z = 0$.	K4	CO5

Z-Z-Z

END

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2024
(Fifth Semester)

Branch – MATHEMATICS

OPERATIONS RESEARCH – I

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 The penalty cost of an artificial variable is _____
(i) 0 (ii) 1 (iii) M (iv) $-M$
- 2 In assignment problem involving 4 workers and 3 jobs, total number of assignment possible is _____
(i) 2 (ii) 3 (iii) 4 (iv) 7
- 3 In an Integer Programming Problem, all the decision variable are _____
(i) Zero (ii) One
(iii) Negative integers (iv) Non-negative integers
- 4 The total float of an activity in a critical path is _____
(i) Zero (ii) One
(iii) Positive (iv) Negative
- 5 Dynamic Programming is a _____ stage decision process.
(i) single (ii) two (iii) multi (iv) infinite

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a Write the computational procedure for determining an optimum solution to a LPP.
OR
b Write the steps for formulating a dual problem.
- 7 a Obtain an Initial basic feasible solution for the following TP by Vogel's approximation method:

	D	E	F	G	Supply
A	40	25	22	33	200
B	44	35	30	30	60
C	38	38	28	30	140
Demand	200	40	120	40	

OR

- b Solve the following assignment method:

	1	2	3	4
A	9	26	17	11
B	13	28	4	26
C	38	19	18	15
D	19	26	24	10

- 8 a From the following data:

	A	B	C
I	5	7	3
II	4	5	8
III	6	6	9

Find the minimum total cost of assigning each worker at the most one job. Formulate this as an integer programming problem.

OR

Cont....

- b Write down the steps involved in solving the Integer Programming by Branch and bound method.
- 9 a Write the rules for constructing a network.

OR

- b Draw a network diagram for the following data:

Activity	A	B	C	D	E	F	G
Preceding Activity	-	-	B	B	B	E	A,D,C

- 10 a Explain the characteristics of Dynamic Programming.

OR

- b A vessel is to be loaded with stocks of 3 items. Each unit of item n has a weight w_n and the value v_n . The maximum cargo weight, the vessel can take is 5 and the details of the three items are as follows:

Item (n)	Weight (w_n) in tons	Value (v_n)
1	1	30
2	3	80
3	2	65

Develop the recursive equation for the above case.

SECTION - C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 x 6 = 30)

- 11 a Use Simplex method to solve the LPP.

Maximize $Z = 107x_1 + x_2 + 2x_3$ Subject to the constraints:

$$14x_1 + x_2 - 6x_3 + 3x_4 = 7; 16x_1 + x_2 - 6x_3 \leq 5;$$

$$3x_1 - x_2 - x_3 \leq 0, x_1, x_2, x_3, x_4 \geq 0.$$

OR

- b Use penalty method to solve the LPP

Maximize $Z = 6x_1 + 4x_2$ Subject to the constraints:

$$2x_1 + 3x_2 \leq 30; 3x_1 + 2x_2 \leq 24; x_1 + x_2 \geq 3; x_1, x_2 \geq 0.$$

- 12 a Find an Optimum solution to the following transportation problem:

	1	2	3	4	Availability
1	21	16	25	13	11
2	17	18	14	23	13
3	32	27	18	41	19
Source	6	10	12	15	43

OR

- b Solve the following assignment problem:

	E	F	G	H
A	18	26	17	11
B	13	28	14	26
C	38	19	18	15
D	19	26	24	10

Cont....

- 13 a Use Branch and bound method to solve the following IPP:

Maximize $Z = 6x_1 + 8x_2$ Subject to the constraints:

$$4x_1 + 16x_2 \leq 32; 14x_1 + 4x_2 \leq 28; x_1, x_2 \geq 0 \text{ and are integers.}$$

OR

- b Use Branch and bound method to solve the following IPP:

Maximize $Z = 7x_1 + 9x_2$ Subject to the constraints:

$$-x_1 + 3x_2 \leq 6; 7x_1 + x_2 \leq 35; x_2 \leq 7; x_1, x_2 \geq 0 \text{ and are integers.}$$

- 14 a Three time estimates of all activities of a project are given below:

Job	1 - 2	1 - 6	2 - 3	2 - 4	3 - 5	4 - 5	6 - 7	5 - 8	7 - 8
Optimistic	3	2	6	2	5	3	3	1	4
Most likely	6	5	12	5	11	6	9	4	10
Pessimistic	15	14	30	8	17	15	27	7	28

Draw the network project and calculate the length and variance of the critical path.

OR

- b Given the following information:

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

- Draw the network diagram.
 - Identify the critical path and find the total project duration.
 - Determine total, free and independent float.
- 15 a Solve an Optimum Sub-division problem is that divide a positive quantity c into n parts in such a way that their product is a maximum.

OR

- b Use Dynamic Programming to solve the following problem

Maximize $Z = y_1^2 + y_2^2 + y_3^2$ Subject to the constraints:

$$y_1 + y_2 + y_3 \geq 15; y_1, y_2, y_3 \geq 0.$$

Z-Z-Z

END

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**BSc DEGREE EXAMINATION DECEMBER 2024
(Third Semester)**

Branch - MATHEMATICS

MATHEMATICAL STATISTICS - I

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Question No.	Question	K Level	CO
1	Given A, B and C are three arbitrary events, then expression for the event at least one occurs is (a) $A \cap B \cap C$ (b) $A \cup B \cup C$ (c) $\overline{A \cap B \cap C}$ (d) $\overline{A \cup B \cup C}$	K1	CO1
2	Given A and B are independent event, then $P(A \cap B)$ is (a) $P(A) \cdot P(B)$ (b) $P(B)$ (c) $P(A) - P(B)$ (d) $P(A) + P(B)$	K2	CO1
3	Give F is a distribution function of a one-dimensional random variable X, then which one is true (a) $F(-\infty) = 1$ (b) $F(\infty) = 0$ (c) $0 \leq F(X) \leq 1$ (d) $F(X) \geq F(Y), x < y$	K1	CO2
4	The mathematical expectation of a random variable X and its square are $\frac{1}{2}, \frac{1}{4}$ respectively, then the variance of X is (a) 1 (b) $\frac{3}{8}$ (c) $\frac{7}{16}$ (d) 0	K2	CO2
5	$M_{cX}(t) = \underline{\hspace{2cm}}$ (a) $cM_X(t)$ (b) $M_X(ct)$ (c) $M_c(Xt)$ (d) none of these	K1	CO3
6	$E[V(X Y)] + V[E(X Y)] = \underline{\hspace{2cm}}$ (a) $E(X Y)$ (b) $V(X Y)$ (c) $E(X)$ (d) $V(X)$	K2	CO3
7	In a Binomial distribution the mean is 4 and the variance is $\frac{8}{3}$. Then the values of n and p are respectively _____ (a) $12, \frac{1}{3}$ (b) $12, \frac{2}{3}$ (c) $16, \frac{1}{3}$ (d) $12, \frac{1}{9}$	K1	CO4
8	The quartile deviation of a normal distribution is approximately _____ (a) $\frac{2\sigma}{\sqrt{3}}$ (b) $\frac{2\sigma}{3}$ (c) $\frac{3\sigma}{\sqrt{2}}$ (d) $\frac{4\sigma}{5}$	K2	CO4
9	Which one of the following is a random sampling? (a) Tippet's random number (b) throwing a die (c) draw a lottery (d) All of these	K1	CO5
10	The principle of least squares states that the parameters involved in $f(x)$ should be chosen in such a way that $\sum y_i - f(x)$ (a) minimum (b) maximum (c) equal (d) different	K2	CO5

Cont...

SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks

(5 × 7 = 35)

Question No.	Question	K Level	CO														
11.a.	Two dice are tossed. Find the probability that the sum is (a) greater than 8 (b) neither 7 nor 11.	K2	CO1														
(OR)																	
11.b.	State and prove addition theorem of probability.																
12.a.	The diameter of an electric cable say X, is assumed to be a continuous random variable with p.d.f $f(x) = 6x(1 - x)$, $0 \leq x \leq 1$. (i) Check that $f(x)$ is p.d.f (ii) Determine a number b such that $P(x < b) = P(x > b)$.	K3	CO2														
(OR)																	
12.b.	State and Prove multiplication theorem of expectation and discuss its generalization.																
13.a.	The joint p.d.f of two random variables x and y are given by $P(X = 0, Y = 1) = \frac{1}{3}$, $P(X = 1, Y = -1) = \frac{1}{3}$ and $P(X = 1, Y = 1) = \frac{1}{3}$. Find (i) marginal distribution of x and y (ii) conditional p.d.f of X given Y= 1.	K2	CO3														
(OR)																	
13.b.	Given $f(x, y) = 8xy$, $0 < x < y < 1$; $f(x, y) = 0$ elsewhere. Find (a) $E(Y X = x)$ (b) $E(XY X = x)$ (c) $Var(Y X = x)$																
14.a.	List out the properties of Normal distribution.	K3	CO4														
(OR)																	
14.b.	Given that $x = 4y + 5$ and $y = kx + 4$ are the regression line of X on Y and Y on X respectively. Show that $0 \leq k \leq \frac{1}{4}$. If $k = \frac{1}{6}$, then find the mean of X and Y. Also find γ_{xy} .																
15.a.	Fit a straight line to the following data <table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>8</td></tr><tr><td>Y</td><td>2.4</td><td>3.0</td><td>3.6</td><td>4</td><td>5</td><td>6</td></tr></table>	X	1	2	3	4	6	8	Y	2.4	3.0	3.6	4	5	6	K3	CO5
X	1	2	3	4	6	8											
Y	2.4	3.0	3.6	4	5	6											
(OR)																	
15.b.	Fit a parabola of second degree to the following data <table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Y</td><td>1</td><td>1.8</td><td>1.3</td><td>2.5</td><td>6.3</td></tr></table>	X	0	1	2	3	4	Y	1	1.8	1.3	2.5	6.3				
X	0	1	2	3	4												
Y	1	1.8	1.3	2.5	6.3												

Cont...

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks

(3 × 10 = 30)

Question No.	Question	K Level	CO																		
16	The contents of Urn – I, II and III are as follows: Urn – I: 1 white, 2 black and 3 red balls Urn – II: 2 white, 1 black and 1 red balls Urn – III: 4 white, 5 black and 3 red balls. One Urn is chosen at random and two balls drawn from it. They happen to be white and red. What is the probability that they come from Urn I, II and III?	K2	CO1																		
17	A random variable X has the following probability function. (i) Find k (ii) Evaluate $P(X < 6)$, $P(X \geq 6)$ and $P(0 < X < 5)$ (iii) If $P(X \leq a) > \frac{1}{2}$ find the minimum value of a and (iv) Determine the distribution function of X. <table border="1"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>P(x)</td><td>0</td><td>k</td><td>2k</td><td>2k</td><td>3k</td><td>k²</td><td>2k²</td><td>7k² + k</td></tr></table>	x	0	1	2	3	4	5	6	7	P(x)	0	k	2k	2k	3k	k ²	2k ²	7k ² + k	K3	CO2
x	0	1	2	3	4	5	6	7													
P(x)	0	k	2k	2k	3k	k ²	2k ²	7k ² + k													
18	Given that two-dimensional continuous random variable (X, Y) has joint p.d.f given by $f(x, y) = \begin{cases} 6x^2y & 0 < x < 1, 0 < y < 1 \\ 0 & \text{otherwise} \end{cases}$ (i) Verify that $\int_0^1 \int_0^1 f(x, y) dx dy = 1$ (ii) Find $P\left(0 < X < \frac{3}{4}, \frac{1}{3} < Y < 2\right)$, $P(X + Y < 1)$, $P(X > Y)$ and $P(X < 1 Y < 2)$	K2	CO3																		
19	Fit a Binomial distribution for the following data: <table border="1"><tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>Total</td></tr><tr><td>f</td><td>5</td><td>18</td><td>28</td><td>12</td><td>7</td><td>6</td><td>4</td><td>80</td></tr></table>	x	0	1	2	3	4	5	6	Total	f	5	18	28	12	7	6	4	80	K3	CO4
x	0	1	2	3	4	5	6	Total													
f	5	18	28	12	7	6	4	80													
20	Define a Sample. Explain the various methods of random sampling.	K3	CO5																		

Z-Z-Z

END

**PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)**

**BSc DEGREE EXAMINATION DECEMBER 2024
(Third Semester)**

Branch - MATHEMATICS

PARTIAL DIFFERETIAL EQUATIONS & FOURIER TRANSFORMS

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	What is a quasi-linear PDE of first order? a) $P(z) \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y} = 0$ b) $P(z) \frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ c) $\left(\frac{\partial z}{\partial x}\right)^2 - \left(\frac{\partial z}{\partial y}\right)^2 = 1$ d) $\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 1$	K1	CO1
	2	Classify the Lagrange's PDE of first order. a) $Pp + Qq = R$ b) $P_q + Q_p = R$ c) $p + q = R$ d) $Pp + Qq = P$	K2	CO1
2	3	What is a linear three-dimensional heat equation? a) $u_{xx} + u_{yy} + u_{zz} = 0$ b) $u_t = k(u_{xx} + u_{yy} + u_{zz})$ c) $u_{tt} = c^2(u_{xx} + u_{yy} + u_{zz})$ d) $u_t + uu_x = \mu u_{xx}$	K1	CO2
	4	Find the solution of the equation $(2D - D' + 4)(D + 2D' + 1)^2 u = 0$. a) $u = e^{-2x} \phi(x + 2y) - e^{-x}[\psi(2x - y) - x\psi_2(2x - y)]$ b) $u = e^{2x} \phi(x + 2y) + e^x[\psi(2x - y) + x\psi_2(2x - y)]$ c) $u = e^{-2x} \phi(x + 2y) + e^{-x}[\psi(2x - y) - x\psi_2(2x - y)]$ d) $u = e^{-2x} \phi(x + 2y) + e^{-x}[\psi(2x - y) + x\psi_2(2x - y)]$	K2	CO2
3	5	If f is even and $L = \pi$, then show that $f(x) = \underline{\hspace{2cm}}$ a) $a_0 + \sum_{n=1}^{\infty} a_n \cos nx$ b) $\sum_{n=1}^{\infty} a_n \cos nx$ c) $\sum_{n=1}^{\infty} b_n \sin nx$ d) $a_0 + \sum_{n=1}^{\infty} b_n \sin nx$	K1	CO3
	6	What is the central starting point of Fourier analysis? a) fast Fourier transform b) Fourier co-efficients c) Fourier series d) discrete Fourier transform.	K2	CO3
4	7	Which is a Fourier cosine integral? a) $f(x) = \int_0^1 A(w) \cos wx \, dw$ b) $f(x) = \int_0^{\infty} B(w) \cos wx \, dw$ c) $f(x) = \int_0^1 B(w) \cos wx \, dw$ d) $f(x) = \int_0^{\infty} A(w) \cos wx \, dw$	K1	CO3
	8	Which is the Fourier cosine transform of $f(x)$? a) $\hat{f}_c(w) = \sqrt{\frac{2}{\pi}} \int_0^{\infty} f(x) \cos wx \, dx$ b) $\hat{f}_c(w) = \int_0^{\infty} A(w) \cos wx \, dx$ c) $\hat{f}_c(w) = \int_0^{\infty} f(x) \cos wx \, dx$ d) $\hat{f}_c(w) = \sqrt{\frac{2}{\pi}} \int_0^1 A(w) \cos wx \, dx$	K2	CO3

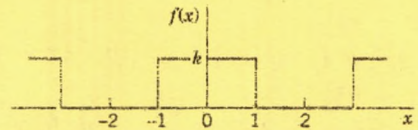
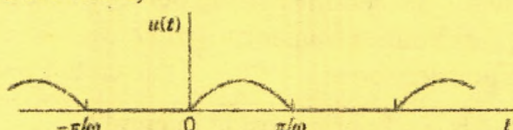
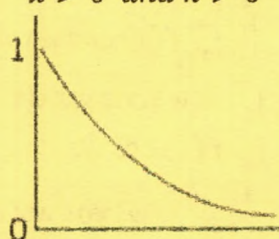
Cont...

		Cont...		
5	9	What are the specific heat σ and the density ρ of the material of the body are called? a) variable b) constant c) constants or variables d) constants and variables	K1	CO4
	10	Choose the heat equation. a) $\frac{\partial u}{\partial t} = c^2 \nabla^2 u$ b) $\frac{\partial u}{\partial t} = c^2 \nabla u$ c) $\frac{\partial u}{\partial t} = c \nabla^2 u$ d) $\frac{\partial u}{\partial t} = c^2 \nabla^2$	K2	CO4

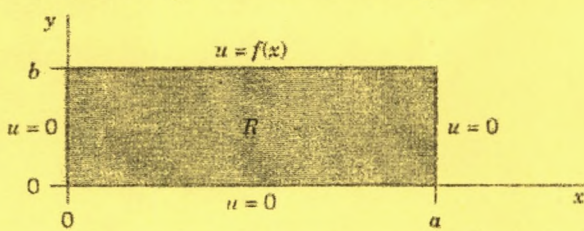
SECTION - B (35 Marks)

Answer ALL questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Find the partial differential equation of the family of planes, the sum of whose x, y, z intercepts is equal to unity.	K2	CO1
		(OR)		
	11.b.	Find the complete integral of the PDE : $p^2y(1+x^2) = qx^2$.		
2	12.a.	Classify and reduce the relation $y^2u_{xx} - 2xyu_{xy} + x^2u_{yy} = \frac{y^2}{x}u_x + \frac{x^2}{y}u_y$ to a canonical form and solve it.	K3	CO2
		(OR)		
	12.b.	Solve the following equation $(D^2 + 2DD' + D'^2 - 2D - 2D')u = \sin(x + 2y)$.		
3	13.a.	Apply the Fourier series to the function,  $f(x) = \begin{cases} 0 & \text{if } -2 < x < -1 \\ k & \text{if } -1 < x < 1 \\ 0 & \text{if } 1 < x < 2 \end{cases} \quad p=2L=4, L=2.$	K3	CO3
		(OR)		
	13.b.	A sinusoidal voltage $E \sin \omega t$, where t is time, is passed through a half-wave rectifier that clips the negative portion of the wave,  Solve the Fourier series of the resulting periodic function $u(t) = \begin{cases} 0 & \text{if } -L < t < 0 \\ E \sin \omega t & \text{if } 0 < t < L \end{cases} \quad p = 2L = \frac{2\pi}{\omega}, L = \frac{\pi}{\omega}$		
4	14.a.	Derive the Fourier cosines and Fourier sine integrals of $f(x) = e^{-kx}$, where $x > 0$ and $k > 0$ 	K4	CO3
		(OR)		

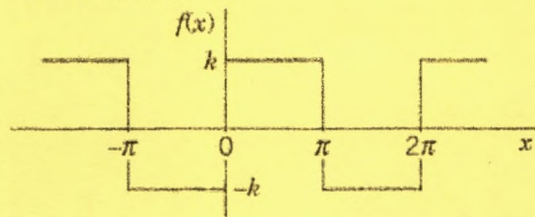
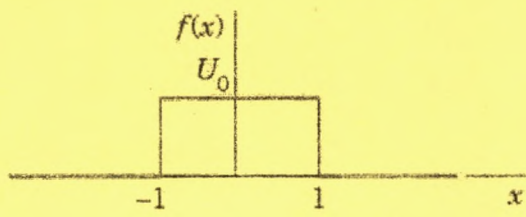
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	14.b.	State and prove Cosine and sine transforms of derivatives.		
5	15.a.	Analyze the temperature $u(x, t)$ in a laterally insulated copper bar 80 cm long if the initial temperature is $100 \sin(\pi x/80)^{\circ}\text{C}$ and the ends are kept at 0°C . How long will it take for the maximum temperature in the bar to drop 50°C ? (Physical data for copper: density-8.92 g/cm^3 , specific heat- 0.092 $\text{cal}/(\text{g}^{\circ}\text{C})$, thermal conductivity- 0.95 $\text{cal}/(\text{cm sec}^{\circ}\text{C})$).	K4	CO4
	(OR)			
	15.b.	Derive Dirichlet problem in a rectangle R. 		

SECTION -C (30 Marks)

Answer ANY THREE questions

ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Analyze the complete integral of $(p^2 + q^2)y = qz$.	K4	CO1
2	17	Transform the following differential equation to a canonical form $u_{xx} + 2u_{xy} + 4u_{yy} + 2u_x + 3u_y = 0$.	K4	CO2
3	18	Classify the Fourier coefficients of the periodic function $f(x)$ in  The formula is $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$ and $f(x + 2\pi) = f(x)$.	K4	CO3
4	19	Derive from Fourier series to Fourier integrals.	K4	CO3
5	20	Simplify by using the Fourier transform the temperature in the infinite bar if the initial temperature is, $f(x) = \begin{cases} U_0 = \text{const} & \text{if } x < 1 \\ 0 & \text{if } x > 1 \end{cases}$ 	K4	CO4