

Seat No. **OCT-NOV 2025 WINTER EXAMINATION****11731 Bachelor of Technology (NEP-2.0)****Sub. Name: Mathematics for Mechanical Engineering****Sub. Code: 114411/112340****Day and Date: Tuesday ,16-12-2025****Total Marks: 60****Time: 02:30 PM To 05:00 PM**

Instructions: 1. All questions are compulsory
2. Figures to the right indicate full marks

Special Inst.: 1) Use of non-programmable calculator is allowed.
2) Assume suitable data if necessary.

Q1)

Attempt any THREE questions from the following: (5 Marks Each)

[15]

- a) Solve the LD equation: $(D^2 + 6D + 5)y = e^{-2x} + 3$. [5]
 b) Evaluate: $\int_0^{\infty} e^{-6t} \sin^2 t \, dt$. [5]
 c) Obtain Fourier series for $f(x) = x^2, -\pi < x < \pi$ [5]
 d) Find inverse Laplace transform of $\frac{s+29}{s^3+4s^2+9s+36}$. [5]

Q2)

Attempt any THREE questions from the following: (5 Marks Each)

[15]

- a) Find unit tangent vector to the curve $x = t, y = t^2, z = t^3$ at $t = 1$. [5]
 b) Find the directional derivative of $\phi = 2x^3y - 3y^2z$ at $p(1, 2, -1)$ in the direction of $Q(3, -1, 5)$. In what direction from P is the directional derivative maximum? [5]
 c) Prove that $\vec{v} = (z^2 + 2x + 3y)\vec{i} + (3x + 2y + z)\vec{j} + (y + 2xz)\vec{k}$ is irrotational. Find a scalar potential ϕ such that $\nabla\phi = \vec{v}$. [5]
 d) Prove that (i) $\text{grad } r^n = nr^{n-2}\vec{r}$ (ii) $\text{div}(\frac{\vec{r}}{r^3}) = 0$. [5]

Q3)

Attempt any THREE questions from the following: (5 Marks Each)

a) Following is the result of Height (x) and weight(y) of the students. Calculate coefficient of correlation. [5]

x	4.6	5.5	5.8	5.8	5.7	5.6	6.0	5.4	5.9	5.7
y	58	67	67	60	65	68	65	66	68	66

b) Obtain the equation of line of regression of cost on age from the following table giving the age of car of certain make and the annual maintenance cost. [5]

Age of car(x)	2	4	6	8
Maintenance(y)	1	2	2.5	3

c) Fit a straight-line $y = a + bx$ to the following data with x as the independent variable [5]

X	1965	1966	1967	1968	1969
y	125	140	165	195	200

d) Using the method of least squares fit the exponential curve of the form $y = ab^x$ to the following data: [5]

x	1	2	3	4
y	4	11	35	100

Q4)

Attempt any THREE questions from the following: (5 Marks Each)

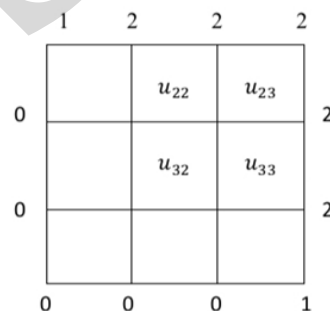
[15]

a) Classify the Partial differential equation: $x^2 \frac{\partial^2 u}{\partial x^2} + (1-y^2) \frac{\partial^2 u}{\partial y^2} = 0$, $-\infty < x < \infty$, $-1 < y < 1$. [5]

b) Eliminate the arbitrary functions f and g from the relation $z = f(x+iy) + g(x-iy)$, $i^2 = -1$ to obtain a partial differential equation. [5]

c) Solve the Partial differential equation $3u_x + 2u_y = 0$ by the method of separation of variables. [5]

d) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in the figure by Gauss Seidel method. (Carry out two iterations only). [5]



End Of Question Paper

Important Note for Chief Exam Officer / SRPD Coordinator / Sr Supervisor/ Student -

This Question Paper may be distributed for following Subjects as common code.

सदरची प्रश्नपत्रिका खालील विषयांकरिता वितरित करता येईल.

1] (1154) B.Tech. CBCS (114411) Mathematics for Mechanical Engineering Part 2 SEM 3

2] (11731) Bachelor of Technology (NEP-2.0) (112340) Mathematics for Mechanical Engineering Part 2 SEM 3