School of Mathematics

Major Examination (Semester-II) 2024-2025

B.Tech. (Computer/ Electronics/Mechanical/Civil/Electrical/Mathematics & Computing)

Entry No: 24RBC055 **Total Number of Pages: [02]**

Date: 28-07-2025 **Total Number of Questions: [16]**

Course Title: Engineering Mathematics-II

Course Code: MTL BS102

Time Allowed: 3 Hours **Max Marks: [40]**

Instructions/NOTE: *Attempt any four questions from each section A, B, & C.*

	Section – A	Marks	COs
Q1.	Define Bernoulli's differential equation with one example.	[02]	CO3
Q2.	Find the particular integral of the differential equation $(D^3 + 6\,D^2 + 11D + 6)y = 2\,Sinx$	[02]	CO3
Q3.	Obtain partial differential equation by eliminating arbitrary constants a, b, c from the relation $z = ax^2 + by^2 + ab$.	[02]	CO4
Q4.	Find the complete integral of PDE $px + qy - z^2 = 1 + p^2 + q^2$.	[02]	CO4
Q5.	Calculate divergence and curl of the vector $\vec{F} = (x^2 - yz)\hat{\imath} + (y^2 - zx)\hat{\jmath} + (z^2 - xy)\hat{k}$.	[02]	CO1
	Section – B		
Q6.	If $\vec{F} = (2x + 6y^2)\hat{\imath} - 10\,yz\hat{\jmath} + x^2z\hat{k}$, evaluate $\oint \vec{F}\,.d\vec{r}$ from (0,0,0) to (1,1,1) along the path $x = t, y = t^2, z = t^3$.	[03]	CO2
Q7.	Solve the differential equation $(x + 2y^3)\frac{dy}{dx} = y$.	[03]	CO3
Q8.	Verify that the differential equation $e^y dx + (xe^y + 2y)dy = 0$ is exact and hence find the solution.	[03]	CO3
Q9.	Find the complete integral of PDE $pe^y = qe^x$.	[03]	CO4
Q10.	Solve the PDE $x(y^n - z^n)p + y(z^n - x^n)q = (x^n - y^n)$.	[03]	CO4
	Section – C		
Q11.	Solve the differential equation, $\frac{d^2y}{dx^2} + a^2y = \tan ax$ by variation of parameter technique.	[05]	CO3
Q12.	Verify the Gauss divergence theorem for the function $\vec{F} = y\hat{\imath} + x\hat{\jmath} + z^2\hat{k}$ over the cylindrical region bounded by $x^2 + y^2 = 9, z = 0$ and $z = 2$.	[05]	CO1

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Q13.	Solve the differential equation $(D^2+1)y = xe^x \cos 2x$.	[05]
Q14.	Verify Greens' Theorem in the plane for $\oint_C (xy + x^2)dx + (x^2 + y^2)dy$ where C is the closed curve of the region bounded by $y = x, \& \ y = x^2$.	[05]
Q15.	A string is strechted and fastened to two points l apart. Motion is started by displacing the string in the form $y = a\, sin\frac{\pi x}{l}$ from which it is released at time $t = 0$. Show that the time displacement of any point at a distance from one end at time t is given by $y(x,t) = a sin\frac{\pi x}{l} \cos\frac{\pi ct}{l}$.	[05]
Q16.	Solve $x^2p^2 + y^2q^2 = z^2$ by Charpit's method.	[05]

Course Outcomes: After the successful completion of this course, students shall be able to:

CO1. Understand the concepts of vector calculus like directional derivatives, gradient, div and curl, and their applications.

CO2. Learn and apply the concepts of vector calculus for the computation of worl circulation, flux, and important theorems.

CO3. Formulate the differential equation and learn various methods of solution of ordin partial differential equation.

CO4. Solve various partial differential equations arising in heat conduction problems an propagation problems

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	Q5, Q12	07	350 (Apprrox.)
CO2	Q6, Q14	08	
CO3	Q1, Q2, Q7, Q8, Q11, Q13	20	
CO4	Q3, Q4, Q9, Q10, Q15, Q16	20	

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School of Mathematics

Mid-Term Examination (Semester-II) 2024-2025

B.Tech. (Computer/ Electronics/Mechanical/Civil/Electrical/Mathematics & Computing)

Entry No: 2 4 B E C 0 S S

Date: 17-03-2025

Total Number of Pages: [01]

Total Number of Questions: [09]

Course Title: Engineering Mathematics-II

Course Code: MTL BS102

Time Allowed: 1.5 Hours **Max Marks: [20]**

Instructions/NOTE: *Attempt any two questions from each section A, B, & C.*

	Section - A	Marks	COs
Q1.	State Stokes' Theorem.	[02]	CO2
Q2.	Find the integrating factor of the differential equation $\frac{dy}{dx} - \frac{2x}{1+x^2}y = x^2 + 2$.	[02]	CO3
Q3.	Prove that $curl(grad\varphi) = 0$.	[02]	CO1
	Section – B		
Q4.	Solve the differential equation $(1+x^2)\frac{dy}{dx} + (1+y^2) = 0$.	[03]	CO3
Q5.	Find the $div\vec{F}$ and $curl\vec{F}$, where $\vec{F} = grad(x^3 + y^3 + z^3 - 3xyz)$.	[03]	CO1
Q6.	Find a unit vector normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point $(2, 4, -2)$.	[03]	CO1
	Section – C		
Q7.	Evaluate $\iint_S \vec{A}.\hat{n}\, dS$, where $\vec{A} = z\hat{\imath} + x\hat{\jmath} - 3y^2z\hat{k}$ and S is the surface of the cylinder $x^2 + y^2 = 16$ included in the first octant between $z = 0$ and $z = 5$.	[05]	CO2
Q8.	Verify Greens' Theorem in the plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined by $x = 0, y = 0, \& x + y = 1$.	[05]	CO2
Q9.	Solve the differential equation $\frac{dy}{dx} + y\tan x = y^3 \sec x$.	[05]	CO3

Course Outcomes: After the successful completion of this course, students shall be able to:

CO1. Understand the concepts of vector calculus like directional derivatives, gradient, divergenc and curl, and their applications.

CO2. Learn and apply the concepts of vector calculus for the computation of work don circulation, flux, and important theorems.

CO3. Formulate the differential equation and learn various methods of solution of ordinary ar partial differential equation.

CO4. Solve various partial differential equations arising in heat conduction problems and wav propagation problems

CO	Questions Mapping	Total Marks	Total Number of Students (to be appeared in Exam)
CO1	Q3, Q5, Q6	08	
CO2	Q1, Q7, Q8	12	
CO3	Q2, Q4, Q9	10	
CO4			

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School Of Mathematics

B.Tech. II Semester (Civil, Computer Science, Electrical, Electronics, Mechanical)

Minor Exam 1: Spring 2023–2024

Entry No.: 68

Date:

Total No. Pages: [2]

Total No. Questions: [3]

Course Title: Engineering Mathematics II (MTL BS-102)

Time alloted : 1 Hours

Total marks: [20]

Attempt all questions.

1. Do any two of the followings each carry two marks.

   (a) Find the unit tangent vector at any point on the curve $x = t^2 + 2, y = 4t - 5, z = 2t^2 - 6t$, where t is any variable. [CO 1]

   (b) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, show that $grad\left(\frac{1}{r}\right) = -\frac{\vec{r}}{r^3}$. [CO 1]

   (c) State divergence theorem. [CO 2]

2. Do any two of the followings each carry three marks.

   (a) Show that $curl(curl\vec{V}) = grad(div\vec{V}) - \nabla^2\vec{V}$. [CO 1]

   (b) Prove that $\nabla^2 f(r) = f''(r) + \frac{2}{r}f'(r)$. [CO 1]

   (c) Find the directional derivative of the function $f(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}$. [CO 1]

3. Do any two of the followings each carry five marks.

   (a) Evaluate $\int\int_S \vec{F}.\hat{n}ds$, where $\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and S is the surface bounding the region $x^2 + y^2 = 4, z = 0, z = 3$. [CO 2]

   (b) If $\vec{A} = 2xz\hat{i} - x\hat{j} + y^2\hat{k}$, evaluate $\int\int\int_V \vec{A}dv$, where V is the region bounded by the surface $x = 0, x = 2, y = 0, y = 6, z = x^2, z = 4$. [CO 2]

   (c) Verify divergence theorem for $\vec{F} = (x^3 - yz)\hat{i} - 2x^2y\hat{j} - 2\hat{k}$, taken over the rectangular parallelopiped $0 \leq x \leq a, 0 \leq y \leq b, 0 \leq z \leq c$. [CO 2]

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School of Philosophy & Culture
Minor-1 Examination (Even Semester) AY 2023-24

Shri Mata Vaishno Devi University

School Of Mathematics
B.Tech. II Semester (Civil, Computer Science, Electrical, Electronics, Mechanical)
Major Exam: Spring 2023-2024

Entry No.: 23bec068
Total No. Pages: [2]
Date:
Total No. Questions: [3]

Course Title: Engineering Mathematics II (MTL BS-102)

Time alloted : 3 Hours
Total marks: [50]

Attempt all questions.

1. Do any five parts. Each question carry two marks.
   (a) Define linear and semi-linear partial differential equations of first order with examples.
   (b) A vector field given by $\vec{A} = (x^2 + xy^2)\hat{i} + (y^2 + x^2y)\hat{j}$ is irrotational.
   (c) Find the unit normal to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$.
   (d) Find integrating factor of $\frac{dy}{dx} + y\tan x = \sec x$.
   (e) Reduce the Bernoulli's equation $\frac{dy}{dx} + Py = Qy^n$ where P and Q are function of x to linear differential equation.
   (f) State wave equation in two dimensions.

2. Do any five parts. Each question carry three marks.
   (a) Solve the differential equation $(e^y + 1)\cos x dx + e^y \sin x dy = 0$.
   (b) Solve the differential equation $(x^2y^3 + xy)dy = dx$.
   (c) Solve the given PDE $(2xy - 1)p + (z - 2x^2)q = 2(x - yz)$.
   (d) Obtain Partial differential equation by eliminating arbitrary function from the given relation $z = f(x + y) + xg(x - y)$
   (e) Find the directional derivative of the function $f(x, y, z) = xy^3 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\hat{i} + 2\hat{j} + 2\hat{k}$.
   (f) Evaluate $\int\int\int_V (2x+y)dV$, where V is closed region bounded by the cylinder $z = 4 - x^2$ and the planes $x = 0, x = 2, y = 0, y = 2$ and $z = 0$.

3. Do any five parts. Each question carry five marks.
   (a) Verify Green's Theorem in the xy-plane for $\oint_C (xy + y^2)dx + x^2dy$, where C is the closed curve which enclosed the region bounded by $y = x$ and $y = x^2$.

Entry No:

(b) Solve the differential equation $(D^2 - 4)y = x \sinh x$.

(c) Solve the differential equation $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = e^x \cos 2x + \cos 3x$.

(d) Solve the differential equation $(p^2 + q^2)y = qz$ by Charpit's method.

(e) Solve the differential equation

$$\cos(x+y)p + \sin(x+y)q = z.$$

(f) A tightly stretched string with fixed end point $x = 0$ and $x = l$ is initially in a position given by $y = y_0 \sin^3(\frac{\pi x}{l})$. If it is released from rest, then find the displacement $y(x,t)$.

COURSE OUTCOMES

CO 1. Understand the concepts of vector calculus like directional derivative, gradient, divergence and curl, and their applications.

CO 2. Learn and apply the concepts of vector integral calculus for the computation of work done, circulation, and flux.

CO 3. Formulate the differential equations concerning physical phenomena like electric circuits, wave motion, heat equation etc.

CO 4. Learn various methods of solution of ordinary and partial differential equations.

CO 5. Solve various partial differential equations arising in heat conduction problems and wave.

CO	Questions Mapping
CO 1	1(b, c), 2(e)
CO 2	2(f), 3(a)
CO 3	1(a), 2(d)
CO 4	1(d, e), 2(a, b, c), 3(b, c, d, e)
CO 5	1(f), 3(f)

Shri Mata Vaishno Devi University

School Of Mathematics

B.Tech. II Semester (Civil, Computer Science, Electrical, Electronics, Mechanical)

Minor Exam 2: Spring 2023–2024

Entry No.:——

Date:——

Total No. Pages: [2]

Total No. Questions: [3]

Course Title: Engineering Mathematics II (MTL BS-102)

Time alloted : 1 Hours

Total marks: [20]

Attempt all questions.

1. Do any two of the followings each carry two marks.
   (a) Find the differential equation of all non-verticle lines in the xy-plane. [CO 3]
   (b) Define integrating factor and exact differential equation. [CO 3]
   (c) Find the order and degree of the differential equation: [CO 3]

$$\left(1+\left(\frac{d^2y}{dx^2}\right)^2\right)^{3/2} = k\left(\frac{d^2y}{dx^2}\right)^{-2}.$$

2. Solve any two differential equations, each carry three marks.
   (a) $(x+y)^2dy = a^2dx.$ [CO 4]
   (b) $x^2ydx - (x^3+y^3)dy = 0.$ [CO 4]
   (c) $x\log x\frac{dy}{dx} + y = 2\log x$ [CO 4]

3. Solve any two differential equations, each carry five marks.
   (a) $(x^2y^2+xy+1)ydx + (x^2y^2-xy+1)xdy = 0.$ [CO 4]
   (b) $(D^2-3D+2)y = e^{-x}\sin x.$ [CO 4]
   (c) $(D^2+3D+2)y = xe^{x}\sin x$ [CO 4]