MATHEMATICS-II

Subject Code : MA201BS
Regulations : R18 - JNTUH
Class : I Year B.Tech II Semester

Department of Science and Humanities

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

MATHEMATICS-II (MA201BS)

COURSE PLANNER (2018-19)

I. COURSE OVERVIEW:

The students will improve their ability to think critically, to analyze a real problem and solve it using a wide array of mathematical tools. They will also be able to apply these ideas to a wide range of problems that include the Engineering applications.

II. PREREQUISITE:

1. Basic knowledge of Differentiation.
2. Basic knowledge of Integration.
3. Basic knowledge of calculation of basic formulas.
4. Basic knowledge of partial differentiation.

III. COURSE OBJECTIVE: To learn

1.	Methods of solving the differential equations of first and higher order.
2.	Evaluation of multiple integrals and their applications.
3.	The physical quantities involved in engineering field related to vector valued functions.
4.	The basic properties of vector valued functions and their applications to line, surface and volume integrals.

IV.COURSE OUTCOMES: After learning the contents of this paper the student must be able to

S. No	**Description**	**Bloom's Taxonomy Level**
1.	Identify whether the given differential equation of first order is exact or not.	Understand, Apply (Level 2, Level 3)
2.	Solve higher differential equation and apply the concept of differential equation to real world problems.	Understand, Apply (Level 2, Level 3)
3.	Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelepiped.	Understand, Apply (Level 2, Level 3)
4.	Evaluate the line, surface and volume integrals and converting them from one to another .	Understand, Apply (Level 2, Level 3)
5	Apply Gauss, Greens and Stokes theorems	Understand, Apply (Level 2, Level 3)

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency Assessed by
PO1	**Engineering knowledge**: To Apply the knowledge of mathematics, science, engineering fundamentals, and Computer Science Engineering to the solution of complex engineering problems encountered in modern engineering practice.	3	Assignments and Tutorials.
PO2	**Problem analysis**: Ability to Identify, formulate, review research literature, and analyze complex engineering problems related to Computer Science reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	2	Assignments, Tutorials and Exams.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	2	Assignments, Tutorials and Exams.
PO4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	1	Assignments, Tutorials and Mock Exams.
PO5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern Computer Science Engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	-	--
PO6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Computer Science Engineering professional engineering	-	--
PO7:	**Environment and sustainability**: Understand the impact of Computer Science Engineering professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	-	--
PO8:	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	-	--
PO9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	-	--
PO10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write	-	--
PO11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	-	--
PO12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	-	--

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)** **4: None**

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Foundation of mathematical concepts:** To use mathematical methodologies to crack problem using suitable mathematical analysis, data structure and suitable algorithm.	**2**	Assignments, Tutorials and Exams.
PSO2	**Foundation of Computer System:** The ability to interpret the fundamental concepts and methodology of computer systems. Students can understand the functionality of hardware and software aspects of computer systems.	**1**	Assignments, Tutorials and Mock Exams.
PSO3	**Foundations of Software development:** The ability to grasp the software development lifecycle and methodologies of software systems. Possess competent skills and knowledge of software design process. Familiarity and practical proficiency with a broad area of programming concepts and provide new ideas and innovations towards research.	**-**	--

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)** **4: None**

VII. SYLLABUS:

UNIT-I: First Order ODE

Exact, linear and Bernoulli's equations; Applications: Newton's law of cooling, Law of natural growth and decay; Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, $\sin ax$, $\cos ax$, polynomials in x, $e^{ax} V(x)$ and $xV(x)$; method of variation of parameters; Equations reducible to linear ODE with constant coefficients: Legendre's equation, Cauchy-Euler equation.

UNIT-III: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form); Evaluation of Triple Integrals: Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals. Applications: Areas (by double integrals) and volumes (by double integrals and triple integrals), Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallelopiped).

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Tangent plane and normal line. Vector Identities. Scalar potential functions. Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

GATE SYLLABUS:

Differential Equations: Ordinary Differential Equations First order ordinary differential equations, existence and uniqueness theorems for initial value problems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients

Linear Systems of Equations:
Linear transformations and their matrix representations, rank; systems of linear equations, Hermitian, Skew Hermitian and unitary matrices, Jordan

Eigen values, Eigen Vectors:
Eigen values and eigenvectors, minimal polynomial, Cayley-Hamilton Theorem, diagonalization

Functions of several variables: Functions of several variables, maxima, minima

Partial Differential Equations:
Partial Differential Equations Linear and quasi-linear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification;

IES SYLLABUS:

Matrix: Matrix theory, Eigen values & Eigen vectors, system of linear equations

Differential Equations: Numerical methods for solution of non-linear algebraic equations and differential equations

Partial differential equations: Partial derivatives, linear, nonlinear and partial differential equations, initial and boundary value problems.

VIII. LESSON PLAN-COURSE SCHEDULE:

Session	**Week No**	**Unit**	**TOPIC**	**Course learning outcomes**	**Reference**
1.	1	1	Introduction to differential equations	**Define DE and PDE**	T1,T2,R2
2.			Linear differential equation	**Solve** problems on linear	T1,T2,R2
3.			Bernoulli’s differential equation	**Solve** problems on bernoullis	T1,T2,R2
4.			Exact differential equation	**Solve** problems on exact	T1,T2,R2
5.	2		Applications of differential equation	**Understand** applications	T1,T2,R2
6.			Newton’s law of cooling	**Solve** problems on law of cooling	T1,T2,R2
7.			Law of natural growth and decay	**Solve** problems on natural	T1,T2,R2

				growth	
8.	3		Law of natural growth and decay	**Solve** problems on natural decay	T1,T2,R2
9.			Equations not of first degree	**Solve** problems on equations not of first degree	T1,T2,R2
10.			Equations solvable for p	**Solve** problems on equations solvable for p	T1,T2,R2
11.			equations solvable for y and x	**Solve** problems on equations solvable for x,y	T1,T2,R2
12.			Clairaut's type	**Solve** problems on clairauts	T1,T2,R2
			***Applications of Electrical Circuits (content beyond syllabus)**	**Understand** applications	
			Mock Test – I		
UNIT – 2					
13.	4	2	Second order linear differential equations with constant coefficients	**Find** second order linear DE	T1,T2,R2
14.			Non-Homogeneous terms of the type e^{ax}	**Solve** problems of type e^{ax}	T1,T2,R2
15.	5		Non-Homogeneous terms of the type $\sin ax$	**Solve** problems of type sinax	T1,T2,R2
16.			Non-Homogeneous terms of the type $\cos ax$	**Solve** problems of type cosax	T1,T2,R2
17.			Non-Homogeneous terms of the type polynomials in x	**Solve** problems of type x	T1,T2,R2
18			Non-Homogeneous terms of the type $e^{ax} V(x)$	**Solve** problems of type $e^{ax} V(x)$	T1,T2,R2
19			Non-Homogeneous terms of the type $xV(x)$	**Solve** problems of type $xV(x)$	T1,T2,R2
20.			method of variation of parameters	**Solve** problems using variation of parameters	T1,T2,R2
21.	6		Equations reducible to linear ODE with constant coefficients	**Find** equations reducible to linear	T1,T2,R2
22.			Equations reducible to linear ODE with constant coefficients	**Find** equations reducible to linear	T1,T2,R2
23.		2	Legendre's equation	**Solve** problems on legendres	T1,T2,R2
24.			Cauchy-Euler equation.	**Solve** problems on cauchys euler equation	T1,T2,R2
			*** Applications of Simple Harmonic Motions (content**	**Understand** applications	

			beyond syllabus)		
			Tutorial / Bridge Class # 1		
UNIT – 3					
25.	7	3	Evaluation of Double Integrals (Cartesian and polar coordinates)	**Apply** double integrals	T2,R3,R1
26.			Evaluation of Double Integrals (Cartesian and polar coordinates)	**Apply** double integrals	T2,R3,R1
27.			Evaluation of Triple Integrals	**Apply** triple integrals	T2,R3,R1
28.			Evaluation of Triple Integrals	**Apply** triple integrals	T2,R3,R1
29.	8		Applications: Areas (by double integrals)	**Find** areas using double integration	T2,R3,R1
30.			Applications: Areas (by double integrals)	**Find** areas using double integration	T2,R3,R1
31.			Applications: volumes (by double integrals and triple integrals)	**Find** volume using triple integration	T2,R3,R1
32.			Applications: volumes (by double integrals and triple integrals)	**Find** volume using triple integration	T2,R3,R1
			Tutorial / Bridge Class # 2		
I Mid Examinations					
33.	9	3	change of order of integration (only Cartesian form)	**Apply** change of order	T2,R3,R1
34.			Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals	**Apply** change of variable	T2,R3,R1
35.			Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallelopiped).	**Find** centre of mass and gravity	T2,R3,R1
36.			Centre of mass and Gravity (constant and variable densities) by double and triple integrals (applications involving cubes, sphere and rectangular parallelopiped).	**Find** centre of mass and gravity	T2,R3,R1
			• **Evaluation of surface and volume using MATLAB (**contents beyond the syllabus)	**Understand** application	
UNIT – 4					
37	10		Vector point functions	**Define** vector point function	T1,T3, R1,R2
38			scalar point functions	**Define** scalar point function	T1,T3, R1,R2

39		4	Gradient	**Apply** Gradient	T1,T3, R1,R2
40			Divergence	**Find** Divergence	T1,T3, R1,R2
41	11		Directional derivatives	**Find** directional derivatives	T1,T3, R1,R2
42			Curl	**Find** Curl	T1,T3, R1,R2
43			Tangent plane and normal line	**Find** tangent and normal plane	T1,T3, R1,R2
44			Vector Identities	**Apply** vector identities	T1,T3, R1,R2
			Tutorial / Bridge Class # 3		
45	12		Vector Identities	**Apply** vector identities	T1,T3, R1,R2
46			Scalar potential functions	**Find** scalar potential function	T1,T3, R1,R2
47			Solenoidal vectors	**Find** solenoidal vector	T1,T3, R1,R2
48			Irrotational vectors	**Find** irrotational vectors	T1,T3, R1,R2
			Applications of improper integrals and Signals and Systems(content beyond the syllabus)	**Understand** application	
			Mock Test - II		
UNIT – 5					
49	13	5	Line integral	**Evaluate** Line integral	T1,T3, R1,R2
50			Line integral	**Evaluate** Line integral	T1,T3, R1,R2
51			Surface integral	**Evaluate** surface integral	T1,T3, R1,R2
52			Surface integral	**Evaluate** surface integral	T1,T3, R1,R2
53	14		Volume integral	**Evaluate** volume integral	T1,T3, R1,R2
54			Volume integral	**Evaluate** volume integral	T1,T3, R1,R2
55			Gauss Divergence Theorem	**Apply** gauss theorem	T1,T3, R1,R2
56			Gauss Divergence Theorem	**Apply** gauss theorem	T1,T3, R1,R2
57	15		Greens Theorem	**Apply** greens theorem	T1,T3, R1,R2
58			Greens Theorem	**Apply** greens theorem	T1,T3, R1,R2
59			Stokes Theorem	**Apply** stokes theorem	T1,T3, R1,R2
60			Stokes Theorem	**Apply** stokes theorem	T1,T3, R1,R2
			PDE applications in Computational Fluid Dynamics and Aerodynamics etc.(content beyond syllabus)	**Understand** application	
			Tutorial / Bridge Class # 4		
II Mid Examinations					

SUGGESTED BOOKS:

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.

REFERENCES:

1. Paras Ram, Engineering Mathematics, 2nd Edition, CBS Publishes
2. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes (PO)												Program Specific Outcomes (PSO)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
I	3	2	2	1	-	-	-	-	-	-	-	-	2	1	-
II	2	2	2	1	-	-	-	-	-	-	-	-	1	1	-
III	3	1	2	1	-	-	-	-	-	-	-	-	2	1	-
IV	3	2	1	1	-	-	-	-	-	-	-	-	2	1	-
V	2	2	2	1	-	-	-	-	-	-	-	-	1	1	-
AVG	2.6	1.8	1.8	1.0	-	-	-	-	-	-	-	-	1.6	1.0	-

1: Slight(Low) **2: Moderate (Medium)** **3: Substantial(High)** **4 : None**

QUESTION BANK: (JNTUH)

DESCRIPTIVE QUESTIONS:

UNIT I

Short Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Solve$(e^y + 1)cosxdx + e^y sinxdy = 0$	Understand	1
2	Solve (1+ $e^{x/y})dx +\ e^{x/y}$(1-x/y) dy=0.	Understand	1
3	Solve the differential equation (y-yx)dx + (x+xy)dy = 0.	Understand	1
4	Write the working rule to solve Bernoulli's equation.	Remember	1
5	A copper ball is heated to a temperature of 80c if at time t=0 in water which is maintained at 30C. If at t=3 minutes, the temperature of the ball is reduced to 50C. Find the time at which the temperature of the ball is 40C.	Apply	1
6	Sovle the differential equation $x^2ydx - (x^3 + y^3)dy = 0$	Understand	1
7	Solve (xy Sin xy + Cos xy)y dx + (xy Sin xy – Cos xy)x dy =0	Understand	1

8	Solve the differential equation $\frac{dy}{dx} + ytanx = y^2secx$	Understand	1
9	If the air is maintained at 25^0C and temperature of the body cools from 140^0C to 80^0C in 20 minutes find when the temperature will be 35^0C.	Apply	1
10	Solve the differential equation $y(2xy + e^x)dx - e^x dy = 0$	Understand	1

Long Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Solve the differential equation $\frac{dy}{dx} + ytanx = y^2secx$	Understand	1
2	Solve the differential equation $(xysinxy + cosxy)ydx + (xysinxy - cosxy)xdy = 0$	Understand	1
3	If the air is maintained at 15^0C and the temperature of the drops from 70_0C to 40^0C in 10 minutes. What will be its temperature after 30 minutes	Apply	1
4	If 30% of radioactive substance disappears in 10 days then how long will it take for 90% of it to disappear?	Apply	1
5	Solve the differential equation $y(2xy + e^x)dx - e^x dy = 0$	Understand	1
6	The temperature of the body drops from 100^0c to 75^0c in 10 minutes when the surrounding air is at 20^0c.then what will be its temperature after half an hour and when will be the temperature 25^0c.	Apply	1
7	Solve $\frac{dy}{dx} - \frac{tany}{1+x} = (1 + x)e^x secy$	Understand	1
8	Solve $(x + y - 1)\frac{dy}{dx} = (x - y + 2)$.	Understand	1
9	Solve $\frac{dy}{dx} + (y - 1)cosx = e^{-sinx}cos^2x$	Understand	1
10	Solve $(2x + y - 3)dy = (x + 2y - 3)dx$	Understand	1

UNIT II

Short Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Solve the differential equation $(D^2 - 4)y = 2cos^2x$	Understand	2
2	Solve the differential equation $(D^2 + 9) = cos3x + sin2x$	Understand	2
3	Solve the Differential equation $(D^4+2D^2+1)y = x^2cos^2x$	Understand	2
4	Solve $(D^2-2D+1)y=x^2e^{3x}-\sin 2x+3$	Understand	2
5	Solve the differential equation $(D^2 + 4) = cos2x + sin3x$		2
6	By using variation of parameters solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$	Understand	2
7	Solve the Differential Equation $(D^2 + 3D + 2)y = e^{2x}cosx + 2\cos(2x + 3)$	Understand	2
8	Solve $(D^2-2D+2)y=e^x \tan x$ by method of variation of parameters	Understand	2
9	Solve $(D^2-2D+1)y=x^2e^{3x}-\sin 2x+3$	Understand	2
10	Solve $(D^2+4D+5)y=5$	Understand	2

Long Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+3y=e^{-x}\sin x+x$	Understand	2
2	Solve $\frac{d^2y}{dx^2}+\frac{dy}{dx}=x^2+2x+4$	Understand	2
3	Solve $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+3y=e^{x}\cos 3x$	Understand	2
4	Solve $\frac{d^2y}{dx^2}-3\frac{dy}{dx}+2y=xe^{3x}+\sin 2x$	Understand	2
5	Solve $x^3\frac{d^3y}{dx^2}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$	Understand	2
6	Solve $(D^2+1)\,x = t\cos 2t$	Understand	2
7	Explain the method of variation of parameters.	Remember	2
8	Solve $(D^3-3D+4)y = 0$	Understand	2
9	Solve $(D^2+4D+3)y = e^{e^x}$	Understand	2
10	Solve $(D^3-6D^2+11D-6)y = e^{-2x}+e^{-3x}$	Understand	2

UNIT III

Short Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Evaluate $\int_0^{\frac{\pi}{4}}\int_0^{a\sin\theta}\frac{r\,dr\,d\theta}{\sqrt{a^2-r^2}}$.	Apply	3
2	Change the order of integration in $\int_0^1\int_{x^2}^{2-x} xy\,dx\,dy$.	Apply	3
3	Evaluate $\int_0^1\int_0^{\sqrt{1-x^2}}\int_0^{\sqrt{1-x^2-y^2}} xyz\ dz\,dy\,dx$.	Apply	3
4	Evaluate $\iiint_V (x+y+z)dx\,dy\,dz$ where the domain V is bounded by the plane $x+y+z=a$ and the coordinate planes.	Apply	3
5	Evaluate the double integral $\int_0^a\int_0^{\sqrt{a^2-y^2}}(x^2+y^2)dydx$.	Apply	3
6	By changing the order of integration evaluate $\int_0^1\int_0^{\sqrt{1-x^2}} y^2\,dy\,dx$.	Apply	3
7	Evaluate $\int_0^{log2}\int_0^x\int_0^{x+logy} e^{x+y+z}dzdydx$	Apply	3
8	Explain change of variable in double and triple integrals	Remember	3
9	Evaluate $\int_0^{4a}\int_{\frac{y^2}{4a}}^{y}\frac{x^2-y^2}{x^2+y^2}dxdy$ by change of variables in polar form	Apply	3

10	Sketch the region of integration of the integral $\int_0^{2a}\int_{\sqrt{2ax-x^2}}^{\sqrt{2ax}} f(x,y)dxdy$	Apply	3

Long Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Evaluate $\iint_R y\,dxdy$ Where R is the region bounded by the parabolas $y^2 = 4x$ and $x^2 = 4y$.	Apply	3
2	Evaluate by changing order of integration $\int_0^a \int_{x/a}^{\sqrt{x/a}} (x^2 + y^2)\, dxdy$	Apply	3
3	Compute the value of $\iint_R y\,dxdy$ Where R is the region in the I[st] quadrant bounded by the Ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$.	Apply	3
4	Evaluate $\iiint (x + y + z)\,dx\,dy\,dz$ over the tetrahedron x=0, y=0, z=0 and the plane	Apply	3
5	Evaluate $\iint_R y\,dxdy$ Where R is the region bounded by the parabolas $y^2 = 4x$ and $x^2 = 4y$.	Apply	3
6	Evaluate $\int_0^{\frac{\pi}{2}}\int_0^{\infty} \frac{rdrd\theta}{(r^2+a^2)^2}$.	Apply	3
7	Evaluate by changing the order of integration $\int_0^1\int_x^{\sqrt{2-x^2}} \frac{xdydx}{\sqrt{x^2+y^2}}$.	Apply	3
8	Evaluate $\int_0^1\int_0^{1-x}\int_0^{1-x-y} dxdydz.$	Apply	3
9	Evaluate $\int_0^{\pi}\int_0^{a(1+cos\theta)} r^2 cos\theta\, dr d\theta$.	Apply	3
10	Evaluate $\int_0^1\int_0^{\sqrt{1-x^2}} y^2 dydx$	Apply	3

UNIT IV

Short Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Prove that $r^n\bar{r}$ is Irrotational.	Understand	4
2	Find $div\,\bar{f}$ where $\bar{f} = r^n\bar{r}$. Find n if it is Solenoidal.	Understand	4
3	Find the directional derivative of $2xy + z^2$ at (1, 1, 3) in the direction of i+2j+3k.	Understand	4
4	If a is constant vector prove grad(a.f) = (a .grad) f + (a x curl f).	Understand	4
5	Show that $curl(r^n\bar{r}) = \bar{0}$.	Understand	4
6	Show that if F and G are irrotational FXG is Solenoidal.	Understand	4

7	Find the work done by F= (2x-y-z)i + (x+y-z)j + (3x-2y-5z)k along a curve 'C' in the xy-plane given by x^2+y^2=9	Understand	4
8	Find the work done by F= (2x-y-z)i + (x+y-z)j + (3x-2y-5z)k along a curve 'C' in the xy-plane given by x^2+y^2=4	Understand	4
9	If $\bar{F} = xy\bar{\imath} - z\bar{\jmath} + x^2\bar{k}$ and c is the curve x = t^2	Understand	4
10	Evaluate the line integral $\int_c \; [(x^2 + xy)dx + (x^2 + y^2)dy]$ where c is the square formed by the lines $x \pm 1$	Apply	4

Long Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Prove that $\nabla(r^n) = nr^{n-2}\bar{r}$.	Understand	4
2	Prove that $div\,(\bar{a} \times \bar{b}) = \bar{b}.curl\,\bar{a} - \bar{a}.curl\,\bar{b}$	Understand	4
3	(a) Prove that $(grad\,r^m) = m(m+1)r^{m-2}$. (b) Show that curl (curl F) = grad(div F) -∇^2F.	Understand	4
4	S.T $\nabla \times (\nabla \times \bar{a}) = \nabla(\nabla.\bar{a}) - \nabla^2\bar{a}$.	Understand	4
5	If $\bar{r}$ is the position vector of the point P(x, y, z) then P.T $\nabla f(r) = f^I(r)\frac{\bar{r}}{r}$.	Understand	4
6	Find the value of a and b so that the surfaces a$x^2 - byz = (a+2)x$ and $4x^2y + z^3 = 4$ may intersect orthogonally at the point (1, -1, 2).	Understand	4
7	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, -1, 2).	Understand	4
8	S.T $\nabla^2[f(r)] = \frac{d^2f}{dr^2} + \frac{2}{r}\frac{df}{dr}$. Where r = $\lvert\bar{r}\rvert$.	Understand	4
9	P.T $\nabla \times \left(\frac{\bar{A}\times\bar{r}}{r^n}\right) = \frac{(2-n)\bar{A}}{r^n} + \frac{n(\bar{r}.\bar{A})\bar{r}}{r^{n+2}}$	Understand	4
10	P.T Curl$(\bar{a} \times \bar{b}) = \bar{a}\,div\bar{b} - \bar{b}div\bar{a} + (\bar{b}.\nabla)\bar{a} - (\bar{a}.\nabla)\bar{b}$.	Understand	4

UNIT V

Short Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	State Gauss divergence theorem.	Remember	5
2	State Green's theorem in a plane,	Remember	5
3	State Stoke's theorem.	Remember	5
4	Verify Green's theorem in plane for $\oint(3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$ where C is the region bounded by $y = \sqrt{x}$ and $y = x^2$.	Apply	5
5	Evaluate $\iint_S \bar{F}.\bar{n}\;ds$, where $\bar{F} = 2x^2y\bar{\imath} - y^2\bar{\jmath} + 4xz^2\bar{k}$ and S is the closed surface of the region in the first octant bounded by the cylinder $y^2 + z^2 = 9$ and the planes $x = 0, x = 2, y = 0, z = 0$.	Apply	5

6	Verify Stokes theorem for $\bar{F} = (y - z + 2)\bar{\imath} + (yz + 4)\bar{\jmath} - xz\bar{k}$ where S is the surface of the cube $x = 0, y = 0, z = 0, x = 2, y = 2, z = 2$ above the xy −plane.	Apply	5
7	Apply stokes theorem, to evaluate $\oint_c ydx + zdy + xdz)$ where c is the curve of intersection of the sphere $x^2 + y^2 + z^2 = a^2$ and $x + z = a$	Apply	5
8	Apply stoke's theorem and show that $\iint_S curl\bar{F}.\bar{n}ds = 0$ $where$ $\bar{F}$ is any $vector$ and s=$x^2 + y^2 + z^2 = 1$	Apply	5
9	Verify green's theorem in the plane for $\oint_c (x^2 - xy^3)dx + (y^2 - 2xy)dy$ where C is a Square with vertices (0,0),(2,0),(2,2),(0,2)	Apply	5
10	Apply Green'stheorem to Evaluate $\oint_c (2x^2 - y^2)dx + (x^2 + y^2)dy$ where c is the boundary of the area enclosed by the x-axis and upper half of the circle $x^2 + y^2 = a^2$	Apply	5

Long Answer Questions

S.No	Question	Blooms taxonomy level	Course outcome
1	Verify Gauss Divergence Theorem for $\bar{f} = (x^3 - yz)\bar{\imath} - 2x^2y\bar{\jmath} + z\bar{k}$ taken over the surface of the cube bounded by the planes x = y = z = a and coordinate planes .	Apply	5
2	If $\bar{F} = 4xz\bar{\imath} - y^2\bar{\jmath} + yz\bar{k}$ evaluate $\int_S \bar{F}.\bar{n}\,ds$ where S is the surface of the cube bounded by $x = 0, x = a, y = 0, y = a, z = 0, z = a$.	Apply	5
3	Verify Green's theorem in plane for $\oint(3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$ where C is the region bounded by $y = \sqrt{x}$ and $y = x^2$.	Apply	5
4	Evaluate $\iint_S \bar{F}.\bar{n}\ ds$, where $\bar{F} = 2x^2y\bar{\imath} - y^2\bar{\jmath} + 4xz^2\bar{k}$ and S is the closed surface of the region in the first octant bounded by the cylinder $y^2 + z^2 = 9$ and the planes $x = 0, x = 2, y = 0, z = 0$.	Apply	5
5	Verify Stokes theorem for $\bar{F} = (y - z + 2)\bar{\imath} + (yz + 4)\bar{\jmath} - xz\bar{k}$ where S is the surface of the cube $x = 0, y = 0, z = 0, x = 2, y = 2, z = 2$ above the xy −plane.	Apply	5
6	Evaluate $\iiint \nabla \cdot F\, dV$ where V is the cylindrical region bounded by $x^2 + y^2 = 9$, z=0, z=2, F =yi +xj +z^2k.	Apply	5
7	Verify Green's Theorem in a plane for $\int_C (y - sinx)dx + cosx\,dy$ where C is the triangle joins (0, 0), (π/ , 0), (π/2, 1).	Apply	5
8	Evaluate using Green's theorem $\int_C x2ydx + y3\,dy$ where C is the closed path formed by y = x, $y^3 = x^2$ form (0, 0) to (1, 1).	Apply	5
9	Evaluate $\iint F \cdot n\, dS$ where $\bar{F}$ = xzi + yzj + z^2k and S is the upper half of the sphere $x^2 + y^2 + z^2 = 1$.	Apply	5
10	Use divergence theorem to Evaluate $\iint(y^2z^2i + z^2x^2j + z^2y^2k)$. n ds where S is the part of the unit sphere above the x y plan.	Apply	5

OBJECTIVE QUESTIONS: JNTUH

UNIT I

1.The general solution of $\frac{dy}{dx} = e^{x+y}$

a) $e^x + e^y = c$ b) $e^x - e^y = c$ c) $e^{xy} = c$ d) none

2. The integrating factor of $(x^3y^3+x^2y^2+xy)\, y\, dx + (x^3y^3 - x^2y^2-xy)\, x\, dy = 0$

a) $\frac{1}{2xy(1+xy)}$ b) $\frac{1}{2x^2y^2(1+xy)}$ c) $\frac{1}{1+xy}$ d) none

3. Degree of $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 10y = 0$ is

a) 0 b) 1 c) 2 d) none

4. The condition for exactness of differential equation if M dx +N dy = 0 is

a) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ b) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$ c) $\frac{-\partial M}{\partial x} = \frac{\partial N}{\partial y}$ d) none

5. Evaluate the Wronskian of e^x & x is ________

a) $(1-x)\, e^x$ b) $(x+1)\, e^x$ c) $x\, e^x$ d) none

6. P.I. of $\frac{d^3y}{dx^3} + y = e^{-x}$ is

a) $xe^{\frac{-x}{3}}$ b) $e^{\frac{-x}{3}}$ c) $-xe^{\frac{-x}{3}}$ d) none

7. The order of $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 10y = 0$ is

a) 0 b) 1 c) 2 d) none

8) The general solution of $\frac{ydx-xdy}{y^2} = 0$

a) $xy = c$ b) $x = cy$ c) $y = cx$ d) none

9) The equation $\frac{dy}{dx} + \frac{ax+hy+g}{hx+by+f} = 0$ is _____

a) homogeneous b) non- homogeneous c) exact d) none

10) The general solution of $\frac{xdy+ydx}{y^2+x^2} = 0$

a) $\log(x+y) = c$ b) $\log(x^2+y^2) = c$ c) $\log xy = c$ d) none

11. The order and degree of $\frac{d^2y}{dy^2} = \left[y + \left(\frac{dy}{dx}\right)^6\right]^{1/4}$ is ________

12 If $x\frac{dy}{dx} = x^2 + y - 2, y(1) = 1$ then y (2) =_______

13. The general solution of linear differential equation $\frac{dy}{dx} = e^{x+y}$ is ________

14. The differential equation is said to be homogeneous if ___________

15. The order of the differential equation $x^3\frac{d^3y}{dx^3} + 2x^2\frac{d^2y}{dx^2} - 3y = x$ is ________

16. Newton's law of cooling is ___________

17. The general solution of $p^2-5p-6=0$ where $p=\frac{dy}{dx}$ is _______

18. The general solution of linear differential equation is __________

19. The solution of $\sqrt{1+x^2}dy + \sqrt{1+y^2}\, dx = 0$ is________

20. The solution of $\frac{dy}{dx} + y\tan x = y^2\sec x$ is __________

UNIT II

1. The general solution of $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 10y = 0$ is

    a) $y = e^x (C_1 \text{Cos } 3x + C_2 \text{Sin } 3x)$ b) $y = C_1 \text{Cos}3x + C_2 \text{Sin } 3x$

    c) $y = C_1 e^{3x} + C_2 e^{-3x}$ d) none

2. $\frac{1}{(D-2)^2} e^{2x} \sin x =$

    a) $e^{2x} \sin x$ b) $- e^{2x} \sin x$ c) $e^{2x} \frac{x^2}{2} \sin 2x$ d) none

3. $x^2 \frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$ is known as ___________ .

    a) Cauchy Euler equation b) Legender equation

    c) Homogeneous equation d) none

4. P.I. of $(D-1)^4 y = e^x$ is

    a) $\frac{x^4}{4}e^x$ b) x^4e^x c) e^x d) $e^x/4$

5. P.I. of (D^2-2D+1) y = Cos hx is

    a) $\frac{x^2}{4}e^x + \frac{e^{-x}}{8}$ b) $\frac{x^2}{4}e^{-x} + \frac{e^x}{8}$ c) $\frac{x^2}{4}e^x$ d) $c_1 e^x + c_2 e^{-x}$

6. Complementary Function of $(D-1)^4 y = e^x$ is

a) $\frac{x^4}{4}e^x$ b) x^4e^x c) $(c_1+c_2x+c_3x^2+c_4x^3)e^x$ d) $e^x/4$

7. Complementary Function of $(D^2-2D+1)\ y = \text{Cos } hx$ is

a) $\frac{x^2}{4}e^x+\frac{e^{-x}}{8}$ b) $(c_1+c_2x)e^x$ c) $\frac{x^2}{4}e^x$ d) $c_1\ e^x + c_2\ e^{-x}$

8. General solution of $(D^2+1)\ y = 0$ is

a) $c_1\cos x + c_2\sin x$ b) $\frac{x^2}{4}e^{-x}+\frac{e^x}{8}$ c) $\frac{x^2}{4}e^x$ d) $c_1\ e^x + c_2\ e^{-x}$

9). $\frac{sinx}{D^2+D+1} =$

a) $\sin x$ b) $\cos x$ c) $\frac{sinx}{3}$ d) none

10) P.I. of $(D^2+a^2)\ y = \text{Cos } ax$ is

a) xcosax b) xsinax c) $\frac{xsinax}{2a}$ d) none

11. The Integrating factor of $\frac{dy}{dx}$ + p(x)y = q(x) is ________
12. _______ is the particular integral of $(D^2+5D+6)y=e^x$
13. The integrating factor of $(1 - x^2)\ y + xy = ax$ is __________
14. The complementary function of $(D-1)^2y=\sin 2x$ is _________
15. The value of $\frac{1}{D+2}(x+e^x)$ is _________
16. The solution of the Differential equation $(D^2+4)y=\tan 2x$ is _________
17. The particular integral of $(D^2+a^2)y=\cos a\ x$ is _________
18. The solution of the Differential equation $(D^2+4)y=\sec 2x$ is __________
19. The value of $\frac{1}{D^2+D+1}\sin x$ is _________
20. The solution of $(D^2 - 4D +4)\ y = x^2\sin x + e^{2x} + 3$ is _________

UNIT III

1. $\int_0^1\int_0^2\int_0^2 x^2yz\ dzdydx =$ _______.

   a) ½ b) ¼ c) 1 d) 3/2

2. $\int_0^1\int_1^2 xy\ dydx =$ _______

   a) ½ b) ¼ c) 1 d) ¾

3. $\int_0^{\pi}\int_0^{acos\theta} rsin\theta drd\theta =$ _______

   a) $\frac{a^2}{2}$ b) $\frac{a^2}{3}$ c) $\frac{a^3}{4}$ d) $\frac{a^3}{3}$

4. The volume of the tetrahedron bounded by the coordinate planes and the plane $x + y + z =1$ is _______.

a) $\frac{1}{2}$ b) $\frac{1}{3}$ c) $\frac{1}{4}$ d) $\frac{1}{6}$

5. The volume of the tetrahedron bounded by the surfaces x = 0,y =0,z=0 and $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}$ 1 is ________.

   a) $\frac{abc}{2}$ b) $\frac{abc}{3}$ c) $\frac{abc}{4}$ d) $\frac{abc}{6}$

6. In polar coordinates $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dx\,dy =$ ________.

   a) $\int_0^{\frac{\pi}{2}} \int_0^\infty e^{-r^2}\,dr d\theta$ b) $\int_0^{\frac{\pi}{4}} \int_0^\infty e^{-r} r\,dr d\theta$ c) $\int_0^{\frac{\pi}{2}} \int_0^\infty e^{-r^2} r dr d\theta$ d) $\int_0^{\frac{\pi}{2}} \int_0^\infty e^{-r}\,dr d\theta$

7. An equivalent iterated integral with order of integration reversed for $\int_0^1 \int_1^{e^x} dy\,dx$ is __.

   a) $\int_0^1 \int_1^{e^y} dx\,dy$ b) $\int_1^e \int_{\log y}^1 dx\,dy$ c) $\int_e^1 \int_1^{\log y} dx\,dy$ d) none.

8. The integrated integral for $\int_{-1}^1 \int_0^{\sqrt{1-x^2}} f(x,y)\,dy\,dx$ after changing order of integration is _

   a) $\int_{-1}^1 \int_{\sqrt{1-y^2}}^{\sqrt{1-y^2}} f\,dx\,dy$ b) $\int_{-1}^1 \int_0^{\sqrt{1-x^2}} f\,dx\,dy$ c) $\int_0^1 \int_{\sqrt{1-y^2}}^{\sqrt{1-y^2}} f\,dx\,dy$ d) none

9. $\iiint (x^2+y^2+z^2)\,dz\,dy\,dx$ where v is the volume of the cube bounded by the coordinate planes x=y=z = 9 is ___________ .

   a) $a^5/5$ b) $a^5/25$ c) a^5 d) $(0.2\,a)^5$

10. The volume of the solid generated by revolution of part of the parabola $y^2 = 4ax$ cut off by latus rectum about the tangent at the vertex is _______.

    a) $\frac{8\pi a^3}{5}$ b) $\frac{16\pi a^3}{5}$ c) $\frac{4\pi a^3}{5}$ d) $\frac{2\pi a^3}{5}$

11. The area of the portion of the plane x + y + z = 1 in the first octant is ________.
12. The value of $\iint xy\,dxdy$ over the area bounded by parabola x=2a and x^2=4ay is ________.
13. $\int_0^2 \int_0^x (x+y)dydx =$ ________.
14. What is the volume bounded by z = $x^2 + y^2$ and z = 4 ________.
15. $\int_{-1}^1 \int_{-2}^2 \int_{-3}^3 dzdydx$ is _______.
16. The iterated integral for $\int_{-1}^1 \int_0^x f(x,y)dydx$ after changing the order of integration is __
17. $\int_0^\pi \int_0^{a\cos\theta} r\,dr d\theta$ is _________.
18. The value of $\iiint (x+y+z)dxdydz$ over the tetrahedron bounded by the co-ordinate planes and the plane x+y+z =1 is ________.
19. The relation between the Cartesian coordinates *x,y,z* and the Cylindrical coordinates ρ,θ,z is ______.
20. The value of volume bounded the *yz* plane , the cylinder $y^2 + z^2 = 4$ and the plane $x+y+z = 3$ is _________.

UNIT IV

1. If $\bar{r}$ is the position vector of any point in space, then $r^n \bar{r}$ is _______.
   a) Irrotational b) Solenoidal c) both(a&b) d) none
2. If curl $\bar{r}$ =0 then $\bar{r}$ is _______.
   a) Solenoidal b) Irrotational c) both(a&b) d) none
3. If curl (grad ϕ)=0 then grad ϕ is _______.
   a) Solenoidal b) both(a&c) c) Irrotational d)none

4. If div $\bar{f}$ =0 then $\bar{f}$ is _______.
   a) Solenoidal b) Irrotational c) both d)none

5. If $\bar{a}$ is const vector then grad ($\bar{a} . \bar{r}$) is _______.
   a) $\bar{a}$ b) 0 c) 1 d)none
6. f =x^3+y^3+3xyz then grad f = _______.
   a) $-(3x^2+3yz)\bar{i}+(3y^2+3xy)\bar{j}+3xy$ b) $(3x^2+3yz)\bar{i}+(3y^2+3xy)\bar{j}+3xy$ c)0 d) none
7. If $\bar{r}$ =xi+yj+zk then $\nabla .[\bar{r}/r^3]$= _______.
   a) 1 b) 0 c) -1 d) none
8. $\bar{r}$=xi+yj+zk then $\nabla[f(r)]$= _______.
   a) $f^1(r)/r$ b) $\bar{r}f^1(r)/r$ c) $\bar{r}f^1(r)$ d)none

9. If $\bar{r}$=xi+yj+zk then grad (r^n) is _______.
   a) $nr^{n-2}\bar{r}$ b) $r^{n-2}\bar{r}$ c) 0 d)none

10. $\nabla[\nabla .\bar{r}/ r]$ = _______.
   a) $2\bar{r}/r^3$ b) $-2\bar{r}/r^3$ c) $\bar{r}/r^3$ d)none

11. $\nabla[r \nabla (1/r^3)]$= _______
12. If $\emptyset=x^2+y^2+z^2-3xyz$ then curl(grad $\emptyset$)= _______
13. If $\bar{r}$=xi+yj+zk then $\nabla^2 (\frac{1}{r})$= _______
14. If $\bar{r}$=xi+yj+zk and if $(r^n \bar{r})$ *is solenoidal then* $n =$ _______
15. If $\bar{a}$ is const vector then curl$(\bar{r} \times \bar{a})$ is _______
16. If $\emptyset=ax^2+by^2+cz^2$ satisfies Laplacian equation then a+b+c = _______
17. If curl$\bar{a}$ =0 then $\bar{a}$ is called _____________
18. Physical interpretation of $|\nabla \varphi|$ is _________
19. Laplacian operator is denoted by__________
20. The harmonic function of φ is __________

UNIT V

1. The work done by the force $(3x-2y)i+(y+2z)j-(x^2)k$ in moving along the straight line joining (0, 0, 0) & (1, 1, 1) is _______.

a)1/2 b) 2/5 c) 5/3 d) none

2. The circulation of $\bar{F}$=(2x-y+2z)i+(x+y-z)j+(3x-2y-5z)k along the circle $x^2+y^2=4$ in the xy plane is _______.

   a) 8π b)5π c) 3π d)none

3. If $\bar{F}=(x+y^2)i-2xj+2yzk$ evaluate $\int \bar{F}.\bar{n}$ ds over the surface $x^2+y^2+z^2=1$ in the first octant is _______.

   a)2/8 b) 3/8 c)1/8 d) none

4. If any closed surface S enclosing a volume V and $\bar{F}$=xi+2yj+3zk then$\iint \bar{f}.\bar{n}$ds= _______.

   a) 6V b)5V c)2V d) none

5. $\iint(xdydx + ydzdx + zdxdy)$ where surface $x^2+y^2+z^2=a^2$ is _______.

   a) b) c) $4\pi a^3$ d) none

6. $\oint Mdx + Ndy$= _______.

   a) $\oiint_S (\frac{\partial N}{\partial x} + \frac{\partial M}{\partial y})dxdy$ b) $\oiint_S (\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y})dxdy$ c)0 d) none

7. If $\bar{F}=(x+y^2)i-2xj+2yzk$ evaluate $\int \bar{F}.\bar{n}$ ds over the surface $x^2+y^2+z^2=1$ in the first octant is-_______.

   a) 3/8 b) 1/2 c) 3/4 d) none

8. The necessary and sufficient condition that the line integral $\int A$.dr=0 for every closed curve C is _______.

   a) simple b) multiple c) both d) none

9. The volume of the line integral $\int grad(x + y - z)d$r from (0, 1, -1) to (1, 2, 0) is _______.

   a) -3 b) 3 c)0 d) none

10. If $\bar{F}$=axi-byj+czk then$\iint \bar{f}.\bar{n}$ ds where S is the surface of the unit sphere is _______.

    a) $\frac{4}{3}\pi$(a+b+c). b)$-\frac{4}{3}\pi$(a+b+c). c) $\frac{4}{3}\pi$(a-b+c). d)none

11. A conservative force field is ___________
12. The relation between surface and volume integrals represents______theorem
13. If $\bar{n}$ is the unit outward drawn normal to any closed surface then $\int div\ \bar{n}$ dV is______
14. The representation of line integral is __________
15. The value of $\int[(x2 + xy)dx + (x2 + y2)dy]$ over the region x=0,x=1,y=0,y=1 is__.
16. The representation of volume integral is __________
17. The relation between line and surface integrals represents______theorem
18. The value of$\int[e^x dx + 2ydy - dz]$ over the region $x^2+y^2=9$, $z=2$ is ________.
19. The representation of surface integral is __________
20. The relation between line and double integrals represents______theorem

WEBSITES:

1. www.geocities.com/siliconvalley/2151/matrices.html
2. www.mathforum.org/key/nucalc/fourier.html

3. www.mathworld.wolfram.com
4. www.eduinstitutions.com/rec.htm
5. www.isical.ac.in
6. http://nptel.ac.in/courses/111108066/
7. http://nptel.ac.in/courses/111106051/
8. http://nptel.ac.in/courses/111102011/
9. http://nptel.ac.in/syllabus/syllabus.php?subjectId=111103019

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JOURNALS:

INTERNATIONAL

1. Journal of American Mathematical Society
2. Journal of differential equations - Elsevier
3. Pacific Journal of Mathematics
4. Journal of Australian Society
5. Bulletin of “The American Mathematical Society”
6. Bulletin of “The Australian Mathematical Society”
7. Bulletin of “The London Mathematical Society”

NATIONAL

1. Journal of Interdisciplinary Mathematics
2. Indian Journal of Pure and Applied Mathematics
3. Indian Journal of Mathematics
4. Proceedings of Mathematical Sciences
5. Journal of Mathematical and Physical Sciences.
6. Journal of Indian Academy and Sciences

LIST OF TOPICS FOR STUDENT SEMINARS:

1. Orthogonal trajectory.
2. Natural law of growth and decay.
3. Newton's law of cooling.
4. Evaluation of Multiple integration.
5. Geometrical interpretation of Curl and Divergence.

CASE STUDIES / SMALL PROJECTS:

1. Describe about the Quadratic forms and its nature.
2. Discuss about the Concept of simple harmonic motion and electrical circuits in detail.
3. Describe about the geometrical meaning of double and triple integration.
4. Discuss about the orthogonal trajectory with examples.
5. Discuss the applicability of vector integral theorem.

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