P.E.S.COLLEGE OF ENGINEERING

(An Autonomous Institution, Aided by Govt. of Karnataka and Affiliated to VTU, Belgaum)

Department of Mathematics

CURRICULUM AND SYLLABUS OF MATHEMATICS

For UG: BE Regular Students

First Year B.E - Programme: First semester for Civil Engineering stream

Semesters	Course Code	Course Title	Teaching hours perweek				Credit Assign
			L	T	P	SS	
I	22MATC11	Calculus, Differential Equations and Linear Algebra	02	02	02	–	**04**
II	22MATC21	Integral Calculus, Partial Differential Equations and Numerical methods	02	02	02	–	**04**

First Year B.E - Programme: First semester for Mechanical Engineering stream

Semesters	Course Code	Course Title	Teaching hours perweek				Credit Assign
			L	T	P	SS	
I	22MATM11	Calculus, Ordinary Differential Equations and LinearAlgebra	02	02	02	–	**04**
II	22MATM21	Integral Calculus, Partial Differential Equations and Numerical methods	02	02	02	–	**04**

First Year B.E - Programme: First semester for Electrical and Electronics engineering stream

Semesters	Course Code	Course Title	Teaching hours perweek				Credit Assign
			L	T	P	SS	
I	22MATE11	Calculus, Differential Equations and Linear Algebra	02	02	02	–	**04**
II	22MATE21	Integral Calculus, Partial Differential Equations and Numerical methods	02	02	02	–	**04**

First Year B.E - Programme: First semester for Computer science engineering stream

Semesters	Course Code	Course Title	Teaching hours perweek				Credit Assign
			L	T	P	SS	
I	22MATS11	Calculus, Differential Equations and Linear Algebra	02	02	02	–	**04**
II	22MATS21	Integral Calculus, Partial Differential Equations and Numerical methods	02	02	02	–	**04**

L: Lecture T: Tutorial P: Practical SS: Self Study

I Semester

Course Title	**Calculus, Differential Equations and Linear Algebra**						
Course Code	**22MATC11**						
Category	**Mathematics for Civil Engineering Stream-I**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the importance of calculus associated with one variable and two variables.
2	**Analyze** Engineering problems by applying Ordinary Differential Equations
3	**Develop** the knowledge of Linear Algebra to solve system of equation by using matrices

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Polar coordinates and curvature:** Introduction, Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems. **Self - study:** Center and circle of curvature, evolutes and involutes**.**	06	02
II	**Series Expansion and Multivariable Calculus:** Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Indeterminate forms -L'Hospital's rule, problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian andproblems. Maxima and minima for a function of two variables. Problems. **Self - study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.	06	02
III	**Ordinary Differential Equations (ODEs) of first order**: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations Integrating factors on $\frac{1}{N}\left[\frac{\partial M}{\partial Y}-\frac{\partial N}{\partial x}\right]$ $and\frac{1}{M}\left[\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right]$ Applications of ODE's - Orthogonal trajectories, Newton's law of cooling. **Nonlinear differential equations**: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems. **Self-Study**: Applications of ODE's: Solvable for x and y. .	06	02
IV	**Ordinary Differential Equations of higher order:** Higher-order linear ODE's with constant coefficients - Inverse differential operator, case (I) to case (IV), method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Problems **Self - study:** Formulation and solution of Cantilever beam. Finding the solution by the method of undetermined coefficients.	06	02

V	**Linear Algebra:** Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigenvectors, Rayleigh's power method to find the dominant Eigen value and Eigenvector. **Self-Study**: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Describe the translation of coordinate system, various types of series of functions, identify the variation of multivariables, and match the system of equations in matrix form

CO2: Explain the graph of function relate to polar coordinates, interpret series of continuous function and demonstrate the methods to describe mathematical solution to equations related to Engineering problems.

CO3: Apply the Mathematical properties to solve illustrative Engineering problems, calculate Maxima and minima of a function and calculate Eigen value relates to Eigenvector of system of equations.

CO4: Analyze the Mathematical model of differential and systems of equations of more than one variable classify various solutions to problems, enumerate numerical solutions to system of equations and familiarize with modern mathematical tools namely SCILAB/PYTHON/MATLAB

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/
4. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

I Semester

Course Title	**Calculus, Ordinary Differential Equations and Linear Algebra**						
Course Code	**22MATM11**						
Category	**Mathematics for mechanical engineering stream-I**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the importance of calculus associated with one variable and two variables.
2	**Analyze** Engineering problems by applying Ordinary Differential Equations
3	**Develop** the knowledge of Linear Algebra to solve system of equation by using matrices

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Polar coordinates and curvature:** Introduction, Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems. **Self - study:** Center and circle of curvature, evolutes and involutes.	06	02
II	**Series Expansion and Multivariable Calculus:** Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Indeterminate forms - L'Hospital's rule, problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian andproblems. Maxima and minima for a function of two variables. Problems. **Self - study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.	06	02
III	**Ordinary Differential Equations (ODEs) of first order**: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations Integrating factors on $\frac{1}{N}\left[\frac{\partial M}{\partial Y}-\frac{\partial N}{\partial x}\right]$ $and\frac{1}{M}\left[\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right]$ Applications of ODE's - Orthogonal trajectories, Newton's law of cooling. **Nonlinear differential equations**: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems. Self-Study: Applications of ODE's: Solvable for x and y. .	06	02
IV	**Ordinary Differential Equations of higher order:** Higher-order linear ODE's with constant coefficients - Inverse differential operator, case-I to case-IV, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Problems **Self - study:** Formulation and solution of Cantilever beam. Finding the solution by the method of undetermined coefficients.	06	02

V	**Linear Algebra:** Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigenvectors, Rayleigh's power method to find the dominant Eigen value and Eigenvector. **Self-Study**: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Describe the translation of coordinate system, various types of series of functions, identify the variation of multivariable's, and match the system of equations in matrix form

CO2: Explain the graph of function relate to polar coordinates, interpret series of continuous function and demonstrate the methods to describe mathematical solution to equations related to Engineering problems.

CO3: Apply the Mathematical properties to solve illustrative Engineering problems, calculate Maxima and minima of a function and calculate Eigen value relates to Eigenvector of system of equations.

CO4: Analyze the Mathematical model of differential and systems of equations of more than one variable classify various solutions to problems, enumerate numerical solutions to system of equations and familiarize with modern mathematical tools namely SCILAB/PYTHON/MATLAB

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

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ONLINE RESOURCES

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QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

I Semester

Course Title	**Calculus, Differential Equations and Linear Algebra**						
Course Code	**22MATE11**						
Category	**Mathematics for Electrical & Electronics Engineering Stream-I**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the importance of calculus associated with one variable and two variables.
2	**Analyze** Engineering problems by applying Ordinary Differential Equations
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Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Polar coordinates and curvature:** Introduction, Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems. **Self - study:** Center and circle of curvature, evolutes and involutes.	06	02
II	**Series Expansion and Multivariable Calculus:** Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Indeterminate forms - L'Hospital's rule, problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian andproblems. Maxima and minima for a function of two variables. Problems. **Self - study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.	06	02
III	**Ordinary Differential Equations (ODEs) of first order**: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations Integrating factors on $\frac{1}{N}\left[\frac{\partial M}{\partial Y}-\frac{\partial N}{\partial x}\right]$ $and\frac{1}{M}\left[\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right]$ Applications of ODE's - Orthogonal trajectories, Newton's law of cooling. **Nonlinear differential equations**: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems. Self-Study: Applications of ODE's: Solvable for x and y. .	06	02
IV	**Ordinary Differential Equations of higher order:** Higher-order linear ODE's with constant coefficients - Inverse differential operator, case-I to case-IV, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Problems **Self - study:** Formulation and solution of Cantilever beam. Finding the solution by the method of undetermined coefficients.	06	02

V	**Linear Algebra:** Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigenvectors, Rayleigh's power method to find the dominant Eigen value and Eigenvector. **Self-Study**: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

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TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

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QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										

Strength of correlation: Low-1, Medium- 2, High-3

I Semester

Course Title	**Calculus, Differential Equations and Linear Algebra**						
Course Code	**22MATE11**						
Category	**Mathematics for CSE Stream-I**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the importance of calculus associated with one variable and two variables.
2	**Analyze** Engineering problems by applying Ordinary Differential Equations
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Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Polar coordinates and curvature:** Introduction, Polar coordinates, Polar curves, angle between the radius vector and the tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems. **Self - study:** Center and circle of curvature, evolutes and involutes.	06	02
II	**Series Expansion and Multivariable Calculus:** Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Indeterminate forms - L'Hospital's rule, problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian andproblems. Maxima and minima for a function of two variables. Problems. **Self - study:** Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.	06	02
III	**Ordinary Differential Equations (ODEs) of first order**: Linear and Bernoulli's differential equations. Exact and reducible to exact differential equations Integrating factors on $\frac{1}{N}\left[\frac{\partial M}{\partial Y}-\frac{\partial N}{\partial x}\right]$ $and\frac{1}{M}\left[\frac{\partial N}{\partial x}-\frac{\partial M}{\partial y}\right]$ Applications of ODE's - Orthogonal trajectories, Newton's law of cooling. **Nonlinear differential equations**: Introduction to general and singular solutions, Solvable for p only, Clairaut's equations, reducible to Clairaut's equations. Problems. Self-Study: Applications of ODE's: Solvable for x and y. .	06	02
IV	**Ordinary Differential Equations of higher order:** Higher-order linear ODE's with constant coefficients - Inverse differential operator, case-I to case-IV, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Problems **Self - study:** Formulation and solution of Cantilever beam. Finding the solution by the method of undetermined coefficients..	06	02

V	**Linear Algebra :** Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigenvectors, Rayleigh's power method to find the dominant Eigen value and Eigenvector. **Self-Study**: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem.	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Describe the translation of coordinate system, various types of series of functions, identify the variation of multivariable's, and match the system of equations in matrix form

CO2: Explain the graph of function relate to polar coordinates, interpret series of continuous function and demonstrate the methods to describe mathematical solution to equations related to Engineering problems.

CO3: Apply the Mathematical properties to solve illustrative Engineering problems, calculate Maxima and minima of a function and calculate Eigen value relate to Eigenvector of system of equations.

CO4: Analyze the Mathematical model of differential and systems of equations of more than one variable classify various solutions to problems, enumerate numerical solutions to system of equations and familiarize with modern mathematical tools namely SCILAB/PYTHON/MATLAB

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

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3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

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5. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/differential-equations/first-order-differential-equations/

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

Suggested Learning Resources:

Reference Books

1. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press,3rd Ed., 2016.
2. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – HillBook Co., Network, 6th Ed., 2017.
3. **Gupta C.B, Sing S.R and Mukesh Kumar:** "Engineering Mathematic for Semester I andII", Mc-Graw Hill Education(India) Pvt. Ltd 2015.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. ChandPublication, 3rd Ed., 2014.
5. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
6. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
7. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

II Semester

Course Title	**Integral Calculus, Partial Differential Equations andNumerical methods**						
Course Code	**22MATC21**						
Category	**Mathematics for Civil Engineering Stream-II**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the fundamentals of Integral calculus, Vector calculus, Numerical Techniques
2	**Analyze** Engineering problems by applying Partial Differential Equations Methods
3	**Develop** the knowledge of solving engineering problems by using numerical Technique.

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Integral Calculus:** Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area and Volume by double integral. Problems. **Beta and Gamma functions**: Definitions, properties, relation between Beta and Gamma functions. Problems. **Self-Study**: Volume by triple integration, Center of gravity	06	02
II	**Vector Calculus:** **Vector Differentiation**: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems. **Vector Integration**: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems. **Self-Study**: Volume integral and Gauss divergence theorem.	06	02
III	**Partial Differential Equations (PDE's)**: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Method of separation of variables. Solution of one-dimensional heat equation and wave equation by the method of separation of variables. **Self-Study**: Derivation of one-dimensional heat equation and wave equation.	06	02
IV	**Numerical methods-1:** **Finite differences**: Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula (All formulae without proof). Problems. **Numerical differentiation:** Numerical differentiation using Newton's forward and backward interpolation formulae,(All formulae without proof)-problems only and Applications to Maxima and Minima **Numerical integration**: Trapezoidal rule, Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule, and Weddle's rule (All rules without proof)- Illustrative problems **Self-Study**: Sterling's formula, Lagrange's interpolation and Lagrange's inverse Interpolation formula. Boole's rule	06	02

V	**Numerical methods -2:** **Solution of algebraic and transcendental equations**: Regula-Falsi and Newton-Raphson methods (only formulae). Problems. **Numerical Solution of Ordinary Differential Equations (ODE's):** Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems. **Self-Study**: Bisection method. Euler's method Adam-Bashforth method	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Knowledge to Evaluate double and triple integration and identify the scalar, vector notation of functions of two and three dimensions ,recognize the partial differential equations and Numerical differences.

CO2: Understand to explain Area, Volume by double integration, change to polar coordinates describe divergence and flux in vector field; classify method of solutions of PDE's, Numerical differentiation and integrations.

CO3: Apply the Mathematical properties to evaluate triple integral and improper integral to interpret the irrotational and solenoidal vector field, find the solutions to problem arises in engineering field.

CO4: Analyze multiple integrals ,vector differentiations and integration, the Mathematical model by partial differential equations, Numerical solution to algebraic and transcendental, ordinary differential equations and familiarize with modern mathematical tools namely SCILAB/PYTHON/MATLAB

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

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2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-303-linear-partial-differential-equations-fall-2006/
4. https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/
5. http://mcatutorials.com/mca-tutorials-numerical-methods-tutorial.php

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

II Semester

Course Title	**Integral Calculus, Partial Differential Equations and Numerical methods**						
Course Code	**22MATM21**						
Category	**Mathematics for mechanical engineering streams -II**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the fundamentals of Integral calculus and Vector calculus
2	**Analyze** Engineering problems by applying Partial Differential Equations
3	**Develop** the knowledge of solving engineering problems by using numerical Technique.

Unit	**Syllabus content**	**No. of hours**	
		Theory	**Tutorial**
I	**Integral Calculus:** Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area and Volume by double integral. Problems. **Beta and Gamma functions**: Definitions, properties, relation between Beta and Gamma functions. Problems. **Self-Study**: Volume by triple integration, Center of gravity	06	02
II	**Vector Calculus:** **Vector Differentiation**: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems. **Vector Integration**: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems. **Self-Study**: Volume integral and Gauss divergence theorem.	06	02
III	**Partial Differential Equations (PDE's)**: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Method of separation of variables. Solution of one-dimensional heat equation and wave equation by the method of separation of variables. **Self-Study**: Derivation of one-dimensional heat equation and wave equation.	06	02
IV	**Numerical methods-1:** **Finite differences**: Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula (All formulae without proof). Problems. **Numerical differentiation:** Numerical differentiation using Newton's forward and backward interpolation formulae,(All formulae without proof)-problems only and Applications to Maxima and Minima **Numerical integration**: Trapezoidal rule, Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule, and Weddle's rule (All rules without proof)- Illustrative problems **Self-Study**: Sterling's formula, Lagrange's interpolation and Lagrange's inverse Interpolation formula. Boole's rule	06	02

V	**Numerical methods -2:** **Solution of algebraic and transcendental equations**: Regula-Falsi and Newton-Raphson methods (only formulae). Problems. **Numerical Solution of Ordinary Differential Equations (ODE's):** Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems. **Self-Study**: Bisection method. Euler's method Adam-Bashforth method	06	02

COURSE OUTCOMES: On completion of the course, student should be able to:

CO1: Knowledge to Evaluate double and triple integration and identify the scalar, vector notation of functions of two and three dimensions ,recognize the partial differential equations and Numerical differences.

CO2: Understand to explain Area, Volume by double integration, change to polar coordinates describe divergence and flux in vector field; classify method of solutions of PDE's, Numerical differentiation and integrations.

CO3: Apply the Mathematical properties to evaluate triple integral and improper integral to interpret the irrotational and solenoidal vector field, find the solutions to problem arises in engineering field.

CO4: Analyze multiple integrals ,vector differentiations and integration, the Mathematical model by partial differential equations, Numerical solution to algebraic and transcendental, ordinary differential equations and familiarize with modern mathematical tools namely SCILAB/PYTHON/MATLAB

TEACHING - LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
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ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
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5. http://mcatutorials.com/mca-tutorials-numerical-methods-tutorial.php

QUESTION PAPER PATTERN (SEE)	
PART-A	PART-B
One question from each unit carrying two marks each	Answer any **TWO** sub questions for maximum 18 marks from each unit

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

II Semester

Course Title	**Integral Calculus, Partial Differential Equations andNumerical methods**						
Course Code	**22MATE21**						
Category	**Mathematics for EEE streams -II**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Learning Objectives:	
1	**Familiarize** the fundamentals of Integral calculus and Vector calculus
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Unit	**Syllabus content**	**No. of hours**	
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I	**Integral Calculus:** Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area and Volume by double integral. Problems. **Beta and Gamma functions**: Definitions, properties, relation between Beta and Gamma functions. Problems. **Self-Study**: Volume by triple integration, Center of gravity	06	02
II	**Vector Calculus:** **Vector Differentiation**: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems. **Vector Integration**: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems. **Self-Study**: Volume integral and Gauss divergence theorem.	06	02
III	**Partial Differential Equations (PDE's)**: Formation of PDE's by elimination of arbitrary constants and functions. Solution of non- homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Method of separation of variables. Solution of one-dimensional heat equation and wave equation by the method of separation of variables. **Self-Study**: Derivation of one-dimensional heat equation and wave equation.	06	02
IV	**Numerical methods-1:** **Finite differences**: Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula (All formulae without proof). Problems. **Numerical differentiation:** Numerical differentiation using Newton's forward and backward interpolation formulae,(All formulae without proof)-problems only and Applications to Maxima and Minima **Numerical integration**: Trapezoidal rule, Simpson's $(\frac{1}{3})^{rd}$ rule, Simpson's $(\frac{3}{8})^{th}$ rule, and Weddle's rule (All rules without proof)- Illustrative problems **Self-Study**: Sterling's formula, Lagrange's interpolation and Lagrange's inverse Interpolation formula. Boole's rule	06	02

V	**Numerical methods -2:** **Solution of algebraic and transcendental equations**: Regula-Falsi and Newton-Raphson methods (only formulae). Problems. **Numerical Solution of Ordinary Differential Equations (ODE's):** Numerical solution of ordinary differential equations of first order and first degree - Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order and Milne's predictor-corrector formula (No derivations of formulae). Problems. **Self-Study**: Bisection method. Euler's method Adam-Bashforth method	06	02

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CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

II Semester

Course Title	**Integral Calculus, Partial Differential Equations andNumerical methods**						
Course Code	**22MATS21**						
Category	**Mathematics for CSE Stream-II**						
Scheme and Credits	Theory/Practical/Integrated					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	02	02	00	04	40	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

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4. https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/
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QUESTION PAPER PATTERN (SEE)	
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CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

Suggested Learning Resources:
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

Reference Books

1. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
2. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., Newyork, 6th Ed., 2017.
3. **Gupta C.B, Sing S. R., and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", McGraw Hill Education(India) Pvt. Ltd 2015.
4. **H. K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
5. **James Stewart: "**Calculus" Cengage Publications, 7th Ed., 2019.
6. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
7. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.