



BMS COLLEGE OF ENGINEERING, BENGALURU
Autonomous Institute Affiliated to VTU

DEPARTMENT OF MATHEMATICS & HUMANITIES

Scheme and Syllabus for
I – VIII Semester
2023-24

DEPARTMENT VISION

Be one of the leading centers for teaching & research in Mathematics

DEPARTMENT MISSION

Encourage analytical, independent, rational thinking and enhance problem solving skills of the students

**B.M.S. COLLEGE OF ENGINEERING, BENGALURU-19**Autonomous Institute, Affiliated to VTU, Belagavi
DEPARTMENT OF MATHEMATICS**2023-2024****Department: Mathematics and Humanities****Semester: I**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	23MA1BSCM	Mathematical Foundation for Civil, Electrical and Mechanical	3	1	0	4	50	50	100
MAT	23MA1BSMCS	Mathematical foundation for Computer Science stream -1	3	1	0	04	50	50	100
MAT	22MA1HSBAK	ಬಳಕೆ ಕನ್ನಡ	1	0	0	04	50	50	100
MAT	22MA1HSSAK	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ	1	0	0	04	50	50	100
AE	22MA1AECEN	Communicative English	1	0	0	01	50	50	100
HSS	22MA1HSCIP / 22MA2HSCIP	Constitution of India and Professional Ethics	1	0	0	01	50	50	100

Department: Mathematics and Humanities**Semester: II**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	23MA2BSMCM	Mathematical foundation for Civil and Mechanical Engineering	3	1	0	4	50	50	100
MAT	23MA2BSMCS	Mathematical foundation for Computer Science Stream-2	3	1	0	4	50	50	100
MAT	23MA2BSMES	Mathematical foundation for Electrical stream – 2	3	1	0	4	50	50	100
MAT	22MA2HSBAK	ಬಳಕೆ ಕನ್ನಡ	1	0	0	04	50	50	100
AE	22MA2HSSAK	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ	1	0	0	04	50	50	100
AE	22MA2AEPWE	Professional Writing Skills in English	1	0	0	04	50	50	100
HSS	22MA1HSCIP / 22MA2HSCIP	Constitution of India and Professional Ethics	1	0	0	01	50	50	100

Department: Mathematics and Humanities**Semester: III**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	23MA3BSMML	Mathematical Foundation for Machine Learning - 1	2	0	1	3	50	50	100
MAT	23MA3BSSDM	Statistics and Discrete Mathematics	2	1	0	3	50	50	100
MAT	23MA3BSTFN	Transform Calculus, Fourier Series and Numerical Techniques	2	1	0	3	50	50	100
MAT	23MA3BSMCV	Mathematics for Civil Engineering - 3	2	1	0	3	50	50	100
MAT	22MA3BSMAT	Additional Mathematics - 1	2	1	0	3	50	-	-
AE	23MA3HSENG/ 23MA4HSENG	Functional English (Lateral Entry Students)	0	0	0	0	-	-	-

Department: Mathematics and Humanities**Semester: IV**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	23MA4BSCPS	Complex Analysis, Probability and Statistical Methods	2	1	0	3	50	50	100
MAT	23MA4BSLAO	Linear Algebra and Optimization	2	1	0	3	50	50	100
MAT	23MA4BSMML	Mathematical Foundation for Machine Learning – 2	2	1	0	3	50	50	100
MAT	23MA4BSMMD	Mathematical Methods for Medical Electronics	2	1	0	3	50	50	100
MAT	23MA4BSBDE	Biostatistics and Design of Experiments	2	1	0	3	50	50	100
MAT	23MA4BSSAP	Statistics and Probability	2	1	0	3	50	50	100
MAT	22MA4BSMAT	Additional Mathematics - II	2	1	0	3	50	-	-
AE	23MA3HSENG/ 23MA4HSENG	Functional English (Lateral Entry Students)	0	0	0	0	-	-	-

Department: Mathematics and Humanities**Semester: VI**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	23MA6OESFE	Mathematical Statistics for Engineers	2	1	0	3	50	50	100
MAT	20MA6IENME	Numerical Methods for Engineers	3	0	0	3	50	50	100

Department: Mathematics and Humanities**Semester: VII**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	21MA7OENMT	Number Theory	3	0	0	3	50	50	100
MAT	21MA7IECGT	Computational Graph Theory	3	0	0	3	50	50	100

Department: Mathematics and Humanities**Semester: VIII**

Course Type	Course Code	Course Title	Credits			Total Credits	Marks		
			L	T	P		CIE	SEE	Total
MAT	21MA8IELIA	Linear Algebra	3	0	0	3	50	50	100



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

FIRST SEMESTER B. E. (CV, EEE, ETE, ECE, MD, EIE, ME, IEM, AS, CH)

Course Title	Mathematical Foundation for Civil, Electrical and Mechanical Engineering stream- 1	Course Code	23MA1BSC EM
Credits	04	L – T – P	3-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus and Matrix theory in Engineering.
- **Gain the knowledge** of Calculus and Matrix theory concepts to implement them in their core domain.
- Improve their **mathematical thinking** and **acquire skills** required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain functioning of various concepts.
- Encourage collaborative (Group Learning) learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT - 1

[09 hours]

Calculus of One Variable:

Introduction to polar coordinates, polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations.

Curvature and Radius of curvature – Cartesian, Parametric, Polar forms.

Self-study: Center and circle of curvature, evolutes and involutes.

Teaching-Learning Process

Chalk and talk method / Power Point Presentation



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<u>UNIT - 2</u>		[10 hours]
Multivariable Calculus Partial differentiation, total derivative - differentiation of composite functions, Jacobian, Taylor's and Maclaurin's series expansion for two variables (statement only) – problems. Applications: Errors and approximations, Maxima and minima for a function of two variables. Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[09 hours]
Ordinary Differential Equations of First Order Introduction to first order ordinary differential equations. 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: Mixing problem, Orthogonal trajectories. Self-Study: Nonlinear differential equations - Introduction to general and singular solutions, solvable for p, for x and y. Clairaut's equations. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[10 hours]
Ordinary Differential Equations of Higher Order Higher-order linear ordinary differential equations with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations. Applications: L-R-C series circuits Self-Study: Formulation and solution of Cantilever beam. Finding the solution by the method of undetermined coefficients. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[10 hours]
Matrices and System of equations Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method, approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Balancing chemical equations, traffic flow. Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem. (RBT Levels: L1, L2 and L3)		



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Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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Course outcomes (Course Skills Set)

After completing the course successfully, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA1BSCCEM	CO 1	Apply the concepts of Calculus and Matrix theory in solving problems.	1	3
	CO 2	Relate the importance of Calculus and Matrix theory concepts to Engineering.	1	1
	CO 3	Demonstrate the understanding of Calculus and Matrix theory concepts through programming skills using modern tool.	1,5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 3, 5 and two questions each from Unit 2 and Unit 4.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay**: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

Reference Books

1. **V. Ramana**: "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed., 2017
2. **S. Pal and S. C. Bhunia**: "Engineering Mathematics", Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and M. Goyal**: "A textbook of Engineering Mathematics", Laxmi Publications, 10th Ed., 2022.
4. **C. R. Wylie, L. C. Barrett**: "Advanced Engineering Mathematics", McGraw – Hill Book Co., New York, 6th Ed., 2017.



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5. **C. B. Gupta, S. R. Sing and M. Kumar:** “Engineering Mathematic for Semester I and II”, McGraw Hill Education (India) Pvt. Ltd, 2015.
6. **H. K. Dass and Er. R. Verma:** “Higher Engineering Mathematics”, S. Chand Publication, 3rd Ed., 2014.
7. **J. Stewart:** “Calculus”, Cengage Publications, 7th Ed., 2019.
8. **G. Williams:** “Linear Algebra with applications”, Jones Bartlett Publishers Inc., 6th Ed., 2017.

Web links and Video Lectures (e-Resources):

1. Calculus of one and multivariable: <https://nptel.ac.in/courses/111104092>
2. Differential Equations: <https://www.classcentral.com/course/differential-equations-engineers-13258> and <https://nptel.ac.in/courses/111106100>
3. Matrices and System of Equations: <https://www.classcentral.com/course/matrix-algebra-engineers-11986> and <https://nptel.ac.in/courses/111106051>
4. Python: https://spokentutorial.org/tutorialsearch/?search_foss=Python%203.4.3&search_language=English&page=1



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SYLLABUS (2023 - 2024)

FIRST SEMESTER B.E. (CS, IS, ML, DS, IOT, CSB, Computer and Management, BT)

Course Title	Mathematical foundation for Computer Science stream -1	Course Code	23MA1BSMCS
Credits	4	L – T – P	3-1-0

Course Objectives: The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Congruences and Matrix theory in computer and allied engineering science.
- **Gain the knowledge** of Calculus, Congruences and Matrix theory concepts to implement them in their core domain.
- Improve their **mathematical thinking** and **acquire skills** required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT - 1

[09 hours]

Calculus of One Variable:

Introduction to polar coordinates, polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations.

Curvature and Radius of curvature - Cartesian, Parametric, Polar forms.

Self-study: Center and circle of curvature, evolutes and involutes.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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<u>UNIT - 2</u>		[10 hours]
Multivariable Calculus Partial differentiation, total derivative - differentiation of composite functions, Jacobian, Taylor's and Maclaurin's series expansion for two variables (statement only) – problems. Applications: Maxima and minima for a function of two variables, Gradient descent method. Self-study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[09 hours]
Ordinary Differential Equations (ODEs) of First Order Introduction to first order ordinary differential equations. 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: Growth and decay, Orthogonal trajectories. Self-Study: Nonlinear differential equations - Introduction to general and singular solutions, solvable for p, for x and y. Clairaut's equations. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[10 hours]
Congruences and its applications Introduction to Congruences, Linear Congruences, The Chinese Remainder theorem, Solving Polynomials, Linear Diophantine Equation, Euler's Theorem, Wilson Theorem and Fermat's little theorem. Application: RSA algorithm. Self-Study: Divisibility, GCD, Properties of Prime Numbers, Fundamental theorem of Arithmetic. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[10 hours]
Matrices and System of equations Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method, approximate solution by Gauss-Seidel method. Eigenvalues and eigenvectors, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector. Applications: Balancing chemical equations, Traffic flow. Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method. Inverse of a square matrix by Cayley- Hamilton theorem. (RBT Levels: L1, L2 and L3).		



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Teaching-Learning Process

Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA1BSMCS	CO 1	Apply the concepts of Calculus, Congruences and Matrix theory in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Congruences and Matrix theory in computer science stream.	1	1
	CO 3	Demonstrate the understanding of Calculus, Congruences and Matrix theory through programming skills using modern tool.	1,5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 3, 5 and two questions each from Unit 2 and Unit 4.

Suggested Learning Resources:

Text Books

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. D. C. Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
4. T. Koshy: "Elementary number theory with applications", Elsevier Science, 2nd Ed., 2007.

Reference Books

1. B. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. S. Pal and S. C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
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4. **C. R. Wylie, L. C. Barrett:** “Advanced Engineering Mathematics” McGraw – Hill Book Co., Newyork, 6th Ed., 2017.
5. **C. B. Gupta, S. R. Sing S. R. and M. Kumar:** “Engineering Mathematic for Semester I and II”, Mc-Graw Hill Education(India) Pvt. Ltd 2015.
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9. **W. Stallings:** “Cryptography and Network Security” Pearson Prentice Hall, 6th Ed., 2013.

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3. Congruences and its applications: <https://www.classcentral.com/course/youtube-math-455-number-theory-90833/classroom> and <https://nptel.ac.in/courses/111101137>
4. Matrices and System of Equations: <https://www.classcentral.com/course/matrix-algebra-engineers-11986> and <https://nptel.ac.in/courses/111106051>
5. Python: https://spokentutorial.org/tutorialsearch/?search_foss=Python%203.4.3&search_language=English&page=1



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

SECOND SEMESTER B. E. (CV, ME, IEM, AS, CH)

Course Title	Mathematical foundation for Civil and Mechanical Engineering stream – 2	Course Code	23MA2BSMCM
Credits	04	L – T – P	3-1-0

Course Objectives: The goal of the course is to

- **Appreciate** the importance of calculus and numerical methods in the field of civil and mechanical engineering stream.
- **Gain the knowledge** of calculus and numerical methods in the field of civil and mechanical engineering stream.
- Improve their **mathematical thinking** and **acquire skills** required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
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- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT - 1

[11 hours]

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: Area(polar curves), Volume by triple integral, Mass of a plane laminar region.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Self-Study: Moment of Inertia along a particular direction.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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<u>UNIT - 2</u>		[10 hours]
VECTOR CALCULUS Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Vector Integration: Line integrals, Green's theorem and Stokes' theorem. Application: Work done by a force. Self-Study: Velocity and acceleration of a moving particle. Gauss divergence theorem. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[10 hours]
PARTIAL DIFFERENTIAL EQUATIONS Formation of partial differential equations (PDE) by elimination of arbitrary constants and functions. Solution of nonhomogeneous PDE by direct integration. Solution of Lagrange's linear PDE. Solution of homogeneous PDE by separation of variables. Applications: Mathematical modelling in terms of one-dimensional heat equation and wave equation. Self-Study: Solution of one-dimensional heat equation and wave equation by the method of separation of variables. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[09 hours]
NUMERICAL METHODS -1 Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. Numerical integration: Simpson's (1/3) rd rule, Simpson's (3/8) th rule and Weddle's rule. Applications: Estimating the velocity, acceleration, area, volume. Self-Study: Bisection method, Newton's divided difference formula. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[08hours]
NUMERICAL METHODS -2 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, Applications: Finding approximate solutions to ODE related to engineering field. Self-Study: Adam-Bashforth method.		



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(RBT Levels: L1, L2 and L3)	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation

Course outcomes (Course Skills Set)

After completing the course successfully, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA1BSMCS	CO 1	Apply the concepts of Calculus, Congruences and Matrix theory in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Congruences and Matrix theory in computer science stream.	1	1
	CO 3	Demonstrate the understanding of Calculus, Congruences and Matrix theory through programming skills using modern tool.	1,5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
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SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 4, 5 and two questions each from Unit 1 and Unit 3.

Suggested Learning Resources:

Text Books

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2. **Srimanta Pal & Subodh C. Bhunia:** “Engineering Mathematics” Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and Manish Goyal:** “A textbook of Engineering Mathematics” Laxmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** “Advanced Engineering Mathematics” McGraw – Hill Book Co., New York, 6th Ed., 2017.
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6. **H. K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.
7. **James Stewart:** “Calculus” Cengage Publications, 7th Ed., 2019.
8. **Gareth Williams:** “Linear Algebra with applications”, Jones Bartlett Publishers Inc., 6th Ed., 2017.

Web links and Video Lectures (e-Resources):

1. Integral Calculus: <https://www.classcentral.com/course/youtube-integral-calculus-90616> and <https://www.edx.org/course/mathtrackx-integral-calculus>
2. Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
3. Vector Calculus: <https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroom> and <https://www.classcentral.com/course/vector-calculus-engineers-17387>
4. Partial Differential Equations: <https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/>, <https://archive.nptel.ac.in/courses/111/101/111101153/> and <https://nptel.ac.in/courses/111103021> and <https://www.classcentral.com/course/swayam-partial-differential-equations-17721>
5. Numerical Methods: <https://www.classcentral.com/course/numerical-methods-engineers-32822>, <https://nptel.ac.in/courses/111107105> and <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

SECOND SEMESTER B.E. . (CS, IS, ML, DS, IOT, CSB, Computer and Management, BT)

Course Title	Mathematical foundation for Computer Science Stream-2	Course Code	23MA2BSMCS
Credits	4	L – T – P	3-1-0

Course Objectives: The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Linear Algebra and Numerical methods in computer and allied engineering science.
- **Gain the knowledge** of concepts of Calculus, Linear Algebra and Numerical techniques to implement them in their core domain.
- Improve their **mathematical thinking** and **acquire skills** required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain functioning of various concepts.
- Encourage collaborative (Group Learning) learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT -1

[11 hours]

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: Area(polar curves), Volume by triple integral.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Self-Study: Duplication formula. Moment of Inertia along a particular direction.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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<u>UNIT - 2</u>		[09 hours]
VECTOR CALCULUS Scalar and vector fields. Gradient, curl and divergence – physical interpretation, solenoidal and irrotational vector fields. Orthogonal Curvilinear coordinates: Scale factors, base vectors, transformation between cartesian and curvilinear systems, Cylindrical polar coordinates, Spherical polar coordinates. Applications: Directional derivative. Self-Study: Area element, volume element in orthogonal curvilinear coordinates. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[11 hours]
VECTOR SPACE AND LINEAR TRANSFORMATIONS Vector spaces: Definition and examples, subspace, linear span, Linearly independent and dependent sets, Basis and dimension. Linear transformations: Definition and examples, Matrix of a linear transformation. Rank and nullity of a linear operator, rank-nullity theorem. Applications: Geometric linear transformation in R^2 for image processing. Self-study: Eigen spaces of a linear transformation. Invertible linear operators. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[09 hours]
NUMERICAL METHODS -1 Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. Numerical integration: Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule. Applications: Estimating the velocity, acceleration, area, volume. Self-Study: Bisection method, Newton's divided difference formula. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[08 hours]
NUMERICAL METHODS -2 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, Applications: Finding approximate solutions to ODE related to engineering field. Self-Study: Adam-Bashforth method. (RBT Levels: L1, L2 and L3).		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	



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Course outcomes (Course Skills Set)

After completing the course successfully, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA2BSMCS	CO 1	Apply the concepts of Calculus, Linear Algebra and numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Linear Algebra and numerical methods in computer science stream.	1	1
	CO 3	Demonstrate the understanding of Calculus, Linear Algebra and numerical methods through programming skills using modern tool.	1, 5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 4, 5 and two questions each from Unit 1 and Unit 3.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal:** "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **D. C. Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

Reference Books

1. **V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed., 2017
2. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and Manish Goyal:** "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., New York, 6th Ed., 2017.



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DEPARTMENT OF MATHEMATICS

5. **Gupta C.B., Sing S. R. and Mukesh Kumar:** “Engineering Mathematic for Semester I and II”, Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. **H. K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.
7. **James Stewart:** “Calculus” Cengage Publications, 7th Ed., 2019.
8. **Gareth Williams:** “Linear Algebra with applications”, Jones Bartlett Publishers Inc., 6th Ed., 2017.

Web links and Video Lectures (e-Resources):

1. Integral Calculus: <https://www.classcentral.com/course/youtube-integral-calculus-90616b> and <https://www.edx.org/course/mathtrackx-integral-calculus>
2. Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
3. Vector Calculus: <https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroom> and <https://www.classcentral.com/course/vector-calculus-engineers-17387>
4. Vector spaces and Linear Transformations: <https://nptel.ac.in/courses/111104137>, <https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/> and <https://www.classcentral.com/subject/linear-algebra>
5. Numerical Methods: <https://www.classcentral.com/course/numerical-methods-engineers-32822>, <https://nptel.ac.in/courses/111107105> and <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

SECOND SEMESTER B. E. (EEE, ETE, ECE, MD, EIE)

Course Title	Mathematical foundation for Electrical stream – 2	Course Code	23MA2BSMES
Credits	4	L – T – P	3-1-0

Course Objectives:

The objectives of the course are to facilitate the learners to

- **Appreciate** the importance of Calculus, Linear Algebra and Numerical methods in Electrical stream.
- **Gain the knowledge** of Calculus, Linear Algebra and Numerical methods in Electrical and allied engineering sciences.
- Improve their **mathematical thinking** and **acquire skills** required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Topics will be introduced in a multiple representation and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT - 1

[11 hours]

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: Area (polar curves), Volume by triple integral.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions.

Self-Study: Duplication formula. Moment of Inertia along a particular direction.

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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<u>UNIT - 2</u>		[9 hours]
VECTOR CALCULUS Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Vector Integration: Line integrals, Green's theorem and Stokes' theorem. Application: Work done by a force. Self-Study: Volume integral and Gauss divergence theorem. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[11 hours]
VECTOR SPACE AND LINEAR TRANSFORMATIONS Vector spaces: Definition and examples, subspace, linear span, Linearly independent and dependent sets, Basis and dimension. Linear transformations: Definition and examples, Matrix of a linear transformation. Rank and nullity of a linear operator, rank-nullity theorem. Applications: Geometric linear transformation in R^2 for image processing. Self-study: Eigen spaces of a linear transformation. Invertible linear operators. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[09 hours]
NUMERICAL METHODS -1 Solution of algebraic and transcendental equations: Newton-Raphson method. Finite differences, Newton's forward and backward interpolation. Lagrange's interpolation and Lagrange's inverse Interpolation. Numerical integration: Simpson's $(1/3)^{rd}$ rule, Simpson's $(3/8)^{th}$ rule and Weddle's rule. Applications: Estimating the velocity, acceleration, area, volume. Self-Study: Bisection method, Newton's divided difference formula. (RBT Levels: L1, L2 and L3)		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[08 hours]
Numerical methods - 2 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, Applications: Finding approximate solutions to ODE related to Electrical engineering field. Self-Study: Adam-Bashforth method. (RBT Levels: L1, L2 and L3).		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	



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Course outcomes (Course Skills Set)

After completing the course successfully, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA2BSMES	CO 1	Apply the concepts of Calculus, Linear Algebra and Numerical methods in solving problems.	1	3
	CO 2	Relate the importance of Calculus, Linear Algebra and Numerical methods in Electrical stream.	1	1
	CO 3	Demonstrate the understanding of Calculus, Linear Algebra and Numerical methods through programming skills using modern tool.	1, 5	2

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 4, 5 and two questions each from Unit 1 and Unit 3.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal:** "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.
3. **David C Lay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

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2. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016.
3. **N. P. Bali and Manish Goyal:** "A textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw – Hill Book Co., Newyork, 6th Ed., 2017.



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5. **Gupta C.B., Sing S. R. and Mukesh Kumar:** “Engineering Mathematic for Semester I and II”, Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. **H. K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication, 3rd Ed., 2014.
7. **James Stewart:** “Calculus” Cengage Publications, 7th Ed., 2019.
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2. Integral and Vector Calculus: https://onlinecourses.nptel.ac.in/noc22_ma03/preview
3. Vector Calculus: <https://www.classcentral.com/course/mit-opencourseware-multivariable-calculus-fall-2007-40962/classroom> and <https://www.classcentral.com/course/vector-calculus-engineers-17387>
4. Partial Differential Equations: <https://ocw.mit.edu/courses/18-152-introduction-to-partial-differential-equations-fall-2011/>, <https://archive.nptel.ac.in/courses/111/101/111101153/> and <https://nptel.ac.in/courses/111103021> and <https://www.classcentral.com/course/swayam-partial-differential-equations-17721>
5. Numerical Methods: <https://www.classcentral.com/course/numerical-methods-engineers-32822>, <https://nptel.ac.in/courses/111107105> and <https://ocw.mit.edu/courses/18-335j-introduction-to-numerical-methods-spring-2019/>



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

THIRD SEMESTER B. E.

(COMMON TO ALL BRANCHES EXCEPT CIVIL ENGG. & CS-STREAM)

Course Title	TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES	Course Code	23MA3BSTFN
Credits	03	L – T – P	2-1-0
Contact Hours	39		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Series, Transforms and Numerical Techniques in Engineering Problems.
- Acquire the knowledge of Series, Transforms and Numerical Techniques to apply them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

LAPLACE TRANSFORMS:

[08 hours]

Definition and Laplace transform of standard functions (statements only). Problems on Laplace transform of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of derivatives and integrals. Laplace Transform of periodic functions (statement only) and unit-step function – Problems.

Inverse Laplace transforms: definition and problems. Solution of differential equations.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-2

FOURIER SERIES:

[08 hours]

Introduction to trigonometric polynomial, trigonometric series. Dirichlet's conditions. Fourier series of periodic functions with period 2π and arbitrary period. Complex Fourier series. Practical harmonic analysis.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-3

FOURIER TRANSFORMS:

[08 hours]

Definition and problems on Fourier Transform. Fourier sine and cosine transforms – Problems. Inverse Fourier transform, Inverse Fourier cosine and sine transforms - Problems. Convolution theorem (only statement) – problems.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-4

NUMERICAL SOLUTION OF PDE:

[07 hours]

Classification of second-order partial differential equations, finite difference approximation of derivatives. Solution of one-dimensional heat equation by Schmidt and Bendre-Schmidt explicit formulae. Solution of one-dimensional wave equation using finite difference method.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-5

CALCULUS OF VARIATIONS:

[08 hours]

Definition, Variation of a functional, Euler-Lagrange equation, variational problems.

Applications: Hanging cable problem, Brachistochrone problem.

Z-TRANSFORMS:

Definition, Standard Z-transforms, Damping rule, Shifting rule. Inverse Z-transform and applications – Solution of difference equations.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSTFN	CO 1	Techniques, Calculus of Variation and Finite Difference Apply the concepts of Series, Transform Methods to solve engineering problems.	1	3
	CO 2	Apply the concepts of Transform Techniques, Calculus of Variation and Finite Difference Methods in engineering using modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.



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SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 3 & 4 and two questions each from Unit 1 and Unit 5.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. B.V. Ramana: "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed.
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. N. P Bali and Manish Goyal: "A textbook of Engineering Mathematics", Laxmi Publications.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics", McGraw-Hill Book Co. New York, 6th Edition.
5. Gupta C.B, Sing S. R. and Mukesh Kumar: "Engineering Mathematics for Semester I and II", Mc-Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics", S. Chand Publication (2014).
7. James Stewart: "Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
2. <http://academicearth.org/>
3. <http://www.bookstreet.in.>
4. [VTU e-Shikshana Program](#)
5. [VTU EDUSAT Program](#)



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SYLLABUS (2023-2024)

THIRD SEMESTER B.E. COURSE (CS CLUSTER except Machine Learning)

Course Title	Statistics and Discrete Mathematics	Course Code	23MA3BSSDM
Credits	03	L – T – P	2 – 1 – 0
Contact hours	39		

Prerequisites: Basic concepts of Permutations, Combinations, probability, statistics, G.C.D., L.C.D., divisors and primes.

Course Objectives: The goal of the course is to

- Appreciate the importance of Discrete Mathematics and statistics in computer and allied engineering science.
- Acquire the knowledge of Discrete Mathematics and Statistics applied in their core domain.
- Improve their Mathematical Thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain the functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

GRAPH THEORY

[08 hours]

Basic concepts: Types of graphs, order and size of a graph, in-degree and out-degree, connected and disconnected graphs, Eulerian graphs, Hamiltonian graphs, sub-graphs, and Isomorphic graphs. Matrix representation of graphs: adjacency matrix, incidence matrix. Trees: spanning tree, minimal spanning tree: Kruskal's algorithm and shortest path-Dijkstra's algorithm

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-2

PROBABILITY DISTRIBUTIONS

[08 hours]

Theoretical distributions: Discrete and continuous random variables

Discrete distributions: Poisson distribution, Geometric distributions. Continuous distributions: Exponential, Gaussian, Uniform Distribution and Gamma distributions.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-3

JOINT PROBABILITY AND MARKOV CHAIN

[08 hours]

Joint Probability Distributions: Discrete and continuous joint random variables, Mathematical expectations, Covariance, and Correlation.

Markov Chain: Probability vector, stochastic matrix, fixed point vector, regular stochastic matrix. Higher transition probabilities, stationary distribution of regular Markov chain.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-4

STATISTICAL INFERENCE

[08 hours]

Introduction, procedure for testing of hypothesis, level of significance.

Large sample: Test of significance for single mean and difference between two means.

Small sample: Test of significance for single mean, the difference between two means, paired t-test, ratio of variances (F-distribution) and Chi-Square goodness of fit.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-5

COMBINATORICS

[07 hours]

Introduction, Binomial and multinomial theorems, Catalan numbers, the principle of inclusion and exclusion, Derangements, Rook Polynomials.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSSDM	CO 1	Apply the concept of Discrete Mathematics and Statistics in Computer and Allied Engineering Science.	1	3
	CO 2	Demonstrate the Importance of Discrete Mathematics and Statistics using Modern IT Tools.	1 & 5	3



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 3 & 5 and two questions each from Unit 1 and Unit 4.

Text Books:

1. Graph Theory and Combinatorics, D. S. Chandrasekharaiah, 4th edition, 2011-12, Prism Engineering Education Series.
2. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.
3. Discrete Mathematics and its applications, Kenneth H. Rosen, 7th edition, McGraw Hill Publishers.

Reference Books:

1. Discrete Mathematics, Kolman, Busby Ross, 5th Edition, 2004, Prentice Hall.
2. Graph Theory with Applications to Engineering and Computer Science, Narsingh Deo, Eastern Economy Edition, PHI Learning Pvt., Ltd.
3. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.

E-books and online course materials:

1. <http://jlmartin.faculty.ku.edu/~jlmartin/courses/math725-S16/>
2. https://www.whitman.edu/mathematics/cgt_online/cgt.pdf

Online Courses and Video Lectures:

1. <https://www.coursera.org/learn/probability-intro>
2. [https://nptel.ac.in/courses/111104026/\(DiscreteMathematics\)](https://nptel.ac.in/courses/111104026/(DiscreteMathematics))
3. [https://nptel.ac.in/courses/111106086/\(Combinatorics\)](https://nptel.ac.in/courses/111106086/(Combinatorics))



SYLLABUS (2023-2024)

THIRD SEMESTER B.E. COURSE

(Artificial Intelligence and Machine Learning)

Course Title	Mathematical Foundation for Machine Learning - 1	Course Code	23MA3BSMML
Credits	03	L – T – P	2-0-1
Contact hours	26 + 0 + 13		

Course Objectives:

The objectives of the course are to facilitate the learners to

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

LINEAR TRANSFORMATIONS -1

[6 hours]

Linear transformations, Matrix as a linear transformation, matrix representation of linear transformations, one-one and onto transformations, singular and non-singular transformations, Determinant of Large matrices and its complexity.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-2

LINEAR TRANSFORMATIONS -2

[5 hours]

Algebra of linear transformations, Geometric linear transformations, Composition of linear transformations, Affine Subspaces, Affine transformations.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-3

VECTOR NORMS AND INNER PRODUCT SPACES

[5 hours]

Norms, Vector norms, matrix norms, L_1 norm, L_∞ norm, the Frobenius norm, condition number, Inner products, lengths and distances, angles and orthogonality, inner product of functions, orthonormal basis.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-4

APPLICATIONS OF INNER PRODUCT

[5 hours]

Orthogonal complements, Orthogonal projections, Gram-Schmidt process, Orthogonal matrices, least square approximations, rotations, metric spaces.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-5

EIGENVALUES AND EIGENVECTORS

[5 hours]

Eigenspaces, Spectral norm, characteristic and minimal polynomials, Eigen decompositions and diagonalizations, diagonalization of symmetric matrices.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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MATHEMATICS LAB:

2 hours/week per batch of 15 students

1 Introduction + 10 lab sessions + 1 repetition class + 1 Lab Assessment

List of Laboratory experiments:

Lab-0: Introduction

Lab-1: Finding Coordinates of vectors and Matrix of linear maps.

Lab-2: Recursive formula for finding large determinants.

Lab-3: Finding composition and inverse of linear transformations.

Lab-4: Plotting linear and affine transformations.

Lab-5: Finding L_1 , L_∞ and Frobenius norms of vectors and matrices.

Lab-6: Finding angles between vectors and checking orthogonality.

Lab-7: Construction of orthonormal basis.

Lab-8: Least-Square solution of linear system of equations.

Lab-9: Finding eigenspaces and calculating spectral norms.

Lab-10: Eigen decomposition of matrices.

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSMML	CO 1	Apply the concepts of Calculus and Linear Algebra to problems in Machine learning.	1	3
	CO 2	Apply the concepts of Calculus and Linear Algebra to Machine learning through modern IT tools.	1 & 5	3



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 2 and 4 and two questions each from Units 3 and 5.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020
2. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
3. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
4. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
2. <https://www.math.ucdavis.edu/~linear/linear.pdf>

Online Courses and Video Lectures:

1. <https://www.coursera.org/learn/linear-algebra-machine-learning>
2. <https://nptel.ac.in/syllabus/111106051/>



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SYLLABUS (2023-2024)

THIRD SEMESTER B.E.

(CIVIL ENGINEERING)

Course Title	Mathematics for Civil Engineering – 3	Course Code	23MA3BSMCV
Credits	03	L – T – P	2-1-0
Contact Hours	39		

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Statistical methods, Probability, Series and Numerical techniques in Engineering Problems.
- Acquire the knowledge of Statistical methods, Probability, Series and Numerical techniques to apply them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and provide real-life examples.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

STATISTICAL METHODS:

[08 hours]

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = ax^b$) by the method of least squares.

Correlation and regression - Karl Pearson's coefficient of correlation and rank correlation. Lines of regression, angle between two regression lines.

Teaching-Learning Process

Chalk and talk method / PowerPoint Presentation

UNIT-2

PROBABILITY DISTRIBUTIONS:

[08 hours]

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Poisson and normal distributions.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Teaching-Learning Process

Chalk and talk method / PowerPoint Presentation



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UNIT-3

LAPLACE TRANSFORMS:

[08 hours]

Definition and Laplace transform of standard functions (statements only). Problems on Laplace transform of $e^{at}f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace transforms of derivatives and integrals. Laplace Transform of periodic functions (statement only) and unit-step function – Problems.
Inverse Laplace transforms: definition and problems. Solution of differential equations.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-4

FOURIER SERIES:

[08 hours]

Introduction to trigonometric polynomial, trigonometric series. Dirichlet's conditions. Fourier series of periodic functions with period 2π and arbitrary period. Practical harmonic analysis.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-5

NUMERICAL SOLUTION OF PDE:

[07 hours]

Classification of second-order partial differential equations, finite difference approximation of derivatives. Solution of one-dimensional heat equation by Schmidt and Bendre-Schmidt explicit formulae. Solution of one-dimensional wave equation using finite difference method.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA3BSMCV	CO 1	Apply the concepts of Statistics, Probability, Series and Numerical techniques to solve engineering problems.	1	3
	CO 2	Apply the concepts of Statistics, Probability, Series and Numerical techniques to engineering problems using modern IT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
	Test 3	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.



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SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 4 & 5 and two questions each from Unit 1 and Unit 3.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed.
2. S. Pal & S. C. Bhunia, "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. N. P. Bali and M. Goyal, "A textbook of Engineering Mathematics", Laxmi Publications.
4. D. G. Zill, "Advanced Engineering Mathematics", Jones and Bartlett learning, 6th Ed, 2018.
5. C. R. Wylie, L. C. Barrett, "Advanced Engineering Mathematics", McGraw–Hill Book Co. New York, 6th Edition.
6. H. K. Dass and R. Verma, "Higher Engineering Mathematics", S. Chand Publication (2014).

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
2. <http://academicearth.org/>
3. <http://www.bookstreet.in>
4. [VTU e-Shikshana Program](#)
5. [VTU EDUSAT Program](#)



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SYLLABUS (2022 - 2023)

FOURTH SEMESTER B. E.

(Common to AS/ME /EEE/ECE/ET/EIE)

Course Title	Complex Analysis, Probability and Statistical Methods	Course Code	23MA4BSCPS
Credits	03	L – T – P	2-1-0
Contact Hours	40		

COURSE OBJECTIVES: The goal of the course is to:

- Appreciate the importance of Complex Analysis, Special Functions, Probability and Statistics in Engineering.
- Acquire the knowledge of Complex Analysis, Special Functions, Probability and Statistics applied in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skill.

UNIT-1

COMPLEX ANALYSIS

[08 hours]

Review of a function of a complex variable, limits, continuity and differentiability.

Analytic functions, Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula and problems.

Conformal mapping: $w = z^2$ and $w = z + \frac{k^2}{z}$ ($z \neq 0$).

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-2

SPECIAL FUNCTIONS:

[08 hours]

Introduction, Ordinary and Singular Points, Series solution of Bessel's differential equation leading to $J_n(x)$, Bessel's function of the first kind, Properties, generating function for $J_n(x)$. Series solution of Legendre's differential equation leading to $P_n(x)$. Legendre polynomials, Rodrigue's formula (without proof) - Problems.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-3

STATISTICAL METHODS:

[08 hours]

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = ax^b$) by the method of least squares.

Correlation and regression - Karl Pearson's coefficient of correlation and rank correlation. Lines of regression, angle between two regression lines.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-4

PROBABILITY DISTRIBUTIONS:

[08 hours]

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Poisson and normal distributions.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Teaching-Learning Process	Chalk and Board, Problem-based learning / Presentation
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UNIT-5

STATISTICAL INFERENCE:

[08 hours]

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means (single mean and difference between two means), student's t-distribution (single mean and difference between two means), Chi-square distribution-goodness of fit.

Teaching-Learning Process	Chalk and Board, Problem-based learning / Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSCPS	CO 1	Apply the concepts of complex variables, special functions, probability and statistics to solve engineering problems.	1	3
	CO 2	Apply the concepts of complex variables, special functions and statistical methods using modern IT tools.	1 & 5	3



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 4, 5 and two questions each from Unit 1 and Unit 3.

SUGGESTED LEARNING RESOURCES:

TEXT BOOKS:

1. Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
2. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics C. Ray Wylie, Louis C. Barrett McGraw-Hill, 6th Edition 1995.
2. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition, 2010.
3. A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014.
4. Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. <http://www.bookstreet.in>
5. [VTU EDUSAT PROGRAMME – 20](#)
6. [VTU e-Shikshana Program](#)



SYLLABUS (2023-2024)
FOURTH SEMESTER B.E. COURSE
(CS CLUSTER Except AIML)

Course Title	Linear Algebra and Optimization	Course Code	23MA4BSLAO
Credits	03	L – T – P	2-1-0
Contact hours	40		

Course Objectives:

The objectives of the course are to facilitate the learners to

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

CONTINUOUS OPTIMIZATION – 1

[7 hours]

Function of several variables, partial differentiation, local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-2

CONTINUOUS OPTIMIZATION-2

[7 hours]

Optimization using gradient descent/ascent and NR method.

Sequential search 3-point search and Fibonacci search.

Constrained Optimization, Method of Lagrange multipliers, KKT optimality conditions.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-3

INNER PRODUCT SPACES

[7 hours]

Inner products, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt orthogonalization process, QR-factorization, least squares problem and least square error. Curve fitting – Principle of least squares, fitting a straight line and fitting a parabola.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-4

EIGENVALUES AND EIGENVECTORS

[7 hours]

Introduction, Polynomials of Matrices, Cayley-Hamilton Theorem, eigen spaces of a linear transformation, Characteristic and Minimal Polynomials of Block Matrices, Jordan Canonical form.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-5

MATRIX DECOMPOSITION AND THEIR APPLICATIONS

[8 hours]

Diagonalization, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, rank and signature of real quadratic forms, Singular value decomposition. Dimensional reduction – PCA.

Teaching-Learning Process:	Chalk and Board, Problem based learning
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSLIA	CO 1	Apply the concepts of linear algebra in Computer and Allied Engineering Sciences.	1	3
	CO 2	Demonstrate the applications of computer science and Allied Engineering Science using modern ICT tools.	1 & 5	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.



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SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 2 and 5 and two questions each from Units 3 and 4.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
2. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
2. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020
3. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
4. Mathematics for Machine learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
2. <https://www.math.ucdavis.edu/~linear/linear.pdf>

Online Courses and Video Lectures:

1. <https://www.coursera.org/learn/linear-algebra-machine-learning>
2. <https://nptel.ac.in/syllabus/111106051/>



SYLLABUS (2023-2024)

FOURTH SEMESTER B.E. COURSE

(Artificial Intelligence and Machine Learning)

Course Title	Mathematical Foundation for Machine Learning – 2	Course Code	23MA4BSMML
Credits	03	L – T – P	2- 0 - 1
Contact hours	26 + 0 + 13		

Course Objectives:

The objectives of the course are to facilitate the learners to:

- Appreciate the importance of linear algebra in computer and allied engineering science.
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

MATRIX OPERATION IN MACHINE LEARNING

[6 hours]

Matrix decompositions – LU and Cholesky decomposition, singular value decomposition, Data compression with SVD, Dimensionality reduction - Principal Component Analysis, the Moore-Penrose pseudoinverse.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-2

VECTOR CALCULUS

[5 hours]

Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-3

APPLICATIONS OF VECTOR CALCULUS

[5 hours]

Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-4

UNIVARIATE OPTIMIZATION

[5 hours]

Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent and NR method, Legendre-Fenchel Transform and convex conjugates.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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UNIT-5

MULTIVARIABLE OPTIMIZATION

[5 hours]

Sequential search 3-point search and Fibonacci search, constrained optimization using Lagrange multipliers, KKT optimality conditions.

Teaching-Learning Process:	Chalk and Board, Problem-based learning
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MATHEMATICS LAB:

2 hours/week per batch of 15 students

1 Introduction + 10 lab sessions + 1 repetition class + 1 Lab Assessment

List of Laboratory experiments:

Lab-0: Introduction.

Lab-1: Finding LU and Cholesky decomposition.

Lab-2: Finding Singular value decomposition and PCA.

Lab-3: Automatic Differentiation and Backpropagation.

Lab-4: Computing gradients of vector-valued function and matrices.

Lab-5: Computing Hessian Matrices and their eigenvalues.

Lab-6: Computing minimum of quadratic functions using the Gradient descent method.

Lab-7: Finding minimum using NR method.

Lab-8: Lagrange's multiplier method for finding extremum values.

Lab-9: Sequential search 3-point search method.

Lab-10: Fibonacci search method.

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA4BSMML	CO 1	Apply the concepts of Calculus and Linear Algebra to problems in Machine learning.	1	3
	CO 2	Apply the concepts of Calculus and Linear Algebra to Machine learning through modern IT tools.	1 & 5	3



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 3 and 5 and two questions each from Units 1 and 4.

SUGGESTED LEARNING RESOURCES:

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. Linear Algebra and its applications, David C. Lay, Steven R. Lay, Judi J Mc. Donald, 6th Edition, 2021, Pearson Education.
3. Linear Algebra: An Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition, Academic press.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson, 2019, Fifth Edition.
3. Schaum's outline series -Theory and problems of linear algebra, Seymour Lipschutz, Marc Lipson, 6th edition, 2017, McGraw-Hill Education.
4. Linear Algebra and its Applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.
5. Linear Algebra, Kenneth Hoffman, Ray Kunze, 2nd edition, Pearson.

E-books and online course materials:

1. <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
2. <https://www.math.ucdavis.edu/~linear/linear.pdf>

Online Courses and Video Lectures:

1. <https://www.coursera.org/learn/linear-algebra-machine-learning>
2. <https://nptel.ac.in/syllabus/111106051/>



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023 - 2024)

FOURTH SEMESTER B. E. (Medical Electronics)

Course Title	Mathematical Methods for Medical Electronics	Course Code	23MA4BSMMD
Credits	03	L – T – P	2-1-0
Contact Hours	40		

COURSE OBJECTIVES: The goal of the course is to:

- Appreciate the importance of Complex Analysis, Special Functions, Probability and Statistics in Engineering.
- Acquire the knowledge of Complex Analysis, Special Functions, Probability and Statistics applied in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies, that teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skill.

UNIT-1

COMPLEX ANALYSIS

[08 hours]

Review of a function of a complex variable, limits, continuity and differentiability.

Analytic functions, Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method-Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem, Cauchy's integral formula and problems.

Conformal mapping: $w = z^2$ and $w = z + \frac{k^2}{z}$ ($z \neq 0$).

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-2

STATISTICAL METHODS:

[08 hours]

Curve Fitting: Fitting the straight line, parabola and geometric curve ($y = ax^b$) by the method of least squares.

Correlation and regression - Karl Pearson's coefficient of correlation and rank correlation-problems. Lines of regression, angle between two regression lines - problems.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-3

PROBABILITY DISTRIBUTIONS:

[08 hours]

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Poisson and normal distributions- problems - Illustrative examples.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-4

STATISTICAL INFERENCE-1:

[08 hours]

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means (single mean and difference between two means), student's t-distribution (single mean and difference between two means), paired t- test.

Teaching-Learning Process	Chalk and Board, Problem based learning / Presentation
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UNIT-5

STATISTICAL INFERENCE -2:

[08 hours]

Test of significance for single proportion [Large sample], difference between two proportions [Large sample], ratio of variances (F- distribution), Chi -Square distribution-goodness of fit. Analysis of variance (one-way).

Teaching-Learning Process	Chalk and Board, Problem based-learning / Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
22MA4BSCPS	CO 1	Apply the concepts of complex variables, probability and statistics to solve engineering problems.	1	3
	CO 2	Apply the concepts of complex variables, and statistical methods using modern IT tools.	1 & 5	3



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 3, 4, 5 and two questions each from Units 1 and 2.

SUGGESTED LEARNING RESOURCES:

TEXTBOOKS:

1. Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
2. Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995.
2. Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010.
3. A Text-Book of Engineering Mathematics, N. P. Bali and Manish Goyal Laxmi Publications 2014.
4. Advanced Engineering Mathematics, Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

WEB LINKS AND VIDEO LECTURES (E-RESOURCES):

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. <http://www.bookstreet.in>
5. [VTU EDUSAT PROGRAMME – 20](#)
6. [VTU e-Shikshana Program](#)



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DEPARTMENT OF MATHEMATICS

SYLLABUS (2023-2024)

FOURTH SEMESTER B.E. COURSE (BT)

Course Title	Biostatistics and Design of Experiments	Course Code	23MA4BSBDE
Credits	3	L – T – P	2-1-0
Contact hours	40		

Pre-requisites:

- Basic concepts of Statistics,
- Basic concepts of Probability- addition theorem, conditional probability, Bayes' theorem, discrete random variable - Binomial distribution.

Course Objectives:

- Students will get acquainted with the procedure of collecting, designing, analyzing, and drawing inferences about the data.
- To understand the fundamentals of design and the methods of optimization.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

- Explanation via real-life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
- Instructions with interactions in classroom lectures (physical/hybrid).
- Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
- Flipped classroom sessions (~10% of the classes).
- Industrial visits, Guest talks, and competitions for learning beyond the syllabus.
- Students' participation through audio-video-based content creation for the syllabus (as assignments).
- Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- Students' seminars (in solo or group) /oral presentations.

UNIT-1

STATISTICS & PROBABILITY DISTRIBUTIONS

[08 hours]

Curve fitting: $y = a + bx$, $y = a + bx + cx^2$, $y = ab^x$; Correlation and regression; Introduction to Probability; Discrete distribution - Poisson; Continuous distributions - Normal.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-2

STATISTICAL INFERENCE – I

[08 hours]

Introduction - Sampling, Estimation – point, interval; Construction of confidence interval; Procedure for testing of hypothesis- level of significance. Test of significance for single proportion [Large sample], difference between two proportions [Large sample], ratio of variances (F- distribution), Chi -Square distribution-goodness of fit.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-3

STATISTICAL INFERENCE – II [COMPARISON OF MEANS]

[08 hours]

Parametric test - Test of significance for single mean & difference of two means [Small & large sample], paired t- test, Analysis of variance (one-way).

Non-parametric test - Kruskal Wallis One Way Analysis of Variance by Ranks, Wilcoxon Signed Rank Test, Wilcoxon Mann-Whitney Test.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-4

DESCRIPTIVE STATISTICS

[08 hours]

Types of variables, measure of spread, logarithmic transformations, multivariate data. Basics of study design, cohort studies, model fitting.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-5

DESIGN AND ANALYSIS OF EXPERIMENTS

[08 hours]

Principles of experimental design, Randomized block design, Completely Randomized block design, Latin Square Design, Factorial Experiments with case studies.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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On completion of the course, student will have the ability to:

Course Code	CO#	Course Outcomes	PO	Strength
23MA4BSBDE	CO1	Analyze and interpret the statistical data for bioscience and allied engineering.	1, 2	3
	CO2	Design and demonstrate the use of Statistical tools to analyze the real-world examples of bioscience and allied engineering as a team.	5, 9, 10	3



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question from Units 2, 4, 5 and two questions from Units 1 and 3.

Text Books:

- Alvin E. Lewis, Biostatistics, McGraw-Hill Professional Publishing 2013.
- T. P. Chapman, Statistical Analysis of Gene Expression Microarray Data CRC 2003.
- John F. Monahan, Numerical Methods of Statistics (Cambridge Series in Statistical and Probabilistic Mathematics), Cambridge University Press, 2011.
- Warren J. Ewens, Gregory Grant, Statistical Methods in Bioinformatics: An Introduction (Statistics for Biology and Health), Springer. 2010.
- P. S. S. Sundar Rao and J. Richard, An introduction to Biostatistics, 4th edition, 2006, Prentice Hall of India.

E-books and online course materials:

1. [VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource](#)
2. https://www.youtube.com/watch?v=1Q6_LRZwZrc
3. <https://www.youtube.com/watch?v=gPt2DubVJQM>
4. <https://www.coursera.org/courses?query=biostatistics>
5. <https://www.edx.org/learn/biostatistics>
6. <https://www.classcentral.com/subject/biostatistics>.



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SYLLABUS (2023 - 2024)

FOURTH SEMESTER B. E. COURSE - (CHEMICAL ENGINEERING)

Course Title	Statistics and Probability	Course Code	23MA4BSSAP
Credits	03	L – T – P	2 – 1 – 0
Contact hours	40 hours		

Prerequisites: Basic concepts of Statistics and Probability, addition theorem, conditional probability, Bayes' theorem, discrete random variable, Binomial distribution. Basic concepts of statistics. Matrices.

Course Objectives:

- To get acquainted with the procedure of collecting, designing, analyzing, and drawing inferences about the data
- To have insight into Statistical methods, Correlation, and Regression analysis.
- To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in design engineering.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and Provide real-life examples.
- Support and guide the students for self-study.
- You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
- Encourage the students for group learning to improve their creative and analytical skills.

UNIT-1

STATISTICS AND PROBABILITY

[08 hours]

Curve fitting – Principle of least squares, fitting a straight line, fitting of a parabola, fitting of the exponential curve of the $y = ab^x$. Correlation and Regression.

Probability distributions: Discrete distribution - Poisson distribution. Continuous distribution- Normal distribution.

Pedagogy:	Chalk and Board, Problem based learning.
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UNIT-2

JOINT PROBABILITY AND MARKOV CHAIN

[08 hours]

Joint Probability Distributions: Discrete random variables, Mathematical expectations, Covariance and Correlation.

Markov Chain: Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chain.

Pedagogy:	Chalk and Board, Problem-based learning.
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UNIT-3

STATISTICAL INFERENCE – I

[08 hours]

Introduction, estimation – point, interval; procedure for testing of hypothesis, level of significance, construction of confidence interval.

[Large sample] Test of significance for single mean, difference between two means, single proportion, difference between two proportions, and difference of two Standard deviations.

Pedagogy:	Chalk and Board, Problem-based learning.
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UNIT-4

STATISTICAL INFERENCE – II

[08 hours]

[Small sample] Test of significance for single mean, difference between two means, paired t-test, ratio of variances (F - distribution), Chi-Square distribution-goodness of fit, independence of attributes. Analysis of variance (one-way and two-way classifications).

Pedagogy:	Chalk and Board, Problem-based learning.
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UNIT-5

DESIGN OF EXPERIMENTS

[08 hours]

Principles of experimental design – Randomization, Replication, Local Control.

Randomized block design, Completely Randomized block design, Latin Square Design– Problems.

Pedagogy:	Chalk and Board, Problem-based learning.
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On Completion of the course, student will have the ability to:

Course Code	CO #	COURSE OUTCOME (CO)	PO	Strength
23MA4BSSAP	CO 1	Apply the basic principles of statistics and probability, Markov chain, and design of experiments to the problems in Engineering.	1	3
	CO 2	Apply the concepts of Sampling distributions to Analyze and interpret the data from real-world examples.	1	3
	CO 3	Demonstrate an understanding of sampling distributions and principles of experimental design.	1, 6, 9, 10	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	
	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.



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SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question from Units 2, 3, 4 and two questions from Units 1 and 5.

Text Books:

1. Fundamentals of Biostatistics, Khirfan A. Khan, Atiya Khanum, 3rd edition, 2012, Ukaaz Publications.
2. An Introduction to Biostatistics, P. S. S. Sundar Rao and J. Richard, 4th edition, 2006, Prentice Hall of India.

Reference Books:

1. Applied Statistics and Probability for Engineers, Douglas C. Montgomery, George C. Runger, 6th edition, Wiley.
2. Biostatistics, P. N. Arora, P. K. Malhan, 2nd edition, 2013, Himalaya Publishing House

E-books and online course materials:

1. <https://www.coursera.org/learn/basic-statistics>
2. <https://www.coursera.org/learn/probability-intro>
3. <https://www.classcentral.com/course/udacity-intro-to-statistics-361>
4. http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook

Online Courses and Video Lectures:

1. <http://ocw.mit.edu/courses/mathematics/18-05-introduction-to-probability-and-statistics-spring-2014/>
2. <http://nptel.ac.in/courses/111105041/1> NPTEL >> Mathematics >> Probability and Statistics
3. [https:// www.khanacademy.org/Math](https://www.khanacademy.org/Math)
4. [https:// www.class-central.com/subject/math](https://www.class-central.com/subject/math) (MOOCS).



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SYLLABUS (2022 - 2023)

THIRD SEMESTER B.E. (FOR LATERAL ENTRY STUDENTS)

Course Title	Additional Mathematics - I	Course Code	22MA3BSMAT
Credits	0	L – T – P	2 – 1 – 0
Contact Hours	40		

Course Objectives: The objective of the course is

- To facilitate the students with a foundation of differential calculus & analytical methods for solving engineering problems.

Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
- State the need for Mathematics with Engineering Studies and Provide real-life examples.

UNIT -1

DIFFERENTIAL AND INTEGRAL CALCULUS:

[8 Hours]

List of standard derivatives including hyperbolic functions, rules of differentiation. Polar curves, angle between the radius vector and the tangent, angle between two curves (No proof). Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems.

List of standard integrals, integration by parts. Definite integrals-problems.

(6L+2T)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT -2

MULTIVARIATE CALCULUS

[08 hours]

Partial differentiation, total derivative-differentiation of composite functions. Jacobian and problems.

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems.

(6L+2T)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT -3

ORDINARY DIFFERENTIAL EQUATIONS (ODE's) OF FIRST ORDER

[08 hours]

Bernoulli's differential equations. Exact and reducible to exact differential equations. Applications of ODE's - Orthogonal trajectories.

Nonlinear differential equations: Introduction to general and singular solutions; Solvable for p only.

(6L+2T)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-4

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

[08 hours]

Higher-order linear ODE's with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre homogeneous differential equations. Problems.

(6L+2T)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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UNIT-5

PARTIAL DIFFERENTIAL EQUATIONS (PDE's)

[08 hours]

Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of PDE by the method of separation of variables. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation.

(6L+2T)

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO
22MA3IMMAT	CO 1	Demonstrate the concepts of differential calculus and Integral Calculus.	1
	CO 2	Apply the concepts of differential calculus to solve ordinary and partial differential equations	1

Assessment Details (CIE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz 1	10	100	05	50
	Quiz 2	10		05	
	Test 1	40		20	
	Test 2	40		20	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.



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Suggested Learning Resources:

Text Books

1. **B. S. Grewal:** “Higher Engineering Mathematics”, Khanna publishers, 44th Ed.2018.
2. **E. Kreyszig:** “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books

1. **B.V. Ramana:** “Higher Engineering Mathematics” McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C. Bhunia:** “Engineering Mathematics” Oxford University Press, 3rd Reprint, 2016.
3. **N. P. Bali and Manish Goyal:** “A textbook of Engineering Mathematics” Laxmi Publications, Latest edition.
4. **C. Ray Wylie, Louis C. Barrett:** “Advanced Engineering Mathematics” McGraw – Hill Book Co. Newyork, Latest ed.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** “Engineering Mathematic for Semester I and II”, Mc- Graw Hill Education (India) Pvt. Ltd 2015.
6. **H. K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication (2014).
7. **James Stewart:** “Calculus” Cengage publications, 7th edition, 4th Reprint 2019.

Web links and Video Lectures (e-Resources):

1. <http://.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. [VTU e-Shikshana Program](#)
5. [VTU EDUSAT Program](#)



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SYLLABUS (2022 - 2023)

FOURTH SEMESTER B.E. (FOR LATERAL ENTRY STUDENTS)

Course Title	Additional Mathematics - II	Course Code	22MA4BSMAT
Credits	0	L – T – P	2 – 1 – 0

Course Objectives: The objective of the course is

- To facilitate the students with a foundation of integral calculus.
- To facilitate the students with a foundation of vector calculus, linear algebra and numerical techniques

Teaching-Learning Process (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples

UNT-1

NUMERICAL METHODS – 1

[08 hours]

Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations; Gauss-elimination method and Approximate solution by Gauss-Seidel method. Eigenvalues and Eigenvectors.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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UNIT-2

NUMERICAL METHODS -2

[08 hours]

Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods (only formulae). Problems.

Finite differences, Interpolation using Newton's forward and backward difference formulae and Lagrange's interpolation formula (without proof). Problems.

Numerical integration: Simpson's $(1/3)^{\text{rd}}$ and $(3/8)^{\text{th}}$ rules (without proof): Problems.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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UNIT-3

NUMERICAL METHODS -3

[08 hours]

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, Milne's predictor-corrector formula (No derivations of formulae). Problems.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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UNIT-4

INTEGRAL CALCULUS

[08 hours]

Multiple Integrals: Evaluation of double integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Evaluation of triple integrals. Problems.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-5

BETA-GAMMA FUNCTIONS AND VECTOR INTEGRATION

[8 Hours]

Beta and Gamma functions: Definitions, properties, the relation between Beta and Gamma functions.

Vector Integration: Line integral, Green's theorem and Stokes' theorem

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

COURSE CODE	CO	COURSE OUTCOME (CO)	PO
22MA4IMMAT	CO 1	Apply the concepts of linear algebra and numerical methods	1
	CO 2	Apply the concepts of integral calculus	1

Assessment Details:

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz 1	10	100	05	50
	Quiz 2	10		05	
	Test 1	40		20	
	Test 2	40		20	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Suggested Learning Resources:

Text Books

1. **B. S. Grewal:** "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books

1. **B.V. Ramana:** "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.



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3. **N.P Bali and Manish Goyal:** “A textbook of Engineering Mathematics” Laxmi Publications, Latest edition.
4. **C. Ray Wylie, Louis C. Barrett:** “Advanced Engineering Mathematics” McGraw – Hill Book Co. New York, Latest ed.
5. **Gupta C. B, Sing S. R. and Mukesh Kumar:** “Engineering Mathematic for Semester I and II”, Mc- Graw Hill Education (India) Pvt. Ltd 2015.
6. **H. K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication (2014).
7. **James Stewart:** “Calculus” Cengage publications, 7th edition, 4th Reprint 2019.

Web links and Video Lectures (e-Resources):

- <http://.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- [VTU e-Shikshana Program](#)
- [VTU EDUSAT Program](#)



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PROPOSED SYLLABUS (2023-2024)

SIXTH SEMESTER B.E. COURSE

Course Title	MATHEMATICAL STATISTICS FOR ENGINEERS	Course Code	23MA6OESFE
Credits	03	L – T– P	2 – 1– 0
Contact hours	36		

Prerequisites: Basic concepts of Permutations, Combinations, Probability and Statistics

Course Objectives: The goal of the course is to

- Appreciate the importance of probability and statistics in engineering science.
- Acquire the knowledge of probability and statistics applied in their core domain.
- Improve their Mathematical Thinking and acquire skills required for sustained lifelong learning.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Show Video/animation films to explain functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world and when that's possible, it helps to improve the students' understanding.

UNIT-1

DESCRIPTIVE STATISTICS

[07 hours]

Introduction to Statistics and Data Analysis - Measure of Central Tendency, Measure of Dispersion.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-2

PROBABILITY DISTRIBUTIONS:

[08 hours]

Theoretical distributions: Discrete and continuous random variables

Discrete distributions: Geometric distributions, Hypergeometric distribution and Uniform



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distribution.

Continuous distributions: Uniform Distribution, Gamma distributions, t-distribution, F-distribution and chi-square distribution.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-3

INFERENTIAL STATISTICS

[07 hours]

Sampling distribution, central limit theorem, weak law for large numbers, Chebyshev's inequality, Markovian inequality, Moment of generating function.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-4

ESTIMATION:

[07 hours]

Parameter estimation-Point and interval; Estimation error-bias, variance and risk, Method of moments, Estimator design approach- Maximum Likelihood, confidence interval.

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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UNIT-5

HYPOTHESIS TESTING:

[07 hours]

Introduction, parametric testing: Proportion, one way and 2-way ANOVA.

Non-parametric test: Chi-square-Independence of attribute, Homogeneity data, Mann-Whitney test and Wilcoxon-signed Rank test

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation
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Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
23MA6OESFE	CO 1	Understanding the fundamentals of statistics.	1	3
	CO 2	Analyze and interpret the statistical data for engineering.	1,2	3
	CO 3	Demonstrate the use of statistical tools to analyze the real-world examples of engineering as a team.	5,9,10	3

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total	50 % Weightage	Total
CIE – Theory	Quiz	10	100	5	50
	AAT	10		5	



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	Test 1	40		20	
	Test 2	40		20	
SEE	End Exam	100		50	

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 1, 3 & 4 and two questions each from Unit 2 and Unit 5.

Text Books:

1. Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M. Ross, 5th edition, Elsevier.
2. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Gupta, Sultan Chand and Sons publishers.

Reference Books:

1. Basic Statistical Methods for Engineers and Scientists, Kennedy, J. B., and Neville, A. M., (1986), 3rd edition, Harper and Row.
2. Basic Statistical Methods for Engineers and Scientists Miller, I. R., Freund, J. E., and Johnson, R., (1990x, 4th edition, Prentice-Hall.

E-books and online course materials:

1. <https://minerva.it.manchester.ac.uk/~saralees/statbook3.pdf>
2. [http://vf.u.bg/en/e-Learning/Math--Soong Fundamentals of probability and statistics for engineers.pdf](http://vf.u.bg/en/e-Learning/Math--Soong_Fundamentals_of_probability_and_statistics_for_engineers.pdf)

Online Courses and Video Lectures:

1. <https://nptel.ac.in/courses/111105041>
2. <https://ocw.mit.edu/courses/18-05-introduction-to-probability-and-statistics-spring-2014/>



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SIXTH SEMESTER – INSTITUTIONAL ELECTIVE

Course Title	NUMERICAL METHODS FOR ENGINEERS	Course Code	20MA6IENME
Credits	03	L – T – P	3 – 0 – 0
Contact hours	39 hours		

Prerequisites: Matrix theory, Differential and Integral Calculus, Differential Equations.

Course Objectives: The purpose of the course is to encourage the students to apply numerical techniques. To enhance computational skills for solving mathematical equations. To train the students to solve the complex engineering problems in their respective domain.

UNIT-1

ITERATIVE METHODS FOR SYSTEM OF EQUATIONS AND EIGEN VALUES AND VECTORS: [07 hours]

Fixed point iteration methods, Thomas algorithm for tri-diagonal systems, Newton's method for solving nonlinear systems,

Power Method, Rayleigh Power method, Jacobi's Methods, Given's Method.

UNIT-2

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION: [08 hours]

Linear interpolation, Piecewise polynomial interpolation: Cubic spline interpolation.

Stirling's formula and Bessel's formula. Richardson extrapolation.

Boole's and Romberg integration. Evaluation of Double Integrals using Numerical Methods – Trapezoidal Rule - Simpson's Rule.

UNIT-3

METHODS FOR INITIAL VALUE PROBLEMS: [08 hours]

Predictor–Corrector methods- Milne's method –Adam's Bashforth method. Finite difference methods. Relaxation Methods; Solution of Eigen value problems (ODE). Solving system of ODE using Runge-Kutta 2nd and 4th order methods.

UNIT-4

METHODS FOR BOUNDARY VALUE PROBLEMS: [08 hours]

Introduction to boundary value problem (BVP): Solving BVP using Shooting method, Finite difference method, cubic spline method and successive over Relaxation (SOR) method.

Solution of integral equations using finite difference method.



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UNIT-5

METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS:

[08 hours]

Solution of Elliptic PDEs, Poisson's equations, Finite difference method for 1D elliptic problem, Finite difference method for 2D elliptic problem, Finite difference for parabolic problems (generality), Lax-Wendorff method, ADI method and SOR Method.

On completion of the course, student will have the ability to:

Course Code	CO #	COURSE OUTCOME (CO)	PO	Bloom's level
20MA6IENME	CO 1	Determine the solution of the non-linear system of equations	1, 2, 5	3
	CO 2	Compute the Eigen values and corresponding Eigen vectors using iterative methods	1, 2, 5	3
	CO 3	Apply numerical techniques to find differentiation and integration.	1, 2, 5	3
	CO 4	Interpret the solutions of ordinary differential equations	1, 2,3,5	3
	CO 5	Analyze the numerical solutions of partial differential equations	1, 2,3,5	3

Text Books:

3. MK Jain, SRK Iyengar and R.K.Jain, Numerical Methods for Scientific and Engineering Computations, 6th edition, 2007, New Age International Publishers.
4. S.S.Sastry, Introductory methods of numerical analysis, Fifth Edition, 2012, PHI Publishers

Reference Books:

1. Steven V. Chapra, Applied Numerical Methods with Matlab for Engineers and Scientists, Third Edition, 2011, McGraw-Hill Edition.
2. Richard L. Burden, Douglas J. Faires, A.M.Burden, Numerical Analysis, 10th Edition, 2010, Cengage Publishers.
3. M.D. Raisinganiah, Integral Equations and Boundary Value Problems, S.Chand Publishers.

E books and online course materials:

1. <https://www.classcentral.com/course/swayam-numerical-methods-for-engineers-14213>

Online Courses and Video Lectures:

1. https://onlinecourses.nptel.ac.in/noc19_ge30/preview
2. <https://ocw.mit.edu/courses/mechanical-engineering/2-993j-introduction-to-numerical-analysis-for-engineering-13-002j-spring-2005/>

Question Paper Pattern:

1. Five full questions to be answered
2. To set SEE question paper, one question each in Units 1, 2, 5 and two questions each in Unit 3 and Unit 4.



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SEVENTH SEMESTER – INSTITUTIONAL ELECTIVE

Course Name	Computational Graph Theory	Course Code	21MA7IECGT
Credits	03	L – T - P	3 - 0 - 0
Contact hours	39 hours		

Course Objectives: The objective of the course is to introduce the concepts in graph Theory, with a sense of algorithms and some modern applications. They will be able to use these methods in subsequent courses in the design and analysis of algorithms, computability theory, software engineering, and computer systems.

UNIT-1

GRAPHS AND DIGRAPHS

[8 hours]

Fundamentals of graphs and digraphs, modelling using graphs and digraphs, graph search – BFS, DFS. The shortest path algorithms: Dijkstra algorithm, Bellman Ford algorithm. Minimum weight spanning tree: Kruskal's algorithm and Prim's algorithms. Applications: Job sequencing problems, designing an efficient computer drum, making a road system one-way.

UNIT-2

EULERIAN AND HAMILTONIAN GRAPHS

[7 hours]

Transportation Problems: Eulerian graphs, Fleury's algorithm, Chinese Postman Problem, Hamiltonian cycles, Travelling Salesman Problem, applications.

UNIT-3

CONNECTIVITY

[8 hours]

Vertex and edge connectivity, separable graphs, block graphs, k-connected graphs, maximum flow Problem, Ford-Fulkerson algorithm, Min Cut - Max Flow theorem, Maximum Flow of Minimum Cost, feasible flows. Construction of reliable communication networks-The minimum connector problem, enumeration of chemical molecules and electrical networks.

UNIT-4

COVERING AND MATCHING

[8 hours]

Vertex and edge covering, vertex and edge independence, matchings, perfect matchings, maximum matching, Hall's theorem, augmenting path, Edmond's algorithm, maximal independent sets, König's Min-Max theorem, Gale-Shapley Algorithm, Minimum path cover, Friend's strangers problem.

UNIT-5

COLORABILITY

[8 hours]

Vertex colouring, Chromatic Number, Bi-chromatic, Edge coloring and its applications to timetabling and sport scheduling, Vizing's theorem, Sequential coloring algorithm, map coloring, Four Color problem, chromatic polynomial. König's theorem, Applications: Scheduling examinations, Frequency assignments, Index registers.



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Text Books

1. Narsing Deo, Graph Theory, PHI, 2014.
2. Geir Agnarsson & Raymond Greenlaw Pearson, Graph Theory, modelling, applications and algorithms, Prentice Hall, 2007.

Reference Books

1. Frank Harary, Graph Theory, Addison Wesley, Reading, Massachussets, 1969.
2. Jonathan L. Gross, Jay Yellen, Graph Theory and its Applications, 2nd Edition, CRC Press LLC, Florida, 2000.
3. Gary Chartrand and Ping Zhang, Introduction to Graph Theory, McGraw Hill, 2005.

At the end of the course the students will be able to

CO	Course Outcomes	PO's
CO-1	Demonstrate an understanding of the fundamental concepts of graph theory, digraphs, trees, finding Paths and cycles, weighted graphs matching and graph coloring.	1,2
CO-2	Apply appropriate graph algorithms to solve problems involving transportation, connection, social networking and scheduling.	1,2
CO-3	Analyse the algorithms to find the shortest path, maximum flow of minimum cost, maximum matching and minimum path cover.	2
CO-4	Use of MATLAB to find the shortest path, minimum weighted spanning tree, maximum flow.	5

Question Paper Pattern

- Each unit consists of one full question.
- Five full question to be answered.
- Internal choice in Unit 1 and Unit 5.



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SEVENTH SEMESTER – INSTITUTIONAL ELECTIVE

Course Title	NUMBER THEORY	Course Code	21MA7IENMT
Credits	03	L – T – P	3 – 0 – 0
Contact hours	39 hours		

Course Objectives: The course is a graduate level introduction Number Theory in which, it will cover fundamentals of the subject. It has contributed to many practical problems such as Coding Theory, Cryptography in modern information technology.

UNIT-1

CONGRUENCES: [09 hours]

Introduction, Congruences and Equivalence Relations, Linear Congruences, Linear Diophantine Equations and the Chinese Remainder Theorem, Modular Arithmetic: Fermat's Theorem, Wilson's Theorem and Fermat Numbers. Polynomial congruences, Pythagorean equations.

UNIT-2

ARITHMETIC FUNCTIONS: [07 hours]

Introduction, Sigma Function, Tau Function, Dirichlet Product, Dirichlet Inverse, Moebius Function, Euler's Function, Euler's Theorem, An application to Algebra.

UNIT-3

PRIMITIVE ROOTS AND INDICES: [07 hours]

The order of a positive integer, primality tests, primitive roots for primes, the algebra of indices.

UNIT-4

QUADRATIC CONGRUENCE AND CONTINUED FRACTION: [09 hours]

Legendre symbol, Quadratic reciprocity, the Jacobi symbol, finite continued fractions, infinite continued fractions.

UNIT-5

NON LINER DIOPHANTINE EQUATIONS: [07 hours]

Pythagorean triangles, Fermat's last theorem, Sum of Squares, Pell's equation, Mordell's equation.



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On completion of the course, student will have the ability to:

CO No	Course Outcomes	PO
1	Apply the concept of congruence to compute system of equations (algebraic equations)	1
2	Demonstrate an understanding towards the nature of different functions	1
3	Demonstrate an understanding primitive roots and indices	1
4	Apply concept of quadratic congruence to evaluate quadratic residues and understand continued fractions.	1
5	Demonstrate an understanding with some important non-linear Diophantine equation.	1

Text Books:

5. Elementary number theory with Applications-2nd Edition-Thomas Koshy 2009.
6. Beginning Number Theory by Neville Robbins-2nd Edition-Jones and Barlett Publ.-2006.

Reference Books:

4. Elementary Number Theory by David M Burton - Tata McGraw Hill Publ.-6th Edition 2006.
5. Elementary Number Theory by Gareth A. Jones and Josephine Mary Jones - Springer-1998.

Question Paper Pattern:

- Each unit consists of one full question.
- Each full question consists of two, three or four subdivisions.
- Five full question to be answered.
- Internal choice in Unit 1 and Unit 4.



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EIGHTH SEMESTER – INSTITUTIONAL ELECTIVE - (Except CSE/ISE Branch)

Course Title	Linear Algebra	Course Code	21MA8IELIA
Credits	03	L – T – P	3 – 0 – 0
Contact hours	36 hours		

Prerequisites: Vector Algebra, Matrix theory, Calculus, Geometry, Group Theory.

Course Objectives: To provide the students with a foundation of concepts in linear algebra that is essential to engineers of computer and information science.

UNIT-1

VECTOR SPACES

[7 hours]

Vector spaces, Subspaces, Linear Combinations, Linear Spans, row space and column space of a Matrix, Linear Dependence and Independence, Basis and Dimension, Coordinates.

UNIT-2

LINEAR TRANSFORMATIONS

[7 hours]

Introduction, Linear Mappings, Geometric linear transformation of \mathbb{R}^n , Kernel and Image of a linear transformations, Matrix representation of linear transformations, Rank-Nullity Theorem(No proof), Singular and Nonsingular linear transformations, Invertible linear transformations.

UNIT-3

EIGENVALUES AND EIGENVECTORS

[8 hours]

Introduction, polynomials of matrices, characteristic polynomial, Cayley-Hamilton theorem, eigenvalues and eigenvectors, eigen spaces of a linear transformation, diagonalization, minimal polynomial, characteristic and minimal polynomials of block matrices, Jordan canonical form.

UNIT-4

INNER PRODUCT SPACES

[7 hours]

Inner product, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem and least square error.

UNIT-5

SYMMETRIC MATRICES AND QUADRATIC FORMS

[7 hours]

Diagonalization of real symmetric matrices, Orthogonal diagonalization of real symmetric matrices, quadratic forms and its classifications, Singular value decomposition.



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On completion of the course, student will have the ability to:

Course Code	CO #	Course Outcome (CO)	PO
21MA8IELIA	CO 1	Apply the concepts of Matrices to Vectors spaces.	1
	CO 2	Relate the concepts of Eigen values, Eigen vectors & functions to linear algebra.	
	CO 3	Apply the concepts of inner products.	

Text Books:

3. Linear Algebra and its applications, David C. lay, Steven R. lay, Judi J Mc. Donald, 5th Edition, 2015, Pearson Education.
4. Linear Algebra and its applications, Gilbert Strang, 4th edition, 2005, Brooks Cole.

Reference Books:

3. Schaum's outline series-Theory and problems of linear algebra, Seymour Lipschutz, 5th edition, 2012, McGraw-Hill Education.
4. Linear Algebra an Introduction, Richard Bronson & Gabriel B. Costa, 2nd edition.

E books and online course materials:

3. <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm>
4. <https://www.math.ucdavis.edu/~linear/linear.pdf>

Online Courses and Video Lectures:

3. <https://www.coursera.org/learn/linear-algebra-machine-learning>
4. <https://nptel.ac.in/syllabus/111106051/>

Question Paper Pattern:

3. Five full questions to be answered.
4. To set one question each in Units 1, 2, 5 and two questions each in Unit 3 and Unit 4.



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SYLLABUS (2022 - 2023)

FIRST SEMESTER B.E.

Course Title	Communicative English	Course Code	22MA1AECEN
Credits	01	L – T – P	1:0:0

Course Objectives:

- To understand the nuances of phonetics, accent, intonation and improve the pronunciation and communication skills
- To learn the basic English grammar and understand all types of English vocabulary and acquire professional communication skills
- Perform as a member of a team and engage in group discussion and oral presentation.

Teaching-Learning Process (General Instructions):

The strategies teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective:

Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.

(i) Direct instructional method (Low/Old Technology), (ii) Flipped classrooms (High/advanced Technological tools), (iii) Blended learning (Combination of both), (iv) Enquiry and evaluation-based learning, (v) Personalized learning, (vi) Problems based learning through discussion, (vii) Following the method of expeditionary learning Tools and techniques, (viii) Use of audio-visual methods through language Labs in teaching of LSRW skills.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can progress the students in theoretical applied and practical skills in teaching of communicative skills in general.

UNIT – 1

[03 hours]

Introduction to Communicative English: Communicative English, Fundamentals of Communicative English, Process of communication, Barriers to Effective Communication, Different styles and levels in Communication, Interpersonal and Intrapersonal Communication Skills.

Teaching-Learning Process

Chalk and talk method / Power Point Presentation



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<u>UNIT - 2</u>		[03 hours]
Introduction to Phonetics: Phonetic Transcription, English Pronunciation, Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non-silent Letters, Syllables, Intonation, Spelling Rules and Words often Misspelt. Common Errors in Pronunciation, Word Pairs (Minimal Pairs) – Exercises, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue Influence.		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[03 hours]
Basic English Communicative Grammar and Vocabulary PART - I: Grammar: Basic English Grammar and Parts of Speech, Articles and Preposition. Question Tags, One Word Substitutes, Strong and Weak forms of words		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[03 hours]
Basic English Communicative Grammar and Vocabulary PART - II: Words formation - Prefixes and Suffixes, Contractions and Abbreviations, Vocabulary – Exercises on synonyms, antonyms, homophones and homonyms.		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[03hours]
Communication Skills for Employment: Job application, Types of official/ employment/ business letters, Resume vs. Bio Data, profile, CV. Information Transfer: Oral Presentation and its Practice. Difference between Extempore/ Public Speaking, Communication Guidelines.		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO
	CO 1	To understand the nuances of phonetics, accent, intonation and improve the pronunciation and communication skills	10
	CO 2	To learn the basic English grammar and understand all types of English vocabulary and acquire professional communication skills.	10
	CO 3	Perform as a member of a team and engage in group discussion and oral presentation.	9, 10



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Assessment Details (both CIE and SEE)

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	AAT	10	50
	Test 1 (Descriptive + MCQ)	40	
SEE	End Exam		

Only one CIE shall be conducted.

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

SEE paper will be set for 50 marks. The pattern of the question paper is **Descriptive and MCQ Mode**. The time allotted for SEE is 120 minutes.

Suggested Learning Resources:

Textbook:

1. **Communication Skills** by Sanjay Kumar & Pushp Lata, Oxford University Press India Pvt Ltd - 2019.
2. **A Textbook of English Language Communication Skills**, (ISBN-978-81-955465-2-7), Published by InfiniteLearning Solutions, Bengaluru - 2022.

Reference Books:

1. **Technical Communication** by Gajendra Singh Chauhan and Et al, (ISBN-978-93-5350-050-4), Cengage learning India Pvt Limited [Latest Revised Edition] - 2019.
2. **English for Engineers** by N. P. Sudharshana and C. Savitha, Cambridge University Press – 2018.
3. **English Language Communication Skills – Lab Manual cum Workbook**, Cengage learning India Pvt Limited [Latest Revised Edition] – (ISBN-978-93-86668-45-5), 2019.
4. **A Course in Technical English – D Praveen Sam, KN Shoba**, Cambridge University Press – 2020.
5. **Practical English Usage** by Michael Swan, Oxford University Press – 2016.



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SYLLABUS (2022 - 2023)

SECOND SEMESTER B.E.

Course Title	Professional Writing Skills in English	Course Code	22MA2AEPWE
Credits	01	L – T – P	1:0:0

Course Objectives:

- To understand and identify the common errors in writing and speaking
- Developing listening and speaking skills through classroom activities based on listening comprehension, recapitulation, interpretation and debate on the same
- To read technical proposals and write good technical reports, to acquire better analytical skills and methodology required for writing projects and research papers.
- Perform as a member of a team and engage in group presentation.

Teaching-Learning Process (General Instructions):

The strategies teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective:

Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve the combination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.

(i) Direct instructional method (Low/Old Technology), (ii) Flipped classrooms (High/advanced Technological tools), (iii) Blended learning (Combination of both), (iv) Enquiry and evaluation-based learning, (v) Personalized learning, (vi) Problems based learning through discussion, (vii) Following the method of expeditionary learning Tools and techniques, (viii) Use of audio-visual methods through language Labs in teaching of LSRW skills.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can progress the students in theoretical applied and practical skills in teaching of communicative skills in general.

<u>UNIT – 1</u>	[03 hours]
Identifying Common Errors in Writing and Speaking English: Common errors identification in parts of speech, Use of verbs and phrasal verbs, Auxiliary verbs and their forms, Subject Verb Agreement (Concord Rules), Common errors in Subject-verb agreement, Sequence of Tenses and errors identification in Tenses. Words Confused/Misused. Analogy of Comparison	
Teaching-Learning Process	Chalk and talk method / Power Point Presentation



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<u>UNIT - 2</u>		[03 hours]
Nature and Style of Sensible Writing: Organizing Principles of Paragraphs, Writing Introduction and Conclusion, Importance of Proper Punctuation, Precis writing, Essay writing, Sentence arrangements and Corrections activities. Misplaced modifiers, Contractions, Collocations, Word Order, Errors due to the Confusion of words.		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 3</u>		[03 hours]
Technical Reading and Writing Practices: Technical writing process, Introduction to Technical Reports writing, Significance of Reports, Types of Reports. Introduction to Technical Proposals Writing, Types of Technical Proposals, Characteristics of Technical Proposals. Scientific Writing Process. Grammar – Voices and Reported Speech, Spotting Error& Sentence Improvement, Cloze Test and Theme Detection Exercises.		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 4</u>		[03 hours]
Professional Communication for Employment: Listening Comprehension, Types of Listening, Listening Barriers, Improving Listening Skills. Reading Comprehension, Tips for effective reading. Emails, Blog Writing and Memos.		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	
<u>UNIT - 5</u>		[03hours]
Professional Communication at Workplace: Group Discussion and Professional Interviews, Characteristics and Strategies of a GD and PI's, Non-Verbal Communication Skills and its importance in GD and Interview. Presentation skills and Formal Presentations by Students, Strategies of Presentation Skills		
Teaching-Learning Process	Chalk and talk method / Power Point Presentation	

Course outcomes (Course Skills Set)

Course Outcomes		PO
CO1	To understand and identify the common errors in writing and speaking.	10
CO2	Developing listening and speaking skills through classroom activities based on listening comprehension, recapitulation, interpretation and debate on the same.	10
CO3	To read Technical proposals and write good technical reports, to acquire better analytical skills and methodology required for writing projects and research papers.	10
CO4	Perform as a member of a team and engage in group presentation.	9, 10



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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	AAT	10	50
	Test 1 (Descriptive + MCQ)	40	
SEE	End Exam		

Only one CIE shall be conducted.

CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.

Semester End Examination:

SEE paper will be set for 50 marks. The pattern of the question paper is **Descriptive and MCQ mode**. The time allotted for SEE is 120 minutes.

Suggested Learning Resources:

Textbook:

1. **“Professional Writing Skills in English”** published by Fillip Learning – Education (ILS), Bangalore – 2022.
2. **“Functional English”** (As per AICTE 2018 Model Curriculum) (ISBN-978-93-5350-047-4) Cengage learningIndia Pvt Limited [Latest Edition 2019].

Reference Books:

1. **English for Engineers** by N.P.Sudharshana and C.Savitha, Cambridge University Press – 2018.
2. **Technical Communication** by Gajendra Singh Chauhan and Et al, (ISBN-978-93-5350-050- Cengage learningIndia Pvt Limited [Latest Revised Edition] - 2019.
3. **Technical Communication – Principles and Practice**, Third Edition by Meenakshi Raman and Sangeetha Sharma, Oxford University Press 2017.
4. **High School English Grammar & Composition** by Wren and Martin, S Chandh & Company Ltd – 2015.
5. **Effective Technical Communication – Second Edition** by M Ashraf Rizvi, McGraw Hill Education (India) Private



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SYLLABUS (2022 - 2023)

ಬಳಕೆ ಕನ್ನಡ			
ವಿಷಯ ಸಂಕೇತ (Course Code)	22MA1HSBAK / 22MA2HSBAK	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯ ಮಾಪನ ಅಂಕಗಳು.	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / week (L:T:P:S))	1-0-0	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01		
ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು: <ol style="list-style-type: none"> 1. To Create the awareness regarding the necessity of learning local language for comfortable and healthy life. 2. To enable learners to Listen and understand the Kannada language properly. 3. To speak, read and write Kannada language as per requirement. 4. To train the learners for correct and polite conversation. 5. To know about Karnataka state and its language, literature and General information about this state. 			
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching – Learning Process – General Instructions): These are sample Strategies; which teacher can use to accelerate the attainment of the course outcomes. <ol style="list-style-type: none"> 1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು. 2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿ ಕೊಡುವುದು. 3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧ ಪಟ್ಟ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು. 4. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚಿಗೆ ಡಿಜಿಟಲೀಕರಣ ಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚುರ್ಚಿಸಲು ಕ್ರಮ ಕೈಗೊಳ್ಳುವುದು . ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ. 5. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯ ಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು. 			



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UNIT – 1		2 Hours
<ol style="list-style-type: none"> 1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language. 2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conversation, Listening and Speaking Activities. Key to Transcription. 3. ವ್ಯಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯ ಸೂಚಕ / ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - Personal Pronouns, Possessive Forms, Interrogative words 		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	
UNIT – 2		3 Hours
<ol style="list-style-type: none"> 1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು – Possessive forms of nouns, dubitive question and Relative nouns. 2. ಗುಣ ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ ಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative, Quantitative and colour Adjectives, Numerals. 		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	
UNIT – 3		3 Hours
<ol style="list-style-type: none"> 1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative cases, and numerals. 2. ಸಂಖ್ಯಾವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers. 		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	
UNIT – 4		3 Hours
<ol style="list-style-type: none"> 1. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು. Permission, Commands, encouraging and Urging words (Imperative words and sentences) 2. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯ ಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು. – Helping verbs “iru and iralla”, corresponding Future and negation verbs. 		



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ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.
UNIT – 5	
1. ಕನ್ನಡ ಭಾಷೆ ಮತ್ತು ಸಾಹಿತ್ಯ, Kannada Language and History. 2. Kannada Language Script Part – 1	
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.

ಬಳಕೆ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು:

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO	Strength
22MA1HSBAK / 22MA2HSBAK	CO 1	To create an awareness regarding the necessity of learning local language for a comfortable living and to know more about Kannada culture and literature.	PO10	3
	CO 2	To develop proper speaking, reading and writing skills in Kannada.	PO10	3
	CO 3	To engage as a member of a team and enhance the skill in group communication and presentation.	PO9	1

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	AAT 1	10	100
	Test 1	40	
SEE	End Exam	50	

Only one CIE shall be conducted after CIE2 and before CIE 3. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

ಪಠ್ಯ ಪುಸ್ತಕ:

ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಬಳಕೆ ಕನ್ನಡ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.



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SYLLABUS (2022 - 2023)

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ			
ವಿಷಯ ಸಂಕೇತ (Course Code)	22MA1HSSAK / 22MA2HSSAK	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯ ಮಾಪನ ಅಂಕಗಳು.	50
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ (Teaching Hours / week (L:T:P:S))	1-0-0	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	50
ಒಟ್ಟು ಬೋಧನಾ ಅವಧಿ Total Hours of Pedagogy	15 ಗಂಟೆಗಳು	ಒಟ್ಟು ಅಂಕಗಳು	100
ಕ್ರೆಡಿಟ್ಸ್ (Credits)	01		
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು : <ol style="list-style-type: none"> 1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು. 2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು. 3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು. ಕನ್ನಡ ಶಬ್ದ ಸಂಪತ್ತಿನ ಪರಿಚಯ. 			
ಭೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching – Learning Process – General Instructions): These are sample Strategies; which teacher can use to accelerate the attainment of the course outcomes. <ol style="list-style-type: none"> 1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು. 2. ಇವತ್ತಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ - ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು. ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶನಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಕಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು. 3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸುವುದು. 			
ಘಟಕ - 1			3 Hours
ಲೇಖನಗಳು: <ol style="list-style-type: none"> 1. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ. 2. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ. 			
ಭೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಪ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.		



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ಘಟಕ - 2		4 Hours
ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ: 1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕ ಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. 2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸಿದರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಪ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	
ಘಟಕ - 3		3 Hours
ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ: 1. ಡಿ. ವಿ. ಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲ ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ. ರಾ. ಬೇಂದ್ರೆ . 3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಪ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	
ಘಟಕ - 4		3 Hours
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಪ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	
ಘಟಕ - 5		2 Hours
1. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ ಚಿ ಬೋರಲಿಂಗಯ್ಯ		
ಭೋದನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪ್ಪ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವೀಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಕಾಂತರ ಚರ್ಚಿಸುವುದು.	



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ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (course Outcomes):

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

Course Code	CO	COURSE OUTCOME (CO)	PO
22KBK17/27	CO 1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.	PO10
	CO 2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಹಾಗೂ ಕನ್ನಡ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುತ್ತದೆ.	PO10
	CO 3	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ, ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಹಾಗೂ ಪ್ರವಾಸ ಕಥನಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.	PO9

Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	AAT 1	10	100
	Test 1	40	
SEE	End Exam	50	

Only one CIE shall be conducted after CIE2 and before CIE 3. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

ಪಠ್ಯ ಪುಸ್ತಕ:

ಡಾ. ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.



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SYLLABUS (2022 - 2023)

Course Title	Constitution of India and Professional Ethics	Course Code	22MA1HSCIP / 22MA2HSCIP
Credits	01	L-T-P-S	1-0-0-0

Total Hours: 15

Course objectives:

The course **Constitution of India and Professional Ethics (22MA1HSCIP/22MA2HSCIP)** will enable the students,

- To educate students about the country's highest law.
- To be familiar with the political system and practices of both state and the central government.
- To know about the risk, workplace safety and to understand issues related to the profession.

Teaching-Learning Process

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Innovative lecture methodologies to be adapted to improve the teaching and learning process.
- Short videos for better understanding and group discussion.
- Encourage collaborative (Group Learning) learning in the class.
- Ask Higher Order Thinking (HOT) questions in the class, which promotes critical thinking.
- Classroom discussions focused on case studies help students strengthen their analytical skills and thinking abilities, such as the capacity to assess, generalise, and analyse knowledge rather than just recollect it.

UNIT-1

[03 hours]

Introduction to Indian Constitution

Indian Constitution: Introduction and Necessity of the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. Preamble and Salient features of the Constitution of India, Fundamental Rights and its limitations.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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UNIT -2

[03 hours]

Fundamental Duties and Directive Principles of State Policy

Fundamental Duties and their significance. Directive Principles of State Policy: Importance and its relevance. Case Studies.

Teaching-Learning Process	Chalk and talk method / Power Point Presentation
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Assessment Details (both CIE and SEE)

Component	Type of assessment	Max. Marks	Total
CIE – Theory	AAT 1	10	100
	Test 1	40	
SEE	End Exam	50	

Only one CIE shall be conducted after CIE2 and before CIE 3. SEE paper shall be set for 50 Questions, each of the 01 marks. The pattern of the Question paper is MCQ (Multiple Choice Questions). The time allotted 01 hour.

Text Books:

- “An Introduction to Constitution of India and Professional Ethics” by Merunandan K.B. and B.R. Venkatesh, Meragu Publications, 3rd edition, 2011.
- “Constitution of India & Professional Ethics & Human Rights” by Phaneesh K. R., Sudha Publications, 10th edition, 2016.

Reference Books:

- “V.N. Shukla's Constitution of India” by Prof (Dr.) Mahendra Pal Singh (Revised), Eastern Book Company, Edition: 13th Edition, 2017, Reprint 2019.
- “Ethics in Engineering” by Martin, W. Mike., Schinzinger, Roland., McGraw-Hill Education; 4th edition (February 6, 2004).

E books and online course materials:

1. <https://www.smartzworld.com/notes/constitution-of-india-and-professional-ethics-notes-vtu-cip-pdf/>
2. <https://legalstudymaterial.com/constitution-of-india/>

Question Paper Pattern:

SEE Multiple Choice Questions (Online Examination)



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COURSE TITLE	Functional English(LATERAL ENTRY STUDENTS)	COURSE CODE	23MA3HSENG/ 23MA4HSENG
CREDITS	00	L – T – P	1 – 0 – 0
CONTACT HOURS	12 Hours		

Course Objectives:

- 1.To impart basic English grammar and essentials of language skills
- 2.To train to identify the nuances of phonetics, intonation and enhance pronunciation skills
- 3.To enhance with English vocabulary and language proficiency

UNIT -I

COMMUNICATION:

- Introduction- Role and Importance of English in the Corporate World.
- Communication-Importance of technical communication-levels, flow of organizational communication
- Effective Presentation strategies: non-verbal communication aspects, Preparing Power Point Presentation
- Public Speaking
- Listening-Types, traits and importance of listening
- Telephone Etiquette
- Interviews-types and preparation.
- Interpersonal Communication Skills –Group Discussion

Additional Reference:

- Communication: Organizational communication, Communication cycle, Barriers
- Language as a tool of communication, characteristics of language
- Non-verbal communication
- Power point presentations
- Traits of a good listener, barriers
- Interviews: questions frequently asked
- Business Meetings/Conferences: Spoken
- Effective reading skills

[4 hours]

UNIT -II

Technical Writing / Speaking: Specific Focus

- Letter Writing –Job Applications, E-mails and other Official Letters
- Writing a résumé
- Writing reports and dissertation/thesis-structure and significance
- Description of Graphics -kinds, construction, use and application (in scientific texts) and Interpretation

Additional Reference:

- Paragraph Writing, Expansion of ideas – Précis Writing
- Business Letters: Significance, purpose, structure, layout, types and samples
- Curriculum Vitae/ résumé/bio-data–different formats



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- Technical Reports: objectives, characteristics and categories
- Manuscript format, prefatory parts and main text
- Interpretation of the diagrams and graphs in paragraphs
- Structure of a Research dissertation/thesis.

[4 hours]

UNIT -III

Grammar: Basics and Structures

- Parts of Speech-in brief
- Transformation of Sentences, Active and Passive Voice, Direct and Indirect Speech.
- Subject-Verb Agreement

Additional Reference:

- Nouns, Pronouns, Tenses, Articles and Prepositions. Adjectives, Conjunctions, Adverbs, Interjection
- Degrees of comparison
- Punctuation
- Types of sentences
- Simple-compound and complex sentences
- Rules governing Active-Passive voice and Direct-Indirect Speech
- Singular and plural nouns and verbs.

[2 hours]

UNIT -IV

Vocabulary

- Correct pronunciation of important words
- Identifying errors in sentences-often mispronounced and misspelt word
- Difference between American and British English,
- Indianism-Mother tongue influence
- Using Idioms and phrases –words commonly misused and confused
- Analogy of Comparison
- Corporate/conventional idioms.

Additional Reference:

- IPA script chart to read sounds-vowels and consonants
- Spellings chart
- Words often mispronounced\
- Homophones and homonyms
- American English- evolution, expressions and slangs
- How American English has influenced corporate world
- Indianized expressions in English
- phrasal verbs and proverbs.

[2 hours]



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Text Book:

1. Practice and Perfect- a workbook issued by the Department of Mathematics and Humanities, BMS College of Engineering.
2. Additional Reference Source prepared by the Faculty of English-issued by the Department of Mathematics and Humanities, BMSCE.

Reference Books:

3. *IELTS Preparation and Practice* by Wendy Sahanaya and Terry Hughes, OUP, 2007.
4. *Technical Communication; Principles and Practice* – Meenakshi Raman and Sangeetha Sharma.
5. *English for Presentations* by Marion Grussendorf, OUP, 2015
6. *Making Sense of English*, M.Yadugiri, Viva Publications
7. *Advanced English Grammar* – Thomson and Martinet, Cambridge University Press.

Course Outcomes:

Course Code	COs	At the end of the course, the student will be able to:	POs mapped	Strength of mapping
23MA3HSENG/ 23MA4HSENG	CO1	Communicate effectively and creatively in both non-verbal and verbal forms in various multi-disciplinary activities.	10	3
	CO2	Upgrade organizational skills/traits, team spirit/working in liaison and thus boost professional etiquette and ethics.	9, 10	3, 2
	CO3	Write effective technical reports, dissertation and project documents and make effective oral and written presentations.	9, 10	1, 3
	CO4	Enhance employability via training in writing correct and effective Applications/Resumes.	10	3
	CO5	Perform well against Domestic and International Industry Standards via group discussions and Power Point Presentations.	9, 10	3, 3
	CO6	Strengthen basic grammar components/structures and overcome mistakes/wrong pronunciation and thereby, encourage speaking/writing in flawless English.	10	3

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