Rayat Shikshan Sanstha's

Sadguru Gadage Maharaj College, Karad

(An Autonomous College)

DEPARTMENT OF MATHEMATICS

Department of Mathematics

B.Sc. II

Semester III & IV

NEP syllabus to be implemented from July 2024 Onwards

Major Papers

Semester: III

Subject Code: - MJ-BMT23-301

Paper V: Multivariable Calculus (Credit 02)

Course Outcomes (COs):

On completion of the course, the students will be able to:

1. To study functions and several variables.
2. To find extreme value of multivariable functions using derivative.
3. Apply a range of techniques to solve differential equations.

UNIT	Content	Hours Allotted
1	**Jacobian** 1.1 Definition of Jacobian and examples. 1.2 Properties of Jacobians. 1.2.1 If J is Jacobian of u, v with respect to x, y and $J'$is Jacobian of x, y with respect to u, v then $JJ' = 1$. 1.2.2 If J is Jacobian of u, v, w with respect to x, y, z and $J'$is Jacobian of x, y, z with respect to u, v, w then $JJ' = 1$. 1.2.3 If p, q are functions of u, v and u, v are functions of x, y then prove that $\frac{\partial(p,q)}{\partial(x,y)} = \frac{\partial(p,q)}{\partial(u,v)} \cdot \frac{\partial(u,v)}{\partial(x,y)}$. 1.2.4 If p, q, r are functions of u, v, w and u, v, w are functions of x, y, z then prove that $\frac{\partial(p,q,r)}{\partial(x,y,z)} = \frac{\partial(p,q,r)}{\partial(u,v,w)} \cdot \frac{\partial(u,v,w)}{\partial(x,y,z)}$. 1.2.5 Examples on these properties.	12
2	**Extreme Values** 2.1 Definition of Maximum, Minimum and stationary values of function of two variables. 2.2 Conditions for maxima and minima (Statement only) and examples. 2.3 Lagrange's method of undetermined multipliers of three variables 2.3.1 the extreme values of the function $f(x, y, z)$ subject to the condition $\emptyset(x, y, z) = 0$. 2.3.2 The extreme values of the function $f(x, y, z)$ subject to the condition $\emptyset(x, y, z) = 0 \; and \; \varphi(x, y, z) = 0$. 2.3.3 Examples based on Lagrange's method of undetermined multipliers of three variables. 2.3.4 Errors and approximations.	12

3	**Ordinary Simultaneous Differential Equations** 3.1 Simultaneous linear differential equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. 3.2 Method of solving simultaneous linear differential equation. 3.3 Geometrical interpretation. 3.4 Examples	11
4	**Total Differential Equations** 4.1Total differential equation $Pdx + Qdy + Rdz = 0$. 4.2 Necessary condition for integrability of total differential equation. 4.3 Method of solving total differential equation. a) Method of inspection b) One variable regarding as constant 4.4 Geometrical interpretation 4.5 Geometrical relation between total differential equation and simultaneous linear differential equation. 4.6 Examples	10

Recommended Books:

1. Differential & Integral Calculus; G. V. Kumbhojkar, G. V. Kumbhojkar; C. Jamnadas & Co.

2. Sharama and Gupta, Differential Equation, Krinshna Prakashan Media co., Meerat.

Reference Books:

1. Gorakh Prasad, Differential Calculus, Pothishala Pvt Ltd., Allahabad

2. Diwan and Agashe, Differential Equation.

Subject Code: - MJ-BMT23-302

Paper VI: Integral Calculus (Credit 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Solving Beta and Gamma functions as a application of improper integral.
2. To solve improper integral with finite and unbounded range.
3. To evaluate the Fourier series of various even and odd functions.
4. Calculate real form of Fourier series of standard periodic function.

UNIT	Contents	Hours Allotted
1	**Gamma and Beta Functions** 1.1 Definition of Gamma function 1.2 Properties of Gamma function 1.2.1 $\lceil\overline{1} = 1$. 1.2.2 Recurrence formula: $\lceil\overline{n} = (n-1)\lceil\overline{n-1}$. 1.2.3 $\lceil\overline{n} = (n-1)!$ where n is a positive integer. 1.2.4 $\lim_{n\to\infty}\lceil\overline{n} = \infty, \lim_{n\to 0}\lceil\overline{n} = 0$. 1.2.5 $\lceil\overline{n} = 2\int_0^\infty e^{-x^2}.x^{2n-1}dx\ , n > 0$. 1.2.6 $\lceil\overline{n} = \alpha^n\int_0^\infty e^{-\alpha x}x^{n-1}dx\ , where\ n > 0\ , \alpha > 0$. 1.2.7 $\int_0^\infty e^{-kx}x^{n-1}dx = \frac{\lceil\overline{n}}{k^n}\ where\ n > 0\ , \alpha > 0$. 1.2.8 $\lceil\overline{\tfrac{1}{2}} = \sqrt{\pi}$. 1.3 Definition of Beta function 1.4 Properties of Beta function 1.4.1 Symmetric property: $\beta(m,n) = \beta(n,m)$. 1.4.2 $\beta\ (m,n) = 2\int_0^{\pi/2} sin^{2m-1}\theta cos^{2n-1}\theta d\theta$. 1.4.3 $\int_0^{\pi/2} sin^p\theta cos\ ^q\theta d\theta = \frac{1}{2}\ \beta\left(\frac{p+1}{2},\frac{q+1}{2}\right)$. 1.4.4 $\beta\ (m,n) = \int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}}\ dx$. 1.4.5 $\int_0^\infty \frac{x^{m-1}}{(a+bx)^{m+n}}\ dx = \frac{1}{a^n b^m}\ \beta(m,n)$. 1.4.6 $\int_0^\infty \frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}\ dx = \beta(m,n)$. 1.5 Relation between Beta and Gamma function $\beta(m,n) = \frac{\lceil\overline{m}\lceil\overline{n}}{\lceil\overline{m+n}}$. 1.6 Duplication formula: $2^{2m-1}\lceil\overline{m}\ \lceil\overline{m+\tfrac{1}{2}} = \lceil\overline{2m}\ \sqrt{\pi}$. 1.7 $\lceil\overline{\tfrac{1}{4}}\ .\ \lceil\overline{\tfrac{3}{4}} = \pi\sqrt{2}$	12

2	**Multiple Integrals** 2.1 Double integral: Evaluation of double integrals. 2.2 Evaluation of double integrals in Cartesian coordinates. 2.3 Evaluation of double integrals over the given region. 2.4 Evaluation of double integrals in polar coordinates. 2.5 Evaluation of double integrals by changing the order of integration 2.6 Triple integrals: Evaluation of triple integrals.	12
3	**Fourier Series** 3.1 Definition of Fourier series with Dirichlet condition. 3.2 Fourier series for the function f(x) in the interval $[-\pi,\pi]$. 3.3 Fourier series for the function f(x) in the interval $[-c,c]$. 3.4 Fourier series for the function f(x) in the interval $[0,2\pi]$. 3.5 Fourier series for the function f(x) in the interval $[0,2c]$. 3.6 Even and odd functions. 3.7 Half Range series	11
4	**Differentiation Under Integral Sign And Error Function** 4.1 Introduction 4.2 Integral with its limit as constant. 4.3 Integral with limit as function of the parameter [Leibnitz rule] 4.4 Error Function	10

Recommended Books:

1. P.N. and J. N. Wartikar, Elements of Applied Mathematics.

2. B. S. Phadatare, U. H. Naik, P. V. Koparde, P. D. Sutar, P. D. Suryvanshi, M. C. Manglurkar, A Text Book of Advanced Calculus Published by Shivaji Univeristy Mathematics Society (SUMS) ,2005.

Reference Books:

1. N. Piskunov, Differential and Integral Calculus, Peace Publisheres.
2. Shanti Narayan, Integral Calculus, S. Chand and Company, New Delhi.

Subject Code: - MJ-BMP23-303

Mathematical Practical-III
Semester-III
Group A

Sr. No	Topic
1	Examples on Jacobian
2	Examples on Extreme values for two variables
3	Examples on Lagrange’s Method of Undetermined Multipliers
4	Examples on ordinary simultaneous differential equation
5	Examples on total differential equation
6	Examples on Gamma and Beta Function
7	Examples on Evaluation of double integrals over the given region
8	Examples on Fourier Series: $[0, 2\pi]$
9	Examples on Fourier Series: $[-\pi, \pi]$
10	Examples on Integral with limit as function of the parameter [Leibnitz rule]

Group B

Sr. No	Topic
1	C-Introduction-I
2	C-Introduction-II
3	Complete structure of C-program
4	Simple C-program
5	If statement, If else statement and switch statement
6	While loop and do while loop
7	For loop
8	Go to, break continue statement
9	One dimensional array
10	Two-dimensional array

Minor Papers
Semester: III
Subject Code: - MN-BMT23-301
Paper V: Calculus (Credit 02)

Course Outcomes (COs):

On completion of the course, the students will be able to:

1. To study functions and several variables.
2. To find extreme value of multivariable functions using derivative.
3. Apply a range of techniques to solve differential equations.

UNIT	Content	Hours Allotted
1	**Jacobian** 1.1 Definition of Jacobian and examples. 1.2 Properties of Jacobians. 1.2.1 If J is Jacobian of u, v with respect to x, y and $J'$is Jacobian of x, y with respect to u, v then $JJ' = 1$. 1.2.2 If J is Jacobian of u, v, w with respect to x, y, z and $J'$is Jacobian of x, y, z with respect to u, v, w then $JJ' = 1$. 1.2.3 If p, q are functions of u, v and u, v are functions of x, y then prove that $\frac{\partial(p,q)}{\partial(x,y)} = \frac{\partial(p,q)}{\partial(u,v)} \cdot \frac{\partial(u,v)}{\partial(x,y)}$. 1.2.4 If p, q, r are functions of u, v, w and u, v, w are functions of x, y, z then prove that $\frac{\partial(p,q,r)}{\partial(x,y,z)} = \frac{\partial(p,q,r)}{\partial(u,v,w)} \cdot \frac{\partial(u,v,w)}{\partial(x,y,z)}$. 1.2.5 Examples on these properties.	12
2	**Extreme Values** 2.1 Definition of Maximum, Minimum and stationary values of function of two variables. 2.2 Conditions for maxima and minima (Statement only) and examples. 2.3 Lagrange's method of undetermined multipliers of three variables 2.3.1 the extreme values of the function $f(x, y, z)$ subject to the condition $\emptyset(x, y, z) = 0$. 2.3.2 The extreme values of the function $f(x, y, z)$ subject to the condition $\emptyset(x, y, z) = 0 \; and \; \varphi(x, y, z) = 0$. 2.3.3 Examples based on Lagrange's method of undetermined multipliers of three variables. 2.3.4 Errors and approximations.	12

3	**Gamma and Beta Functions** 1.1 Definition of Gamma function 1.2 Properties of Gamma function 1.2.1 $\vert\overline{1} = 1.$ 1.2.2 Recurrence formula: $\vert\overline{n} = (n-1)\vert\overline{n-1}.$ 1.2.3 $\vert\overline{n} = (n-1)!$ where n is a positive integer. 1.2.4 $\lim_{n\to\infty}\vert\overline{n} = \infty, \lim_{n\to 0}\vert\overline{n} = 0.$ 1.2.5 $\vert\overline{n} = 2\int_0^\infty e^{-x^2}.x^{2n-1}dx\ , n > 0.$ 1.2.6 $\vert\overline{n} = \alpha^n\int_0^\infty e^{-\alpha x}x^{n-1}dx\ \ , where\ n > 0\ , \alpha > 0.$ 1.2.7 $\int_0^\infty e^{-kx}x^{n-1}dx = \frac{\vert\overline{n}}{k^n}\ where\ n > 0\ , \alpha > 0.$ 1.2.8 $\vert\overline{\tfrac{1}{2}} = \sqrt{\pi}\ .$ 1.3 Definition of Beta function 1.4 Properties of Beta function 1.4.1 Symmetric property: $\beta(m,n) = \beta(n,m).$ 1.4.2 $\beta\ (m,n) = 2\int_0^{\pi/2} sin^{2m-1}\theta cos^{2n-1}\theta d\theta.$ 1.4.3 $\int_0^{\pi/2} sin^p\theta cos\ ^q\theta d\theta = \frac{1}{2}\ \beta\left(\frac{p+1}{2},\frac{q+1}{2}\right).$ 1.4.4 $\beta\ (m,n) = \int_0^\infty \frac{x^{m-1}}{(1+x)^{m+n}}\ dx.$ 1.4.5 $\int_0^\infty \frac{x^{m-1}}{(a+bx)^{m+n}}\ dx = \frac{1}{a^n b^m}\ \beta(m,n).$ 1.4.6 $\int_0^\infty \frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}\ dx = \beta(m,n).$ 1.5 Relation between Beta and Gamma function $\beta(m,n) = \frac{\vert\overline{m}\vert\overline{n}}{\vert\overline{m+n}}\ .$ 1.6 Duplication formula: $2^{2m-1}\vert\overline{m}\ \vert\overline{m+\tfrac{1}{2}} = \vert\overline{2m}\ \sqrt{\pi}\ .$ 1.7 $\vert\overline{\tfrac{1}{4}}\ .\vert\overline{\tfrac{3}{4}} = \pi\sqrt{2}$	11
4	**Vector Calculus** 4.1 Differentiation of vector. 4.2 Tangent line to curve. 4.3 Velocity and Acceleration 4.4 Gradient, Divergence and Curl; Definitions and examples 4.5 Solenoidal and Irrational Vector 4.6 Conservative vector field. 4.7 Properties of Gradient Divergence and Curl 4.7.1 If $\bar{a}$ is a constant vector then $div\ \bar{a} = 0\ and$ $curl\ \bar{a} = 0.$ 4.7.2 $div\left(\bar{f}+\bar{g}\right) = div\ \bar{f} + div\ \bar{g}$ 4.7.3 $curl\left(\bar{f}+\bar{g}\right) = curl\ \bar{f} + curl\ \bar{g}$ 4.7.4 If $\bar{f}$ is a vector point function and Φ is a scalar point function then $div(\Phi\bar{f}) = \Phi div\ \bar{f} + (grad\ \Phi).\bar{f}$	10

	4.7.5 If $\bar{f}$ is a vector point function and Φ is a scalar point function then $curl(\Phi\bar{f})$= $grad\ \Phi \times \bar{f} + (\Phi\ curl\bar{f})$. 4.7.6 $div\ (\bar{f} \times \bar{g})$ = $\bar{g}.curl\ \bar{f} - \bar{f}.curl\ \bar{g}$ 4.7.7 $divgrad\ \Phi = \nabla^2\Phi$ 4.7.8 $curlgrad\ \Phi = \bar{0}$. 4.7.9 $div\ curl\ \bar{f} = 0$. 4.7.10 $curl\ curl\ \ \bar{f} = grad\ div\ \bar{f} - \nabla^2$.	

Recommended Books:

1. Differential & Integral Calculus; G. V. Kumbhojkar, G. V. Kumbhojkar; C. Jamnadas & Co.

2. Sharama and Gupta, Differential Equation, Krinshna Prakashan Media co., Meerat.

Reference Books:

1. Gorakh Prasad, Differential Calculus, Pothishala Pvt Ltd., Allahabad

2. Diwan and Agashe, Differential Equation.

Subject Code: - MN-BMP23-303

Mathematical Practical-III
Semester-III

Sr. No	Topic
1	Examples on Jacobian
2	Examples on properties of Jacobian
3	Examples on Lagrange's Method of Undetermined Multipliers
4	Examples on Extreme values for two variables
5	Examples on Gamma Function
6	Examples on Beta function
7	Examples on Duplication formula
8	Examples on Gradient
9	Examples on Divergence
10	Examples on Curl

Semester-III

SEC-II

Geogebra Application Developer (Theory)

Course Outcomes (Cos):

On completion of the course, the students will able to:

1. Grasp experimental, problem-oriented and research –oriented of learning of mathematics, both in the classroom and at home.
2. Prove theorems using Geogebra software.

Unit	Contents	Hours Allotted
1	**Introduction to Geogebra** 1.1About Geogebra Software and Geogebra website 1.2 How to use the online interface of Geogebra 1.3 Online resources available to teach various branches of Math using Geogebra 1.4 Download and install Geogebra on Linux OS 1.5 Open Geogebra in Ubuntu Linux using Dash home 1.6 Benefits of Geogebra 1.7About Geogebra interface, Menu bar and Geometric tools 1.8 Open Geogebra interface in Ubuntu Linux and windows 10OS 1.9 How to delete objects, enable and disable grid and axis, Algebra and graphics views, change object properties of lines 1.10 Dependent and independent objects, properties of graphics view.	10
2	**Mathematics with Geogebra** 2.1Basics of Triangles 2.2Congruency of triangles 2.3Properties of Quadrilaterals 2.4Types of symmetry 2.5Polynomials.	10

Recommended Books:

1. Judith and Markus Hohenwarter, Introduction to GeoGebra,(Grant, Johannes Kepler University, Linz, Austria: Judith, Markus, and the GeoGebra Team,2011),
2. Markus Hohenwarter, The official Manual of GeoGebra.

Semester-III

SEC-III

Geogebra Application Developer (Practical)

Sr. No.	Topic
1	Construction and prove side side side rule of congruency.
2	Construction and proof of angle side angle rule of congruency
3	Construction and proof of side angle side rule of congruency
4	Construction of parallelogram using parallel lines, kites using intersecting circles, rhombus with a given length.
5	Reflection of an object about a line, about a point.
6	Rotation of an object around a point.
7	Use of input bar to type and display polynomials and Remainder theorem to divide polynomials
8	Slope, degree, zeros, roots and factorization of polynomial using Geogebra.

Semester: IV
Subject Code: - MJ-BMT23-401

Paper VII: Discrete Mathematics (Credit 02)

Course Outcomes (COs)
On completion of the course, the students will be able to:

1. To extend student's logical and mathematical maturity and ability to deal with abstraction
2. To understand the basic concept of graph theory.
3. Recognize standard valid and invalid argument forms.
4. Describe an algorithm and evaluate the time required for performance of an algorithm.

UNIT	Contents	Hours Allotted
1	**Relations** 1.1 Product sets, Relations, Inverse relation 1.2 Pictorial representation of relations 1.3 Composition of relations and matrices 1.4 Types of relation – Reflexive, Symmetric, Anti symmetric, Transitive and its examples 1.5 Closure properties and its examples 1.6 Equivalence relations and partitions. 1.7 Examples on Equivalence relation 1.8 Partial ordering relations. 1.9 Congruence Relation 1.9.1 Theorem: (with proof) Let m be a positive integer. Then: (i) For any integer a, we have $a \equiv a \pmod{m}$ (ii) If $a \equiv b \pmod{m}$, then $b \equiv a \pmod{m}$ (iii) If $a \equiv b \pmod{m}$ and $b \equiv c \pmod{m}$, then $a \equiv c \pmod{m}$ 1.9.2 Theorem: (with proof) Let $a \equiv c \pmod{m}$ and $b \equiv d \pmod{m}$. then: (i) $a + b \equiv c + d \pmod{m}$ (ii) $a.b \equiv c.d \pmod{m}$	11
2	**Division Algorithm** 2.1 Division Algorithm for positive integers (with proof) 2.2 Division Algorithm for integers (without proof) 2.3 Basic properties of divisible 2.3.1 Theorem: (statement only) Let a, b, c are integers (i) If $a\|b$ and $b\|c$, then $a\|c$ (ii) If $a\|b$ then, for any integer x, $a\|bx$ (iii) If $a\|b$ and $a\|c$. then $a\|(b+c)$ and $a\|(b-c)$ (iv) If $a\|b$ and $b \neq 0$, then $a = \pm b$ or $\|a\| < \|b\|$ (v) If $a\|b$ and $b\|a$, then $\|a\|=\|b\|$, i.e., $a=\pm b$ (vi) If $a\|1$, then $a=\pm 1$	11

	2.4 G.C.D. 2.4.1 Theorem: (with proof) Let d is the smallest integer of the form ax + by then d = g.c.d.(a,b) 2.4.2 Theorem: (with proof) If d = g.c.d. (a,b) then there exists integers x and y such that d = ax + by 2.5 Properties of g.c.d. (with proof) 2.5.1 Theorem: (with proof) A positive integers d = gcd (a, b) if and only if d has following two properties: (1) d divides both a and b (2) If c divides both a and b, then c|d 2.5.2 Simple properties of the greatest common divisor (with proof) (a) gcd (a, b) = gcd (b, a) (b) If $x > 0$, then gcd (ax, bx) = x, gcd (a, b) (c) If d = gcd (a, b), then gcd (a|d, b|d) = 1 (d) For any integer x, gcd (a, b) = gcd (a, b + ax) 2.6 Euclidean algorithm 2.7 Examples on Euclidean algorithm. 2.8 Relatively prime integers 2.8.1 Theorem: (with proof) If g.c.d.(a, b) = 1 and a and b both divides C then ab divides C. 2.8.2 Theorem: (with proof) Let a prime p divides a product ab then p|a or p|b.	
3	**Logic** 3.1 Revision 3.1.1 Logical propositions (statements) 3.1.2 Logical connectives 3.1.3 Propositional Form 3.1.4 Truth tables 3.1.5 Tautology and contradiction 3.1.6 Logical Equivalence 3.2 Algebra of propositions 3.3 Valid Arguments 3.4 Rules of inference 3.5 Methods of proofs 3.5.1 Direct proof 3.5.2 Indirect proof 3.6 Predicates and Quantifiers	11
4	**Graph Theory** 4.1 Graphs and Multi-graphs 4.2 Degree of a vertex 4.2.2 Hand Shaking Lemma – The sum of degree of all vertices of a Graph is equal to twice the number of edges.	12

	4.2.3 Theorem:- An undirected graph has even number of vertices of odd degree. 4.3 Types of graphs 4.3.1 Complete graph 4.3.2 Regular graph 4.3.3 Bipartite graph 4.3.4 Complete bipartite graph 4.3.5 Complement of a graph 4.4 Matrix representation of graph 4.4.1 Adjacency Matrix 4.4.2 Incidence Matrix 4.5 Connectivity 4.5.1 Walk, trail, path and cycle.	

Recommended Books:

2. **Discrete Mathematics** by S. R. Patil, M.D. Bhagat, R.S. Bhamare, D. M. Pandhare, Nirali Prakashan, Pune.
3. **DISCRETE MATHEMATICAL STRUCTURES** (6th Edition) by Kolman, Busby, Ross, Pearson Education (Prentice Hall)

Reference Books:

1. SCHAUM'S outlines "**DISCRETE MATHEMATICS**" (Second edition) by Seymour Lipschutz, Marc Lipson, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Subject Code: - MJ-BMT23-402
Paper VIII: Integral Transform (Credit 02)

Course Outcomes (COs)
On completion of the course, the students will be able to:

1. Understand the concept of Laplace Transform.
2. Apply properties of Laplace Transform to solve differential equations.
3. Understand relation between Laplace and Fourier Transform.
4. Understand infinite and finite Fourier Transform.
5. Apply Fourier transform to solve real life problems.

UNIT	Contents	Hours Allotted
1	**Laplace Transform:** 1.1 Definitions; Piecewise continuity, 1.2 Function of exponential order, 1.3 Function of class A, 1.4 Existence theorem of Laplace transform. 1.5 Laplace transform of standard functions. 1.6 First shifting theorem and Second shifting theorem and examples, 1.7 Change of scale property and examples, 1.8 Laplace transform of derivatives and examples, 1.9 Laplace transform of integrals and examples. 1.10 Multiplication by power of t and examples. 1.11 Division by t and examples. 1.12 Laplace transform of periodic functions and examples. 1.13 Laplace transform of Heaviside's unit Step function	12
2	**Inverse Laplace Transform:** 2.1 Definition, Standard results of inverse Laplace transform, Examples, 2.2 First shifting theorem and Second shifting theorem and examples. 2.3 Change of scale property and Inverse Laplace of derivatives, examples. 2.4 The Convolution theorem and Multiplication by S, examples. 2.5 Division by S, inverse Laplace by partial fractions, examples, 2.6 Solving linear differential equations with constant coefficients by Laplace transform.	11

3	**Infinite Fourier Transform:** 3.1 The infinite Fourier transform and inverse: Definition, examples. 3.2 Infinite Fourier sine and cosine transform and examples. Definition. 3.3 Infinite inverse Fourier sine and cosine trans form and examples. 3.4 Relationship between Fourier transform and Laplace transform. 3.5 Change of Scale Property and examples. 3.6 Modulation theorem. 3.7 The Derivative theorem. 3.8 Extension theorem. Convolution theorem and examples.	11
4	**Finite Fourier Transform:** 4.1 Finite Fourier Transform and Inverse, Fourier Integrals, 4.2 Finite Fourier sine and cosine transform with examples. 4.3 Finite inverse Fourier sine and cosine transform with examples. 4.4 Fourier integral theorem. 4.5 Fourier sine and cosine integral (without proof) and examples.	11

Recommended Books:

1. **Laplace and Fourier Transform:** J. K. Goyal, K. P. Gupta, A Pragati Edition (2016).

2. **Integral Transform:** Dr. S. Shrenadh, S. Chand Prakashan

Reference Books:

1. **Integral Transforms and Their Applications**: B. Davies, Springer Science Business Media LLC (2002)

2. **Laplace Transforms**: Murray R. Spiegel, Schaum’s outlines

Subject Code: - MJ-BMP23-403

Mathematical Practical-IV

Semester-IV

Group A

Sr. No	Topic
1	Examples on Relation & Equivalence relations
2	Examples on Euclidean Algorithm for finding g. c. d.
3	Examples on types of graphs
4	Examples on matrix representation of graph
5	Examples on logic
6	Examples on Laplace transform of Integral
7	Examples on Evaluation of integrals using properties of Laplace transform.
8	Examples on Inverse Laplace by Convolution Theorem
9	Examples on Infinite Fourier sine transform and inverse
10	Examples on Infinite Fourier cosine transform and inverse

Group B

Sr. No	Topic
1	Function: User defined functions, C-program – ${}^{n}C_{r}$ using function.
2	Numerical Integrations: (In C Program): Trapezoidal rule
3	Simpson's (1/3)rd rule
4	Simpson's (3/8)th rule.
5	Numerical Methods for solution of Ordinary Differential Equations: (Using Calculators) Gaussian Elimination Method
6	Gauss – Jordan (Direct) Method
7	Gauss Seidel (Iterative) Method.
8	Euler Method
9	Euler Modified Method
10	Runge- Kutta Second and Fourth order method.

Minor Papers

Semester: IV

Subject Code: - MN-BMT23-401

Paper VI: Basic Discrete Mathematics (Credit 02)

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. To extend student's logical and mathematical maturity and ability to deal with abstraction
2. To understand the basic concept of graph theory.
3. Recognize standard valid and invalid argument forms.
4. Describe an algorithm and evaluate the time required for performance of an algorithm.

UNIT	Contents	Hours Allotted
1	**Relations** 1.1 Product sets, Relations, Inverse relation 1.2 Pictorial representation of relations 1.3 Composition of relations and matrices 1.4 Types of relation – Reflexive, Symmetric, Anti symmetric, Transitive and its examples 1.5 Closure properties and its examples 1.6 Equivalence relations and partitions. 1.7 Examples on Equivalence relation 1.8 Partial ordering relations.	11
2	**Congruence Relation** 2.1 Definition of congruence relation 2.2 Examples on congruence relation. 2.3 Theorem: (with proof) Let m be a positive integer. Then: (i) For any integer a, we have $a \equiv a \pmod m$ (ii) If $a \equiv b \pmod m$, then $b \equiv a \pmod m$ (iii) If $a \equiv b \pmod m$ and $b \equiv c \pmod m$, then $a \equiv c \pmod m$ 2.4. Theorem: (with proof) Let $a \equiv c \pmod m$ and $b \equiv d \pmod m$. then: (i) $a + b \equiv c + d \pmod m$ (ii) $a.b \equiv c.d \pmod m$	11
3	**Logic** 3.1 Revision 3.1.1 Logical propositions (statements) 3.1.2 Logical connectives 3.1.3 Propositional Form 3.1.4 Truth tables 3.1.5 Tautology and contradiction 3.1.6 Logical Equivalence	11

	3.2 Algebra of propositions 3.3 Valid Arguments 3.4 Rules of inference 3.5 Methods of proofs 3.5.1 Direct proof 3.5.2 Indirect proof 3.6 Predicates and Quantifiers	
4	**Graph Theory** 4.1 Graphs and Multi-graphs 4.2 Degree of a vertex 4.2.2 Hand Shaking Lemma – The sum of degree of all vertices of a Graph is equal to twice the number of edges. 4.2.3 Theorem:- An undirected graph has even number of vertices of odd degree. 4.3 Types of graphs 4.3.1 Complete graph 4.3.2 Regular graph 4.3.3 Bipartite graph 4.3.4 Complete bipartite graph 4.3.5 Complement of a graph 4.4 Matrix representation of graph 4.4.1 Adjacency Matrix 4.4.2 Incidence Matrix 4.5 Connectivity 4.5.1 Walk, trail, path and cycle.	12

Recommended Books:

4. **Discrete Mathematics** by S. R. Patil, M.D. Bhagat, R.S. Bhamare, D. M. Pandhare, Nirali Prakashan, Pune.

5. **DISCRETE MATHEMATICAL STRUCTURES** (6th Edition) by Kolman, Busby, Ross, Pearson Education (Prentice Hall)

Reference Books:

2. SCHAUM'S outlines "**DISCRETE MATHEMATICS**" (Second edition) by Seymour Lipschutz, Marc Lipson, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Subject Code: - MN-BMP23-403

Mathematical Practical-IV

Semester-IV

Sr. No	Topic
1	Examples on Relation
2	Examples on Equivalence relations
3	Examples on congruence relations
4	Examples on logic
5	Examples on Predicates and Quantifiers
6	Examples on Valid Arguments
7	Examples on types of graphs
8	Examples on Connectivity
9	Examples on Adjacency Matrix
10	Examples on Incidence Matrix

Semester-IV
SEC-IV
Machine learning with python (Theory)

Course Outcomes (Cos):
On completion of the course, the students will able to:

1. Use Python to read and write files.
2. Discover how to work with lists and sequence data.
3. To introduce students to the basic concepts and techniques of machine learning.
4. To develop skills of using recent machine learning.
5. To gain experience of doing independent study and research.

Unit	Contents	Hours Allotted
1	**Python Programming Language** 1.1 Introduction to ML 1.2 python and IDE(Installation), 1.3 python programming and Inbuilt data types, 1.4 introduction to python loop and functions 1.5 NumPy package, pandas package, 1.6 matplotlib -data visualization.	10
2	**Introduction to Machine Learning** 2.1 Descriptive statistics, 2.2 hypothesis testing and process,inferential statistics, 2.3 concepts like- regression, correlation, 2.4 logistic regression, 2.5 introduction to Machine learning algorithms. 2.6 Creating machine learning Models.(Regression and Classification.)	10

Recommended Books:

1. Python 3 for Absolute beginners Tim Hall and J-P Stacey
2. Python for Everybody Dr. Charles R. Severance

Semester-IV
SEC-V
Machine learning with python
(Practical)

Sr. No.	Topic
1	Data types
2	Loop and functions.
3	Python programme to display calendar
4	Making a Simple calculator
5	Understanding Data through Visualization
6	Understanding Data stastically.
7	Creating regression Model
8	Creating classification Model