Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

CIRCULAR NO.SU/Sci./B.Sc.Maths/CBC&GS/38/2023

In continuation of this office CIRCULAR NO.SU/B.Sc./CBC&GS /64/2023/29372-79 dated 18.05.2023 at Serial No.01. It is hereby inform to all concerned that, the Revised syllabus prepared by the Board of Studies in Mathematics, and recommended by the Dean, Faculty of Science & Technology, **the Hon'ble Vice-Chancellor has accepted Revised Syllabus of B.Sc.Mathematics IIIrd and IVth semester as per Choiced Based Credit and Grading System in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.**

This shall be effective from the Academic Year 2023-24 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. SU/SCI/2023/12545-53
Date:-20.10.2023.

Deputy Registrar,
Academic Section.

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1] **The Principal of all concerned affiliated Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

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DR.BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

AURANGABAD-431004 (MS) INDIA

Undergraduate Bachelor Degree Program in Science and Technology

B.Sc. Mathematics

B.Sc.Second Year (Semester-III & IV)

Revised Course Structure and Curriculum

Choice Based Credit and Grading System

(Effective from Academic Year 2023-2024)

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Dr. Jagdish Nanaware
Chairman
BOS in Mathematics
Dr B.A.Marathwada University
Aurangabad - 431001 (M.S)

Dr.Babasaheb Ambedkar Marathwada University

Aurangabad-431004 (MS) India

Revised Course Structure of **B.Sc.(Mathematics) Second Year** (Semester-III and Semester-IV)

B.Sc. Second Year (Semester-III)								
	Course Code	Course Title	Total Periods (Teaching Periods /week)	Credits	Scheme of Examination			
					Max. Marks	CIA	UA	Min. Marks
DSC-1C Core Courses	**MAT-301 Paper -V**	**Differential Equations**	**60(5/week)**	**2**	**50**	**10**	**40**	**20**
	MAT-302 Paper-VI	**Laplace and Fourier Transforms**	**60(5/week)**	**2**	**50**	**10**	**40**	**20**
	MAT-302P Paper-V&VI	**Lab Course-I (Based on MAT-301 & MAT- 302)**	**60(5/week) Annual Exam.**	**3**	**50**	**10**	**40**	**20**
SEC-1 Elective Course (Any One)	**MAT-303 Paper-VII**	**Mechanics-I**	**45(5/week)**	**2**	**50**	**10**	**40**	**20**
	MAT-304 Paper-VIII	**Graph Theory**	**45(5/week)**	**2**	**50**	**10**	**40**	**20**
				9	150	30	120	60
Total Credits for Semester-III: 9								

B.Sc. Second Year (Semester-IV)								
	Course Code	Course Title	Total Periods (Teaching Periods /week)	Credits	Scheme of Examination			
					Max. Marks	CIA	UA	Min. Marks
DSC-1D Core Courses	**MAT-401 Paper-IX**	**Partial Differential Equations**	**60(5/week)**	**2**	**50**	**10**	**40**	**20**
	MAT-402 Paper-X	**Numerical Analysis**	**60(5/week)**	**2**	**50**	**10**	**40**	**20**
	MAT-402P Paper-X&XI	**Lab Course-II (Based on MAT-401 & MAT -402)**	**60(5/week) Annual Exam.**	**3**	**50**	**10**	**40**	**20**
SEC-2 Elective Course (Any One)	**MAT-403 Paper-XI**	**Mechanics-II**	**60** 45 **(5/week)**	**2**	**50**	**10**	**40**	**20**
	MAT-404 Paper-XII	**Complex Analysis**	**60** 45 **(5/week)**	**2**	**50**	**10**	**40**	**20**
				9	150	30	120	60
Total Credits for Semester-IV : 9								

UA- University Assessment **CIA-** Continuous Internal Assessment

Note: CIA : **Internal Test -05** Marks and **Assignment/Tutorial-05** Marks

(Two internal tests of 05 marks each be conducted and average of the two tests will be considered)

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Aurangabad-431004 (MS) India

Revised Curriculum of B.Sc. (Mathematics) Second Year (Semester-III and Semester-IV)

B.Sc.Second Year (Semester-III)

Discipline Specific Courses

Course Code: **MAT-301** Course Name: **Differential Equations**

Credits :**02** Total Periods: **60**

Course Objectives:

Student will learn the basic methods of finding solutions of differential equations.

Course Outcomes:

CO1: Determine solution of first order linear differential equation

CO2: Determine solution of exact differential equation

CO3: Determine solution of linear equation with constant coefficient using general and short method

CO4: Determine solution of linear homogeneous differential equation

Unit-I: Equations of the First Order and of the First Degree

Ordinary and partial differential equations, Order and degree, Solution and constant of integration, Derivation of differential equation, Equation of the first order and the first degree, Equations of the form $f_1(x)dx + f_2(y)dy = 0$, Equations homogeneous in x and y, Non-homogeneous equations of the first degree in x and y, Exact differential equations, Condition that an equation of the first order to be exact, Rules for finding the solution of an exact differential equation. Integrating factors, The number of integrating factors is infinite, Integrating factors found by inspections. Rules for finding integrating factors, Rules *I&II*, Rules *III&IV*, Rule *V*, Linear equations, Equation reducible to the linear form.

Unit-II: Equations of the First Order but not of First Degree

Equations that can be resolved into component equations of the first degree, Equations that can't be resolved into component equations, Equations solvable for y, Equation solvable for x, Equations that do not contain x, that do not contain y, Equations homogeneous in x and y, Equations of first degree in x & y: Clairaut's equation.

Unit-III: Linear Equations With Constant Coefficients

Linear equations defined, The Complementary Function, The particular integral, The complete solution, The linear equation with constant coefficients and second member zero, Case of the auxiliary equation having equal roots, Case of the auxiliary equation having imaginary roots, The symbol D, Theorem concerning D, Another way of finding the solution when the auxiliary equation has repeated roots,The linear equation with constant coefficients and a second member a function of x, The symbolic function $1/f(D)$, Methods of finding the particular integral. Short method of finding the particular integrals in certain cases: Integral corresponding to a term of the form e^{ax},x^m,sinax or cosax in the second member, Integral corresponding to a term of the form $e^{ax}V$ and xV in the second member.

Unit-IV: Linear Equations with Variable Coefficients

The homogeneous linear equation first method of solution, Second method of solution:(A) To find the complementary function,(B) To find the particular integral, The symbolic function $f(\theta)$ and $1/f(\theta)$, Method of finding the particular integral, Integral corresponding to a term of the form x^m in the second member, Equation reducible to the homogeneous linear form.

Recommended Text Book:

Daniel A. Murray: Introductory Course in Differential equations, Khosala Publishing House, New Delhi.

Scope:

Unit I. : Chapter I: Art. 1 to 3, Chapter II: Art. 8 to 21.
Unit-II : Chapter III: Art 22 to 28(Complete)
Unit-III: Chapter VI: Art 49 to 64
Unit-IV :,Chapter VII: Art 65 to 71

Reference Books:

1. M.D.Raisinghania: Ordinary and Partial Differential Equations, S.Chand and Company Limited.
2. G.Birkhoff and G.C.Rota: Ordinary Differential Equations, John Wiley and Sons.
3. Frank Ayres: Theory and Problems on Differential Equations, McGraw Hill.
4. George F.Simmons: Differential Equations with Applications and Historical Notes, Tata McGraw Hill Publishing House Limited.

Course Code: **MAT-302** Course Name: **Laplace and Fourier Transforms**

Credits:**02** Total Periods: **60**

Course Objectives:

Student will learn the fundamental properties of Laplace and Fourier transforms.

Course Outcomes:

CO1: Determine Laplace transform for various functions and understand the properties of Laplace transforms

CO2: Determine inverse Laplace transform, properties of inverse Laplace Transform, and solve the problems using convolution theorem

CO3: Determine Fourier transform and understand the properties of Fourier transform, Fourier sine and cosine transforms

CO4: Apply Laplace transform to find solutions of differential equations.

Unit I: Beta Function, Gamma Function and Laplace Transforms

Beta and Gamma functions, Elementary properties of Gamma function, Relation between Beta and Gamma functions. Introduction, Laplace Transform, Important Formulae, Properties of Laplace Transforms, Laplace Transform of the Derivative of $f(t)$, Laplace Transform of the Derivative of Order n, Laplace Transform of Integral of $f(t)$, Laplace Transform of $t.f(t)$ (Multiplication by t), Laplace Transform of $1/t\ f(t)$ (Division by t), Unit Step Function, Second Shifting Theorem, Impulse Function, Periodic Functions, Convolution Theorem, Evaluation of Integrals, Formulae of Laplace Transform, Properties of Laplace Transform.

Unit II: Inverse Laplace Transforms

Inverse Laplace Transforms, Important Formulae, Multiplication by s, Division by s (Multiplication by 1/s), First Shifting Property, Second Shifting Property, Inverse Laplace Transforms of Derivatives, Inverse Laplace Transform of Integrals, Partial Fractions Method, Inverse Laplace Transform by Convolution.

Unit III: Solutions of Differential Equations and Integral Transforms

Solution of Differential Equations by Laplace Transforms, Solution of Simultaneous Differential Equations by Laplace Transforms

Unit IV: Fourier Transforms

Introduction, Integral Transforms, Fourier Integral Theorem, Fourier Sine and Cosine Integrals, Fourier's Complex Integral, Fourier Transforms, Fourier Sine and Cosine Transforms, Properties of Fourier Transforms.

Recommended Text Book:

1. **J.N.Sharma, A. R.Vasishtha:** Real Analysis, Krishna Prakashan Media Pvt.Ltd., Meerut.
2. **H.K.Dass**: Advanced Engineering Mathematics, S.Chand & Company Ltd.(2004)

Scope:

Unit I: (Chapter 14) Article 9,10,13 [1]
(Chapter13) Articles13.1 to 13.15, Article 13.17 to 13.19 [2]

Unit II: (Chapter13) Articles13.20 to 13.29 [2]

Unit III: (Chapter13) Articles13.30 to 13.31 [2]

Unit IV: (Chapter14) Articles14.1 to 14.8 [2]

Reference Books:

1. Grove A.C.: An Introduction to Laplace Transforms and Z-Transforms, Prentice Hall 1991.
2. Doetsch G.: Introduction to Theory and Application of Laplace Transforms, Springer Verlag,1990.
3. Murray Spigel: Schaum Outline of Laplace Transforms, Schaum Outline Series, Mc-Graw Hill 2012.
4. Joel L.Schiff: The Laplace Transforms:Theory and Applications, Springer,2008.
5. R.J.Becrends, H.G.Morsche J.C.Vande Berg and E.M.Vande Vrie: Fourier and Laplace Transform,Cambridge Press,2003.

Course Code: **MAT-302P** Course Name: **Lab Course-I**

(Based on MAT-301&MAT 302)

Credits:**03** Total Periods: **60**

At least Eight Practicals shall be conducted from each section

Section-A- MAT-301

Practical I	**Problems based on variable separable form.** 1. Solve $\frac{dy}{dx}+\frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}=0$. 2. Solve $\left(y-x\frac{dy}{dx}\right)=a\left(y^2+\frac{dy}{dx}\right)$. 3. Solve $3e^x \tan y\, dx+(1-e^x)\, sec^2 y\, dy=0$. **Problems on homogenous differential equation.** 1. Solve $y^2dx+(xy+x^2)dy=0$. 2. Solve $x^2ydx-(x^3+y^3)dy=0$. 3. Solve $(4y+3x)\frac{dy}{dx}+y-2x=0$. **Problems on non-homogenous differential equation.** 1. Solve $(3y-7x+7)dx+(7y-3x+3)dy=0$. 2. Solve $(y-3x+3)\frac{dy}{dx}=2y-x-4$.
Practical II	**Problems on exact differential equation.** 1. Solve $(a^2-2y-y^2)dx-(x+y)^2dy=0$. 2. Solve $(2ax+by+g)dx+(2cy+bx+e)dy$. 3. Solve $(2x^2y+4x^3-12xy^2+3y^2-xe^y+e^{2x})dy+(12x^2y+2xy^2+4x^3-4y^2+2ye^{2x}-e^y)dx=0$. **Problems based on Rule I and Rule II of Integrating Factor.** 1. Solve $(x^2-2xy^2)\,dx-(x^3-3x^2y)\,dy=0$. 2. Solve $y(xy+2x^2y^2)\,dx+x(xy-x^2y^2)\,dy=0$. **Problems based on Rule III of Integrating Factor.** 1. Solve $(x^2+y^2+2x)\,dx+2y\,dy=0$. 2. Solve $(x^2+y^2)\,dx-2xy\,dy=0$.
Practical III	**Problems based on Rule IV of Integrating Factor.** 1. Solve $(3x^2y^4+2xy)\,dx+(2x^3y^3-x^2)\,dy=0$. 2. Solve $(y^4+2y)\,dx+(xy^3+2y^4-4x)\,dy=0$. **Problems based on Rule V of Integrating Factor.** 1. Solve $(2x^2y-3y^4)\,dx+(3x^3+2xy^3)\,dy=0$. 2. Solve $(y^2+2x^2y)\,dx+(2x^3-xy)\,dy=0$. **Problems on linear differential equation.** 1. Solve $\frac{dy}{dx}+y=e^{-x}$. 2. Solve $cos^2x\frac{dy}{dx}+y=tanx$. 3. Solve $(x+1)\frac{dy}{dx}-ny=e^x(x+y)^{n+1}$. 4. Solve $(x^2+1)\frac{dy}{dx}+2xy=4x^2$.

Practical IV	**Problems on equation reducible to the linear form.** 1. Solve $\frac{dy}{dx}+\frac{2}{x}y=3x^2y^{\frac{4}{3}}$. 2. Solve $\frac{dy}{dx}+\frac{xy}{1-x^2}=xy^{\frac{1}{2}}$. 3. Solve $3x(1-x^2)y^2\frac{dy}{dx}+(2x^2-1)y^3=ax^3$. **Unit II: Equations of the first order but not of first degree** **Problems on equation that can be resolved into component equation of the first degree.** 1. Solve $p^3(x+2y)+3p^2(x+y)+(y+2x)p=0$. 2. Solve $\left(\frac{dy}{dx}\right)^3=ax^4$. 3. Solve $4y^2p^2+2pxy(3x+1)+3x^3=0$. 4. Solve $p^2-7p+12=0$. **Problems on equation solvable for y.** 1. Solve $y=x+a\ tan^{-1}p$. 2. Solve $4y=x^2+p^2$. 3. Solve $xp^2-2yp+ax=0$. **Problems on equation solvable for x.** 1. Solve $x=y+p^2$. 2. Solve $x=y+a\log p$. 3. Solve $p^2y+2px=y$.
Practical V	**Problems on equation that do not contain x; that do not contain y** 1. Solve $y=2p+3p^2$. 2. Solve $x(1+p^2)=1$. 3. Solve $x^2=a^2(1+p^2)$. 4. Solve $y^2=a^2(1+p^2)$. **Problems on equations homogenous in x and y.** 1. Solve $y^2+xyp-x^2p^2=0$. 2. Solve $y=yp^2+2px$. **Problems on Clairaut's equation.** 1. Solve $y=xp+sin^{-1}p$. 2. Solve $e^{4x}(p-1)+e^{2y}p^2=0$. 3. Solve $xy(y-px)=x+py$.
Practical VI	**Linear Equations with Constant Coefficients and Second Member Zero.** 1. Solve $\frac{d^2y}{dx^2}+5\frac{dy}{dx}-12y=0$. 2. Solve $9\frac{d^2y}{dx^2}+18\frac{dy}{dx}-16y=0$. **Case of Auxiliary Equation having Equal Roots.** 1. Solve $\frac{d^3y}{dx^3}-3\frac{d^2y}{dx^2}+4y=0$. **Case of Auxiliary Equation having Imaginary Roots.** 1. Solve $\frac{d^2y}{dx^2}+m^2y=0$.

Practical VII	**Integral corresponding to the term of the form e^{ax} in the second member.** 1. Solve $\frac{d^3y}{dx^3} - y = (e^x - 1)^2$. 2. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 2e^{\frac{5}{2}x}$. **Integral corresponding to the term of the form x^m in the second member.** 1. Solve $\frac{d^3y}{dx^3} + 8y = x^4 + 2x + 1$. **Integral corresponding to the term of the form $\sin ax$ or $\cos ax$ in the second member.** 1. Solve $\frac{d^2y}{dx^2} - 4y = 2\sin\frac{1}{2}x$. 2. Solve $\frac{d^3y}{dx^3} + y = \sin 3x - cos^2\frac{1}{2}x$.
Practical VIII	**Integral corresponding to the term of the form $e^{ax}V$ in the second member.** 1. Solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{2x}\sin x$. 2. Solve $\frac{d^2y}{dx^2} + 2y = x^2e^{3x} + e^x\cos 2x$. **Integral corresponding to the term of the form xV in the second member.** 1. Solve $\frac{d^2y}{dx^2} + 4y = x\sin x$. 2. Solve $\frac{d^2y}{dx^2} - y = x^2\cos x$.
Practical IX	**Problems on homogenous linear equation with variable coefficients.** 1. Solve $x^2\frac{d^2y}{dx^2} + y = 3x^2$. **Second method of solution to find complementary function.** 1. Solve $x^4\frac{d^4y}{dx^4} + 6x^3\frac{d^3y}{dx^3} + 9x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = 0$.
Practical X	**Problems on finding particular integral.** 1. Solve $x^2\frac{d^2y}{dx^2} + 5x\frac{dy}{dx} + 4y = x^4$. 2. Solve $x^2\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 20y = (x+1)^2$. **Problems on equation reducible to homogenous linear form.** 1. Solve $(5+2x)^2\frac{d^2y}{dx^2} - 6(5+2x)\frac{dy}{dx} + 8y = 0$. 2. Solve $(2x-1)^3\frac{d^3y}{dx^3} + (2x-1)\frac{dy}{dx} - 2y = 0$.

Recommended Text Book:

Daniel A. Murray: Introductory Course in Differential equations, Khosala Publishing House, New Delhi.

Section-B-MAT-302

Practical I	1. Find Laplace Trans form of $t^2 \sin 2t$ 2. If $L\{F(t)\} = f(s)$, then prove that $L\{t^n F(t)\} = (-1^n)\frac{d^n f(s)}{ds^n}$
Practical II	1. Prove that $\beta(l,m) = \frac{\Gamma(l)\Gamma(m)}{\Gamma(l+m)}$, where l, m are positive integers $\int_0^\infty \frac{sint}{t} dt = \frac{\pi}{2}$ 2. If $L^{-1}\{f(s)\} = F(t), L^{-1}\{g(s)\} = G(t)$ then prove that $$L^{-1}\{f(s).g(s)\} = \int_0^t F(u)G(t-u)du$$
Practical III	1. Prove that $L\{(1+te^{-t})^3\} = \frac{1}{s} + \frac{3}{(s+1)^2} + \frac{6}{(s+2)^3} + \frac{6}{(s+3)^4}$ 2. Find the Fourier transform of $$f(x) = \begin{cases} 1, if \lvert x\rvert < a, \\ 0, if\ \lvert x\rvert > a \end{cases}$$
Practical IV	1. Using Laplace transform, find the solution of the differential equation $y'' + 25y = 10\cos 5t$ where $y(0) = 2$ and $y'(0) = 0$ 2. Find the Laplace transform of $sin^3 2t$.
Practical V	1. Find $L\{t^3 cos2t\}$. 2. Find $L\left\{\frac{t^3 cos2t}{t}\right\}$
Practical VI	1. Find $L\{t^5 e^{3t}\}$ 2. Evaluate $L\{F(t)\}$, if $$F(t) = \begin{cases} (t-1)^2, if\ t > a, \\ 0, if\ 0 < t < a \end{cases}$$
Practical VII	1. Find the Laplace Transform of $\frac{sin2t}{t}$ 2. If $F(t) = t^3 + 3t^2 + 4t + 5$ then find $L\{F'''(t)\}$

Practical VIII	1. Find the Inverse Laplace transform of $\frac{s}{(s+7)^4}$. 2. Find the Inverse Laplace Transform of $f(s) = \frac{s+3}{s^2+2s+1}$. 3. Using Heaviside's expansion formula find $L^{-1}\left\{\frac{2s^2+5s-4}{s^3+s^2-2s}\right\}$ 4. Find $L^{-1}\left\{\frac{3s^2+4s+5}{s^3-6s^2+11s-6}\right\}$
Practical IX	1. Find $L^{-1}\left\{\frac{s+5}{(s+1)(s^2+1)}\right\}$ 2. Find the Inverse Laplace transform of $\frac{2s-5}{9s^2-25}$ 3. Find the Inverse Laplace transform of $\frac{1}{s(s^2+16)}$
Practical X	1. Solve the differential equation using Laplace transform method $y''+4y'+4y=6e^{-t}$, where $y(0) = -2$ and $y'(0)=8$ 2. Solve the following equation by Laplace transform $y'' - y = t; \quad y(0) \quad y'(0) = 1$
Practical XI	1. Find finite Fourier sine and cosine transform of $F(t) = 1$ 2. Find the finite sine transform of 1) e^{4t} 2) $sin2t$ 3) $cos5t$ 4) t^2

Recommended Text Book:

1. **J.N.Sharma, A. R.Vasishtha:** Real Analysis, Krishna Prakashan Media Pvt.Ltd., Meerut.

2.H.K.Dass: Advanced Engineering Mathematics, S.Chand & Company Ltd.(2004)

Skill Enhancement Courses

Course Code: **MAT-303** Course Name: **Mechanics-I**

Credits:**02** Total Periods: **60**

Course Objectives:

Students will be able to describe forces, resultant of forces, vector moment of forces, moment of couple, laws and rules

Course Outcomes:

CO1: Describe different types of forces, triangle law of forces, Parallelogram of forces, resultant of forces, sine rule and cosine rule

CO2: Explain resultant of several co-planar forces, equation of the line of action of the resultant, equilibrium of a rigid body under three co-planar forces

CO3: Explain Lami's theorem and polygon of forces

CO4: Explain vector moment of a force and vector moment of couple and describe basic concepts of centre of gravity and its applications

Unit I : Forces Acting on a Particle

Particle, Rigid body, Force, The force as a vector, Equilibrium, An Axiom for the equilibrium of two forces, Statics, Resultant of forces, Law of a parallelogram of forces, Principle of transmissibility of forces, Deductions, Resultant of forces m.OA and n.OB, Components and resolved parts, The algebraic sum of resolved parts of two forces,To find the magnitude and direction of the resultant of any number of co-planar forces acting at a point, Resultant of parallel forces.

Unit II: Equilibrium of Forces Acting on a Particle

Triangle law of forces, Converse of the triangle law of forces, Polygon of forces, Lami's theorem, Conditions of equilibrium of forces acting on a particle.

Unit III: Forces Acting on a Rigid Body

Introduction, Moment of a force, Sum of vector moments of two like parallel forces, Couples, Conditions of equilibrium of forces acting on a rigid body, Trigonometrical Theorems.

Unit-IV: Centre of Gravity

Centroid of weighted points, Centre of gravity, Center of gravity of some uniform bodies.

Recommended Text Book:

V.Tulsani, T.V.Warehekar, N.N.Saste: Mechanics and Differential Geometry Second Edition (1987) , S.Chand and Co.(Pvt.)Ltd., New Delhi.

Scope: Part-I : Statics

Chapter (1): Complete

Chapter (2): Complete

Chapter (3): Complete

Chapter (4): Articles 4.1 to 4.7

Reference Books:

1. **S.L.Loney:** An Elementary Treatise on Statics, AITBS Publishers and Distributors, New Delhi.
2. **B.R.Thakur, G.P.Shrivastava :** Mechanics,Ram Prasad and Sons, Agra-3.
3. **M.L.Khanna:** Statics, Kedarnath Ramnath Prakashan, Meerut.

Course Code: **MAT-304** Course Name: **Graph Theory**

Credits :**02** Total Periods: **60**

Course Objectives:

Student will be able to analyse the graphs, trees and apply it to solve problems.

Course Outcomes:

CO1: Describe and identify the type of graphs

CO2: Explain isomorphism and connectedness of graphs

CO3: Explain and understand the properties of trees

CO4: Understand cut-sets , cut-vertices and its properties

Unit I. Introduction

What is a Graph?, Application of Graphs, Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex and Null Graph.

Unit II. Paths and Circuits

Isomorphism, Subgraphs, Walks, Paths, and Circuits, Connected Graphs, Disconnected Graphs, and Components, Euler Graphs, Operations on Graphs, More on Euler Graphs, Hamiltonian Paths and Circuits, The Traveling Salesman Problem.

Unit III. Trees and Fundamental Circuits

Trees, Some Properties of Trees, Pendant Vertices in a Tree, Distance and Centers in a Tree Rooted and Binary Trees, On Counting Trees, Spanning Trees,Fundamental Circuits, Spanning Trees in a Weighted Graph.

Unit IV. Cut-Sets and Cut-Vertices

Cut-Sets, Some Properties of a Cut-Set, All Cut-Sets in a Graph, Fundamental Circuits and Cut-Sets,Connectivity and Separability.

Recommended Text Book :

Narsingh Deo : Graph Theory with Applications to Engineering and Computer Science, Printice-Hall of India Pvt. Lt. New Delhi.(2010)

Scope: Unit 1 : Chapter 1: Sec.1.1 to 1.5

Unit 2: Chapter 2: Sec. 2.1 to 2.2, 2.4 to 2.10

Unit 3: Chapter 3: Sec. 3.1 to 3.8, 3.10

Unit 4: Chapter 4 : Sec. 4.1 to 4.5

Reference books:

1. John Clark and Derek Holton: A First Look at Graph Theory (Allied Publishers)
2. C.L.Liu: Elements of Discrete Mathematics, Tata Mc-Graw Hill, Fourth Edition
3. Robin J. Wilson: Introduction to Graph Theory, Fourth Edition (low price edition)
4. Douglas West: Introduction to Graph Theory, Second edition.
5. R.Balakrishnan, K.Ranganathan: A Textbook of Graph Theory

B.Sc. Second Year (Semester-IV)

Discipline Specific Courses

Course Code: **MAT-401** Course Name: **Partial Differential Equations**

Credits:**02** Total Periods: **60**

Course Objectives:

Student will learn the methods of finding solutions of partial differential equations.

Course Outcomes:

CO1: Solve Lagrange's equation

CO2: Find different types of solutions like complete integral, Singular integral and general integral

CO3: Determine the solution of partial differential equations using Charpit's Method

CO4: Describe Monge's Method, Method of transformation

Unit I:

Partial differential equation (PDE), Order and method of forming PDE, solution of equations by direct integration, Lagrange's linear equations, method of multipliers.

Unit II:

Partial differential equations non-linear in p and q, Charpit's method, Linear homogeneous PDE of n^{th}order with constant coefficients, Rules for finding the complementary functions, Rules for finding the particular integral.

Unit III:

Non-homogeneous linear equations, Monge's method, Method of separation of variables, Equations of vibrating strings, Solution of the wave equation by D'Almberts method.

Unit IV:

One-dimensional heat flow, Two-dimensional heat flow, Laplace equations in polar co-ordinates, Transmission line equations.

Recommended Text Book:

H.K.Dass: Advanced Engineering Mathematics, S.Chand and Company Ltd.(2004).

Scope:

Unit I: Chapter 9 : 9.1,9.2,9.3,9.4,9.5,9.6,9.7.

Unit II: Chapter 9 : 9.8,9.9,9.10,9.11,9.12.

Unit III: Chapter 9 : 9.13,9.14,9.15,9.16,9.17,9.18.

Unit IV: Chapter 9 : 9.19,9.20, 9.21, and 9.22.

Reference Books:

1. D.A.Murray: Introductory course in Differential equation, NewYork Longmans and Green Co. London and Bombay.
2. M.D.Raisinghania: Ordinary and Partial Differential equations, S.Chand and Co.
3. T.M.Karade: Lectures on Differential equation, Sonu-Nilu Pub. Nagpur.
4. I.N.Sneddon: Elements of Partial Differential Equation, McGraw Hill co.
5. Peter Olver: Introduction to Partial Differential equation Springer Cham Heidelberg NewYork Dordrecht London.
6. A.Singaravelu: Engineering Mathematics, Engineering Mathematics, Meenakshi Agency Chennai.
7. W.E.Williams: Partial Differential equations, Claredon Press Oxford.
8. M.E.Tayor: Partial Differential equations, Springer Cham Heidelberg NewYork Dordrecht London.

Course Code: **MAT-402** Course Name: **Numerical Analysis**

Credits:**02** Total Periods: **60**

Course Objectives:

Student will learn the finite differences, interpolating methods and numerical methods to solve differential equations.

Course Outcomes:

CO1: Describe Finite Differences and apply Newton's Formulae for Interpolation

CO2: Explain and apply Lagrange's and Newton divided difference formula for interpolation

CO3: Apply Gauss interpolation formulae, Stirling's and Bessel's formulae for interpolation

CO4: Apply numerical differentiation and numerical quadrature formulae.

Unit I: Finite Differences and Interpolation with Equal Intervals

Finite Differences: Introduction, Differences, Theorem, Factorial Notation, Factorial Function, The operator E, The operators D and ∇ Interpolation: Interpolation with equal intervals, Newton-Gregory Formula for forward interpolation, Newton-Gregory formula for Backward interpolation, Equidistant terms with one or more missing terms.

Unit II: Interpolation with Unequal Intervals

Introduction, Interpolation with unequal arguments, Divided differences with unequal arguments, Divided differences when two or more arguments are same or coincident, Properties of divided differences (Theorem 3 and Theorem 4 statement s only), Newton's formula for unequal intervals, Lagrange's interpolation formula for unequal intervals.

Unit III: Central Differences Interpolation Formulae

Introduction, Operators ∇, δ, σ and μ, Gauss's central difference formula, Stirling's formula, Bessel's formula.

Unit IV: Numerical Differentiation and Numerical Integration

Introduction, Approximate expressions for the derivative of a function, Introduction, A general quadrature formula for equidistant ordinates, Some important approximate quadrature formulae: The Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule, Weddle's rule.

Recommended Text Book:

H.C.Saxena: Finite Differences and Numerical Analysis, S.Chand & Co. New Delhi.Fourteenth Revised edition (1998).

Scope:

Unit-I: Chapter 1:1.1,1.2,1.3,1.5.1,1.5.3,1.6,1.6.1,1.6.2,1.7,1.8,1.8.1,1.8.2, 1.8.3.
Unit-II: Chapter 2:2.1,2.1.1,2.2 (Theorem 3 and Theorem 4 statements only),2.3,2.4.1
Unit-III: Chapter 3: 3.1, 3.2, 3.3, 3.4, 3.5
Unit-IV: Chapter 5:5.1,5.2,5.3
Chapter 6:6.1,6.2,6.3,6.3.1,6.3.2,6.3.3,6.3.4.

Reference Books:

1. S.S.Sastry: Introductory Methods of Numerical Analysis, Prentice-Hall of India Private Ltd.(Second Edition)1997.
2. E.V. Krishnamurthi & Sen: Numerical Algorithm,Affiliate East, West press Private Limited 1986.
3. M.K.Jain,SRK Iyengar,R.K.Jain:Numerical Methods for Scientific and Engineering Computations, New Age International Limited

Course Code: **MAT-402P** Course Name: **Lab Course-II**

(Based on MAT-401&MAT 402)

Credits: **02** Total Periods: **60**

Note : At least Eight practical's shall be conducted from each section

Section-A-MAT-401

Practical-I	To find the solution of the equation of the type Pp + Qq=R. 1. P-676 Ex. 6 2. P-676 Ex. 7 3. P-677 Ex. 8.
Practical-II	To find the solution of the Partial differential equation of the type Pp + Qq=R, by method of multipliers. 1. P-678 Ex. 10 2. P-676 Ex. 12 3. P-677 Ex. 17.
Practical-III	To find the solution of partial differential equation non-linear in p and q. 1. P-684 Ex. 19 2. P-686 Ex. 24 3. P-687 Ex. 26.
Practical-IV	To find the solution of the Partial differential equation, by Charpits method. 1. P-689 Ex. 27 2. P-690 Ex. 28.
Practical-V	To find the solution of the Linear homogeneous Partial differential equations of nth order with constant coefficients. 1. P-694 Ex. 33 2. P-694 Ex. 35.
Practical-VI	To find the solution of the Non- homogeneous Linear Partial differential equations. 1. P-702 Ex. 47 2. P-703 Ex. 49.
Practical-VII	To find the solution of the Non Linear Partial differential equation of the second order by Monge's method. 1. P-705 Ex. 50

	2. P-706 Ex. 51.
Practical-VIII	To obtain the solution of equation of Vibrating string. 1. P-710 Ex. 3 2. P-711 Ex. 4.
Practical-IX	To obtain the solution of One dimensional Heat flow 1. P-721 Ex. 11 2. P-722 Ex. 12.
Practical –X	To obtain the solution of Laplace Equation in polar co-ordinates 1. P-729 Ex. 15 2. P-730 Ex. 16.

Recommended Text Book:

H.K.Dass: Advanced Engineering Mathematics, S.Chand and Company Ltd.(2004).

Section-B MAT-402

Practical I	**To solve the problems:** 1. Page 33 Exercise 1 Problem 1 Subproblems (i), (iii), (iv). 2. Page 33 Exercise 1 Problem 2 Subproblems (i), (ii). **3.** Page 33 Exercise 1 Problem 3 Subproblems (iii), (v)
Practical II	**To solve the problems:** 1. Page 35 Exercise 1 Problem 5 (a), 5 (b). 2. Page 35 Exercise 1 Problem 6 (a) (i) to (v), 6 (c) (i) to (ii). 3. Page 35 Exercise 1 Problem 7 (a), 7 (b).
Practical III	**To solve the problems:** 1. Page 36 Exercise 1 Problem 8 (b). 2. Page 37 Exercise 1 Problem 10 (b). 3. Page 37 Exercise 1 Problem 11 (i), (ii)

Practical IV	**To solve the problems:** 1. Page 38 Exercise 1 Problem 20. 2. Page 38 Exercise 1 Problem 22 (a), (b). 3. Page 39 Exercise 1 Problem 23 (a), (b).
Practical V	**To solve the problems:** 1. Page 69 Exercise 2 Problem 1 (b). 2. Page 69 Exercise 2 Problem 4. 3. Page 69 Exercise 2 Problem 5.
Practical VI	**To solve the problems:** 1. Page 69 Exercise 2 Problem 6. 2. Page 70 Exercise 2 Problem 7 (a), (b), (c). 3. Page 71 Exercise 2 Problem 13 (a), (b).
Practical VII	**To solve the problems:** 1. Page 87 Exercise 3 Problem 1 (b) (i) to (v). **2.** Page 87 Exercise 3 Problem 1 (c) (i) to (iii). **3.** Page 87 Exercise 3 Problem 1 (e) (i) to (vi).
Practical VIII	**To solve the problems:** 1. Page 90 Exercise 3 Problem 5 (a), (b). 2. Page 90 Exercise 3 Problem 7 (i), (ii). 3. Page 90 Exercise 3 Problem 8. 4. Page 91 Exercise 3 Problem 10. **5.** Page 91 Exercise 3 Problem 11 (a) to ©
Practical IX	**To solve the problems:** 1. Page 115 Exercise 5 Problem 1 (a) to (c). 2. Page 115 Exercise 5 Problem 2.

	3. Page 116 Exercise 5 Problem 5 (a) (i) to (iii), (b). 4. Page 116 Exercise 5 Problem 6 (a). 5. Page 117 Exercise 5 Problem 7 (a), (b).
Practical X	**To solve the problems:** 1. Page 144 Exercise 6 Problem 3 (c) to (d). 2. Page 145 Exercise 6 Problem 4 (b), (d). 3. Page 146 Exercise 6 Problem 5 (a) to (d). 4. Page 146 Exercise 6 Problem 6 (a) (except Weddle's Rule). 5. Page 146 Exercise 6 Problem 7 (i), (iii).

Recommended Text Book:

H.C.Saxena: Finite Differences and Numerical Analysis, S.Chand & Co. New Delhi.Fourteenth Revised edition (1998).

Examination Scheme for practical courses (Lab Course-I &Lab Course-II) :

Annual examination shall be conducted in presence of external examiner chosen from the panel of examiners declared by university.

CIA	Attendance	Max.Marks(A)	Tests	Max. Marks(B) (Best of Test-I & Test -II)	Total Marks (A+B)
	Above 90%	03	Test -I	07	10
	Between 80%-89%	02	Test-II	07	
	Between 75%-79%	01			
UA	Record Book/Practical Book	05	Practical	30	40
			Viva-Voce	05	

Skill Enhancement Courses

Course Code: **MAT-403** Course Name: **Mechanics-II**

Credits:**02** Total Periods: **60**

Course Objectives:

Students will be able to find the velocity, acceleration, speed, angular momentum, field of force and motion under gravity.

Course Outcomes:

CO1: Find velocity and acceleration in terms of vector derivatives, curvature, Angular speed and angular velocity

CO2: Describe Radial and Transverse components of velocity and acceleration, areal speed and velocity

CO3: Explain Newton's Law of motion, angular momentum, work, energy, vector point function, Field of force.

CO4: Describe motion under gravity, projectile, Motion of projectile, Parabola of safety, motion in resisting medium, areal velocity of central orbit, Pedal's equation.

Unit-I: Kinematics and Dynamics of a Particle in two Dimensions

Introduction, Definitions, Velocity and acceleration in terms of vector derivatives, Tangent and unit vector along the tangent, Rate of change of unit vector moving in a plane, Curvature, principal normal, Tangential and normal components of velocity and acceleration, Angular speed and angular velocity, Radial and transverse components of velocity and acceleration, Areal speed and areal velocity.

Unit-II: Kinetics of a Particle

Introduction, Newton's law of motion, Matter, Linear momentum, Angular momentum, An Impulsive force and its impulse, Conservation of linear momentum, Impact of two bodies, Work, Energy, Scalar point function, Vector point function, Field of force, Conservative field of force.

Unit-III : Motion of a Projectile and Motion in a Resisting Medium

Rectilinear motion, Motion under gravity, Projectile, Motion of projectile, Range on an inclined plane, Parabola of safety, Projectile to pass through a given point, Motion in a resisting medium, Motion of a body moving under gravity and in a medium whose resistance varies as velocity.

Unit-IV: Central Orbits

Definitions, Areal velocity in central orbit, Differential equation of central orbit, Apses, Law of force, Pedal equation of some curves.

Recommended Text Book:

V.Tulsani, T.V.Warehekar, N.N.Saste: Mechanics and Differential Geometry Second Edition (1987) , S.Chand and Co.(Pvt.)Ltd., New Delhi.

Scope: Part-II : Dynamics of a Particle

Chapter (1): Complete

Chapter (2): Complete

Chapter (3): Complete

Chapter (4): Articles 4.01 to 4.10

Reference Books:

1. S.L.Loney: An Elementary Treatise on Statics, AITBS Publishers and Distributors, New Delhi.

2. B.R.Thakur, G.P.Shrivastava : Mechanics,Ram Prasad and Sons, Agra-3.

3. M.L.Khanna: Dynamics, Kedarnath Ramnath Prakashan, Meerut.

Course Code: **MAT- 404** Course Name: **Complex Analysis**

Credits:**02** Total Periods: **60**

Course Objectives:

To make students aware of generalization of real number system and calculus. This course improves mathematical skill and ability to solve various integration.

Course Outcomes:

CO1: Understand the concept of analytic function,Cauchy Riemann Equations

CO2: Understand the concept of harmonic functions

CO3: Understand the concept of complex integration and residues

CO4: Understand the concept of contour integration.

Unit-I:Complex Numbers

Complex numbers, Geometrical representation of imaginary numbers, Argand diagram, Modulus and argument, Exponential and circular functions of complex variables, Formulae of hyperbolic functions, De Moivre's theorem, Roots of a complex number.

Unit-II: Functions of Complex Variables

Introduction, Complex variable, Function of complex variable, Limits of complex variable, Continuity, Differentiability, Analytic functions, The Necessary and sufficient conditions for analytic functions, Cauchy Riemann equations in polar form, Orthogonal curves, Harmonic functions, Method to find a conjugate functions.

Unit-III: Complex Integration

Complex integration, Simply connected region, Cauchy's integral theorem, Cauchy's integral formulae, Morera's theorem, Cauchy's inequality, Liouville's theorem.

Unit-IV: Singularities and Residues

Singular point, Residues, Method of finding residues, Residue theorem, Evaluation of real definite integrals by contour integration, Integration round the unit circle.

Recommended Text book:

H.K.Dass: Advanced Engineering Mathematics, S.Chand and Co. Ltd, New Delhi (2004)

Scope:

Unit-I. Chapter 6: Article 6.1 to 6.4, 6.7 to 6.10

Unit-II. Chapter 7: Article 7.1 to 7.13

Unit-III. Chapter 7: Article 7.29 to 7.31, 7.33 to 7.37

Unit-IV. Chapter 7: Article 7.41 to 7.46

Reference Books:

1. Shanti Narayan: Theory of Functions of Complex Variables, S.Chand and Company, New Delhi.
2. Complex Variables: Schaum's Outline Series.
3. S.K.Sharma and R.K.Sharma: Complex Analytic Functions: Theory and Applications, New Age International Publishers

Dr.Babasaheb Ambedkar Marathwada University,Aurangabad

Faculty of Science and Technology

B.Sc. Mathematics Second Year (IIIrd/IVth Semester)

Model Question Paper Pattern_ CBCS

Time-1.30 Hours Max.Marks-40

Instructions:

1. All questions are compulsory
2. Figures to the right indicate full marks
3. Use of nonprogrammabe calculator is allowed (Only for Numerical Analysis paper)

Q.No. 1. Answer any five questions in brief. Each question carries 02 marks **10**

(a) Define the term----

(b) Give an example of-------

(c) Define the term--------

(d) Explain in brief-------

(e) Prove that-------

(f) Show that --------

(g) Show that-------

Q.No. 2. (A) Attempt any one of the follwing : **8**

(a) Show that----------

(b) Prove that---------

(B) Attempt any one of the following: **7**

(c) Solve---------

(d) Obtain the solution of---------

Q.No. 3. (A) Attempt any one of the follwing : **8**

(a) Show that----------

(b) Prove that---------

(B) Attempt any one of the following: **7**

(c) Solve---------

(d) Obtain the solution of---------

Note: Subquestions may be set in Q.No. 2 and Q.No.3