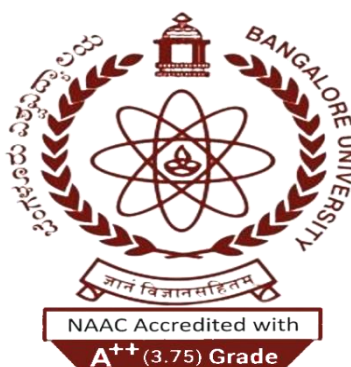


BANGALORE UNIVERSITY

DEPARTMENT OF MATHEMATICS



Syllabus for Bachelor of Science (B.Sc., Degree) V & VI Semesters Mathematics Courses (Under-Graduate (UG) Program with Mathematics as one of the three Major subjects)

**Framed according to the State Education Policy
(SEP-2024)**

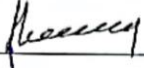
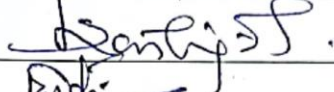
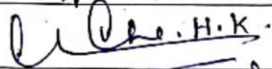
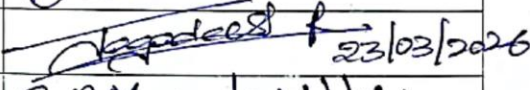
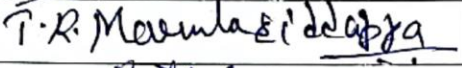
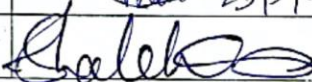
EFFECTIVE FROM ACADEMIC YEAR 2026-27

BANGALORE UNIVERSITY
Department of Mathematics

Date: 23-03-2026

PROCEEDING OF THE BOARD OF STUDIES (BOS) IN UG- MATHEMATICS

The meeting of the Board of Studies (BOS) in UG Mathematics for the year 2026-27 was held on **Monday, 23rd March 2026**, at 11.00am in the Department of Mathematics, Jnanabharathi Campus, Bangalore University, Bengaluru. The following members attended the meeting:

Sl. No.	Name	Signature
1	Dr. B. CHALUVARAJU, Chairman	
2	Mr. H. S. MAHESH, Member	
3	Dr. SHAILAJA M., Member	
4	Mrs. JYOTHI D. K., Member	
5	Mrs. MAMATHA H. K., Member	
6	Dr. JAGADEESH R., Member	 23/03/2026
7	Mr. T. R. MARULASIDDAPPA, Member	
8	Dr. BALBHEEM SAIBANNA, Member	 23/3/26
9	Dr. SHOBHAN KUMAR D. M., Member	

Agenda and Resolutions:

1. Final draft of the **UG-Mathematics Syllabus (V & VI Semester B. Sc.,)** was checked and discussion held. The suggestions given by the BOS members and subject experts were incorporated.
2. The syllabus framed as per UGC, KSHCE-State Education Policy (SEP) - 2024 and Bangalore University guidelines. The syllabus prepared by teachers with a Mathematics practical component, by using Free/Libre and Open Source Software (FLOSS) packages. The BOS also resolved to change the list of practical experiments each year. Finally, the syllabus was approved by all the members.
3. The committee approved the updated panel of examiners for UG (Mathematics).

The Chairman thanked the members for their cooperation.

Copy to:

1. The Registrar, Bangalore University, Bengaluru.
2. The PS to the Vice-Chancellor, Bangalore University, Bengaluru.


[Dr. B. CHALUVARAJU]
CHAIRMAN
BU-BOS in UG-Mathematics
Department of Mathematics
Bangalore University
Jnanabharathi
Bangalore - 560 056.

MISSION AND VISION OF THE NEW SYLLABUS IN MATHEMATICS

MISSION

- Improve retention of mathematical concepts in the student. Also, develop a spirit of inquiry in the student.
- To improve the perspective of students on mathematics as per modern requirement.
- To initiate students to enjoy mathematics, pose and solve meaningful problems, to use abstraction to perceive relationships and structure and to understand the basic structure of mathematics.
- To enable the teacher to demonstrate, explain and reinforce abstract mathematical ideas by using concrete objects, models, charts, graphs, pictures, posters with the help of Free/Libre and Open-Source Software (FLOSS) tools on a computer.
- Exploit techno-savvy nature in the student to overcome math-phobia.
- To orient students towards relating Mathematics to applications.

VISION

- To remedy Math phobia through authentic learning based on hands-on experience with computers.
- To show that ICT can be a panacea for quality and efficient education when properly integrated and accepted.
- To provide greater scope for individual participation in the process of learning and becoming autonomous learners.
- To provide scope for greater involvement of both the mind and the hand this facilitates cognition.
- To ultimately see that the learning of mathematics becomes more alive, vibrant, relevant and meaningful; a program that paves the way to seek and understand the world around them. A possible by-product of such an exercise is that math-phobia can be gradually reduced amongst students.
- To help the student build interest and confidence in learning the subject.

Support system for Students and Teachers learning FLOSS TOOLS:

As a national-level initiative towards learning **FLOSSE** (Free/Libre and Open-Source Software for Education) promotes the use of FLOSS tools in academia and research. The **FOSSEE** project is part of the National Mission on Education through Information and Communication Technology (ICT), Ministry of Education (MoE) and IIT Bombay for MHRD, Government of India is giving free training to teachers interested in learning open-source software's like **SCILAB, WXMAXIMA, PYTHON, OCTAVE, GEOGEBRA, TORA** and others.

Name of the Degree Program : Bachelor of Science-B. Sc., (with three Major)

Discipline/Subject : Mathematics

Scheme : State Education Policy (SEP) - 2024

PROGRAMME OUTCOMES (POs)

PO 1	Disciplinary Knowledge: The capability of demonstrating comprehensive knowledge of mathematics and understanding of one or more disciplines that form a part of an UG program of study.
PO 2	Nature of Mathematics: Understanding the concise, precise and rigorous nature of Mathematics and its applications in real-world problems.
PO 3	Communication Skills: Ability to (i) arrange and link their mathematical thinking through communication; (ii) communicate their logical and clear mathematical thinking to their friends, teachers, and others; (iii) analyze and assess mathematical thinking and strategies used by others; and (iv) use mathematical language to express mathematical ideas correctly.
PO 4	Critical & Analytical thinking: Ability to (i) employ critical thinking in understanding the concepts in every area of mathematics; (ii) performing some mathematical operation on the given statement to find the probable result. Questions based on analytical reasoning test the logical reasoning and analytical ability of a candidate.
PO 5	Problem Solving: Ability to analyze the problems, and define appropriate computing requirements for its solutions. This enhances students' overall development and equips them with

	modeling ability, and problem-solving skills.
PO 6	Research-related skills: Capability for inquiring about appropriate questions relating to the concepts in various fields of mathematics. Further, to know about the advances in various branches of mathematics.
PO7	Information & Digital Literacy: Ability to (i) find, evaluate, organize, use, and communicate information in all its various formats, most notably in situations requiring decision-making, problem solving, or the acquisition of knowledge; (ii) the skills associated with using technology to enable users to find, evaluate, organize, create, and communicate information. Also, capability to use appropriate softwares to solve the mathematical problems.
PO 8	Self-directed learning: Ability to working independently and to make an in-depth study of various notions of Mathematics.
PO 9	Lifelong learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.
PO 10	Professional and Applicational skills: (i) Include students' habits, characteristics, and abilities that influence the candidate work style, mainly time-management, organization and communication; (ii) Ability to understand, verify and solve the mathematical problems by using the various methodologies within the mathematics. Also, the mathematical concepts are linked to other allied topics.
PO 11	Higher studies: Ability to peruse advanced studies and research in pure, applied, and computational mathematical sciences.
PO 12	Employability: Ability to work in finance, technology, research, or any other fields that relies on mathematical fields.

PEDAGOGY

Lectures by conventional method, use of ICT and conducting competitions like Quiz, Seminars, Desk Work, Book Chapter, Problem Solving, Power Point Presentation, etc.

COURSE PATTERN & SCHEME EXAMINATION

Sem. Name	Paper Code	Subjects	Instruction hrs / Week	Duration of Exam (hrs)	Marks			Credits
					IA	Exam	Total	
V	MATDSCT-5.1	Mathematics-V	4	3	20	80	100	3
	MATDSCP-5.1	Mathematics Practical-V	4	3	10	40	50	2
	MATDSCT-5.2	Mathematics-VI	4	3	20	80	100	3
	MATDSCP-5.2	Mathematics Practical-VI	4	3	10	40	50	2
VI	MATDSCT-6.1	Mathematics-VII	4	3	20	80	100	3
	MATDSCP-6.1	Mathematics Practical-VII	4	3	10	40	50	2
	MATDSET-6.2 (A)	Mathematics-VIII	4	3	20	80	100	3
	MATDSET-6.2 (B)	Mathematics-IX	4	3	20	80	100	3
	MATDSSP-6.3	Skill Based Commercial Mathematics Practical-VIII	4	3	10	40	50	2

Abbreviation for **MAT**–Mathematics; **DSC**–Discipline Subject Core; **DSS**–Discipline Specific Skill; **T**–Theory; **P**–Practical; **I.A**-Formative/Internal Assessment; **S.A.** - Summative Assessment; E–Elective.

ASSESSMENT

Weightage for the Assessments (in percentage)

Type of Course	Formative Assessment (I.A.)	Summative Assessment (S.A.)
Theory	20%	80 %
Practical	20%	80 %

FORMATIVE ASSESSMENT

Types of Course	Internal Assessment (I.A.)	
Theory	C1: Sessional Tests	10 Marks
	C2: Assignments / Seminar	10 Marks
	Total	20 Marks
Practical's	C1: Sessional Tests	10 Marks

FIFTH SEMESTER

MATDSCT 5.1: MATHEMATICS-V

Teaching Hours	: 4 Hours / week	Credits	: 3
Total Teaching Hours	: 56 Hours	Max. Marks	: 100 (SA 80 + IA 20)

COURSE OBJECTIVE:

The primary objectives for these subjects cover fundamental concepts in abstract algebra (Rings, Integral Domains, Fields), advanced multivariable calculus (Line and Multiple Integrals), and modeling (Partial Differential Equations) in an UG syllabus is to equip students with the fundamental concepts and tools of above subjects and their applications in various fields.

COURSE OUTCOMES (COS):

By the end of the program the students will be equipped with the following aspects:	
CO 1	Understand the concepts of Rings, subrings, Ideals, Quotient rings, Homomorphism and their properties. Also, learn the concepts of Integral Domain and Fields along with potential properties.
CO 2	Analyze the concepts of line and multiple integrals and its applications to the concepts of length, area, surface area and volume of solids of revolution
CO 3	Analyze the concepts of total and simultaneous differential equations and orthogonal curvilinear systems. Also, apply techniques of partial differential equations in various physical and geometrical situations.
CO 4	Determine the method of solving problems on heat and wave equations using PDE.

CONTENTS		Teaching Hours
Unit 1	Rings and Fields: Rings, Types of Rings, Properties of rings – Rings of integers modulo n – Subrings, Ideals - examples and standard properties, Quotient rings- examples and standard properties. Homomorphism and its related properties, Kernel of Homomorphism of Rings and related problems, Fundamental Theorem of Homomorphism of Rings, Isomorphism of Rings and its related properties, Integral Domain and Fields –Properties and some theorems.	14
Unit 2	Line and Multiple Integrals: Line integral and basic properties, examples evaluation of line integrals.	14

	Double integral- its conversion to iterated integrals. Evaluation of double integrals by change of order of integration and by change of variables. Computation of surface area using double integrals. Triple integrals and evaluation, change of variables, volume as a triple integrals. Applications.	
Unit 3	Partial Differential Equations-I: Total and simultaneous differential equations: Total differential equations, necessary condition for equation $Pdx + Qdy + R dz = 0$ to be integrable, simultaneous equations of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Orthogonal curvilinear system: Definition of orthogonal curvilinear coordinates, fundamental vectors or scale factors or material factors, quadratic differential form. Cylindrical and Spherical polar coordinates, showing spherical and cylindrical coordinate system is orthogonal curvilinear coordinate system.	14
Unit 4	Partial Differential Equations-II: Formation of partial differential equation, equations of first order Lagrange's linear equation, Charpit's method, Standard types of first order non-linear partial differential equations. Solution of second order linear partial differential equation in two variables with constant coefficients by finding complementary function and particular integral, Solution of one-dimensional heat equation and wave equation using Fourier series.	14

TEXT/ REFERENCE BOOKS

1. V. K. Khanna and S. K. Bhambri. *A Course in Abstract Algebra*, 5th Edition. Vikas Publishing House Pvt. Ltd., New Delhi, 2016.
2. I. N. Herstein, *Topics in Algebra*, 4th ed. Vikas Pub. House Pvt. Ltd, New Delhi, India, 1991.
3. Michael Artin, *Algebra*, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
4. John B Fraleigh, *A First course in Abstract Algebra*, 3rd ed.: Narosa Pub. House., 1990.
5. Shanthi Narayan and P.K. Mittal, *Differential Calculus* - S. Chand & Co., New Delhi, 2014.
6. Shanthi Narayan and P.K. Mittal, *Integral Calculus* S. Chand & Company, New Delhi, 2013.
7. M. D. Raisinghania, *Ordinary and Partial Differential Equations*, S Chand & Co., 2014.
8. Frank Ayres, *Schaum's outline of theory and problems of Differential Equations*, 1st ed. USA: McGraw-Hill, 2010.

9. S. Narayanan and T K Manicavachogam Pillay, *Differential Equations.*: SV Pub. Ltd., 1981.
10. Phoolan Prasad and R. Ravindran, *Partial Differential Equations*, New Age Intl. Ltd, 1986.

WEB RESOURCES:

1. <http://www.nptelvideos.in/2012/11/mathematics.html>
2. <https://www.my-mooc.com/en/categorie/mathematics>
3. <http://ocw.mit.edu/courses/mathematics/>
4. <https://ndl.iitkgp.ac.in/>
5. <http://cec.nic.in/cec/>
6. <https://www.doabooks.org/>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSCT 5.1: MATHEMATICS-V												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	3	3	3	2	3	3	3
CO2	2	3	2	2	3	3	2	2	3	2	2	3
CO3	1	2	3	2	2	2	2	3	2	2	2	3
CO4	2	2	3	3	2	3	3	2	1	2	3	3

*Low correlate-1; Moderate correlate-2; High (Substantial) correlate-3.

MATDSCP 5.1: MATHEMATICS PRACTICAL-V	
Teaching Hours	: 4 Hours / week
Credits	: 2
Total Teaching Hours	: 56 Hours
Max. Marks	: 50 (SA 40 + IA 10)

COURSE OBJECTIVES:

Mathematics Practical-V with Python skill is helpful for Employability in IT industries, Entrepreneurship in Produce innovative IT solutions and services based on global needs and trends.

COURSE OUTCOMES (COs):

Course Outcomes	This practical course will enable the students to:
CO1	Understand the textbook companion activity aims to port solved examples from standard textbooks using Free/Libre and Open Source Software (FLOSS).

CO2	Identify the given problem with the help of logic/aim/motivation to narrate the elements of Ring theory by using FLOSS.
CO3	Apply fundamental line and multiple integral concepts to solve problems, and their proficiency in using FLOSS for computation and visualization.
CO4	Provide a huge database of Companions as a learning resource by adopting FLOSS for learning PDE and its applications.

Mathematics Practical - V with Free/Libre and Open-Source Software (FLOSS) tool for computer programs.

Note-1: Before the execution, all problems must be solved manually and the same should also be written in the records along with Aim / Motivation, Algorithm, Computer Program / Python code and output. The minimum 15 programs must be done from the following list **of suggested programs:**

1. Program to verify the ring is commutative ring.
2. Program to verify the ring is with unity.
3. Program to verify the ring is ring with or without zero divisors.
4. Program to evaluate line integral with constant limits.
5. Program to evaluate double integral with constant limits.
6. Program to evaluate double integral with variable limits.
7. Program to evaluate triple integral with constant limits.
8. Program to evaluate triple integral with variable limits.
9. Program to express vector in cylindrical coordinates.
10. Program to express vector in spherical coordinates.
11. Program to finding solutions to the problems on total and simultaneous differential equations.
12. Program to finding solutions to the problems on different types of partial differential equations. (Type 1 and Type 2)
13. Program to finding solutions to the problems on different types of partial differential equations.(Type 3 and Type 4)
14. Program to solving second order Homogeneous linear partial differential equations in two variables with constant Co-efficient.
15. Program to solving second order non-homogeneous linear partial differential equations in two variables with constant Co-efficient.
16. Program to finding solution of one- dimensional heat equation using Fourier series with Dirichlet condition.

17. Program to finding solution of one- dimensional wave equation using Fourier series with Dirichlet condition.

Note-2: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

TEXT / REFERENCE BOOKS

1. Sandeep Koranne, *Handbook of Open-Source Tools*, Springer US, 2015.
2. Brian Heinold, *A Practical Introduction to Python Programming*, Department of Mathematics and Computer Science, Mount St. Mary's University, 2019.
3. J. C. Bautista, *Mathematics and Python Programming*, Lulu Press, Incorporated, 2014.
4. Eric Ayars, *Computational Physics with Python*, California State University, 2013.
5. Martin C. Brown, *Python: The complete Reference*, 4th Edition, Mc.GrawHill, 2018.

WEB RESOURCES:

1. <http://www.univie.ac.at/future.media/moe/galerie.html>
2. <http://faculty.msmarj.edu/heinold/python.html>
3. <https://kitchingroup.cheme.cmu.edu/pycse/pycse.html>
4. <https://www.vlab.co.in/>
5. <https://fossee.in/>
6. <http://www.python.org>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSCP 5.1: MATHEMATICS PRACTICAL-V												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	3	3	2	3	2	3	3
CO2	2	2	3	2	1	3	2	2	2	2	1	3
CO3	1	1	2	2	2	2	2	1	3	2	2	3
CO4	2	2	1	3	2	3	3	2	1	2	3	3

*Low correlate-1; Moderate correlate-2; High (Substantial) correlate-3.

MATDSCT 5.2: MATHEMATICS-VI

Teaching Hours	:4 Hours / week	Credits	: 3
Total Teaching Hours	:56 Hours	Max. Marks	: 100 (SA 80 + IA 20)

COURSE OBJECTIVE:

Numerical Analysis typically focuses on equipping students with the ability to understand and apply numerical techniques to solve mathematical problems that may not have analytical solutions. These techniques are used in solving real life problems and appreciate the way the techniques are modified to improve the accuracy.

COURSE OUTCOMES (COS):

By the end of the program the students will be equipped with the following aspects:	
CO 1	Understand the numerical analysis with computing (in an approximate way) the solution of the roots of algebraic and transcendental equations, and also differential equations.
CO 2	Apply and compute the theoretical basis of various numerical methods, including their derivation, error analysis, and conditions for their effectiveness. Also, solving the systems of linear and non-linear equations.
CO 3	Learn and solve the finite difference operators related problems (i.e., forward, backward, and central interpolation formula) to represent and analyze the behavior of functions at discrete points. Also, able to construct interpolating polynomials using techniques like Lagrange interpolation and Newton's divided difference interpolation
CO 4	Learn and apply to approximate definite integrals using methods like the trapezoidal rule and Simpson's rule. Further, to solve initial value problems for ordinary differential equations using methods like Euler's method, Runge-Kutta methods, and predictor-corrector methods.

CONTENTS		Teaching Hours
Unit 1	Algebraic and Transcendental Equations : Errors: Significant digits, absolute, relative, percentage errors, rounding off and truncation errors (meanings and related problems) Solutions to algebraic and transcendental equations: Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method.	14

Unit 2	System of Linear Algebraic Equations: Direct Methods: Gauss elimination method, Gauss-Jordan elimination method and LU-Decomposition method. Iterative Methods: Jacobi method, Gauss-Seidel method, Successive-Over Relaxation (SOR) method.	14
Unit 3	Polynomial Interpolations : Finite Differences: Forward, backward and shift operators: definitions, properties and problems. Polynomial Interpolation: Newton-Gregory forward and backward interpolation formulas, Gauss's Forward and backward interpolation formulas. Lagrange interpolation formula, Newton's divided differences and Newton's general interpolation formula (Discussion on setting up the polynomials, differences between them and problems on their applications).	14
Unit 4	Numerical Differentiation and Integration: Numerical Differentiation: Formula for derivatives (till second order) based on Newton-Gregory forward and backward interpolations (Derivations and problems based on them). Numerical Integration: General quadrature formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule and problems. (Derivations for only general quadrature formula, trapezoidal rule and Simpson's 1/3rd rule and problems on all the formulas).	14

TEXT / REFERENCE BOOKS

1. E. Isaacson and H. B. Keller, *Analysis of Numerical methods*, revised ed. Dover Publications, 2012.
2. S. S. Sastry, *Introductory methods of Numerical Analysis*, 5th Edition, PHI Pvt.Ltd., 2012.
3. E. Kreyszig, *Advanced Engineering Mathematics*, 10th ed. Wiley India Pvt. Limited, 2015.
4. M. K. Jain, S.R.K. Iyengar and R. K. Jain, *Numerical Methods for Scientific and Engineering computation*, 4th Edition, New Age International, 2005.
5. S. R. K. Iyengar and R. K. Jain, *Numerical Methods: Problems and Solutions*, 3rd Edition, New Age International, 2020.
6. H. C. Saxena, *Finite Difference and Numerical Analysis*, S. Chand Publishers, 2010.
7. B. D. Gupta, *Numerical Analysis*, Konark Publishers Pvt. Ltd, 1990.

8. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Ed. India, 2007.
9. C. F. Gerald and P. O. Wheatley, *Applied Numerical Analysis*, Pearson Ed., India, 2008.

WEB RESOURCES:

1. <http://www.nptelvideos.in/2012/11/mathematics.html>
2. <https://www.my-mooc.com/en/categorie/mathematics>
3. <http://ocw.mit.edu/courses/mathematics/>
4. <https://ndl.iitkgp.ac.in/>
5. <http://cec.nic.in/cec/>
6. <https://www.doabooks.org/>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSCT 5.2: MATHEMATICS-VI												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	3	3	3	2	3	3	3
CO2	2	3	2	1	2	3	3	2	3	3	3	2
CO3	1	2	2	2	1	2	2	3	2	2	2	3
CO4	2	2	3	3	2	3	3	2	2	2	3	3

*Low correlate-1; Moderate correlate-2;High (Substantial) correlate-3.

MATDSCP 5.2: MATHEMATICS PRACTICAL-VI			
Teaching Hours	:4 Hours / week	Credits	:2
Total Teaching Hours	:56 Hours	Max. Marks	: 50 (SA 40 + IA 10)

COURSE OBJECTIVES:

Mathematics Practical-VI with Python skill is helpful for Employability in IT industries, Entrepreneurship in Produce innovative IT solutions and services based on global needs and trends.

COURSE OUTCOMES (COs):

Course Outcomes	This practical course will enable the students to:
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CO1	Articulate the rationale behind various techniques of numerical analysis such as in finding roots, integrals, and derivatives by using FLOSS tools.
CO2	Understand the concepts of Algebraic and transcendental equations. Also solving the systems of linear and non-linear equations via computer programming.
CO3	Learn and solve the finite difference operators related problems (i.e., forward, backward, and central interpolation formula) by applying FLOSS packages.
CO4	Solve numerical differential equation (both ordinary and partial) related problems using suitable numerical technique by using FLOSS tools.

The Mathematics Practical-VI with Free / Libre and Open Source Software (FLOSS) tool for computer programs.

Note-1: Before the execution, all problems has to be solved manually and the same should also be written in the records along with Aim / Motivation, Algorithm, Computer Program / Python code and output. The minimum 15 programs have to be done from the following list of suggested programs:

1. Program to find a real positive root of an algebraic and transcendental equation using bisection method
2. Program to find a real positive root of an algebraic and transcendental equation using Regula-Falsi method
3. Program to find a real positive root of an algebraic and transcendental equation using Newton- Raphson method
4. Program to solve system of equations by Gauss elimination method
5. Program to solve system of equations by Gauss –Jordan method
6. Program to solve system of equations by Jacobi iteration method
7. Program to solve system of equations by Gauss –Seidel iteration method
8. Construction of forward and backward difference table for the given data.
9. Program to find the value by interpolation using Newton-Gregory Forward method for equal intervals
10. Program to find the value by interpolation using Newton-Gregory Backward method for equal intervals
11. Program to find the value by interpolation using Lagrange’s interpolation method for unequal intervals.
12. Program to find the value by interpolation using Inverse Lagrange’s interpolation method for

unequal intervals.

13. Program to find the first order and second order derivative value by using Newton-Gregory Forward interpolation method for equal intervals.
14. Program to find the first order and second order derivative value by using Newton-Gregory Backward interpolation method for equal intervals.
15. Program to evaluate the integral by using Trapezoidal rule
16. Program to evaluate the integral by using Simson's $\frac{1}{3}$ rd rule
17. Program to evaluate the integral by using Simson's $\frac{3}{8}$ rd rule.
18. Program to evaluate the integral by using Weddle's rule.

Note-2: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

TEXT / REFERENCE BOOKS

1. Sandeep Koranne, *Handbook of Open Source Tools*, Springer US, 2015.
2. Philip N. Klein, *Coding the Matrix: Linear Algebra through Computer Science Applications*, Newtonian Press, 2013.
3. Brian Heinold, *A Practical Introduction to Python Programming*, Department of Mathematics and Computer Science, Mount St. Mary's University, 2019.
4. J. C. Bautista, *Mathematics and Python Programming*, Lulu Press, Incorporated, 2014.

WEB RESOURCES:

1. <http://www.univie.ac.at/future.media/moe/galerie.html>
2. <http://faculty.msmar.edu/heinold/python.html>
3. <https://www.vlab.co.in/>
4. <https://fossee.in/>
5. <http://www.python.org>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSCP 5.2: MATHEMATICS PRACTICAL-VI												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	3	2	3	3	2	3	3	3	3	2	3	3
CO2	2	3	2	2	2	3	2	2	2	2	3	2
CO3	1	2	2	3	3	3	3	3	2	3	2	3
CO4	2	2	2	2	2	3	3	2	3	2	3	3

*Low correlate-1; Moderate correlate-2; High (Substantial) correlate-3.

SIXTH SEMESTER

MATDSCT 6.1: MATHEMATICS-VII	
Teaching Hours	:4 Hours / week
Credits	:3
Total Teaching Hours	:56 Hours
Max.Marks:100 (SA 80 + IA 20)	

COURSE OBJECTIVE:

This topic exploring various examples of Vector space, to identify subspace, linear combination, linear dependent and independent, basis, dimension, linear transformation and its applications. The fundamental properties of the calculus of variations and Improper integrals are leads to exploring their properties, and mastering techniques for analyzing their practical applications. These are emphasizes rigorous proofs and logical reasoning, helping students develop critical and problem-solving abilities.

COURSE OUTCOMES (COS):

By the end of the program the students will be equipped with the following aspects:	
CO 1	Understand the concepts of Vector spaces, subspaces, linear combination, linear dependence, linear independence, bases and dimension.
CO 2	Learn the fundamental concept Linear transformation, matrix, eigenvalue and eigenvector and its basic properties.
CO 3	Understanding and applying concepts like functional, Euler equations, and various methods for finding optimal solutions (extremals) in Calculus of Variations.
CO 4	Identify the given integral is proper or improper. Also, appraise and develop the applications of Beta-Gamma functions.

CONTENTS		Teaching Hours
Unit 1	Vector Spaces: Definition, examples and properties; Subspaces - Examples, criterion for a subset to be a subspace and some properties;	

	Linear Combination - Linear span, Linear dependence and independence, basic properties of linear dependence and independence, techniques of determining linear dependence and independence in various vector spaces and related problems; Basis and dimension - Co-ordinates, ordered basis, some basic properties of basis and dimension and subspace spanned by given set of vectors; Quotient space. Dimension of quotient space (derivation in finite case); Sum and Direct sum of subspaces - Dimensions of sum and direct sum spaces (Derivation in finite case).	14
Unit 2	Linear transformation: Definition, examples, equivalent criteria, some basic properties and matrix representation and change of basis and effect on associated matrix, similar matrices; Rank – Nullity theorem - Null space, Range space, proof of rank nullity theorem and related problems. Eigenvalues and eigenvectors of linear transformations.	14
Unit 3	Calculus of Variations: Variation of a function $f = f(x, y, y')$ -variation of corresponding functional, extremal of a functional, variational problem, Euler's equation and particular forms, examples, standard problems like geodesics, minimal surface of revolution, hanging chain problem, Brachistochrone problem, isoperimetric problem.	14
Unit 4	Improper Integrals: Improper integrals of the first, second, and third kind with examples. Improper integral as the limit of proper integral. Beta-Gamma Functions - Definition, properties and examples, relation between beta and gamma functions, standard theorems, Application of definite integrals duplication formula and its applications.	14

TEXT/ REFERENCE BOOKS

1. V. K. Khanna and S. K. Bhambri. *A Course in Abstract Algebra*, 5th Edition. Vikas Publishing House Pvt. Ltd. New Delhi, 2016.
2. I. N. Herstein, *Topics in Algebra*, 4th ed. Vikas Pub. House Pvt. Ltd, New Delhi, India, 1991.
3. Michael Artin, *Algebra*, 2nd ed. New Delhi, India: PHI Learning Pvt. Ltd., 2011.
4. John B Fraleigh, *A First course in Abstract Algebra*, 3rd ed.: Narosa Pub. House., 1990.
5. M. D. Raisinghania, *Vector Calculus*, S. Chand Co. Pvt.Ltd., 2013.
6. M. Spiegel, *Vector Analysis*, 2ndEd., Schaum's Outline Series, Mc-Graw Hill Pub., 2017.

7. Shanthi Narayan and P. K. Mittal, *Integral Calculus*, Reprint, S. Chand and Co. Pvt. Ltd., New Delhi, 2013.
8. B. S. Grewal, *Higher Engineering Mathematics*, 42nd ed. Khanna Publishers, 2017.
9. A. S. Gupta, *Calculus of Variations*, Prentice Hall of India, New Delhi, 2011.
10. R. K. Sharma, *Calculus of Variations*, Medtech, 2017

WEB RESOURCES:

1. <http://www.nptelvideos.in/2012/11/mathematics.html>
2. <https://www.my-mooc.com/en/categorie/mathematics>
3. <http://ocw.mit.edu/courses/mathematics/>
4. <https://ndl.iitkgp.ac.in/>
5. <http://cec.nic.in/cec/>
6. <https://www.doabooks.org/>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSCT 6.1: MATHEMATICS-VII												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	3	3	3	3	3	2	3	3	3
CO 2	3	3	2	2	3	3	2	2	3	3	2	3
CO 3	2	2	3	3	2	2	3	3	2	3	3	2
CO 4	2	2	3	3	2	3	3	2	3	2	3	3

*Low correlate-1; Moderate correlate-2; High (Substantial) correlate-3.

MATDSCP 6.1: MATHEMATICS PRACTICAL-VII			
Teaching Hours	:4 Hours / week	Credits	:2
Total Teaching Hours	:56 Hours	Max. Marks	: 50 (SA 40 + IA 10)

COURSE OBJECTIVES:

The Mathematics Practical-VII with Python skill is helpful for Employability in IT industries, Entrepreneurship in Produce innovative IT solutions and services based on global needs and trends.

COURSE OUTCOMES (COs):

Course Outcomes	This practical course will enable the students to:
CO1	Apply and illustrate the fundamental concepts of vector space and their proficiency in using FLOSS tools for problem solving and visualization.
CO2	Solve and analyze the problem of Linear transformation, matrix, eigenvalue and eigenvector via FLOSS packages.
CO3	Solve and analyze the problem of functional, Euler equations, and various methods for finding optimal solutions (extremals) in Calculus of Variations via FLOSS tools.
CO4	Learning and analyzing the theoretical concepts of improper integrals, developing skills in using FLOSS for visualization, and exploring real-world applications.

The Mathematics Practical-VII with Free/Libre and Open-Source Software (FLOSS) tool for computer programs.

Note-1: Before the execution, all problems must be solved manually and the same should also be written in the records along with Aim / Motivation, Algorithm, Computer Program / Python code and output. The minimum 15 programs must be done from the following list **of suggested programs:**

1. Program to expressing a vector as a linear combination of given set of vectors.
2. Program to examine whether the given set of vectors are linear independence and linear dependence of vectors.
3. Program to verifying whether the given set of vectors form a Basis or not.
4. Program to finding the basis of the subspace spanned by the set of vectors.
5. Program to finding the dimension of the subspace spanned by the set of vectors.
6. Program to verifying whether a given transformation is linear or not.
7. Program to finding a matrix of linear transformation.
8. Program to find the Eigenvalues of a given linear transformation.
9. Program to find the Eigenvectors of a given linear transformation.
10. Program to verification of Rank-Nullity theorem.
11. Program to give example on Euler's equation in full form.
12. Program to give example on particular forms of Euler's equation.
13. Program to give examples on minimum surface of revolution and Brachistochrone problem.
14. Program to give examples on Isoperimetric problems.
15. Program to evaluate the integrals using the Gamma function.
16. Program to evaluate the integrals using the Beta function.

Note-2: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

TEXT / REFERENCE BOOKS

1. Sandeep Koranne, *Handbook of Open-Source Tools*, Springer US, 2015.
2. Philip N. Klein, *Coding the Matrix: Linear Algebra through Computer Science Applications*, Newtonian Press, 2013.
3. Brian Heinold, *A Practical Introduction to Python Programming*, Department of Mathematics and Computer Science, Mount St. Mary's University, 2019.
4. J. C. Bautista, *Mathematics and Python Programming*, Lulu Press, Incorporated, 2014.
5. Eric Ayars, *Computational Physics with Python*, California State University, 2013.
6. John Kerl, *Concrete abstract algebra in Python*, 2013.

WEB RESOURCES:

1. <http://www.univie.ac.at/future.media/moe/galerie.html>
2. <http://faculty.msmar.edu/heinold/python.html>
3. <https://kitchingroup.cheme.cmu.edu/pycse/pycse.html>
4. <https://www.vlab.co.in/>
5. <https://fossee.in/>
6. <http://www.python.org>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSCP 6.1: MATHEMATICS PRACTICAL-VII												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	3	3	2	3	3
CO2	2	3	3	3	3	3	2	2	2	2	2	3
CO3	2	2	2	2	3	3	3	3	3	3	2	2
CO4	3	3	3	3	2	3	3	2	2	2	3	3

*Low correlate-1; Moderate correlate-2; High (Substantial) correlate-3.

MATDSET 6.2 (A): MATHEMATICS-VIII

Teaching Hours	:4 Hours / week	Credits	:3
Total Teaching Hours	:56 Hours	Max. Marks	: 100 (SA 80 + IA 20)

COURSE OBJECTIVE:

This courses aim to provide a foundational understanding of functions of a complex variable, focusing on analytic functions, Cauchy's theorem, Laurent series, and contour integration. Also, understanding how the conformal mappings transform complex regions. These objectives are designed to build a strong theoretical foundation with applications in engineering and physical sciences.

COURSE OUTCOMES (COs):

By the end of the program the students will be equipped with the following aspects:	
CO 1	Gain knowledge about the complex number system, the complex function, complex integration and their geometrical representations on the complex plane.
CO 2	Understanding the concepts of limit, continuity, differentiability and analyticity for complex functions.
CO 3	Analyze elementary transformations such as translation, rotation, magnification, and inversion.
CO 4	Understanding the concepts of the cross-ratio of four points and conformal mapping. Also, determine the method of transforming bilinear and other transformations.

CONTENTS		Teaching Hours
Unit 1	Complex Numbers and Variables: Complex numbers, Algebra of complex numbers, Cartesian and polar form, Finding the modulus and argument of a complex number, geometrical representation, Complex plane, Euler 's formula, De Moivre's theorem and problems on it.	14
Unit 2	Complex Functions: Functions of a complex variable- limit, continuity and differentiability of a complex function. Analytic function-Cauchy- Riemann equations in cartesian and polar forms, sufficiency condition for analyticity (cartesian form only) Harmonic function, standard properties of analytic functions, construction of analytic function when real and imaginary part is given, Milne- Thomson method.	14

Unit 3	Complex Integration: Definitions of Complex integration, properties and problems, Cauchy's integral theorem, proof using Green's and Stoke's theorem - direct consequences, Cauchy's integral formula with proof, Cauchy's generalized formula for derivatives with proof and applications for evaluation of simple line integrals, Cauchy's inequality and Liouville's theorem with proofs, Fundamental theorem of algebra with proof.	14
Unit 4	Complex Transformation: Definitions of Conformal transformations, some elementary transformation viz, translation, rotation, magnification and inversion- examples. The bilinear transformation: cross ratio - invariant points of bilinear transformation, properties: (i) Bilinear transformation sets up one to one correspondence between extended z- plane and extended w- plane: (ii) Preservation of cross ratio under a bilinear transformation; and (iii) A bilinear transformation transforms circles onto circles or straight lines. Problems on finding bilinear transformation and finding images under a bilinear transformation and invariant points of bilinear transformation. Discussion of transmissions $w = z^2$, $w = \sin z$, $w = \cosh z$ and $w = e^z$	14

TEXT/REFERENCE BOOKS

1. Shanthinarayan and P. K. Mittal, *Theory of functions of a Complex variables*, S Chand Co. Pvt. Ltd., 2005.
2. R. V. Churchill and J. W. Brown, *Complex Variables and Applications*, 5th ed.: McGraw Hill Companies., 1989.
3. L. V. Ahlfors, *Complex Analysis*, 3rd ed.: Mc Graw Hill. , 1979.
4. A. R. Vashista, *Complex Analysis*, Krishna Prakashana Mandir, 2012.
5. S. Ponnuswamy, *Foundations of Complex Analysis*, Narosa Pub. House, New Delhi, 2004.

WEB RESOURCES:

1. <http://www.nptelvideos.in/2012/11/mathematics.html>
2. <https://www.my-mooc.com/en/categorie/mathematics>
3. <http://ocw.mit.edu/courses/mathematics/>
4. <https://ndl.iitkgp.ac.in/>
5. <http://cec.nic.in/cec/>
6. <https://www.doabooks.org/>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSET 6.2(A): MATHEMATICS - VIII												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	3	3	2	3	2	3	3	3
CO2	2	3	3	2	2	2	3	2	2	3	3	3
CO3	3	2	2	3	3	3	2	3	2	2	2	3
CO4	2	3	3	3	2	3	2	2	3	3	3	3

*Low correlate-1; Moderate correlate-2;High (Substantial) correlate-3.

MATDSET 6.2 (B): MATHEMATICS-IX	
Teaching Hours	:4 Hours / week
Credits	: 3
Total Teaching Hours	:56 Hours
Max. Marks	: 100 (SA 80 + IA 20)

COURSE OBJECTIVE:

The course objectives for Linear Programming Problems (LPP) and Operations Research (OR) are to equip students with mathematical modeling skills to optimize business and engineering decisions under resource constraints. Students learn to formulate problems, apply techniques like the Simplex method and graphical analysis, and solve transportation, assignment, and game theory scenarios

COURSE OUTCOMES (COs):

By the end of the program the students will be equipped with the following aspects:	
CO 1	Formulation optimization model and applying a appropriate optimization techniques for decision making.
CO 2	Solve linear programming problems using appropriate optimization techniques.
CO 3	Finding the optimal strategy for minimization of cost of shipping of products from source to destination. Illustrate the applications of transportation problems and game theory.
CO 4	Determine the method of optimizing the allocation of resources to demand points in the best possible way.

CONTENTS		Teaching Hours
Unit 1	Introduction to OR and Linear Programming: Introduction to OR- origin of operation research, historical stand point, methodology, different phases characteristics, scope and application. Linear programming: LPP, Formulation- graphical solution, simplex method. Artificial variable technique- Big M method.	14
Unit 2	Transportation and Assignment Problems: Transportation problem-Definition, Linear form, Northwest corner rule, Least Cost method, Vogel's approximation method. Unbalanced problems and degeneracy in transportation, modified distribution method. Assignment Problems: Formulation, Solution to assignment problems by Hungarian method, unbalanced, Maximization assignment problems.	14
Unit 3	Sequencing and Game Theory: Sequencing- Basic assumptions, Sequencing -n Jobs through two machines Model and n- jobs through three Machines model. Game Theory- Definition, pure strategic problems, saddle point, max- min and min- max criteria, principle of dominance, solution of games with saddle point, Mixed strategy problems, Solution of 2×2 games by arithmetic method and solution of $2 \times m$ and $m \times 2$ games by graphical method.	14
Unit 4	Network problems and Project Management: Network problems-Shortest path problem, minimum spanning tree problem. Project management: Introduction, construction of networks, Fulkerson's rule for numbering the nodes, Critical path method to find the expected completion time of a project, determination of floats in networks.	14

TEXT/REFERENCE BOOKS

1. Taha, Hamdy, *Operations Research*, 7th edition, USA: Macmillan Publishing Co., 2003
2. Robert J. Vanderbei, *Linear Programming*, Springer, 1996.
3. R Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear programming and Network flows*, 2nd Ed., John Wiley and Sons, India, 2004.
4. Dimitris Bertsimas and J. N. Tsitsiklis, *Introduction to linear Optimization*, Athena Scientific, 1997.

5. Rajesh Mishra. *Operations Research and Decision-Making Techniques*. Mumbai: Himalaya Publishing House, 2019.
6. R. N. Tiwari, *Operations Research: Methods and Problems*. New Delhi: CBS Publishers & Distributors, 2020.

WEB RESOURCES:

1. <http://www.nptelvideos.in/2012/11/mathematics.html>
2. <https://www.my-mooc.com/en/categorie/mathematics>
3. <http://ocw.mit.edu/courses/mathematics/>
4. <https://ndl.iitkgp.ac.in/>
5. <http://cec.nic.in/cec/>
6. <https://www.doabooks.org/>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSET 6.2 (B): MATHEMATICS-IX												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	3	2	3	3	3	3	2
CO2	2	3	2	3	2	1	3	2	2	3	2	3
CO3	2	2	1	2	3	3	2	3	2	3	1	2
CO4	3	3	2	3	2	3	2	2	3	3	3	3

*Low correlate-1; Moderate correlate-2; High (Substantial) correlate-3.

MATDSSP 6.3: SKILL BASED COMMERCIAL MATHEMATICS	
PRACTICAL - VIII	
Teaching Hours	:4 Hours / week
Credits	:2
Total Teaching Hours	: 56 Hours
Max. Marks	: 50 (SA 40 + IA 10)

COURSE OBJECTIVE:

This course aims to provide students with a solid foundation in financial mathematics, economics, and mathematical modeling, enabling them to understand and analyze various real-world economic phenomena. It includes developing analytical and problem-solving skills, understanding the

mathematical tools used in finance and economics, and applying them to practical scenarios. It develops ability to calculate interest and annuities, analyze market dynamics using demand and supply functions, interpret cost and profit functions, and formulate and solve linear programming problems.

COURSE OUTCOMES (COs):

By the end of the program the students will be equipped with the following aspects:	
CO 1	Calculate simple, compound interest for various scenarios and to compute EMIs using both reducing balance and flat interest systems.
CO 2	Determine the present and future values of annuities and apply this knowledge to financial decision-making.
CO 3	Understand the relationships between demand, supply, and market equilibrium, and interpret them using mathematical models.
CO 4	Develop graphing skills to visually represent economic relationships and analyze their implications.

The skill based Commercial Mathematics Practical-VIII with Free/Libre and Open-Source Software (FLOSS). Especially, Excel and Tora tool for computer programs .

Note-1: Before the execution, all problems must be solved manually and the same should also be written in the records along with Aim / Motivation, Algorithm, Computer Program / Excel and Tora code and output. The minimum 15 programs must be done from the following list **of suggested programs:**

Module 1: Interest and Annuity

I - Simple Interest and Compound Interest, Compounded more than once a year.

1. Practical based on simple interest (finding Interest and Final Amount)
2. Practical based on Simple interest (finding rate of interest)
3. Practical based on Simple interest (finding period)
4. Practical based on Compound interest (finding Interest and Final Amount)
5. Practical based on Compound interest (finding rate of interest)
6. Practical based on Compound interest (finding period)
7. Practical based on Compound interest where compounding is more than once in a year

II - Annuity, Immediate and due, Present value, Future value of an Annuity

8. Practical on Annuity Immediate and Annuity Due

9. Practical on finding Present value and Future value of an Annuity

III -Equated Monthly Installments (EMI) using reducing balance & flat interest system.

10. Practical on EMI using reducing balance method
11. Practical on EMI using flat interest method.

Students are encouraged to use excel to solve practical problems.

Module 2: Functions in Economics and LPP

IV- Concept of real functions: constant function, linear function, quadratic function

12. Practical based on constant function, linear function and quadratic function (students will be expected to identify and differentiate between these types of functions)
13. Practical based on graphs of constant, linear and quadratic functions

V- Concept of Demand, Supply, Total Revenue, Average Revenue

14. Practical on demand function and supply function
15. Practical based on graphs of constant, linear and quadratic functions

VI- Concept of Total Cost, Average Cost and Profit function. Equilibrium Point

16. Practical on Total Cost and Average cost
17. Practical on Profit function
18. Practical on Equilibrium point

Students are encouraged to use Tora for solving LPP practical problems.

Note-2: The above list may be changed annually with the approval of the BOS in UG (Mathematics).

TEXT/REFERENCE BOOKS

1. M. Wilson, *Business Mathematics*, Himalaya Publishing House, 2012.
2. R. Jayaprakash Reddy, Y. Mallikarjuna Reddy, *A textbook of Business Mathematics*, APH Pub Co.,2008.
3. S.K. Khandelwal, *Business Mathematics and Statistics*, International Book House Ltd. 2012.
4. K.L. Sehgal, *Business Mathematics*, Himalaya Publishing House. 2021.
5. Sharon Burton and Nelda Shelton, *Business Math Using Excel*, South Western Educational Publishing, 2011.
6. Taha, Hamdy, *Operations Research*, 7th edition, USA: Macmillan Publishing Co., 2003

WEB RESOURCES:

1. <http://www.nptelvideos.in/2012/11/mathematics.html>

2. <https://ecampusontario.pressbooks.pub/businessmath/>
3. <https://www.scribd.com/document/812100878/Tora-Practical>
4. <https://www.udemy.com/course/business-math-with-excel>
5. <https://zalamsyah.staff.unja.ac.id/>
6. <https://sourceforge.net/projects/tora/>

COURSE ARTICULATION MATRIX MAPPING OF POs v/s COs*

MATDSSP 6.3: SKILL BASED COMMERCIAL MATHEMATICS PRACTICAL - VIII												
Course Outcomes (COs)	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	2	3	2	3	3	3
CO2	2	3	3	2	2	3	2	3	2	3	2	2
CO3	2	2	2	2	3	3	2	3	2	1	2	2
CO4	2	3	2	3	2	3	2	2	3	3	2	3

*Low correlate-1; Moderate correlate-2;High (Substantial) correlate-3.

BANGALORE UNIVERSITY

B. Sc. Degree (Mathematics)

FORMAT OF QUESTION PAPER OF MATHEMATICS -THEORY

(V & VI Semester B. Sc.,)

Time: 3 Hours

Max. Marks: 80

SECTIONS	PATTERN UNIT WISE	MARKS
A	Answer any TEN (12 questions are given from all units-each unit cover 3 questions)	$10 \times 2 = 20$
B	Answer any THREE (05 questions are given from Unit-I)	$3 \times 5 = 15$
C	Answer any THREE (05 questions are given from Unit-II)	$3 \times 5 = 15$
D	Answer any THREE (05 questions are given from Unit-III)	$3 \times 5 = 15$
E	Answer any THREE (05 questions are given from Unit-IV)	$3 \times 5 = 15$
TOTAL MARKS		80

FORMAT OF QUESTION PAPER OF MATHEMATICS - PRACTICAL

(V & VI Semester B.Sc.,)

Time: 3 Hours

Max. Marks: 40

SECTIONS	PATTERN UNIT WISE	MARKS
A	Answer any ONE (02 questions are given from Unit-I)	$01 \times 07 = 07$
B	Answer any ONE (02 questions are given from Unit-II)	$01 \times 07 = 07$
C	Answer any ONE (02 questions are given from Unit-III)	$01 \times 07 = 07$
D	Answer any ONE (02 questions are given from Unit-IV)	$01 \times 07 = 07$
Viva-Voce		06
Lab Record		06
TOTAL MARKS		40
