DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ B.Sc./NEP/54/2023

It is hereby inform to all concerned that, the syllabus prepared by the Board of Studies & Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology the **Academic Council at its meeting held on 30 November 2023 has accepted the Following Syllabi as per Norms of National Education Policy – 2020** under the Faculty of Science & Technology run to the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith:-

Sr.No.	Courses	Semester
1.	B.A./B.Sc. Statistics	Ist and IInd semester
2.	B.A./B.Sc. Mathematics	Ist and IInd semester
3.	B.Sc.Forensic Science	Ist and IInd semester
4.	Bachelor of Computer Application	Ist and IInd semester
5.	B.Sc. Information Technology	Ist and IInd semester
6.	B.Sc.Automobile Technology	Ist and IInd semester
7.	B.Sc.Electronics	Ist and IInd semester
8.	B.Sc.Networking & Multimedia	Ist and IInd semester
9.	B.Sc.Fisheries Science	Ist and IInd semester
10.	B.Sc.Botany	Ist and IInd semester

This shall be effective from the Academic Year 2024-25 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,
Chhatrapati Sambhajinagar
431 004.
REF.No.SU/2023/1991-19
Date:- 20.12.2023.

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**Deputy Registrar,
Academic Section.**

Copy forwarded with compliments to :-

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

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

Copy to :-

1] **The Director, Board of Examinations & Evaluation, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.**

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

3] The Programmer [Computer Unit-1] Examinations, Dr. Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

DR. BABASAHEB AMBEDKAR MARATHWADA

UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

FACULTY OF SCIENCE & TECHNOLOGY

3 Years/4 Years B.A./ B.Sc. (Hons) &

4 Years B.A./B.Sc. (Hons. with Research) Programme

Course Structure

Subject: MATHEMATICS
B.A./ B.Sc. First Year (Semester-I & II)

(Effective from 2024-25)

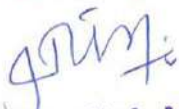J. A. Nanawase

Dr.Babasaheb Ambedkar Marathwada

University,Chhatrapati Sambhajinagar

Credit Distribution structure for three/four year Honours/Honours with Research Degree Programme with Multiple Entry and Exit Option (Discipline Specific) B. Sc. (Mathematics)

Level	Semester	Major		Minor (Choose any one from Pool of courses from same faculty/ discipline)	Generic/OE (Choose any one from Pool of courses offered as a generic of Major)	VSC, SEC(VSEC) (Choose any one from Pool of Major)	AEC, VEC, IKS	OJT,FP,CEP,CC,RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	Electives (Choose any one from Pool of courses)							
4.5	I	DSC-1 : 2 DSC-2 : 2 DSC-3 : 2	--	--	GE-1:2 GE-2:2	VSC:2, SEC:2	AEC: 2, (Eng.) VEC:2, (Indian Constitution) IKS:2	CC:2 (Health & Wellness)	22	UG Certificate 44
	II	DSC-4 : 2 DSC-5 : 2 DSC-6 : 2	--	2	GE-3:2 GE-4:2	VSC:2, SEC:2	AEC: 2, (English.) VEC:2, (Environment Education)	CC:2(Yoga education/ Sport and fitness)	22	
	Cum. Cr.	12	--	2	8	4+4	4+4+2	4	44	

Level	Semester	Major		Minor	Generic/OE	VSC, SEC	AEC, VEC, IKS	OJT,FP,CEP,CC,RP	Cum. Cr./Sem.	Degree/Cum. Cr.
5	III	DSC-7: 3 DSC-8: 3 DSC-9 :2	--	4	2	VSC:2,	AEC:2(MIL)	FP:2 CC:2 (Cultural Activities/ NSS/NCC)	22	UG Diploma 88
	IV	DSC-10:3 DSC-11:3 DSC-12:2	--	4	2	SEC:2,	AEC:2 (MIL)	CEP:2 CC:2 (Fine/Applied/ Visual/ Performing Arts)	22	
	Cum. Cr.	28	--	10	12	6+6	8+4+2	8+4	88	

5.5	V	DSC-13: 3 DSC-14: 3 DSC-15: 2	DSE-1:4	4		VSC:4,		FP/CEP:2	22	UG Degree 132
	VI	DSC-16:3 DSC-17:3 DSC-18:4	DSE-2:4	4				OJT:4	22	
	Cum. Cr.	46	8	18	12	10+6	8+4+2	8+6+4	132	

Exit Option : Award of UG Degree in Major with 132 credits OR Continue with Major and Minor

6	VII	DSC-19:3 DSC-20:3 DSC-21:3 DSC-22:3 DSC-23:2	DSE-3:4	RM:4					22	UG Honours Degree 176
	VI	DSC-24:3 DSC-25:3 DSC-26:3 DSC-27:3 DSC-28:2	DSE-4:4					OJT:4	22	
	Cum. Cr.	74	16	18+4	12	10+6	8+4+2	8+6+8	176	

Four Year UG Honours Degree in Major and Minor with 176 Credits

6	VII	DSC-29:4 DSC-30:4 DSC-31:2	DSE:3:4	RM:4				RP:4	22	UG Honours with Research Degree 176
	VIII	DSC-32:4 DSC-33:4 DSC-34:2	DSE:4:4					RP:8	22	
	Cum. Cr.	64	16	18+4	12	10+6	8+4+2	8+6+8+12	176	

Four Year UG Honours with Research Degree in Major and Minor with 176 credits

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

1. Introduction to Undergraduate Degree course in Mathematics:

As per the recommendations of the NEP-2020, the undergraduate degree course in mathematics is a six/ eight semester course spread over three/ four academic years. The teaching – learning process is student-centric and it involves both theory and practical components. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. Besides the Discipline Specific Core(DSC) courses, a student can opt courses from the syllabus comprising of Discipline Specific Electives(DSEs), Generic Electives(GEs), Skill Enhancement Courses(SECs), Ability Enhancement courses(AECs) and Value Addition Courses(VACs). Thereby, bringing out the multidisciplinary approach and adherence to innovative ways within the curriculum framework. Moreover, it allows a student maximum flexibility in pursuing his/her studies at the undergraduate level to the extent of having the liberty to eventually design the degree with multiple exit options depending upon the needs and aspirations of the student in terms of his/her goals of life, without compromising on the teaching learning, both in qualitative and quantitative terms. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

2. Courses of Study:
Courses of the study indicate pursuance of study in a particular discipline. Every discipline shall offer four categories of courses of study, viz. Discipline Specific Core (DSC) courses, Discipline Specific Electives (DSEs), Skill Enhancement Courses (SECs) and Generic Electives (GEs). Besides these four courses, a student will select Ability Enhancement Courses (AECs) and Value-Added Courses (VACs) from the respective pool of courses offered by the University.

a) **Discipline Specific Core (DSC):** Discipline Specific Core is a course of study, which should be pursued by a student as a mandatory requirement of his/ her programme of study. In Bachelor of Science (Hons.) Mathematics programme, DSCs are the core credit courses of Mathematics which will be appropriately graded and arranged across the semesters of study, being undertaken by the student, with multiple exit options as per NEP 2020.

b) **Discipline Specific Elective (DSE):** The Discipline Specific Electives (DSEs) are a pool of credit courses of Mathematics from which a student will choose to study based on his/ her interest.

c) **Generic Elective (GE):** Generic Electives is a pool of courses offered by various disciplines of study (excluding the GEs offered by the parent discipline) which is meant to provide multidisciplinary or interdisciplinary education to students. In case a student opts for DSEs beyond his/ her discipline specific course(s) of study, such DSEs shall be treated as GEs for that student.

d) **Ability Enhancement course (AEC), Skill Enhancement Course (SEC) and Value Addition Course (VAC):** These three courses are a pool of courses offered by all the Departments in groups of odd and even semesters from which a student can choose.

i. **AEC:** AEC courses are the courses based upon the content that leads to knowledge enhancement through various areas of study. They are based on Language and Literature, and Environmental Science which are mandatory for all disciplines.

ii. **SEC:** SECs are skill-based courses in all disciplines and are aimed at providing hands-on training, competencies, proficiency and skills to students. SEC courses may be chosen from a pool of courses designed to provide skill-based instruction.

iii. **VAC:** VACs are common pool of courses offered by different disciplines and aimed towards personality building, embedding ethical, cultural and constitutional values; promote critical thinking, Indian knowledge systems, scientific temperament, communication skills, creative writing, presentation skills, sports and physical education and team work which will help in all round development of students.

Programme Duration and Exit Options: The minimum credit to be earned by a student per semester is 22 credits. The mandatory number of credits which have to be secured for the purpose of award of Undergraduate Certificate/ Undergraduate Diploma/Appropriate Bachelor's Degree in Mathematics is given in the table.

Programme Objectives:

The undergraduate degree course in Mathematics aims to provide:

a) In-depth knowledge in Mathematics through understanding of key mathematical concepts, principles, theories and their applications.

b) inculcate strong interest in learning mathematics,

c) evolve broad and balanced knowledge and understanding of definitions, key concepts, principles and theorems in Mathematics,

d) enable learners/students to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics,

e) develop in students the ability to apply relevant tools developed in mathematical theory to handle issues and problems in social and natural sciences,

f) provide students with sufficient knowledge and skills that enable them to undertake further studies in mathematics and related disciplines,

g) sufficient subject matter competence and enable students to prepare for various competitive examinations such as IIT-JAM, GATE, GRE, UGC-CSIR, NET/JRF and Civil Services Examinations etc.

Programme Outcomes:

The learning outcomes of the undergraduate degree course in Mathematics are as follows:

a) Communicate mathematics effectively by written, computational and graphic means.

b) Create mathematical ideas from basic axioms.

c) Gauge the hypothesis, theories, techniques and proofs provisionally.

d) Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis.

e) Identify applications of mathematics in other disciplines and in the real-world, leading to enhancement of career prospects in a plethora of fields and research.

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in B.Sc. (Mathematics) **students will be able to:**
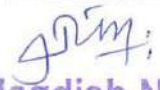
- **PSO 1. Disciplinary Knowledge:** Bachelor degree in Mathematics is the culmination of in-depth knowledge of Algebra, Calculus, Geometry, differential equations and several other branches of pure and applied mathematics. This also leads to study the related areas..

- **PSO 2.Communication Skills:** Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gain edin this program will lead to the proficiency in analytical reasoning which can be used for modelling and solving of real life problems.

- **PSO.3 Critical thinking and analytical reasoning:** The students undergoing this programme acquire ability of critical thinking and logical reasoning and capability of recognizing and distinguishing and various aspects of real life problems.

- **PSO.4. Problem Solving:** The Mathematical knowledge gained by the students through this programme develops an ability to analyse the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall developments.

- **PSO.5. Research related skills:** The completing this programme develops the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.

- **PSO.6. Information/digital Literacy:** The completion of this programme will enable the learner to use appropriate software's to solve system of algebraic equations and differential equations.

- **PSO.7. Self-directed learning:** The students completing this programme will develop ability of working independently and to make an in-depth study of various notions of Mathematics.

- **PSO.8. Moral and ethical awareness/reasoning:** The student completing this program will develop an ability to identify unethical behaviour such as fabrication, falsification or misinterpretation of data and adopting objectives, unbiased and truthful actions in all aspects of life in general and Mathematical studies in general.

- **PSO.9. Lifelong learning:** this programme provides self-directed learning and lifelong learning skills. This programme helps the learner to think independently and develop algorithms and computational skills for solving real world problems.

- **PSO.10.** Ability to pursue advanced studies and research in pure and applied Mathematical sciences.

Credit distribution structure for three/ fours year Honours/ Honours with Research Degree Programme with Multiple Entry and Exit options –(Discipline Specific Core in MATHEMATICS)

Class: B.Sc. (MATHEMATICS) First Year First Semester

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major Mandatory (Choose any one)	MATDSC1	Differential Calculus	2	-	2	-	2+2+2=6
	MATDSC2	Discrete Mathematics	2	-	2	-	
	MATDSC3	Lab Course-I (Based on MATDSC1 & MATDSC2)	-	4	-	2	
Generic Electives (GE) /Open Elective (OE) (Choose any one)	MATGE101 OR MATGE102	Business Mathematics-I OR Fundamentals of Mathematics-I	2	-	2	-	2+2= 04
	MATOE101 OR MATOE102	Matrices OR Financial Mathematics	2	-	2	-	
VSC (Choose any one)	MATVSC 101 OR MATVSC 102	Geometry-I OR Introduction to Latex-I	1	2	1	1	2+2= 04
SEC (VSEC) (Choose any one)	MATSEC 101 OR MATSEC 102	Combinatorial Mathematics OR Theory of Equations	1	2	1	1	
AEC,VEC,IKS Ability Enhancement Course	AEC1	AEC-1– English (Common across faculty)	2	-	2	-	2+2+2=06
	VEC1	VEC-1 (Constitution of India) (Common across faculty)	2	-	2	-	
	IKS1	IKS-1 (Ancient Indian Mathematics)	2		2	-	
OJT,FP,CEP, CC,RP	CC1	CC– 1.Health and wellness (Common across faculty)	-	4	-	2	02
			16	12	16	06	22 credits

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Class: B.Sc. (Mathematics) First Year:

First Semester:
1. DSC-1: **MATDSC1: Differential Calculus**
   DSC-2: **MATDSC2: Discrete Mathematics**
   DSC-3: **MATDSC3: Lab Course-I**
2. GE-1: (Choose any one from Pool /Basket)
   1. : **MATGE101: Business Mathematics-I**
   2. : **MATGE102: Fundamental of Mathematics-I**

   OE-1: (Choose any one from Pool /Basket)
   1. : **MATOE101:Matrices**
   2. : **MATOE102:Financial Mathematics**

3. VSC-1: (Choose any one from Pool /Basket)
   1. : **MATVSC101: Geometry-I**
   2. : **MATVSC102: Introduction to Latex-I**

4. SEC-1: (Choose any one from Pool /Basket)
   1. : **MATSEC101: Combinatorial Mathematics**
   2. : **MATSEC102: Theory of Equations**
5. AEC-1: English – common to all faculty
6. VEC-1: Constitution of India (common to all faculty)
7. IKS-1: : **Ancient Indian Mathematics** (common to all faculty)
8. CC-1: Health and Wellness (common to all faculty)

Class: **B.Sc.** (Mathematics) First Year- Second Semester

Course type	Course Code	Course Name	Teaching Scheme (Hrs./week)		Credits Assigned		Total Credits
			Theory	Pract.	Theory	Pract.	
Major	MATDSC4	Integral Calculus	2	-	2	-	2+2+2=6
	MATDSC5	Differential Equations	2	-	2	-	
	MATDSC6	Lab Course-II (Based on MATDSC4 &MATDSC5)	-	4	-	2	
Minor	MATM101	Quantitative Aptitude-I	2	-	2	-	2
Generic Electives (GE) /Open Elective (OE) (Choose any one)	MATGE201 OR MATGE202	Business Mathematics-II OR Fundamentals of Mathematics-II	2	-	2	-	2
	MATOE201 OR MATOE202	Trigonometry OR Graph Theory	2	-	2	-	2
VSC (Choose any one)	MATVSC 201 OR MATVSC 202	Geometry-II OR Introduction to Latex-II	1	2	1	1	2+2 =04
SEC (VSEC) (Choose any one)	MATSEC 201 OR MATSEC 202	Financial Accounting OR Basics of Statistics	1	2	1	1	
AEC,VEC,IKS Ability Enhancement Course	AEC2	AEC-2– English (Common across faculty)	2	-	2	-	2+2=04
	VEC2	VEC-2 (Environmental Science) (Common across faculty)	2	-	2	-	
OJT,FP,CEP, CC,RP (Choose any one)	CC2	CC-2 (Yoga education/sports and fitness (Common across faculty)	-	4	-	2	2
			16	08	16	06	22 credits

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Second Semester:
1. DSC-4: **MATDSC4: Integral Calculus**

   DSC-5: **MATDSC5: Differential Equations**

   DSC-6: **MATDSC6: Lab Course-II**
2. M-1: : (Choose any one from Pool /Basket)
   1. **MATM101: Quantitative Aptitude-I**
3. GE-3: (Choose any one from Pool /Basket)
   1. **MATGE201: Business Mathematics-II**
   2. **MATGE202: Fundamentals of Mathematics-II**

   OE-4: (Choose any one from Pool /Basket)
   1. **MATOE201: Trigonometry**
   2. **MATOE202: Graph Theory**
4. VSC-2: (Choose any one from Pool /Basket)
   1. **MATVSC201:Geometry-II**
   2. **MATVSC202: Introduction to Latex-II**
5. SEC-2: : (Choose any one from Pool /Basket)
   1. **MATSEC201: Financial Accounting**
   2. **MATSEC202: Basic Statistics**
6. AEC-2: English Communication (common to all faculty)
7. VEC-2: Environment Education (common to all faculty)
8. CC-2: Yoga education/ Sports and fitness (common to all faculty)

ABBREVIATION:

Major – Comprising Mandatory and Elective (Minimum 50% of total credits corresponding to 3 or 4 year UG degree)

Minor – Minor subjects may be from different disciplines of the same faculty of DSC Major (Core) or from different faculty altogether

OE – Open Elective (Choose any one from Pool/Basket of Courses from same discipline or faculty /other discipline or faculty) Faculty wise baskets of OE shall be prepared by University

VSC – Vocational Skill Course (Choose any one from pool of Major) including hands on training corresponding to the Major and / or Minor Subject

SEC – Skill Enhancement Course (Choose any one from pool / basket skill courses approved by University)

AEC – Ability Enhancement Course (Two of 2+2 credits of English & Two 2+2 of Modern Indian Languages)

VEC – Value Education Course (such as understanding India, Environment Science/Education, and Digital and Technological Solutions)

IKS – Indian Knowledge System (Major Specific IKS included under Major approved by University)

OJT – On Job Training

FP – Field Project (corresponding to the Major (Core) Subject)

CEP – Community Engagement Project (corresponding to the Major (Core) Subject)

CC – Co-Curricular Courses (such as Health and Wellness, Yoga education Sports and fitness, Cultural Activities, NSS/NCC and Fine /Applied/Visual/Performing Arts)

RP – Research Project (corresponding to the Major (Core) Subject)

MIL – Modern Indian Languages

Internship/Apprenticeship - (corresponding to the Major (Core) Subject)

Subject: Mathematics

Discipline Specific Course (DSC)

The course –**Major (DSC)** in Ist semester has **Three** compulsory courses (Paper I, II &III) for

Six credits: Each course has **02** credits. Details of the courses are as under.

Course No.-1 (Paper No. I) MATDSC1: Differential Calculus

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	DSC	Theory	02	02	30	90Min	20	30	50

Course No.1 (Paper -I): Title: Differential Calculus

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Find the logarithmic differentiation.

CO 2: Find the derivative of implicit functions.

CO 3: Find the nth derivatives of functions.

CO 4: Find the Maclaurin's series expansion of functions.

CO 5: Find the partial derivatives of functions.

Syllabus- Course 1 MATDSC1: Title- Differential Calculus	Total Hrs: 30
Unit-I	**15 hrs**
Differentiation: Hyperbolic functions, derivatives of hyperbolic functions, derivatives of inverse hyperbolic functions, logarithmic differentiation, derivation of implicitly defined functions. **Successive Differentiation**: Higher order derivatives, calculation of nth derivatives, Some standard results, Determination of nth derivative of rational functions, the nth derivatives of the products of the powers of sines and cosines, Leibnitz's theorem, nth derivative of the product of two functions.	
Unit-II	**15 hrs**
Mean Value Theorems: Rolle's theorem, Lagrange's mean value theorem, Meaning of the sign of derivative, Cauchy's mean value theorem, higher derivatives. Taylor's theorem, Maclaurin's theorem, Maclaurin's power series for a given function, Expansion of e^x, Expansion of $sinx$, Expansion of $cosx$, Expansion of $(1 + x)^m$, Expansion of $log(1 + x)$. **Partial Differentiation:** Introduction, Function of two variables, Neighbourhood of a	

point (a, b), Continuity of a function of two variables, limit of a function of two variables, partial derivatives, partial derivatives of higher orders, homogeneous function, Euler's theorem on homogeneous function, Theorem on total differentials, differentiation of composite function and implicit function.

Recommended Text Book: Shanti Narayan, P. K. Mittal: Differential Calculus, Shyamlal Charitable Trust, Reprint 2018

Scope:

Chapter 4: Articles 4.7, 4.7.1, 4.7.2, 4.9, 4.10

Chapter 5: Complete

Chapter 8: Articles 8.1, 8.2, 8.3, 8.5, 8.6, 8.6.1, 8.6.2, 8.6.3

Chapter 11: Articles 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.6.1, 11.8, 11.8.1, 11.9, 11.9.1, 11.9.3, 11.9.4

Books Recommended:

1. **Differential Calculus**, Dr. **Gorakh Prasad**, Reprint 2013, New. Revised Edition, Pothishala Private Ltd.

2. **Mathematical Analysis, S. C. Malik** and **Savita Arora,** New Age International, Limited Publisher.

Recommended Videos:

1. https://www.youtube.com/watch?v=bJPuy0QZ-tE
2. https://www.youtube.com/watch?v=0apMXhWG_W8
3. https://www.youtube.com/watch?v=wMd4YRyBmjA
4. nptel.ac.in/courses/111/105/111105069/

Course No.-2 (Paper No. II) **MATDSC2 Discrete Mathematics**

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	DSC	Theory	2	2	30	90 Min	20	30	50

Course No.2 (Paper -II): Title: Discrete Mathematics

Course Outcome (CO):

After completion of course (No.2), students will be able to:

CO 1: Construct the truth tables of given proposition

CO 2: Prove the properties of set operations.

CO3: find different types of relations and functions.

CO4: Understand Boolean algebra and apply to minimize the switching circuits.

Syllabus- Course 2: MATDSC2 Title:- Discrete Mathematics	Total Hrs.: 30
Unit-I	**15 hrs.**
Mathematical Logic: Proposition, type of proposition, the propositional calculus, the negation of a proposition, disjunction, conjunction, tautoliges and contractions, logical equivalence, the algebra of proposition, conditional proposition, converse, inverce and contrapositive proposition, the negation of a conditional proposition, biconditional proposition, arguments. **Set theory:** Sets, set designation, null set and unit sets, special sets of numbers, universal set, subsets, equal sets, set operations, union operation, properties of union operation, intersection, properties of intersection operation, distributive property, complementation, relative complement, properties of complement, properties of difference, symmetric difference, power set, Cartesian products.	
Unit-II	**15 hrs.**
Relation: relation, equivalence relation (Omit example 3.2.8), partial order relation. **Functions:** Functions, inverse mapping, composition of mappings, binary operations, method of constructing the operation table, countable and uncountable sets. **Boolean algebra and Switching circuits:** Introduction, definition, principle of duality, laws of Boolean algebra, Boolean function, Application to switching networks.	

Recommended Text-Book:

B.S. Vatsa and Suchi Vatsa: Discrete Mathematics, New Age International Publishers, Fourth Revised Edition (2009).

Scope:

Chapter 1: Complete.

Chapter 2: Articles 2.1 to 2.19.

Chapter 3: Articles 3.1, 3.2 and 3.4 to 3.9.

Chapter 5: Articles 5.1, 5.2, 5.5..

Reference Books:
1. Swapan Kumar Sarkar: A Textbook of Discrete Mathematics, S. Chand, Ninth edition 2016 (Reprint 2021).
2. Kenneth H. Rosen: Discrete Mathematics and its Applications, McGraw-Hill Book Company, seventh edition.

Course No.-3 (Paper No. III) MATDSC3: Lab Course-I

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 03	DSC	Practical	2	4	60	90 Min	20	30	50

Course No.-3 (Paper No. III) Title of Course: Lab Course-I

(Based on MATDSC1and MATDSC2)

Course Outcome (CO):

After completion of course (No.3), students will be able to:

CO1: Differentiate logarithmic, implicit functions and find nth order derivatives.

CO 2: Verify mean value theorems.

CO 3: Apply Euler's theorem for homogeneous functions.

CO 4: Study the different types of set operations.

CO 5: Study Boolean Algebra and apply to switching networks.

Syllabus- Course 3: Title:- Lab Course-I (Based on MATDSC1and MATDSC2)	Total Hrs.: 60
Practical – 01	
To solve exercise on logarithmic differentiation (article 4.9). To solve exercise on differentiation of implicit function (article 4.10)	
Practical – 02	
To solve exercise on higher order derivatives (article 5.1). To solve exercise on determination of nth derivatives of rational functions (article 5.3).	
Practical – 03	
To solve exercise on the nth derivatives of the products of the powers of sine and cosines (article 5.4). To solve exercise on Leibnitz's theorem ((article 5.5).	
Practical – 04	
To solve exercise on Rolle's theorem (article 8.1) To solve exercise on Lagrange's mean value theorem (article 8.2)	
Practical – 05	
To solve exercise on Cauchy's mean value theorem (article 8.5) To solve exercise on generalised mean value theorem (article 8.6.1)	

Practical – 06	
To solve exercise on partial derivative and partial derivative of higher order (article 11.6 & 11.6.1).	
Practical – 07	
To solve exercise on Euler's theorem on homogeneous function (article 11.8.1)	
Practical – 08	
To solve exercise on differentiation of composite function and implicit function (article 11.9.3 & 11.9.4)	
Practical – 09	
To solve exercise on the algebra of proposition. (article 1.9)	
Practical – 10	
To solve exercise on conditional and biconditional proposition (articles 1.10 & 1.11)	
Practical – 11	
To solve the problems on union and intersection operations (articles 2.8 to 2.11).	
Practical – 12	
To solve the problems on complement, relative complement and symmetric difference (articles 2.13 to 2.17).	
Practical – 13	
To solve the problems on Relation.	
Practical – 14	
To solve the problems on Functions.	
Practical – 15	
To solve the problems on Boolean algebra and Switching circuits.	

Recommended Text Book: As in Course MATDSC-1 and MATDSC-2

Generic/Open Elective Course (GE-1)

The course GE-1 in Ist semester has **Two** courses (Paper I & II) for **Two** credits: Each course has **02** credits. Student can choose any one of the course. Details of the courses are as under.

Course No.-1 (Paper No. I) MATGE101: Business Mathematics-I

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	GE-1	Theory	2	2	30	90 Min	20	30	50

Course No.1 (Course -I) Title: MATGE101: Business Mathematics-I

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Apply knowledge of ratios, proportions, currency and discounts to simple business.

CO 2: Apply the concept of functions to cost and profit etc.

Syllabus- Course 1: Title- Business Mathematics-I	Total Hrs: 30
Unit-I	**15 hrs**
Ratios, Proportions, Ratios with more than two quantities, Retail calculations, Rates and currency conversions, Trade discounts , Cash discounts	
Unit-II	**15 hrs**
Example of a function, Linear functions, Cost functions, Equations and functions, System of equations, Profit volume analysis.	

Recommended Text Book:

Chis Kellman, Leslie Major, Don Mallary, Frank Gruen, Amy Goldiest,: Business Mathematics, BCIT (2021)

Scope:

Chapter-1: 1.1 to 1.7.   Chapter- 2 : 2.1 to 2.6

Books Recommended:

1. Singh J. K., Business Mathematics, Himalaya Publishing House, 2021.

2. Vohra N.D., Business Mathematics and Statistics, McGraw Hill Education (India) Pvt. Ltd, 2012.

Course No.-2 (Paper No.II) MATGE102: Fundamentals of Mathematics-I

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	GE-1	Theory	2	2	30	90 Min	20	30	50

Course No.2: Title : MATGE102: Fundamentals of Mathematics-I

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Classify the equations, functions and understand limits and derivatives.

CO 2: Understand the laws of limits, solutions of differential equations.

Syllabus- Course 2: Title- : Fundamentals of Mathematics-I	Total Hrs: 30
Unit-I	**15 hrs**
Linear equations, Quadratic equations, Higher degree equations, Progressions, Logarithms, Functions, Further discussion of functions, Notation and natural domains, Inverse functions, Absolute values, Average speed and average velocity, Instantaneous velocity and limits, Theorems on Limits, The derivative.	
Unit-II	**15 hrs**
Inverse functions and the inverse of the exponential, Laws of logarithms, The derivative of the log function, Antiderivative of $1/x$, Derivatives of b^x and $\log_b x$, Introduction, An approximate solution of a differential equation, Variables and separable, composition of approximate and exact solutions, Population changes, The logistic equation.	

Recommended Text Book:

R.A.Rosenbaum and G.Philip Johnson: Calculus: Basic Concepts and Applications, Cambridge University Press, Digitally Printed Version 2018.

Scope:

Chapter 0: 0.9 to 0.13. **Chapter 1: 1.9 to 1.12.** **Chapter 2: 2.1 to 2.3, 2.7**

Chapter 7:7.2 to 7.6. **Chapter 8: 8.1 to 8.6**

Books Recommended:

1. Allel R.G.A: Basic Mathematics: Macmilan, New Delhi.

2. Shanti Narayan, P. K. Mittal: Differential Calculus, Shyamlal Charitable Trust, Reprint 2018.

Generic/Open Elective Course (OE-1)

The course **OE-1** in Ist semester has **Two** courses (Paper I & II) for **Two** credits: Each course has **02** credits. Student can choose any one of the courses. Details of the courses are as under.

Course No.-1 (Paper No. I) MATOE101: Matrices

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	OE-1	Theory	2	2	30	90 Min	20	30	50

Course No.1 (Course -I): Title: MATOE101: Matrices

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Identify and apply different types of matrices.

CO 2: Compute the adjoint and inverse of matrix.

CO 3: Find the rank of matrix and solve system of linear equations.

Syllabus- Course 1: Title- Matrices	Total Hrs: 30
Unit-I	**15 hrs**
Matrices: Matrices, Different types of matrices, some special types of matrices, sub-matrix of a matrix, Determinant of a square matrix, Minors of matrix. Algebra of Matrices:Sum of matrices, difference of matrices, some theorems, product of matrices, Reversal law for the transpose of a product, Associate Law, Distributive Law, Some Special types of matrices, Adjoint of a square matrix, Inverse of a matrix, Matrix Division, Partitioning of Matrices.	
Unit-II	**15 hrs**
Rank of Matrix: Rank of Matrix, Elementary transformations of matrix, Theorems, Reduction to Normal form, Elementary matrices, Elementary Transformations and elementary matrices, Rank of a product. System of Linear Equations: System of linear homogeneous equations, systems of linear non-homogeneous equations, Applications to Geometry.	

Recommended Textbook:

Shanti Narayan, P.K.Mittal:A Textbook of Matrices, S Chand & Company Ltd. (2009)

Scope:

Chapter 1: 1.4, 1.5, 1.6, 1.7, 1.8, 1.9

Chapter 2: 2.4, 2.5, 2.6, 2.7, 2.9, 2.10, 2.12, 2.13, 2.14, 2.16, 2.17

Chapter 4: 4.2, 4.3, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.12

Chapter 6: 6.2, 6.6, 6.8

Recommended Books:

1. Suddhendu Biswas, Text Book of Matrix Algebra, Third edition, Prentice Hall of India (2012)

2. Joel N. Franklin, Matrix Theory, Dover Publications (2023)

3. Dennis S. Bernstein, Matrix Mathematics, University Press (2009)

4. Vinit K.Sinha, Introduction to Matrix Theory, Alpha Science (2015)

Course No.-2 (Paper No. II) MATOE102: Financial Mathematics

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	OE-1	Theory	2	2	30	90 Min	20	30	50

Course No.2 (Course -II): Title : MATOE102:Financial Mathematics

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Understand and apply annuities.

CO 2: Apply and understand the rate of return.

Syllabus- Course 2: Title- Financial Mathematics	Total Hrs: 30
Unit-I	**15 hrs**
Adding to a saving account, Withdrawing from a saving account, Loans and down payments, Leases and annuities due, Deferred annuities, Back to back annuities.	
Unit-II	**15 hrs**
Evaluating a business plan, Rate of return, Net present value, Cash flow on the BAII plus, Internal rate of return	

Recommended Text Book:

Chis Kellman, Leslie Major, Don Mallary, Frank Gruen, Amy Goldiest,: Business Mathematics, BCIT (2021)

Scope:

Chapter-5: 5.1 to 5.6

Chapter- 6: 6.1 to 6.5.

Reference Books:

1. Kellison Stephen G., The Theory of Interest, 3rd Edition. McGraw-Hill International Edition (2009).

2. UK Institute of Actuaries core leading for the subject CT1-Financial Mathematics.

3. Elliott R.J. and Kopp P.E. Mathematics of Financial Markets. Springer (1999)

Vocational Skill Core (VSC-1)

The course **Vocational Skill Core-1** in Ist semester has **Two** courses for **Two** credits each.

Student has to choose any one of the course. Details of the courses are as under.

Course No.-1 (Paper No. I) MATVSC101: Geometry-I

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	VSC-1	Theory /Practical	2 1 T+1P	3	45	90 Min	20	30	50

Course No.1 (Course –I): Title: MATVSC101: Geometry-I

Course Outcome (CO):

Course Outcome (CO):

After completion of course students will be able to:

CO 1: Understand distance and section formulae for points in space and projection on a straight line

CO 2: Determine a plane under given conditions and length of the perpendicular from a point to a plane.

Syllabus- Course 1: Title- Geometry-I	Total Hrs: 45
Unit-I :Theory	**15 hrs**
Co-ordinates: Co-ordinates of a point in space, further explanation about co-ordinates, distance between two points, division of the join of the two points, tetrahedron, angle between two lines, direction cosines of a line, a useful relation, relation between direction cosines, projection on a straight line, projection of a point on a line, projection of a segment on another line, projection of a broken line, projection of the join of two lines, angle between two lines. **The Plane:** General equation of first degree, Theorem, converse of preceding theorem, transformation to normal form, direction cosines of the normal to a plane, angle between two planes, determination of a plane under given conditions, intercept form of the equation of a plane, plane through three points, system of Planes, two sides of a plane, length of the perpendicular from a point to a plane.	
Unit-II: Practical (15 x 2Hrs)	**30 Hrs**
Minimum Fifteen practicals shall be conducted based on Unit-I	

Recommended Text-Book:

Shanti Narayan and P.K. Mittal: Analytical Solid Geometry, S. Chand and Company Ltd, New Delhi, Seventeenth Edition, 2013.

Scope:

Unit-I: Chapter 1 Complete.

Unit- II: Chapter 2, Articles 2.1 to 2.7.

Reference Books:

1. P.K. Jain and Khalil Ahmad: A Text Book of Analytical Geometry of Three dimensions, Wiley Eastern Ltd. 2018.
2. R.J.T. Bell: Elementary Treatise on Coordinate Geometry of Three dimensions, MacMillan India Ltd.

Course No.-2 (Paper No. II) MATVSC102: Introduction to Latex-I

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	VSC-1	Theory / Practical	2 1T+1P	3	45	90 Min	20	30	50

Course No.1 (Course -I): Title : MATVSC102: Introduction to Latex-I

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Install latex and understand document class, sections, and subsections.

CO 2: Understand and apply text formatting and math mode and graphics.

Syllabus- Course 2: Title- Introduction to Latex-I	Total Hrs: 45
Unit-I: Theory	**15 hrs**
LaTex Installation: Introduction to LaTeX and Installation, Structure and preparation of basic document Document class: Changing the class (article, report) and document options, Sectioning and sub sectioning Text Formatting: Lists, Font size and display, Special characters, Foot note. Math mode and graphics: Mathematical Formulas, Exponents and Subscripts, Fractions, Sums, Integrals, and Limits, Roots, Text in Math Displays, Operators	
Unit-II: Practical (15 x 2Hrs)	**30 Hrs**
Minimum Fifteen practicals shall be conducted based on Unit-I	

Books Recommended:

1 Leslie Lamport, LaTeX a Document Preparation System User's Guide and Reference Manual, Addison-Wesley Publishing Company.

2. Online LaTeX Editor https://www.overleaf.com/

Skill Enhancement Course (SEC-1)

The course **SEC-1** in Ist semester has**Two** courses for **Two** credits each. Student can choose any one of the course. Details of the courses are as under.

Course No.-1 (Paper No. I) MATSEC101: Combinatorial Mathematics

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	SEC-1	Theory /Practical	2 1T+1P	3	45	90 Min	20	30	50

Course No.1: Title: MATSEC101: Combinatorial Mathematics

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Apply the concept of permutations.
CO 2: Understand and apply the concept of combinations.

Syllabus- Course 1: Title- Combinatorial Mathematics	Total Hrs: 30
Unit-I :Theory	15 hrs
Combinatroics: Introduction, Sum rule principle, product rule principle, factorial notation, permutations, permutation of things not all different, circular permutations, To find the number of circular permutation of n different things taken all at a time, Combinations, To find the value of ^nC_r, division into groups (partitions), To find the number of ways in which $(m + n + p)$ different things be divided into three groups of m, n and p things respectively, To find the total number of ways in which it is possible to make a selection by taking some or all of n things at a time, To find the total number of ways in which a selection can be made out of $p + q + r$ things, of which p are alike of one kind, q alike of second kind and r alike of third kind, To find the value of r for which ^nC_r is greatest, the pigeonhole principle, the inclusion-exclusion principle.	
Unit-II: Practical (15 x 2Hrs)	30 Hrs
Minimum Fifteen practicals shall be conducted based on Unit-I	

Recommended Textbook:

B.S. Vatsa and Suchi Vatsa: Discrete Mathematics, New Age International Publishers, Fourth Revised Edition (2009).

Scope:

Chapter 10: Complete.

Reference Books:

1. Swapan Kumar Sarkar: A Textbook of Discrete Mathematics, S. Chand, Ninth edition 2016 (Reprint 2021).

2. Kenneth H. Rosen: Discrete Mathematics and its Applications, McGraw-Hill Book Company, seventh edition.

3. Krishnamurthy V.: Combinatorics, Theory and Applications, East-West Press 2008.

4. Brualdi R.A.: Introductory Combinatorics, 5th Ed., Pearson Education Inc., 2009.

Course No.-2 (Paper No. II) MATSEC102: Theory of Equations

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	SEC-1	Theory	2 1T+1P	3	45	90 Min	20	30	50

Course No.2: Title : MATSEC102: Theory of Equations

Course Outcome (CO):

After completion of course (No.2), students will be able to:

CO 1: Determine the solution of nth degree equation.

CO 2: Solve the bi quadratic equation by Ferrari's and Descartes method.

Syllabus- Course 2: Title:- Theory of Equations	Total Hrs:45
Unit-I :Theory	**15 Hrs**
Every equation of the nth degree has n roots and no more, relation between roots and coefficients, these relation are not sufficient for the solution, cases of solution under given conditions, every case of symmetrical function of the roots, imaginary and surd roots occur in pairs, formation and solution of equation with surd roots, Descartes rule of signs, value of $f(x+h)$, calculation of $f(x+h)$, by Horner's process, $f(x)$ changes its value gradually, $f(a)$ and $f(b)$ are of contrary signs, roots of an equation of an odd degree and even degree, determination of equal roots, sum of an assigned power of the roots, Transformation of equations, equation with roots of sign opposite to those of f(x)=0, equation with roots multiples of those of $f(x)$=0, equation with roots reciprocals of those of $f(x)$=0, discussion of reciprocal equations, equation with roots squares of those of $f(x)$=0, equation with roots exceeding by h those of $f(x)$ = 0, removal of an assigned term, equation with roots of given functions of those of $f(x)$=0, cubic equations, solution by trigonometry in the irreducible case, biquadratic equations, Ferrari's and Descartes solution	
Unit-II: Practical (15 x 2Hrs)	**30 Hrs**
Minimum Fifteen practicals shall be conducted based on Unit-I	

Recommended Textbook:

H.S. Hall and S.R. Knight: Higher Algebra, A.I.T.B.S. Publishers & Distributors, Reprint 2003.

Scope:

Chapter XXXV Articles 534 to 583.

Indian Knowledge System (IKS)

The course IKS in I semester has **One** course for **Two** credits. Details of the course is as under.

Course No.-1 (Paper No. I) MATIKS101: Ancient Indian Mathematics

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	IKS	Theory	2	2	30	90 Min.	20	30	50

Course No.1 : Title : MATIKS101: Ancient Indian Mathematics

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Students able to apply ancient methods to evaluate multiplication of two to three digit numbers.
CO 2: Students able to do division by ancient methods.

Syllabus- Course 1: Title- Ancient Indian Mathematics	Total Hrs: 30
Unit-I	15 hrs
1. Ekadhikenpurven method (multiplication of two numbers of two digits) 2. Eknunenpurven method (multiplication of two numbers of three digits) 3. Urdhvatiragbhyam method (multiplication of two numbers of three digits) 4. NikhilamNavtashchramamDashtaha (multiplication of two numbers of three digits) 5. Combined Operations	
Unit-II	15 hrs
Part A: Division 1. NikhilamNavtashchramamDashtaha (two digits divisor) 2. ParavartyaYojyet method (three digits divisor) Part B: Divisibility 1. Ekadhikenpurven method (two digits divisor) 2. Eknunenpurven method (two digits divisor)	

Recommended Books:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.
2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.
3. Vedic GanitaPraneta, Siksha Sanskriti Uthana Nyasa, New Delhi.
4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.
5. Leelavati, ChokhambbaVidyaBhavan, Varanasi.
6. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.

B.Sc. Semester – II

Subject: Mathematics

Discipline Specific Course (DSC)

The course –DSC in IInd semester has **three** compulsory courses (Paper I, II & III) for **Six** credits: Each course has **02** credits. Details of the courses are as under.

Course No.-1 (Paper No. I) MATDSC4:Integral Calculus

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	DSC	Theory	2	2	30	90 Min	20	30	50

Course No.1 (Paper -I): Title of the Course: Integral Calculus

Course Outcome (CO):

After completion of course No.1, students will be able to:

CO 1: Evaluate integrals using reduction formulae

CO 2: Evaluate integrals of algebraic rational functions.

CO 3: Evaluate integrals of trigonometric functions.

CO 4: Determine areas of plane regions, length of curves and volume of surfaces of revolution.

Syllabus- Course 1: Title- Integral Calculus	Total Hrs: 30
Unit-I	**15 hrs**
Methods of Integration: Reduction formulae. **Integration of Algebraic Rational Functions:** Integration of Rational Functions , Case of non-repeated linear factors only in the denominator, Case of non-repeated linear or repeated linear factors only in the denominator, Case of linear or quadratic non- repeated factors only in the denominator. **Integration of Trigonometric Functions:** Integration of $\sin^n x$, where n is a positive integer, reduction formulae for integration of $\sin^n x$, Evaluation of the definite integral of $\sin^n x$, Integration of $\cos^n x$, where n is positive integer, reduction formulae for integration of $\cos^n x$.	
Unit-II	**15 hrs**
Evaluation of the definite integral of $\cos^n x$. Integration of $\sin^p x \, \cos^q x$, where p and q are positive integers. Reduction formulae for integration of $\sin^p x \, \cos^q x$. **Definite Integrals:** Introduction, fundamental theorem of integral calculus. Definite integral as the limit of a sum. **Areas of Plane Regions:** Areas of a region bounded by a curve, x-axis and two	

ordinates. Area Enclosed by two curves, Quadrature of hyperbola, Sectorial Area.

Rectification, Length of Plane Curves: Introduction, Cartesian Equations $y = f(x)$, Other expressions for lengths of arcs. Cartesian Equations $x = f(y)$, Parametric Cartesian Equations $x = f(t)$, $y = \Phi(t)$, Polar Equations $r = f(\theta)$.

Volumes and Surfaces of Revolution: Introduction, Volume of the solid revolution.

Recommended Textbook: Shanti Narayan and P.K. Mital:Integral Calculus, S.Chand and Company Limited Revised Edition 2008, 2013.

Scope:

Chapter 2: Articles 2.8
Chapter 3: Articles 3.1 to 3.4
Chapter 4: Articles 4.1, 4.1.1, 4.2, 4.2.1, 4.3.
Chapter 6: Articles 6.1, 6.3.
Chapter 8 : Articles 8.1, 8.11, 8.2, 8.3
Chapter 9 : Articles 9.1, 9.2, 9.3, 9.31, 9.32, 9.33.
Chapter 10 : Articles 10.1, 10.2

Reference Books:

1. Gorakh Prasad : Integral Calculus, Pothishala Private Limited 2018.

2. G.B.Thomas and R.L.Finney :Clculus, 9 th Ed.Pearson Education, Delhi,2005.

Course No.-2 (Paper No. II) MATDSC5: Differential Equations

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	DSC	Theory	2	2	30	90Min	20	30	50

Course No.2 (Paper -II): Title of the Course: Differential Equations

Course Outcome (CO):

After completion of course (No.2), students will be able to:

CO 1: Determine the solution of first order linear differential equations.

CO 2: Determine the solution of exact differential equations.

CO 3: Determine the solution of linear equations with constant coefficient using general and short method.

CO 4: Determine the solution of linear homogeneous differential equations.

Syllabus- Course 1: Title- Differential Equations	Total Hrs: 30
Unit-I	**15 hrs**
Differential Equations: Ordinary and partial differential equations, Order and degree, Solutions and constants of integration, The derivation of a differential equation, Solutions, general, particular, singular. **Equations 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 be exact, Rule for finding the solution of an exact differential equation. Integrating factors, Linear equations, Equations reducible to the linear form. **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.	
Unit-II	**15 hrs**
The symbol D, The linear equation with constant coefficients and second member a function of x, The symbolic function 1/f(D), Methods of finding the particular integral. Short methods 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. **Linear equation 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 functions $f(\theta)$ and $1/f(\theta)$, methods of finding the particular integral, Integral corresponding to a term of the form x^a in the second member, Equations reducible to the homogeneous linear form.

Recommended Textbook:

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

Scope:

Chapter I: Art. 1 to 4.
Chapter II: Art. 8 to 14, 20, 21.
Chapter VI: Art 49 to 53, 56 to 64.
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 No.-3 (Paper No. III) MATDSC6:Lab Course-II

Course No.	Type of Course	Theory / Practic al	Credi ts	Instructi on hour per week	Total No. of Lectures/Ho urs / Semester	Durati on of Exam	Formativ e Assessme nt Marks	Summati ve Assessme nt Marks	Tota l Mar ks
Course 03	DSC	Practic al	2	4	60	90 Min	20	30	50

Course No.-3 (Paper No. III) Title of Course: Lab Course-II

(Based on MATDSC-4 and MATDSC-5)

Course Outcome (CO):

After completion of course (No.3), students will be able to:

CO1: Compute the integrals using reduction formulae.

CO 2: Evaluate integrals of algebraic rational functions and trigonometric functions.

CO 3: Compute the areas and volumes of surfaces of revolutions.

CO 4: Understand and apply methods to find the solution of differential equations.

Syllabus- Course 3: Title:- Lab Course-II (Based on MATDSC-4 and MATDSC-5)	Total Hrs.: 60
Practical – 01	
To find the integral using reduction formulae.	
Practical – 02	
To evaluate integral of algebraic rational functions when denominator has repeated, non repeated linear factors and quadratics factors in the denominator.	
Practical – 03	
To compute the integration of $\sin^n x$ and $\cos^n x$, where n is positive integer.	
Practical – 04	
To evaluate Integration of $\sin^p x \cdot \cos^q x$, where p and q are positive integers.	
Practical – 05	
To solve the problems on definite integral as the limit of a sum.	
Practical – 06	
To solve the problems on areas of a region bounded by a given curve.	
Practical – 07	
To evaluate the length of given curve.	

Practical – 08	
To find volume of solid of revolution.	
Practical – 09	
To solve the problems on equations homogeneous in x and y and non-homogeneous equations of the first degree in x and y. To solve the problems on Exact differential equations.	
Practical – 10	
To solve the problems on linear equations and equations reducible to the linear form.	
Practical – 11	
To find the solution of linear equation with constant coefficients and second member zero. (Including case of the auxiliary equation having equal roots and imaginary roots).	
Practical – 12	
To solve the problems on integral corresponding to a term of the form e^{ax}, x^m and sinax or cosax in the second member.	
Practical – 13	
To solve the problems on integral corresponding to a term of the form $e^{ax}V$ and xV in the second member.	
Practical – 14	
To solve the problems on the homogeneous linear differential equations by first method of solution.	
Practical – 15	
To solve the problems on the homogeneous linear differential equation by second method of solution. (To find the complementary function and particular integral)	

Recommended Textbook: As in Course MATDSC-4 and MATDSC-5

Minor Course (M-1)

The course **M-1** in IInd semester has **One** course (Paper I) of Two credits.

Course No.-1 (Paper No. I) MATM101: Quantitative Aptitude-I

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	M-1	Theory	2	2	30	90 Min	20	30	50

Course No.1 (Paper-I): Title of the Course: Quantitative Aptitude-I

Course Outcome (CO):

After completion of course No.1, students will be able to:

CO 1: Apply the concepts in solving mathematical problems to succeed in various competitive examinations.

CO 2: Explain the knowledge of the various techniques of quantitative aptitude and reasoning.

Syllabus- Course 1: Title- Quantitative Aptitude-I	Total Hrs: 30
Unit-I	**15 hrs**
Number System, Types of Numbers, series (AP and GP), Algebraic operations BODMAS, Divisibility, LCM and HCF, Fraction, Simplification.	
Unit-II	**15 hrs**
Time and Distance, Problems based on Trains, Boats and Streams. Time, work and wages, Pipes and Cistern, Problems on Clock, Problems on Calendar.	

Recommended Books:

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations, Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.

2. R V Praveen, Quantitative Aptitude and Reasoning, PHI publishers.

3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.

4. Abhijit Guha: Quantitative Aptitude for Competitive Examination, Tata Mc Graw Hill publications

Generic/Open Elective Course (GE/OE-2)

The course **GE-2** in IInd semester has **Two** courses (Paper I & II) of Two credits each.

Student has to choose any one course. Details of the courses are as under.

Course No.-1 (Paper No. I) MATGE201: Business Mathematics-II

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	GE-2	Theory	2	2	30	90 Min	20	30	50

Course No.1 (Paper-I): Title of the Course: Business Mathematics-II

Course Outcome (CO):

After completion of course No.1, students will be able to:

CO 1: Understand and evaluate the simple interest.

CO 2: Understand and evaluate the compound interest.

Syllabus- Course 1: Title- Business Mathematics-II	Total Hrs: 30
Unit-I	**15 hrs**
Simple Interest: Example on Simple Interest, Exact time, Calculating the amount of interest, Calculating principal and rate and time, Calculating the future value, Time diagrams, Calculating present value, Time value of money, Equations of value.	
Unit-II	**15 hrs**
Compound Interest: Introduction to compound interest, Nominal and periodic rates, Compound interest formula, Present value, Multiple cash flows, Equivalent values, Compound BAII plus, Equivalent and effective rates, Fractional periods, Average rates.	

Recommended Textbook:

Chis Kellman, Leslie Major, Don Mallary, Frank Gruen, Amy Goldiest,: Business Mathematics, BCIT (2021)

Scope:

Chapter-3: 3.1 to 3.9. Chapter-4: 4.1 to 4.10.

Recommended Books:

1. S. A. Bari: Practical Business Mathematics New Literature Publishing Company New Delhi

2. K. Selvakumar: Mathematics for Commerce Notion Press, Chennai

3. Dinesh Khattar & S. R. Arora : Business Mathematics with Applications S. Chand Publishing New Delhi

4. N.G. Das &Dr. J.K. Das: Business Mathematics and Statistics McFraw Hill New Delhi

5. M. K. Bhowal :Fundamentals of Business Mathematics Asian Books Pvt. Ltd New Delhi

Course No.-2 (Paper-II) Title: MATGE202: Fundamentals of Mathematics-II

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	GE-2	Theory	2	2	30	90 Min	20	30	50

Course No.2 (Paper -II): Title: Fundamentals of Mathematics-II

Course Outcome (CO):

After completion of Generic/elective course No.2, students will be able to:

CO 1: Perform vector addition, vector multiplication, inner product norm, and standard deviation.

CO 2: Solve system of linear equations.

Syllabus- Course 2: Title- : Fundamentals of Mathematics-II	Total Hrs: 30
Unit-1	**15 hrs**
Vectors: Vectors, Vector addition, Scalar-vector multiplication, Inner product, Complexity of vector computations, **Norm and Distance:** Norm, Distance, Standard Deviation.	
Unit-II	**15 hrs**
Matrices: Matrices, Zero and identity matrices, Transpose, Addition and norm, Matrix-vector multiplication, Complexity, **Linear Equations:** Linear and affine functions, Linear function models, System of linear equations.	

Recommended Textbook:

Stephan Boyd, Lieven Vandenberghe: Introduction to Applied Linear Algebra, Cambridge University Press, New Delhi (2018)

Scope:

Chapter 1: 1.1 to 1.5.   Chapter 3 : 3.1 to 3.3.

Chapter 6: 6.1 to 6.5.   Chapter 8 : 8.1 to 8.3.

Books Recommended:

1. Bernard and Child: Higher Algebra, Arihant Publications.
2. I. Stewart, D. Tall, The Foundations of Mathematics. Oxford University Press.
3. M.K. Sen, S. Ghosh and P. Mukhopadhyay, Topics in Abstract Algebra, University Press.

The course **(OE-2)** in IInd semester has **Two** courses (Paper I & II) for **Two** credits each.

Student has to choose any one course. Details of the courses are as under.

Course No.-1 (Paper No. I) MATOE201: Trigonometry

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	OE-2	Theory	2	2	30	90 Min	20	30	50

Course No.1 (Paper-I): Title: MATOE-201: Trigonometry

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Expand the trigonometric functions.

CO 2: Evaluate and understand hyperbolic functions.

CO 3: Do understand and apply the exponential and logarithmic series.

Syllabus- Course 1: Title- Trigonometry	Total Hrs: 30
Unit-I	**15 hrs**
Trigonometrical ratios for angles less than a right angle, Simple problems in heights and distances.	
Unit-II	**15 hrs**
Trigonometrical functions of angles of any size and sign, Trigonometrical ratios of the sun and the differences of two angles.	

Recommended Text Book:

S.L. Loney: Plane Trigonometry, Part I, Arihant Prakashan, Meerut 2009.

Scope:

Chapter-2 : Complete. Chapter- 3 : Complete.

Chapter - 5: Complete. Chapter - 7 : Complete.

Reference Books:

1. P.Kandasamy, K.Thilagavathy (2004): Mathematics for B.Sc. Vol.-I, II, III & IV, S.Chand& Company Ltd., New Delhi-55.

2. B.S.Grewal. (2002): Higher Engineering Mathematics.Khanna Publishers. New Delhi.

3. A.Singaravelu (2003): Algebra and Trigonometry, Vol.-I Meenakshi Agency, Chennai.

4. P.R.Vittal (2004): Trigonometry, Margham Publications, Chennai.

Course No.-2 (Paper No. II) MATOE202: Graph Theory

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	OE-2	Theory	2	2	30	90 Min.	20	30	50

Course No.2 (Paper -II): Title: MATOE202: Graph Theory

Course Outcome (CO):

After completion of course No.2, students will be able to:

CO 1: Identify the different types of graphs.

CO 2: Understand the concepts of directed graphs and connectivity.

Syllabus- Course 2: Title- Graph Theory	Total Hrs: 30
Unit-I	**15 hrs**
Basic results: Introduction, Basic concepts, Subgraphs, Degree of vertices, Paths and connectedness, Automorphism of a simple graph. Linear graphs, Operation on graphs, Graph products, An application to chemistry, Application to social psychology.	
Unit-II	**15 hrs**
Directed Graphs: Introduction, Basic concepts, Tournaments, k-Partite tournaments **Connectivity:** Introduction, Vertex cuts and edge cuts, Connectivity and edge connectivity, Blocks, Cyclical edge connectivity of a graph, Menger's theorem (Only statement).	

Recommended Text Book:

R.Balkrishnan and K.Ranganathan: A Textbook of Graph Theory (Second Edition) Springer, 2012.

Scope:

Chapter 1: 1.1 to 1.11. Chapter 2: 2.1 to 2.4. Chapter 3: 3.1 to 3.6.

Reference Books:

1 P.Gupta, V.Agarwal: Graph Theory, Pragati Prakashan Meerat (2009)

2. John Clark and Derek Holton: A First Look at Graph Theory (Allied Publishers)
3. C.L.Liu: Elements of Discrete Mathematics, Tata Mc-Graw Hill, Fourth Edition.

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	VSC-2	Theory /Practical	2 1T+1P	3	45	90 Min	20	30	50

Course No.2 (Course -II): Title : MATVSC202: Introduction to Latex -II

Course Outcome (CO):

After completion of course (No.2), students will be able to:

CO 1:Understand the techniques of inserting pictures.

CO 2: Prepare the presentation in beamer environment.

Syllabus- Course 2: Title:-Introduction to Latex-II	Total Hrs: 45
Section-A Theory	**15 hrs**
Inserting picture objects, text, boxes, straight lines, arrow, stacks, circles, oval, framing, curve, grid, repeat patterns. Making presentation slides in beamer class LaTeX, various styles in beamer presentation, dynamic slides. PostScript macros for Generic TeX (PsTrix): arguments, dimension, coordinates, angles, line styles, fill styles, custom styles, custom graphics, picture tools, text tricks, node and connection special tricks. Basics of MathJax, Mathjax configuration options.	
Unit-II: Practical (15 x 2Hrs)	**30 Hrs**
Minimum Fifteen practicals shall be conducted based on Unit-I	

Books Recommended:

1. Kottwitz, S. LaTeX Beginner's Guide. Packt Publishing Ltd., UK, 2011.

2. Leslie L. A Document Preparation System User's Guide and Reference Manual, AddisonWesley Publishing Company, 2001.

3. Tantau,T.: User Guide to the Beamer Class, http://latex-beamer.sourceforge.net.

4.Oetiker,T.:TheNot So Short Introduction to LATEX2E, https://tobi.oetiker.ch/lshort/lshort.pdf.

Skill Enhancement Course (SEC-2)

The course **SEC-2** in IInd semester has **Two** courses for **Two** credits each. Student has to choose any one course. Details of the courses are as under.

Course No.-1 (Paper No. I) MATSEC201: Financial Accounting

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 01	SEC-2	Theory /practical	2 1T+1P	3	45	90 Min	20	30	50

Course No.1 (Paper-I): Title: MATSEC201: Financial Accounting

Course Outcome (CO):

After completion of course (No.1), students will be able to:

CO 1: Understand the basic accounting and financial terminology.

CO 2: Understand how financial transactions are recorded.

CO 3: Use of financial statements to assess a company's performance.

Syllabus- Course 1: Title- **Financial Accounting**	**Total Hrs: 45**
Unit-I: Theory	**15 hrs**
Introduction to Accounting: Importance and Limitations of accounting. Various concepts of Accounting Information, Accounting Principles, Conventions and Concepts. Journal, Ledger, Trial Balance, Rectification of Errors, Preparation of Bank Reconciliation, final Accounts with Adjustment entries. Valuation of Stock, Accounting Treatment of Depreciation, Reserve and Provision. Analysis of Financial Statement: Ratio Analysis.	
Unit-II: Practical (15 x 2Hrs)	**30 Hrs**
Minimum Fifteen practicals shall be conducted based on Unit-I	

Books Recommended:

1. Narayanswami, R. (2005). Financial Accounting Managerial Perspective. 2 nd Edition. Prentice Hall of India Pvt. Ltd.

2. Mukherjee, A., & Hanif, M., (2003). Financial Accounting. 1st Edition. Tata Mc. Graw Hill.

3. Maheshwari, S.N., & Maheshwari, S. K., (2013). An Introduction to Accountancy. 11 th Edition. Vikas Publishing House.

4. Bhattacharya, A.K., (2011). Essentials of Financial Accounting. 2nd Edition. Prentice Hall of India Pvt. Ltd.

5. Chowdhary A., (2007). Fundamentals of Accounting and Financial Analysis. 1st Edition. Pearson Education.

6. Suggestive digital platforms web links: NPTEL/SWAYAM/MOOCS.

Course No.-2 (Paper No.II) MATSEC202: Basic Statistics

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course 02	SEC-2	Theory	2 1T+1P	3	45	90 Min	20	30	50

Course No.2 (Paper -II): Title: MATSEC202: Basic Statistics

Course Outcome (CO):

After completion of course (No.2), students will be able to:

CO 1: Understand and find mean, mode, median and deviation.

CO 2: Understand and apply the concepts of probalility.

Syllabus- Course 2: Title- Basic Statistics	Total Hrs: 45
Unit-I: Theory	**15 hrs**
Statistics: Statistics, Frequency distribution, Graphical representation, Average or Measures of central tendency, Arithmetic mean, median, mode, Geometric mean, Harmonic mean, Average deviation or mean deviation, Standard deviation, Shortest method for calculating standard deviation, Moments, Moment generating function, Skewness, Corelation, Scattered diagram or dot diagram. **Probability:** Probability, Definitions, Addition law of probability, Multiplication law of probability, Conditional probability, Baye's theorem (Only statement).	
Unit-II: Practical (15 x 2Hrs)	**30 Hrs**
Minimum Fifteen practicals shall be conducted based on Unit-I	

Recommended Textbook:

H.K.Das: Advanced Engineering Mathematics,Twenty first revised edition (Reprint 2016) ,

S.Chand and Company Pvt.Ltd.

Scope:

Chapter -10 : 10.1 to 10.17. Chapter -11 : 11.1 to 11.6.

Books Recommended:

1. Irwin Miller, Marylees Miller, John E.: Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.

2. A.M. Mood, F.A. Graybill, D.C. Boes: Introduction to the Theory of Statistics, Tata McGraw-Hill.