Telephone No. 2419677/2419361
Fax: 0821-2419363/2419301

e-mail : registrar@uni-mysore.ac.in
www.uni-mysore.ac.in

UNIVERSITY OF MYSORE

Estd. 1916

VishwavidyanilayaKaryasoudha
Crawford Hall, Mysuru- 570 005

No.AC2(S)/151/2020-21

Dated: 26-10-2021

Notification

Sub:- Syllabus and Examination Pattern of Mathematics (UG) with effective from the Academic year 2021-22 as per NEP-2020.

Ref:- 1. Decision of Board of Studies in Mathematics (UG) meeting held on 27-09-2021.
2. Decision of the Faculty of Science & Technology Meeting held on 16-10-2021.
3. Decision of the Academic Council meeting held on 22-10-2021.

*****

The Board of studies in Mathematics (UG) which met on 27-09-2021 has recommended & approved the syllabus and pattern of Examination of Mathematics Programme with effective from the Academic year 2021-22 as per NEP -2020.

The Faculty of Science & Technology and Academic Council at their meetings held on 16-10-2021 and 22-10-2021 respectively have also approved the above said proposal and it is hereby notified.

The syllabus and Examination pattern is annexed herewith and the contents may be downloaded from the University Website i.e., www.uni-mysore.ac.in.

Registrar

Registrar
University of Mysore
Mysore

To:-

1. All the Principal of affiliated Colleges of University of Mysore, Mysore. Those who are running B.Sc Courses.
2. The Registrar (Evaluation), University of Mysore, Mysuru.
3. The Chairman, BOS/DOS, in Mathematics, Manasagangothri, Mysore.
4. The Dean, Faculty of Science & Technology, DoS in Psychology, MGM.
5. The Director, Distance Education Programme, Moulya Bhavan, Manasagangotri, Mysuru.
6. The Director, PMEB, Manasagangothri, Mysore.
7. Director, College Development Council , Manasagangothri, Mysore.
8. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
9. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of

NATIONAL EDUCATION POLICY 2020 INITIATIVES

B.A./B.Sc. (Hons) Mathematics,
B.A./B.Sc. with Mathematics as a Major/Minor Subject

SYLLABUS FOR

B.Sc. MATHEMATICS (FIRST YEAR)
(60:40 PATTERN)

W.E.F. THE ACADEMIC YEAR
2021-22

UNIVERSITY OF MYSORE
MYSURU

Preamble

The subject wise expert committee to draft model curriculum contents in Mathematics constituted by the Department of Higher Education, Government of Karnataka, Bangalore vide GO No. ED 260 UNE 2019 (PART-1) DATED 13.08.2021 is pleased to submit its partial report on the syllabus for the First Year (First & Second Semesters) B.A./B.Sc.(Basic/Honors) Mathematics and detailed Course Structure for B.A./B.Sc.(Honors) Mathematics and M.Sc. (One Year) Mathematics.

The committee discussed various models suggested by the Karnataka State Higher Education Council in its joint meetings with the Chairpersons of Board of Studies of all state universities in Karnataka and resolved to adopt Model IIA (*Model Program Structure for the Bachelor of Arts (Basic/Hons.)/ Bachelor of Science (Basic/Hons.*) for the subjects with practical's with Mathematics as Major/Minor.

To achieve the core objectives of the National Education Policy 2020 it is unanimously resolved to introduce computer based practical's for the Discipline Core (DSC) courses by using Free and Open Source Software's (FOSS) tools for implementation of theory based on DSC courses as it is also suggested by the LOCF committee that the papers may be taught using various Computer Algebra System (CAS) software's such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and widen up the horizon of students' self-experience. In view of these observations the subject expert committee suggested the software's Phython /R / Msxima/ Scilab/ Maple/MatLab/Mathematica for hands on experience of implementation of mathematical concepts in computer based lab.

The expert committee suggests the implementation this curriculum structure in all the Departments of Mathematics in Universities/Colleges in Karnataka.

The subject expert committee designed the Course Learning Outcome (CO) to help the learners to understand the main objectives of studying the courses by keeping in mind of the Programme outcomes (PO) of the graduate degree with honors in Mathematics or a graduate degree with Mathematics as a major subject.

As the Mathematics subject is a vast with several branches of specializations, it is difficult for every student to learn each branch of Mathematics, even though each paper has its own importance. Hence the subject expert committee suggests number of elective papers (for both Discipline electives and Open Electives) along with Discipline Core Courses. The BoS in Mathematics of universities may include additional electives based on the expertise of their staff and needs of the students'. A student can select elective paper as per her/his needs and interest.

The subject expert committee in Mathematics suggests that the concerned Department/Autonomous Colleges/Universities to encourage their faculty members to include necessary topics in addition to courses suggested by the expert committee.

Name of the Degree Program : B.A./B.Sc.
Discipline Course : Mathematics
Starting Year of Implementation : 2021-22

Programme Outcomes (PO): By the end of the program the students will be able to :

PO 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 such as computer science and other allied subjects
PO 2	**Communication Skills**: Ability to communicate various mathematical concepts effectively using examples and their geometrical visualization. The skills and knowledge gained in this program will lead to the proficiency in analytical reasoning which can be used for modeling and solving of real life problems.
PO 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 the various aspects of real life problems.
PO 4	**Problem Solving** : The Mathematical knowledge gained by the students through this programme develop an ability to analyze the problems, identify and define appropriate computing requirements for its solutions. This programme enhances students overall development and also equip them with mathematical modelling ability, problem solving skills.
PO 5	**Research related skills:** The completing this programme develop the capability of inquiring about appropriate questions relating to the Mathematical concepts in different areas of Mathematics.
PO 6	**Information/digital Literacy**: The completion of this programme will enable the learner to use appropriate softwares to solve system of algebraic equation and differential equations.
PO 7	**Self – directed learning**: The student completing this program will develop an ability of working independently and to make an in-depth study of various notions of Mathematics.
PO 8	**Moral and ethical awareness/reasoning:** : The student completing this program will develop an ability to identify unethical behavior 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 particular.
PO 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 word problems.
PO 10	Ability to peruse advanced studies and research in pure and applied Mathematical sciences.

Assessment

Weightage for the Assessments (in percentage) for first two semesters

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	40%	60 %
Practical	50%	50 %
Projects	--	--
Experiential Learning (Internship etc.)	--	--

Contents of Courses for B.A./B.Sc. with Mathematics as Major Subject & B.A./B.Sc. (Hons) Mathematics

Model IIA

Semester	Course No.	Theory/ Practical	Credits	Paper Title	Marks in percentage	
					S.A.	I.A.
I	MATDSCT1.1	Theory	4	Algebra - I and Calculus - I	60	40
	MATDSCP1.1	Practical	2	Theory based Practical's on Algebra - I and Calculus – I	50	50
	MATOET1.1 MATOET1.2 MATOET1.3	Theory Theory Theory	3	Optional Mathematics – I Business Mathematics – I Mathematical Aptitude – I	60	40
II	MATDSCT2.1	Theory	4	Algebra – II (Number Theory) and Calculus - II	60	40
	MATDSCP2.1	Practical	2	Theory based Practical's on Algebra – II (Number Theory) and Calculus – II	50	50
	MATOET2.1 MATOET2.2 MATOET2.3	Theory Theory Theory	3	Optional Mathematics – II Business Mathematics-II Mathematical Aptitude – II	60	40

1. Scheme of Admission: As per the University rules.
2. Eligibility: As prescribed by the University.
3. Scheme of Examination: Continuous assessment.

THEORY EXAMINATION (For Discipline Specific Course(DSC) papers):

(i) Internal Assessment

C1 Component: 20 Marks. This will be based on test for 10 marks and seminar for 10 marks. This should be completed by the 8th week of the semester.
C2 Component: 20 Marks. This will be based on test for 10 marks and assignment for 10 marks. This should be completed by the 15th week of the semester.

(ii) *C3 component* **(Main Examination of 2 hours duration)**: 60 Marks. The pattern of the question paper will be as follows:

There will be 04 questions. All questions must be answered. All questions carry 15 marks.

Question 1. This question covers unit I of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

Question 2. This question covers unit II of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

Question 3. This question covers unit III of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

Question 4. This question covers unit IV of the syllabus. There will be 5 sub- questions each carrying 5 marks. The student has to answer any three of the 5 sub-questions.

PRACTICAL EXAMINATION (For Discipline Specific Course (DSC) papers):

(i) Internal Assessment: 50% (20% + 10% + 20%)

This will be based on test (20%marks), Seminar/practical record maintenance (10% marks) and assignment (20% marks). This should be completed by the 15th week of the semester.

(ii) Main Examination (2 hours duration): **50%** (40% + 10%)

There will be 3 questions each carrying equal marks. The student has to answer any two of the 3 questions. Each student will be subjected to viva-voce examination, based on practical syllabus, for 10% marks.

THEORY EXAMINATION (For Open Elective (OE) papers):

(i) Internal Assessment

C1 Component: 20 Marks. This will be based on test for 10 marks and seminar for 10 marks. This should be completed by the 8th week of the semester.

C2 Component: 20 Marks. This will be based on test for 10 marks and assignment for 10 marks. This should be completed by the 15th week of the semester.

(ii) *C3 component* **(Main Examination of 2 hours duration)**: 60 Marks. The pattern of the question paper will be as follows:

There will be 03 questions. All questions must be answered. All questions carry 20 marks.

Question 1. This question covers unit I of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

Question 2. This question covers unit II of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

Question 3. This question covers unit III of the syllabus. There will be 6 sub- questions each carrying 5 marks. The student has to answer any four of the 6 sub-questions.

4. Minimum marks for Securing Credits: 30% in Theory Examination and 40% overall.
5. Minimum credits for getting B.Sc. Degree: As per NEP regulations.
6. Award of certificate/diploma/degree: As per NEP regulations.

CURRICULUM STRUCTURE FOR UNDERGRADUATE DEGREE PROGRAM

Name of the Degree Program : B.A. / B.Sc. (Honors)
Discipline/Subject : Mathematics
Starting Year of Implementation: 2021-22

PROGRAM ARTICULATION MATRIX

Semester	Course No.	Programme Outcomes that the Course Addresses	Pre-Requisite Course(s)	Pedagogy*	Assessment**
I	MATDSCT1.1	PO 1, PO 2, PO 3	---	MOOC	CLASS TESTS
II	MATDSCT2.1	PO 1, PO 2, PO 3, PO 8	MATDSCT1.1	PROBLEM SOLVING	
III	MATDSCT3.1	PO 1, PO 4, PO7, PO 8	-----	SEMINAR	SEMINAR
IV	MATDSCT4.1	PO 1, PO 4, PO7, PO 8	MATDSCT3.1	PROJECT BASED	QUIZ
V	MATDSCT5.1	PO 1, PO 2, PO 3, PO 5	----	LEARNING	ASSIGNMENT
V	MATDSCT5.2	PO 3, PO 4, PO 7, PO10	MATDSCT2.1	ASSIGNMENTS	
VI	MATDSCT6.1	PO 6, PO 7, PO 10.	MATDSCT5.2	GROUP DISCUSSION	
VI	MATDSCT6.2	PO 3, PO 4, PO 5, PO 8, PO 9, PO 10.	MATDSCT1.1 & MATDSCT2.1		
VII	MATDSCT7.1	PO 3, PO 4, PO5, PO 7, PO 9.	MATDSCT1.1 & MATDSCT2.1		TERM END EXAM
VII	MATDSCT7.2	PO 2, PO 4, PO 5, PO 10	MATDSCT3.1		
VII	MATDSCT7.3	PO 2, PO 4, PO 5, PO 10	MATDSCT3.1		
VIII	MATDSCT8.1	PO 2, PO 4, PO 5, PO 10	MATDSCT5.1		
VIII	MATDSCT8.2	PO 2, PO 4, PO 5, PO 10	MATDSCT4.1		VIVA-VOCE
VIII	MATDSCT8.3	PO 2, PO 4, PO 5, PO 10	MATDSCT7.3		

** Pedagogy for student engagement is predominantly Lecture. However, other pedagogies enhancing better student engagement to be recommended for each course. This list includes active learning/ course projects / Problem based or Project based Learning / Case Studies / Self Study like Seminar, Term Paper or MOOC.

*** Every Course needs to include assessment for higher order thinking skills (Applying/ / Evaluating / Creating). However, this column may contain alternate assessment methods that help formative assessment (i.e. assessment for Learning).

Credit Distribution for B.A./B.Sc.(Honors) with Mathematics as Major in the 3rd Year
(For Model IIA)

Subject	Semester	Major/ Minor in the 3rd Year	Credits					
			Discipline Specific Core (DSC)	Open Elective (OE)	Discipline Specific Elective (DSE)	AECC & Languages	Skill Enhancement Courses (SEC)	Total Credits
Mathematics	I - IV	Major	4 Courses (4+2)x 4=24	4 Courses 3 x 4 = 12	---	(4+4=8) Courses 8x(3+1)= 32	2 Courses 2x(1+1)= 4	72
Other Subject		Minor	24	--	--	--	--	24
								96
Mathematics	V & VI	Major	4 Courses 4x(3+2)=20	-----	2 Courses 2 x 3 = 06	---	2 Courses 2 x 2 = 4	30
Other Subject		Minor	10	--	--	--	--	10
(96+40)**=136**								
Mathematics	VII & VIII	Major	2 Courses 2x(3+2)=10 3 Courses 3 x 4 = 12 1 Course 1 x 3 = 3 Total=25	-----	2 Courses 2 x 3 = 6 Res.Meth 1 x 3 = 3 2 Courses 2 x 3 = 6 Total= 15	----	-----	40
Total No. of Courses			14	04	07	08	04	
								136+40**=176**

Syllabus for B.A./B.Sc. with Mathematics as Major Subject & B.A./B.Sc. (Hons) Mathematics

SEMESTER – I

MATDSCT 1.1: Algebra - I and Calculus – I	
Teaching Hours : 4 Hours/Week	**Credits: 4**
Total Teaching Hours: 56 Hours	**Max. Marks: 100** **(S.A.-70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous linear of *m* equations in *n* variables by using concept of rank of matrix.
- Students will be familiar with the techniques of integration and differentiation of function with real variables.
- Students learn to solve polynomial equations.
- Learn to apply Reduction formulae.

Unit-I: Matrix: Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction to Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hours**

Unit-II: Theory of equations: Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hours**

Unit-III: Polar Co-ordinates: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature. **14 Hours**

Unit-IV: Successive Differentiation and Integral Calculus-I: nth Derivatives of Standard functions e^{ax+b}, a^x, $(ax+b)^n$, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$, Leibnitz theorem and its applications.
Recapitulation of definite integrals and its properties. Reduction formulae for $\int \sin^n x\, dx$, $\int \cos^n x\, dx$, $\int \sin^n x \cos^m x\, dx$, $\int \tan^n x\, dx$, $\int \cot^n x\, dx$, $\int \sec^n x\, dx$, $\int \mathrm{cosec}^n x\, dx$, $\int x^n \sin x\, dx$, $\int x^n \cos x\, dx$, $\int x^n e^{ax}\, dx$, $\int x^n (\log x)^m\, dx$ with definite limits. **14 Hours**

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices - A R Vasista, Krishna Prakashana Mandir.
5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
6. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus - S Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.
10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013.

MATDSCP 1.1: Practical's on Algebra - I and Calculus – I	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50 (S.A.-35 + I.A. – 15)**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open Source Software (FOSS)* tools for computer programming
- Solve problem on algebra and calculus theory studied in **MATDSCT 1.1** by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in Computer Lab (FOSS)

Suggested Software's: Maxima/Scilab /Python/R.

Introduction to the software and commands related to the topic.

1. Computation of addition and subtraction of matrices,
2. Computation of Multiplication of matrices.
3. Computation of Trace and Transpose of Matrix
4. Computation of Rank of matrix and Row reduced Echelon form.
5. Computation of Inverse of a Matrix using Cayley-Hamilton theorem.
6. Solving the system of homogeneous and non-homogeneous linear algebraic equations.
7. Finding the nth Derivative of e^{ax}, trigonometric and hyperbolic functions
8. Finding the nth Derivative of algebraic and logarithmic functions.
9. Finding the nth Derivative of $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$.
10. Finding the roots of the equation, factoring.
11. Finding the angle between the radius vector and tangent.
12. Finding the curvatures of the given curves.

Open Elective Course

(For students of Science stream who have not chosen Mathematics as one of Core subjects)

MATOET 1.1: Optional Mathematics – I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.-70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- Learn to solve system of linear equations.
- Solve the system of homogeneous and non homogeneous m linear equations by using the concept of rank of matrix.
- Students will be familiar with the techniques of differentiation of function with realvariables.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Learn to apply Reduction formulae.

Unit-I: Matrices: Recapitulation of Symmetric and Skew Symmetric matrices, Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem (Without Proof). **14 Hours**

Unit-II: Theory of equations: Euclid's algorithm, Polynomials with integral coefficients, Remainder theorem, Factor theorem, Fundamental theorem of algebra(statement only), Irrational and complex roots occurring in conjugate pairs, Relation between roots and coefficients of a polynomial equation, Symmetric functions, Transformation, Reciprocal equations, Descartes' rule of signs, Multiple roots, Solving cubic equations by Cardon's method, Solving quartic equations by Descarte's Method. **14 Hours**

Unit-III: Polar Co-ordinates: Polar coordinates, angle between the radius vector and tangent. Angle of intersection of two curves (polar forms), length of perpendicular from pole to the tangent, pedal equations. Derivative of an arc in Cartesian, parametric and polar forms, curvature of plane curve-radius of curvature formula in Cartesian, parametric and polar and pedal forms- center of curvature, circle of curvature. **14 Hours**

Reference Books:

1. University Algebra - N.S. Gopala Krishnan, New Age International (P) Limited.
2. Algebra – Natarajan, Manicavasagam Pillay and Ganapathy.
3. Theory of Matrices - B S Vatsa, New Age International Publishers.
4. Matrices – A. R. Vasista, Krishna Prakashana Mandir.
5. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
6. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi.
7. Calculus – Lipman Bers, Holt, Rinehart & Winston.
8. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd.,

vol. I & II.
9. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc. Graw.
10. Shanthinarayan – Integral Calculus, New Delhi: S. Chand and Co. Pvt. Ltd.
11. Shanthinarayan and P K Mittal, Integral Calculus, Reprint. New Delhi: S. Chand and Co. Pvt. Ltd., 2013.

Open Elective

(For Students of all Streams)

MATOET 1.2: Business Mathematics-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Totat Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- Translate the real word problems through appropriate mathematical modellling.
- Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context.
- Finding the extreme values of functions.
- Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.

Unit-I: Algebra – Set theory and simple applications of Venn Diagram, relations, functions, indices, logarithms, permutations and combinations. Examples on commercial mathematics. **14 Hours**

Unit - II: Matrices: Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants upto third order; Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics. **14 Hours**

Unit - III: **Differential Calculus**: Constant and variables, functions, Limits & continuity. Differentiability and Differentiation, partial differentiation, rates as a measure, maxima, minima, Partial Derivatives up to second order; Homogeneity of functions and Euler's Theorem; Total Differentials; Differentiation of implicit function with the help of total differentials, Maxima and Minima; cases of one variable involving second or higher order derivatives; Cases of two variables involving not more than one constraint. **14 Hours**

Reference Books:

1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi.
2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill,

London.
3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.
4. Business Mathematics, Soni R.S., Pitamber Publishing House, Delhi.

Open Elective

(For Students of all Streams)

MATOET 1.3: Mathematical Aptitude-I	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Totat Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

Unit-I: Number System, Types of Numbers, series (AP and GP), Algebraic operations BODMAS, Divisibility, LCM and HCF, Fraction, Simplification. **14 Hours**

Unit-II: Time and Distance, Problems based on Trains, Boats and Streams. **14 Hours**

Unit-III: Time, work and wages, Pipes and Cistern, Problems on Clock, Problems on Calendar. **14 Hours**

Reference Books:

1. R.S. Aggarwal, “Quantitative Aptitude for Competitive Examinations”, Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.

SEMESTER – II

MATDSCT 2.1: Algebra – II {Number Theory) and Calculus – II	
Teaching Hours : 4 Hours/Week	**Credits: 4**
Totat Teaching Hours: 56 Hours	**Max. Marks: 100 (S.A.-70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruences and its applications.
- Identify and apply the intermediate value theorems and L'Hospital rule.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- Students learn to find areas and volumes using integration.

Unit-I: Number Theory: Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 hours**

Unit-II: Differential Calculus-I: Limits, Continuity, Differentiability and properties. Properties of continuous functions. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and evaluation of limits using L'Hospital rule. **14 Hours**

Unit-III: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables. **14 hours**

Unit-IV: Integral Calculus-II: *Line integral*: Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas using double integrals. *Triple integral*: Definition of triple integrals and evaluation-change ofvariables, volume as triple integral. **14 hours**

Reference Books:

1. Differential Calculus, Shantinarayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, New Delhi: S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6^{th} edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

PRACTICAL

MATDSCP 2.1: On Algebra – II (Number Theory) and Calculus – II	
Practical Hours : 4 Hours/Week	**Credits: 2**
Total Practical Hours: 56 Hours	**Max. Marks: 50 (S.A.-35 + I.A. – 15)**

Course Learning Outcomes: This course will enable the students to

- Learn *Free and Open Source Software (FOSS)* tools for computer programming
- Solve problem on algebra and calculus by using FOSS software's.
- Acquire knowledge of applications of algebra and calculus through FOSS

Practical/Lab Work to be performed in Computer Lab

Suggested Software's: Maxima/Scilab /Phython/R.

1. Programs related to Number Theory.
2. Program to verify Mean value theorems.
3. Program for finding the Taylor's and Maclaurin's expansions of the given functions.
4. Program to verify the Euler's theorem and its extension.
5. Programs to construct series using Maclaurin's expansion for functions of two variables.
6. Program to evaluate the line integrals with constant and variable limits.
7. Program to evaluate the Double integrals with constant and variable limits.
8. Program to evaluate the Triple integrals with constant and variable limits.

Open Elective

(For students of Science stream who have not chosen Mathematics as one of the Core subjects)

MATOET 2.1: Optional Mathematics – II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100 (S.A.- 70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- Learn the concept of Divisibility.
- Learn about prime and composite numbers.
- Learn the concept of congruences and its applications.
- Understand the concept of differentiation and fundamental theorems in differentiation and various rules.
- Find the extreme values of functions of two variables.
- To understand the concepts of multiple integrals and their applications.

Unit-I: Number Theory: Division Algorithm, Divisibility, Prime and composite numbers, Euclidean algorithm, Fundamental theorem of Arithmetic, The greatest common divisor and least common multiple. Congruences, Linear congruences, Simultaneous congruences, Euler's Phi-function, Wilson's, Euler's and Fermat's Theorems and their applications. **14 hours**

Unit-II: Partial Derivatives: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem and extension of Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.
14 hours

Unit-III: Integral Calculus: *Line integral*: Definition of line integral and basic properties, examples on evaluation of line integrals. *Double integral*: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, *Triple integral*: Definition of triple integrals and evaluation-change of variables, volume as triple integral. **14 hours**

Reference Books:

1. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi.
2. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd., 2019.
3. Calculus – Lipman Bers, Holt, Rinehart & Winston.
4. Calculus - Shanthinarayanan & T. K. Manicavachogam Pillay, S. Viswanathan Pvt. Ltd., vol. I & II.
5. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA:Mc. Graw Hill, 2008.
6. Integral Calculus, Shanthinarayan, S. Chand and Co. Pvt. Ltd.
7. Integral Calculus, Shantinarayan and P K Mittal, S. Chand and Co. Pvt. Ltd.
8. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.
9. David M Burton, Elementary Number Theory, 6^{th} edition, McCraw Hill, 2007.
10. Emil Grosswald, Topics from the Theory of Numbers, Modern Birhauser, 1984.
11. Ivan Niven, Herbert S. Zuckerman and Hugh L. Montgomery, An Introduction to the Theory of Numbers, John Willey (New York), 1991.

Open Elective

(For Students of all streams)

MATOET 2.2: Business Mathematics-II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Total Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- Integrate concept in international business concept with functioning of global trade.
- Evaluate the legal, social and economic environment of business.
- Apply decision-support tools to business decision making.
- Will be able to apply knowledge of business concepts and functions in an integrated manner.

Unit - I: Commercial Arithmetic: Interest**:** Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Installments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems. **14 Hours**

Unit - II: Measures of central Tendency and Dispersion: Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M.

and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems.

14 Hours

Unit - III: Correlation and regression: Concept and types of correlation, Scatter diagram, Interpretation with respect to magnitude and direction of relationship. Karl Pearson's coefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems. **14 Hours**

Reference Books:

1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi
2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai
3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi
4. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi
5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi
6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge
7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark
8. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.
9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi.
10. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd. Calcutta.
11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta.
12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.

Open Elective

(For Students of all Streams)

MATOET 2.3: Mathematical Aptitude-II	
Teaching Hours : 3 Hours/Week	**Credits: 3**
Totat Teaching Hours: 42 Hours	**Max. Marks: 100** **(S.A.- 70 + I.A. – 30)**

Course Learning Outcomes: This course will enable the students to

- have a strong base in the fundamental mathematical concepts.
- grasp the approaches and strategies to solve problems with speed and accuracy
- gain appropriate skills to succeed in preliminary selection process for recruitment

Unit-I: Percentage, Average, Problems based on Ages, Ratio and Proportion, Partnership and share, Mixtures. **14 Hours**

Unit-II: Profit, Loss and Discount, Simple Interest, Compound Interest, Shares and Debentures. **14 Hours**

Unit-III: Permutations and Combinations, Probability, True discount and Banker's discount. **14 Hours**

Reference Books:

1. R.S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", Revised Edition, S. Chand and Co. Ltd, New Delhi, 2018.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude : Numerical Ability (Fully Solved) Objective Questions, Kiran Prakashan, Pratogitaprakasan, Kic X, Kiran Prakasan publishers.
4. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill publications.