



HINDUSTAN

INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)
————— CHENNAI —————

B. Sc. Mathematics

(Duration: 3 Years)

CURRICULUM and SYLLABUS

(Applicable for Students admitted from Academic Year 2022-23)

DEPARTMENT OF MATHEMATICS

SCHOOL OF LIBERAL ARTS AND APPLIED SCIENCES

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

HINDUSTAN INSTITUTE OF TECHNOLOGY & SCIENCE

VISION AND MISSION

MOTTO:

To Make Every Man a Success and No Man a Failure

VISION:

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

MISSION:

- To create an ecosystem that promotes learning and world class research.
- To nurture creativity and innovation.
- To instil highest ethical standards and values.
- To pursue activities for the development of the Society.
- To develop national and international collaborations with institutes and industries of eminence.
- To enable graduates to become future leaders and innovators.

VALUE STATEMENT

- Integrity, Innovation, Internationalization

DEPARTMENT OF MATHEMATICS

VISION AND MISSION

VISION

To be a worldwide Centre for Excellence in Mathematics and scientific computing for the growth of Science and Technology.

MISSION

M1 Imparting of quality mathematics education and the inculcating of the spirit of research through innovative teaching and research methodologies.

M2 To achieve high standards of excellence in generating and propagating knowledge in Mathematics.

M3 To build a community that champions and promotes the mathematician in everyone.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The Program Educational Objectives (PEOs) for Mathematics describe accomplishments that students are expected to attain within three years after graduation.

PEO I Graduates will acquire knowledge and expertise to excel in professional career.

PEO II Graduates will obtain and apply the practical and technical skills to identify, analyze and solve the problems related to the industries.

PEO III Graduates will develop and possess professional attitude and skills to be socially responsible individual and work as team in their work place and society considering the professionals ethics, environmental factors, and contribute to the economic growth of the country.

PEO IV Graduates will utilize their expertise gained to pursue higher studies and outshine in careers like teaching, research or technologists.

PEO V Graduates will be competent to exhibit their acquired

multidisciplinary skills for the lifelong learning in their professional and personal upliftment.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)

On successful completion of the program, graduates will be able to:

PO I Knowledge Domain: Demonstrate an understanding of the basic concepts in mathematics, statistics, operations research and their importance in the solution of some real- world problems.

PO II Problem Analysis: Analyze and solve the well-defined problems in mathematics statistics, and operations research. Utilize the principles of scientific enquiry, thinking analytically, clearly and critically, while solving problems and making decision. Find, analyze, evaluate and apply information systematically and shall make defensible decisions.

PO III Presentation and Interpretation of Data: Demonstrate the ability to manipulate and visualize data and to compute standard statistical summaries.

PO IV Modern Tool Usage: Learn, select, and apply appropriate methods and procedures, resources and computing tool such as Excel, MATLAB, MATHEMATICA, SPSS etc with an understanding of the limitations.

PO V Ethics: Analyze relevant academic, professional and research ethical problems and commit to professional ethics and responsibilities with applicable norms of the data analysis and research practices.

PO VI Communication: Effectively communicate about their field of expertise on their activities, with their peer and society at large. Such as, being able to comprehend and write effective reports and design documentation, make effective presentations.

PO VII Project Management: Apply Knowledge and understanding of principles of mathematics and statistics effectively as an individual, and as a member or leader in diverse teams to manage projects in multidisciplinary environment.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO I Acquire knowledge in functional areas of Mathematics and apply in all the fields of learning.

PSO II Develop critical thinking, creative thinking, self-confidence for eventual success in career.

PSO III Employ mathematical ideas encompassing logical reasoning, analytical, numerical ability, theoretical skills to model real-world problems and solve them.

**B.Sc. Mathematics
(120 CREDIT STRUCTURE)**

SEMESTER – I

S. No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	CF	*****	Regional Language I (Tamil/Hindi/Telugu/Malayalam)	3	0	0	3	1	3
		*****	Foreign Language I (French/German/ Spanish/Korean/ Japanese/Mandarin)						
2.	CF	*****	English–I	3	0	0	3	1	3
3.	PC	MAA 0107	Classical Algebra	3	1	0	4	1	4
4.	PC	MAA 0110	Calculus	3	1	0	4	1	4
5.	PC	PHA0101	Physics-I	3	0	0	3	0	3
6.	PC	CAB0105	Python Programming and MATLAB	2	0	2	3	0	4
7.	PC	MAA0106	Value Education	1	0	0	1	0	1
Total				18	2	2	21	4	22
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER – II

S. No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	CF	*****	Regional Language II (Tamil/Hindi/Telugu/Malayalam)	3	0	0	3	1	3
		*****	Foreign Language II (French/German/ Spanish/Korean/ Japanese/Mandarin)						
2.	CF	*****	English–II	3	0	0	3	1	3

3.	PC	MAA 0121	Trigonometry, Vector Calculus and Fourier Series	3	0	2	4	1	5
4.	PC	MAA 0122	Differential Equations and Transforms	3	0	2	4	1	5
5.	PC	PHA0116	Physics-II	3	0	0	3	1	3
6.	PC	PHA0141	Physics Practical	0	0	4	2	0	4
			Total	15	0	8	19	5	23
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER – III									
S. No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	PC	MAA0206	Modern Algebra	3	1	0	4	1	4
2.	PC	MAA0207	Mathematical Analysis	3	1	0	4	1	4
3.	PC	MAA0208	Complex Functions	3	1	0	4	1	4
4.	PC	MAA0209	Probability and Statistics	3	1	0	4	1	4
5.	PC	CAB0211	Object Oriented Programming Using C++	3	0	2	4	0	5
			Total	15	4	2	20	4	21
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER – IV									
S. No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	PC	MAA0220	Linear Algebra	3	1	0	4	1	4
2.	PC	MAA0221	Real Analysis	3	1	0	4	1	4
3.	PC	MAA0222	Complex Analysis	3	1	0	4	1	4
4.	PC	MAA0223	Advanced Statistics	3	1	0	4	1	4
5.	PC	CAB0225	Introduction to Data Science	3	1	0	4	0	4
			Total	15	5	0	20	4	20
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER – V									
S. No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	PC	MAA0301	Numerical Analysis	3	0	2	4	1	5
2.	PC	MAA0306	Statics and Dynamics	3	1	0	4	1	4
3.	PC	MAA0307	Operations Research	3	1	0	4	1	4
4.	PC	MAA0308	Discrete Mathematics	3	1	0	4	1	4
5.	PC	MAA0309	Three-Dimensional Analytical Solid Geometry	3	1	0	4	0	4
			Total	15	4	2	20	4	21
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER – VI

S. No.	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
1.	PC	MAA0319	Number Theory	3	1	0	4	1	4
2.	PC	MAA0320	Graph Theory	3	1	0	4	1	4
4.	PC	MAB0321	Project	0	0	24	12	0	24
			Total	6	2	24	20	2	32

L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study;

TCH- Total Contact Hours

SEMESTER I

COURSE TITLE	CLASSICAL ALGEBRA				CREDITS	4				
COURSE CODE	MAA0107	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To expose the students to the theory of equations and series									
Course Objective	<ol style="list-style-type: none"> 1. To enable the students to learn Binomial, Exponential, Logarithmic series and their application to summation of series. 2. To study intensively the convergence and divergence of different types of series. 3. To demonstrate the standard methods to solve both polynomial and transcendental type equations. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Analyze the concept of Binomial, Exponential, Logarithmic series and their application to summation of series. 2. Find the convergence or divergence of an infinite series. 3. Obtain the absolute convergence series using Cauchy's and Raabe's Test. 4. Calculate the approximate roots of the equation. 5. Identify multiple roots using Horner's method. 									
Prerequisites: Knowledge of Limits and sequence										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	P O- 3	PO-4	P O - 5	PO-6	PO-7	PSO- 1	PSO -2	PSO-3

CO-1	2	1	2	-	2	-	-	1	-	-
CO-2	2	1	2	-	2	-	-	2	1	2
CO-3	2	-	3	-	2	-	-	-	2	2
CO-4	2	2	1	-	2	-	-	3	2	3
CO-5	2	2	3	-	3	-	-	2	3	1
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Summation of Series using Binomial and Exponential Theorem (9L+3T=12)										
Binomial, exponential theorems-their statements only- their immediate application to summation and approximation only. Self-Study: Proof of Binomial and Exponential Theorems									CO-1 BTL-3	
MODULE 2: Logarithmic Series, Convergence and Divergence of Series (9L+3T=12)										
Logarithmic series theorem-statement and proof-immediate application to summation and approximation only. Convergence and divergence of series – definitions, elementary results comparison tests- D'alembert's and Cauchy's tests. Self-Study: Divergence of series									CO-2 BTL-3	
MODULE 3: Absolute Convergence of Series (9L+3T=12)										
Absolute convergence-series of positive terms-Cauchy's condensation test-Raabe's test. Self-Study: Series of positive terms									CO-3 BTL-3	
MODULE 4: Theory of Equations (9L+3T=12)										
Roots of an equation- Relations connecting the roots and coefficients-transformations of equations-character and position of roots- Descartes's rule of signs-symmetric function of roots-Reciprocal equations. Self-Study: Reciprocal equations									CO-4 BTL-3	
MODULE 5: Multiple Roots (9L+3T=12)										

Multiple roots-Rolle's theorem - position of real roots of $f(x) = 0$ – Newton's method of approximation to a root – Horner's method.		CO-5 BTL-3
TEXT BOOKS		
1.	T. K. Manikavasagam Pillai, T. Natarajan and K.S Ganapathy (2013), <i>Algebra</i> , Viswanathan Printers and Publishers Private Ltd, Chennai.	
REFERENCE BOOKS		
1.	P. Kandasamy and K. Thilagavathy (2014), <i>Mathematics for B.Sc. Branch I -Vol. I</i> , S. Chand and Company Ltd, New Delhi.	
E BOOKS		
1.	N. P. Bali (2010), <i>Algebra</i> , Laxmi Publications-New Delhi Edition.	
MOOC		
1.	https://www.brainkart.com/article/Introduction-to-Binomial,-Exponential-and-Logarithmicseries_35107/2	
2.	http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf	
3.	http://home.iitk.ac.in/~psraj/mth101/lecture_notes/Lecture11-13.pdf	
4.	https://maths4uem.files.wordpress.com/2015/09/1028-infinite-series.pdf	
5.	https://ocw.mit.edu/high-school/mathematics/exam-prep/concept-of-series/series-convergedivergence/	

COURSE TITLE	CALCULUS			CREDITS	4
COURSE CODE	MAA01110	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description Calculus concepts explored include limits and continuity, derivatives, definite integrals, exponential and logarithmic functions, trigonometric functions, and techniques of integration.

Course Objective To orient the students to get an idea of curvatures, integration of different types of functions, its geometrical applications, double, triple and improper integrals.

Course Outcome Upon completion of this course, the students will be able to

1. Calculate the radius of curvature
2. Demonstrate an understanding of types of integration.
3. Evaluation of double integral and triple integrals.
4. Obtain the double integration using change the order of integration.
5. Evaluate the Beta and Gamma function to solve the multiple integrals.

Prerequisites: Knowledge of algebra, geometry and trigonometry

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	2	-	2	3	-	-	1	1	-
CO-2	3	-	-	2	3	-	-	-	1	2
CO-3	2	3	-	1	3	-	-	-	3	-
CO-4	3	1	-	2	3	-	-	2	3	-

CO-5	2	3	-	3	2	-	-	3	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Curvature (9L+3T=12)										
Curvature-radius of curvature in Cartesian and polar forms-evolutes and envelopes- Pedal equations- total differentiation- Euler's theorem on homogeneous functions. Self-Study: Homogeneous functions									CO-1 BTL-3	
MODULE 2: Integration (9L+3T=12)										
Integration of $\frac{f'(x)}{f(x)}$, $f'(x)\sqrt{f(x)}$, $\frac{px+q}{\sqrt{ax^2+bx+c}}$, $\sqrt{\frac{x-a}{x-b}}$, $\sqrt{(x-a)(x-b)}$, $\frac{1}{\sqrt{(x-a)(x-b)}}$, $\frac{1}{\cos x+bsinx+c}$, $\frac{1}{\cos 2x+bsin 2x+c}$ - Integration by parts - Bernoulli's Formula.									CO-2 BTL-3	
MODULE 3: Evaluation of double and triple integrals (9L+3T=12)										
Reduction formulae- problems- evaluation of double and triple integrals-applications to calculations of areas and volumes-areas in polar coordinates. Self-Study: Areas in polar coordinates.									CO-3 BTL-3	
MODULE 4: Change of variables in double and triple integrals (9L+3T=12)										
Change of order of integration in double integral- Jacobians- Change of variables in double and triple integrals.									CO-4 BTL-3	
MODULE 5: Beta and Gamma Functions (9L+3T=12)										
Beta and Gamma integrals-their properties, relation between them-evaluation of multiple integrals using Beta and Gamma functions - Improper Integrals. Self-Study: Improper Integrals.									CO-5 BTL-3	
TEXT BOOKS										

1.	S. Narayanan and T. K. M. Pillai. (2011), <i>Calculus</i> Vol 1, Viswanathan Publishers, Chennai.
2.	S. Narayanan and T.K.M. Pillai. (2010) <i>Calculus</i> Vol 2, Viswanathan Publishers, Chennai.
REFERENCE BOOKS	
1.	P. Kandasamy and K. Thilagarathy (2010), <i>Mathematics for BSc – Vol I and II</i> , S. Chand and Co. New Delhi.
2.	Shanthi Narayanan and J. N. Kapoor, (2014) <i>A Text Book of Calculus</i> , S. Chand & Co. New Delhi.
E BOOKS	
1.	http://www.themathpage.com
2.	http://mathworld.wolfram.com
MOOC	
1.	https://ocw.mit.edu/resources/res-18-006-calculus-revisited-single-variable-calculus-fall-2010/studymaterials/ 2. 3. 4.
2.	https://www.whitman.edu/mathematics/calculus_online/chapter15.html
3.	https://www.khanacademy.org/math/calculus-home
4.	https://www.sac.edu/FacultyStaff/HomePages/MajidKashi/PDF/MATH_150/Bus_Calculus.pdf
5.	http://www.analyzemath.com/calculus

COURSE TITLE	PHYSICS-I					CREDITS	3			
COURSE CODE	PHA0101	COURSE CATEGORY		PC	L-T-P-S	3-0-0-0				
Version	1.0	Approval Details			LEARNING LEVEL	BTL-3				
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project		Surprise Test / Quiz	Attendance	ESE				
15%	15%	10%		5%	5%	50%				
Course Description	To expose the students to the basics of Allied Physics.									
Course Objective	<ol style="list-style-type: none"> 1. To enable the students to about the mechanics of science, electricity and elasticity. 2. To study intensively Gravitational forces, sound, optical fibers regarding. 3. To demonstrate the standard methods about the electronics and its functions. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Develop an understanding on the concept of Simple Harmonic Motion, Angular Momentum, Moment of Inertia, Kinetic Energy. 2. Acquire a clear knowledge regarding law of gravitation, Kepler's law, Poisson's ratio, cantilever. 3. Apply the appropriate tests to find the transverse waves, Melde's experiment, detection of ultrasonics. 4. Apply Newton's rings in determination of wave length and refractive index of liquid. 5. Differentiate the forward bias, reverse bias characteristics 									
Prerequisites: Knowledge of Physical Science.										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	1	-	3	-	1	-	2	2	-	1

CO-2	2	-	1	-	2	-	-	1	2	-
CO-3	1	2	-	-	2	-	3	2	1	3
CO-4	2	-	1	-	-	-	1	-	3	-
CO-5	-	1	2	-	3	-	2	1	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Mechanics										(9L)
Simple harmonic motion, phase-equations of wave motion-compound pendulum- center of suspension-interchangeability center of oscillation and suspension.Moment of Inertia – Radius of gyration – Angular Momentum – torque – Theorems of M.I - M.I. of uniform rod, disc, circular ring, solid sphere.									CO-1 BTL-3	
MODULE 2: Gravitation and Elasticity										(9L)
Law of gravitation–constant G - Kepler’s laws-relation between G and g – earth’s mass and density -variation of the acceleration due to gravity - orbital velocity - escape velocity.Types of moduli - Hooke’s law - Stress-strain relation - Poisson’s ratio relation between Y, η and K.									CO-2 BTL-3	
MODULE 3: Sound										(9L)
Transverse waves – velocity along a stretched string-laws of transverse vibration of strings -verification of laws - Melde’s experiment. Ultrasonics-generation - piezo-electric effect - Detection of ultrasonics-applications (SONAR & NDT).									CO-3 BTL-3	
MODULE 4: Optics										(9L)
Geometrical Optics: Spherical aberration of a thin lens – Methods of reducing spherical aberration – Coma – Aplanatic surface – Astigmatism – Curvature of the field – Distortion. Interference: Introduction – Air wedge – Newton’s rings – Colors of thin films. Diffraction : Plane diffraction Grating – Theory of plane transmission Grating									CO-4 BTL-3	
MODULE 5: Semiconductor Physics										(9L)

Semiconductors - Intrinsic and Extrinsic types - pn junction - Forward bias, reverse bias characteristics – Half-wave, Full wave and Bridge Rectifier - Zener diode and its V-I characteristics.	CO-5 BTL-3
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TEXT BOOKS

1.	V. K. Mehta (2014), <i>Principles of Electronics</i> , S. Chand and Company Ltd, New Delhi.
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REFERENCE BOOKS

1.	A. S. Vasudeva (2013), <i>Modern Engineering Physics</i> , S. Chand and Company Ltd, New Delhi.
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E BOOKS

1.	Allied Physics (Paper I and II), 1/e S Chand Publishing
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MOOC

1.	https://nptel.ac.in/courses/115103108/
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COURSE TITLE	PYTHON PROGRAMMING AND MATLAB			CREDITS	3					
COURSE CODE	CAB0105	COURSE CATEGORY	PC	L-T-P-S	2-0-2-0					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	It is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods.									
Course Objective	<ol style="list-style-type: none"> 1. To understand the Python Programming environment 2. Able to do simple calculations using MATLAB 3. Able to carry out simple numerical computations and analyses using MATLAB 									
Course Outcome	<p>Upon completion of this course, the student should be able to:</p> <ol style="list-style-type: none"> 1. Demonstrate an understanding on Basic principles of computers and file systems 2. Design Control Structures using Python programming 3. Define classes and functions 4. Acquire the knowledge of basis in MATLAB and find vectors and matrices in MATLAB. 5. Design simple algorithms to solve problems. 									
Prerequisites: Knowledge of matrices and vectors										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	3	1	-	2	-	1	3
CO-2	2	2	-	3	-	-	2	2	2	3

CO-3	2	-	1	3	1	-	2	-	3	1
CO-4	2	-	2	3	2	-	2	-	3	2
CO-5	2	3	2	3	-	-	2	2	-	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Introduction to Python Programming (6L+6P=12)										
Relationship between computers and programs - Basic principles of computers -File systems - Using the Python interpreter -Introduction to binary computation -Input / Output									CO-1 BTL-3	
MODULE 2: Data types and Control Structures (6L+6P=12)										
Operators (unary, arithmetic, etc.) -Data types, variables, expressions, and statements -Assignment statements - Strings and string operations - Control Structures: loops and decision									CO-2 BTL-3	
MODULE 3: Modularization and Classes (6L+6P=12)										
Standard modules -Packages - Defining Classes -Defining functions - Functions and arguments (signature)									CO-3 BTL-3	
MODULE 4: MATLAB Basics , Matrices and vectors in MATLAB (6L+6P=12)										
The MATLAB environment- Basic computer programming- Variables and constants, operators and simple calculations - Formulas and functions- MATLAB toolboxes. Matrix and linear algebra review- Vectors and matrices in MATLAB- Matrix operations and functions in MATLAB.									CO-4 BTL-3	
MODULE 5: MATLAB programming (6L+6P=12)										
Algorithms and structures- MATLAB scripts and functions (m-files) - Simple sequential algorithms - Control structures (if...then, loops) Reading and writing data, file handling - Personalized functions- Toolbox structure - MATLAB graphic functions									CO-5 BTL-3	
TEXT BOOKS										

1.	Stephen J. Chapman (2012), <i>MATLAB Programming for Engineers</i> , Nelson Education Limited, USA.
2	Wesley Chun (2007), <i>Core Python Programming</i> , Prentice Hall, USA.
REFERENCE BOOKS	
1.	Rudra Pratap (2016), <i>Getting Started with MATLAB</i> , Oxford University Press, Jericho.
2.	R Nageshwara Raoda (2016), <i>Core Python Programming</i> , Dreamtech Press, New Delhi.
E BOOKS	
1.	Learn Python, Break Python: A Beginner's Guide to Programming, by Breaking Stuff Books (learnpythonbreakpython.com)
MOOC	
1.	Python 3.4.3 - Course (swayam2.ac.in)
2	Training - Courses in MATLAB, Simulink, and Stateflow - MATLAB & Simulink (mathworks.com)

COURSE TITLE	VALUE EDUCATION			CREDITS	1					
COURSE CODE	MAA0106	COURSE CATEGORY	PC	L-T-P-S	1-0-0-0					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	Values Education is an essential element of whole-person education which aims at fostering students' positive values and attitudes through the learning and teaching of various Key Learning Areas/subjects and the provision of relevant learning experiences.									
Course Objective	<ol style="list-style-type: none"> 1. To understand value education. 2. To know about salient values for life. 3. To get the idea about human rights. 4. To perceive the knowledge on environment and ecological balance. 5. To figure out social evils. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Develop the role of culture and civilization. 2. Demonstrate self-esteem and self-confidence. 3. Analysis human rights. 4. Acquire the knowledge of environment and ecological balance. 5. Demonstrate the social evils. 									
Prerequisites: Basics of Human Rights										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	3	3	-	-	-	-
CO-2	-	-	-	-	3	3	-	-	-	-

CO-3	-	-	-	-	3	3	-	-	-	-
CO-4	-	-	-	-	3	3	-	-	-	-
CO-5	-	-	-	-	3	3	-	-	-	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Value Education										(3)
Value education-its purpose and significance in the present world – Value system – The role of culture and civilization – Holistic living – balancing the outer and inner – Body, Mind and Intellectual level – Duties and responsibilities.										CO-1 BTL-3
MODULE 2: Salient Values for Life										(3)
Salient values for life – Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity, and inclusiveness, Self-esteem and self-confidence, punctuality – Time, task and resource management – Problem solving and decision-making skills – Interpersonal and Intra personal relationship – Team work – Positive and creative thinking.										CO-2 BTL-3
MODULE 3: Human Rights										(3)
Universal Declaration of Human Rights – Human Rights violations – National Integration – Peace and non-violence – Dr.A P J Kalam’s ten points for enlightened citizenship – Social Values and Welfare of the citizen – The role of media in value building.										CO-3 BTL-3
MODULE 4: Environment and Ecological Balance										(3)
Interdependence of all beings – living and non-living. The binding of man and nature – environment conservation and enrichment.										CO-4 BTL-3
MODULE 5: Social Evils										(3)
Social Evils – Corruption, Cyber-crime, Terrorism – Alcoholism, Drug addiction – Dowry – Domestic violence – untouchability – female infanticide – atrocities against women – How to tackle them										CO-5 BTL-3

TEXT BOOKS	
1.	Swami Vivekananda (2020), <i>Call to the Youth for Nation Building</i> , Advanta Ashrama, Calcutta.
2.	M.G. Cithara (2015), <i>Education and Human Values</i> , A.P.H. Publishing Corporation, New Delhi.
3.	S. K. Chakravarthy (2014), <i>Values and ethics for Organizations: Theory and Practice</i> , Oxford University Press, New Delhi.
REFERENCE BOOKS	
1.	M. K. Satchidananda (2003), <i>Ethics, Education, Indian Unity and Culture</i> , Ajanta Publications, Delhi.
2.	M. S. Das and V. K. Gupta (2000), <i>Social Values among Young adults: A changing Scenario</i> , M.D. Publications, New Delhi.
E BOOKS	
1.	https://www.learningclassesonline.com/2021/02/value-education-pdf.html
2.	https://educatorsresource.in/product-category/digital-books/value-education/
MOOC	
1.	https://www.academia.edu/13372051/VALUE_EDUCATION_IN_MOOC

SEMESTER II

COURSE TITLE	TRIGONOMETRY, VECTOR CALCULUS AND FOURIER SERIES				CREDITS	4				
COURSE CODE	MAA 0121	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	Designed to develop an understanding of topics which are fundamental to the Study of calculus, Fourier series and multiple integrals.									
Course Objective	To enable the students to learn about the expansion of trigonometric, hyperbolic functions, vector calculus and the expansions of Fourier series.									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Evaluate the expansion of trigonometric functions and hyperbolic functions. 2. Acquire the basic knowledge of logarithm of complex quantities. 3. Determine and apply the important quantities associated with vector fields such as the divergence, curl and scalar potential. 4. Examine line integral, surface integral, volume integral and inter-relations among them. 5. Find Fourier series of a given periodic function 									
Prerequisites: Knowledge in Vector Algebra, Differentiation and Integration										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	1	1	3	3	-	-	1	2	3
CO-2	2	2	-	3	2	-	-	3	2	-

CO-3	2	2	3	3	2	-	1	-	3	3
CO-4	2	2	3	3	3	-	1	3	3	2
CO-5	2	3	-	3	2	-	1	-	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Expansion in Series										(6L+6P=12)
Expansion in Series – Expansion of $\cos n\theta$, $\sin n\theta$ in a series of cosines and sines of multiples of θ – Expansions of $\cos n\theta$, $\sin n\theta$ and $\tan n\theta$ in powers of sines, cosines and tangents – Expansion of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in powers of θ – hyperbolic functions and inverse hyperbolic functions. Self-Study: Inverse hyperbolic functions. LAB: Expansions of $\cos n\theta$, $\sin n\theta$ and $\tan n\theta$ in powers of sines, cosines.									CO-1 BTL-3	
MODULE 2: Logarithm of Complex Quantities and Summation of Series										(6L+6P=12)
Logarithm of complex quantities - summation of series – when angles are in arithmetic progression, method of summation – method of differences. LAB: Summation of series									CO-2 BTL-3	
MODULE 3: Vector Differentiation										(6L+6P=12)
Scalar and vector fields – Differentiation of vectors – Gradient, Divergence and Curl-Solenoidal and irrotational vectors-Laplacian Operator. Self-Study: Laplacian Operator. LAB: Gradient, Divergence, Curl, Irrotational and solenoidal vector fields.									CO-3 BTL-3	
MODULE 4: Vector Integration										(6L+6P=12)
Integration of vectors – line integral – surface integral – Green’s theorem in the plane – Gauss divergence theorem – Stoke’s theorem - verification of the above said theorems. Self-Study: Surface Integral LAB: Solutions of Problems on Gauss Divergence Theorem, Stoke’s theorem, Green’s theorem.									CO-4 BTL-3	
MODULE 5: Fourier Series										(6L+6P=12)
Periodic functions – Fourier series of periodicity 2π – half range series, Change									CO-5 BTL-3	

of Interval and Harmonic Analysis. Self-Study: Periodic Functions LAB: Solutions of Fourier Series		
TEXT BOOKS		
1.	P. Kandasamy and K. Thilagavathi (2010), <i>Mathematics for B.Sc. Branch I, Volume I, II and IV</i> , S. Chand and Company Ltd, New Delhi.	
REFERENCE BOOKS		
1.	P. Duraipandian and Laxmiduraipandian (2017), <i>Vector Analysis</i> , Emerald Publishers. Chennai.	
2.	K. Manichavasagam Pillai and S.Narayanan (2009), <i>Trigonometry</i> , Viswanathan Publishers and Printers Pvt. Ltd. New Delhi	
E BOOKS		
1.	http://www.freebookcentre.net/maths-books-download/Calculus.-Applications-and-Theory.html	
2.	http://www.freebookcentre.net/maths-books-download/Fourier-Analysis-by-Gustaf-Gripenberg.html	
MOOC		
1.	http://www.nptelvideos.in/2012/11/mathematics-iii.html	
2.	http://www-math.mit.edu/~djk/18_01/chapter20/section03.html	
3.	https://www.whitman.edu/mathematics/calculus_online/chapter16.html	
4.	http://www.mecmath.net/calc3book.pdf	

COURSE TITLE	DIFFERENTIAL EQUATIONS AND TRANSFORMS				CREDITS	4				
COURSE CODE	MAA0122	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To impart knowledge on the method of solving Partial differential equations, and ordinary differential Equations using Laplace Transforms.									
Course Objective	This course includes the study of first order differential equations, higher order linear differential equations, Laplace transforms, numerical methods, boundary value and initial value problems, qualitative analysis of solutions, and applications of differential equations.									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Solve higher order linear differential equations. 2. Demonstrate the solution of higher order using Euler's homogeneous 3. Demonstrate competency to solve linear PDE by Lagrange's method. 4. Analyze the concepts of Laplace transforms and inverse Laplace transforms. 5. Identify the inverse LaPlace transform. 									
Prerequisites: Knowledge of ordinary and Partial Derivatives										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	1	2	3	2	-	-	1	3	2
CO-2	2	1	-	3	-	-	-	1	3	-

CO-3	-	2	2	3	3	-	1	-	3	-
CO-4	2	1	2	3	3	-	1	-	3	-
CO-5	2	-	2	3	3	-	1	3	-	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Linear First Order Differential Equation (6L+6P=12)

Ordinary Differential Equations: Equations of First Order and of Degree Higher than one –Solvable for p, x, y– Clairaut’s Equation – Simultaneous Differential Equations with constant coefficients of the form (i) $f_1(D)x + g_1(D)y = \phi_1(t)$ (ii) $f_2(D)x + g_2(D)y = \phi_2(t)$ where f_1, g_1, f_2 and g_2 are rational functions $D=d/dt$ with constant coefficients and ϕ_1, ϕ_2 explicit functions of t.

Self-Study: Clairaut’s Equation,

LAB: Solution of first order differential equations

**CO-1
BTL-3**

MODULE 2: Higher Order Linear Differential Equation (6L+6P=12)

Finding the solution of Second and Higher Order with constant coefficients with Right Hand Side is of the form where V is a function of x – Euler’s Homogeneous Linear Differential Equation.

LAB: Solution of first second differential equations

**CO-2
BTL-3**

MODULE 3: Partial Differential Equations (6L+6P=12)

Partial Differential Equations: Formation of equations by eliminating arbitrary constants and arbitrary functions –Solutions of P.D Equations – Solutions of Partial Differential Equations by direct integration – Methods to solve the first order P.D. Equations in the standard forms –Lagrange’s Linear Equations.

Self-Study: Solutions of Partial Differential Equations by direct integration

LAB: Solution of Lagrange’s and Standard PDE differential equations

**CO-3
BTL-3**

MODULE 4: Laplace Transforms (6L+6P=12)

Laplace Transforms: Definition – Laplace Transforms of standard functions – Linearity property –First Shifting Theorem – Transform of $tf(t)$, $f(t)/t$, $f'(t)$, $f''(t)$, Inverse Laplace Transforms – Applications to solutions of First Order and Second Order Differential Equations with constant coefficients.

Self-Study: First Shifting Theorem

**CO-4
BTL-3**

LAB: To find Laplace and Inverse Laplace of elementary function		
MODULE 5: Fourier Transforms		(6L+6P=12)
Fourier Integral Theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of Simple functions - Convolution theorem - Parseval's identity. LAB: To find Fourier Transform of elementary function		CO-5 BTL-3
TEXT BOOKS		
1.	P. Kandasamy and K. Thilagavathi (2014), <i>Mathematics for B.Sc – Branch – I Volume III</i> , S. Chand and Company Ltd, New Delhi.	
2.	Dr. J. K. Goyal and K.P. Gupta (2015), <i>Laplace and Fourier Transforms</i> , Pragati Prakash Publishers, Meerut.	
REFERENCE BOOKS		
1.	S. Narayanan and T. K. Manickavasagam Pillai (2011), <i>Calculus Vol III</i> , S. Viswanathan Printers and Publishers Pvt. Ltd, Chennai.	
2.	N. P. Bali. (2017), <i>Differential Equations</i> , Laxmi Publication Ltd, New Delhi.	
E BOOKS		
1.	https://www.math.hkust.edu.hk/~machas/differential-equations.pdf	
2.	http://www.mmcmadinagar.ac.in/econtent/physics/DifferentialEquationsAndTheirApplications.pdf	
MOOC		
1.	https://nptel.ac.in/courses/111105035/	
2.	http://www.nptelvideos.in/2012/11/mathematics-iii.html	
3.	https://www.digimat.in/nptel/courses/video/111108081/L02.html	
4.	https://www.math.ust.hk/~machas/differential_equations.pdf .	
5.	https://www.ijsr.net/archive/v2i1/ijsrn2013331.pdf	
6.	https://www.whitman.edu/mathematics/calculus_online/chapter17.html	

COURSE TITLE	PHYSICS-II				CREDITS	3				
COURSE CODE	PHA0116	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To expose the students to the basics of Allied Physics.									
Course Objective	<ol style="list-style-type: none"> 1. To enable the students to about the mechanics of science, electricity and elasticity. 2. To study intensively Gravitational forces, sound, optical fibers regarding. 3. To demonstrate the standard methods about the electronics and its functions. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Verify Einstein's photo electric equation by Millikan's experiment 2. Differentiate nuclear Fission and nuclear Fusion 3. Acquire an knowledge on Raman effect – Raman shift. 4. Apply the principles of LED and LCD 5. Prove Demorgan's theorems 									
Prerequisites: Knowledge of Physical Science.										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	P O-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	1	-	3	-	1	-	2	2	-	1
CO-2	2	-	1	-	2	-	-	1	2	-
CO-3	1	2	-	-	2	-	3	2	1	3

CO-4	2	-	1	-	-	-	1	-	3	-
CO-5	-	1	2	-	3	-	2	1	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Electrostatics										(9L)
Coulomb's inverse square law – Gauss theorem and its applications (Intensity at a point due to a charged sphere & cylinder), Principle of a capacitor – Capacity of a spherical and cylindrical capacitors – Energy stored in a capacitor – Loss of energy due to sharing of charges - Capacitors in series and parallel – Types of capacitors. Self-Study: Gauss Theorem										CO-1 BTL-3
MODULE 2: Modern physics										(9L)
Wave mechanics: De Broglie concept of matter waves – characteristics and calculation of De Broglie wave length -Study of De Broglie matter wave by G. P. Thomson experiment. X-rays: Continuous and Characteristic X-rays – Mosley's Law and importance – Bragg's law – Miller indices – Determination of Crystal Structure by Laue's Powder photograph method.										CO-2 BTL-3
MODULE 3: Nuclear physics										(9L)
Nucleus – Classification of Nuclei – Nuclear Size – Charge – Mass and Spin – Liquid drop model. Nuclear Radiations and their properties, particle accelerators – Betatron and Proton Synchrotron, Elementary particles and their classifications. Self-Study: Nuclear Physics										CO-3 BTL-3
MODULE 4: Laser physics										(9L)
Principles of laser – Lasing action - Population inversion – Meta stable state – Types – Nd-YAG – Helium – neon laser – applications of lasers . Raman effect – Raman shift – Stokes and anti-stokes lines										CO-4 BTL-3
MODULE 5: Digital Electronics										(9L)

<p>Number systems – conversion of binary into decimal – conversion of decimal to binary – binary addition and subtraction – Basic logic gates – NAND and NOR as an universal logic gates – De Morgan’s theorems – Boolean algebra – applications of De Morgans theorems – Half adder and full adder circuits. Self-Study: Basic Logic gates</p>	<p>CO-5 BTL-3</p>
<p>TEXT BOOKS</p>	
<p>1.</p>	<p>V. K. Mehta (2014), <i>Principles of Electronics</i>, S. Chand and Company Ltd. New Delhi.</p>
<p>REFERENCE BOOKS</p>	
<p>1.</p>	<p>R. K. Gaur, S. L. Gupta (2013), <i>Engineering Physics</i>, Dhanpat Rai Publications, 8th Edition, New DELhi.</p>
<p>2.</p>	<p>B. L. Theraja (2010), <i>Basic Electronics: Solid State</i>, S. Chand and Company Ltd, Chennai</p>
<p>3.</p>	<p>K. Thyagarajan and A. Ghatak (2010), <i>Lasers, Graduate Texts in Physics</i>, Springer Science+Business, Media, LLC.</p>
<p>E BOOKS</p>	
<p>1.</p>	<p>Allied Physics (Paper I and II), 1/e S Chand Publishing</p>
<p>MOOC</p>	
<p>1.</p>	<p>https://nptel.ac.in/courses/115103108/</p>

COURSE TITLE	PHYSICS PRACTICAL				CREDITS	2				
COURSE CODE	PHA0141	COURSE CATEGORY	PC	L-T-P-S	0-0-4-0					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	Basic Experiments in Electricity and Magnetism: Sonometer, RC Time Constant, Kirchhoff's Laws, Magnetic Field of a Current, Lenses, Young's Double Slit Experiment, Electromagnetic Induction, Ohm's Law.									
Course Objective	To learn the models and experiment in physics practical.									
Course Outcome	Upon completion of this course, the students will be able to know innovative experiments about Physics.									
Prerequisites: Higher Allied Practical – Physics.										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	1	-	-	3	2	-	1	2	-
CO-2	3	3	1	-	2	2	-	3	-	-
CO-3	3	-	-	-	-	2	1	-	2	1

CO-4	3	2	1	-	-	2	2	1	-	-
CO-5	2	-	-	-	1	2	3	2	-	3

1: Weakly related, 2: Moderately related and 3: Strongly related

**List of Experiments
(12P)**

1. Moment of inertia – Torsional pendulum method
2. Young’s modulus - Uniform bending - Optic lever method
3. Young’s modulus - Non-Uniform bending - Pin and microscope
4. Frequency of A.C - Sonometer
5. Thermal conductivity - Lee’s disc method.
6. Refractive index of a solid prism - Spectrometer
7. (i-d) curve - solid prism - Spectrometer
8. Wavelengths of spectral lines – Grating - Normal incidence - Spectrometer
9. Wavelength of spectral lines – Grating - Minimum deviation - Spectrometer
10. Air Wedge Experiment - Newton’s rings method.
11. Characteristics of Pn Junction diode
12. Verification of truth tables of logic gates.

BTL-3

TEXT BOOKS

- | | |
|----|---|
| 1. | M. N. Srinivasan, S. Balasubramanian and R. Renganathan (2017), <i>A Text book of Practical Physics</i> , Sultan Chand & Sons, New Delhi. |
|----|---|

REFERENCE BOOKS

- | | |
|----|--|
| 1. | C. C Ouseph, G. Rangarajan (2015), <i>A Text Book of Practical Physics</i> , S. Viswanathan Publisher-Part I, Chennai. |
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SEMESTER III

COURSE TITLE	MODERN ALGEBRA				CREDITS	4				
COURSE CODE	MAA0206	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	The course discusses how algebra allows us to abstract out the geometric objects and numbers.									
Course Objective	Focuses on the concepts of algebraic structures which is one of the pillars of modern Mathematics and emphasis on their properties and applications.									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Compare the properties and extend group structure to finite permutation groups. 2. Evaluate subgroups and its types. 3. Evaluate the concepts of homomorphism, isomorphism and automorphism. 4. Demonstrate ring from groups. 5. Obtain ideals and quotients from rings. 									
Prerequisites: Knowledge of basic Algebra.										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	-	2	-	-	2	-	3

CO-2	2	-	3	-	-	-	-	3	3	-
CO-3	1	2	-	-	2	-	-	3	-	2
CO-4	2	2	2	-	3	-	-	3	-	3
CO-5	2	2	-	-	-	-	-	-	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Groups and its Basic Properties (9L+3T=12)										
Sets – mappings – Relations and binary operations – Groups: Abelian group, Symmetric group -Definitions and Examples – Basic properties. Self-Study: Sets									CO-1 BTL-3	
MODULE 2: Subgroups and Normal Subgroups (9L+3T=12)										
Subgroups – Cyclic subgroup - Index of a group – Order of an element – Fermat theorem – A, Counting Principle - Normal Subgroups and Quotient Groups. Self-Study: Quotient Groups									CO-2 BTL-3	
MODULE 3: Automorphisms (9L+3T=12)										
Homomorphisms (Applications 1 and 2 are omitted) -Automorphisms – Inner automorphism – Cayley’s theorem, permutation groups.									CO-3 BTL-3	
MODULE 4: Rings (9L+3T=12)										
Definition and Examples –Some Special Classes of Rings– Commutative ring – Field –Integral domain - Homomorphisms of Rings.									CO-4 BTL-3	
MODULE 5: Ideals and Quotient Rings (9L+3T=12)										
Ideals and Quotient Rings – More Ideals and Quotient Rings – Maximal ideal - The field of Quotients of an Integral Domain.									CO-5 BTL-3	
TEXT BOOKS										

1.	I.N. Herstein (2006), <i>Topics in Algebra</i> , John Wiley and Sons, New York.
REFERENCE BOOKS	
1.	Surjeet Singh and Qazi Zameeruddin (2013), <i>Modern Algebra</i> , Vikas Publishing house, Ahmedabad.
2.	A. R. Vasishtha (2019), <i>Modern Algebra</i> , Krishna Prakashan Mandir, Meerut, India.
E BOOKS	
1.	https://www.dymocks.com.au/book/advanced-modern-algebra-by-joseph-j-rotman-9781470411763
MOOC	
1.	https://www.classcentral.com/course/swayam-modern-algebra-14201
2.	https://nptel.ac.in/courses/111/106/111106113/
3.	https://nptel.ac.in/courses/106/104/106104149/

COURSE TITLE	MATHEMATICAL ANALYSIS				CREDITS	4				
COURSE CODE	MAA0207	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	This course covers the fundamentals of mathematical analysis.									
Course Objective	<ol style="list-style-type: none"> To present a deeper and rigorous understanding of fundamental concepts like continuity, Connectivity, derivative, monotonic functions with properties and Riemann - integral. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Demonstrate the understanding of continuity, uniform continuity, compactness, and connectedness. Determine monotonic functions. Evaluate algebra of derivatives using some methods. Obtain properties of monotonic functions. Determine the Riemann integrability and the Riemann-Stieltjes integrability of abounded function. 									
Prerequisites: Knowledge in Mappings and Properties of Real Numbers										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	-	3	-	-	-	3	-

CO-2	-	2	-	-	-	-	-	2	-	3
CO-3	2	-	2	-	3	-	3	2	2	-
CO-4	2	2	-	-	1	-	-	3	2	1
CO-5	2	-	3	-	2	-	3	-	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Topological Mappings								(9L+3T=12)		
<p>Examples of continuous functions –continuity and inverse images of open or closed sets –functions continuous on compact sets –Topological mappings – Bolzano’s theorem. Self-Study: Topological mappings</p>									CO-1 BTL-3	
MODULE 2: Monotonic Functions								(9L+3T=12)		
<p>Connectedness –components of a metric space – Uniform continuity - Uniform continuity and compact sets –fixed point theorem for contractions – monotonic functions. Self-Study: Uniform continuity</p>									CO-2 BTL-3	
MODULE 3: Derivatives								(9L+3T=12)		
<p>Definition of derivative –Derivative and continuity –Algebra of derivatives – the chain rule–one sided derivatives and infinite derivatives –functions with non-zero derivatives –zero derivatives and local extrema –Rolle’s theorem –The mean value theorem for derivatives – Taylor’s formula with remainder. Self-Study: Rolle’s theorem</p>									CO-3 BTL-3	
MODULE 4: Functions of bounded variation								(9L+3T=12)		
<p>Properties of monotonic functions –functions of bounded variation –total Variation –additive properties of total variation on (a, x) as a function of x – functions of bounded variation expressed as the difference of increasing functions –continuous functions of bounded variation. Self-Study: Monotonic functions</p>									CO-4 BTL-3	

MODULE 5: The Riemann- Stieltjes integral		(9L+3T=12)
Introduction –Notation –The definition of Riemann –Stieltjes integral – linear properties –Integration by parts –change of variable in a Riemann – Stieltjes integral –Reduction to a Riemann integral.		CO-5 BTL-3
TEXT BOOKS		
1.	M. Apostol (2005), <i>Mathematical Analysis</i> , Narosa Publishing Company, Chennai.	
REFERENCE BOOKS		
1.	R.R.Goldberg (2009), <i>Methods of Real Analysis</i> , NY, John Wiley, New York.	
2.	G.F.Simmons (2011), <i>Introduction to Topology and Modern Analysis</i> , McGraw – Hill, New York	
3.	G. Birkhoff and MacLane (2017), <i>A survey of Modern Algebra</i> , Macmillian, 3 rd Edition, NewYork.	
4.	J.N.Sharma and A.R.Vasistha (2017), <i>Real Analysis</i> , Krishna Prakashan Media (Ltd), Uttar Pradesh.	
E BOOKS		
1.	Mathematical Analysis, Second Edition (ru.ac.bd)	
MOOC		
1.	https://www.whitman.edu/Documents/Academics/Mathematics/grady.pdf	
2.	https://nptel.ac.in/courses/122/101/122101003/	
3.	https://www.math.ucdavis.edu/~emsilvia/math127/chapter7.pdf	
4.	https://nptel.ac.in/courses/111/106/111106053/	

COURSE TITLE	COMPLEX FUNCTIONS				CREDITS	4				
COURSE CODE	MAA0208	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To expose the students about Complex analysis									
Course Objective	To equip the students with the understanding of the fundamental concepts of complex functions, analyticity, power series and complex integration.									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Obtain the cross ratio using bilinear transformation. 2. Calculate a function for its analyticity and find its series development. 3. Determine power series and elementary functions. 4. Obtain the relationship between conformal mapping and harmonic functions. 5. Compute contour integrals directly and by the fundamental theorem. 									
Prerequisites: Knowledge of Calculus and its types										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	2	2	-	-	2	-	3

CO-2	-	3	-	3	-	-	-	1	2	-
CO-3	2	2	3	-	3	-	-	3	2	-
CO-4	2	-	3	2	2	-	3	-	3	2
CO-5	2	2	-	3	-	-	3	3	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Complex Plane								(9L+3T=12)		
Complex number –Field of Complex numbers – Conjugation – Absolute value -Argument –Elementary Transformations i) $w=z +\alpha$ ii) $w =az$ iii) $w =1/z$. Fixed points -cross-ratio-invariance of cross-ratio under bilinear transformation –Definition of extended complex plane– Stereographic projection. Self-Study: Bilinear Transformation									CO-1 BTL-3	
MODULE 2: Analytic Functions								(9L+3T=12)		
Complex Functions- Limit of a function –continuity –differentiability – Analytical function defined in a region –necessary conditions for differentiability –sufficient conditions for differentiability –Cauchy-Riemann equation in polar coordinates –Definition of entire function. Self-Study: Entire Function									CO-2 BTL-3	
MODULE 3: Power Series and Elementary Functions								(9L+3T=12)		
Absolute convergence –circle of convergence –Analyticity of the sum of power series in the Circle of convergence (term by term differentiation of a series) Elementary functions: Exponential, Logarithmic, Trigonometric and Hyperbolic functions. Self-Study: Trigonometric Functions									CO-3 BTL-3	
MODULE 4: Harmonic Functions and Conformal Mapping								(9L+3T=12)		
Definition and determination. Conformal Mapping: Isogonal mapping –									CO-4 BTL-3	

Conformal Mapping-Mapping $z \mapsto f(z)$, where f is analytic, particularly the mappings, $w = e^z$, $w = z^2$, $w = \sin z$, $w = \cos z$, $w = z + 1/z$.		
MODULE 5: Complex Integration		(9L+3T=12)
Simply and multiply connected regions in the complex plane. Integration of $f(z)$ from definition along a curve joining z_1 and z_2 . Proof of Cauchy's Theorem (using Goursat's lemma for a simply connected region). Statement of Cauchy's integral formula for higher derivatives -Morera's theorem.		CO-5 BTL-3
TEXT BOOKS		
1.	P. Duraipandian and Laxmi Duraipandian (2006), <i>Complex Analysis</i> , Emerald Publishers, Chennai.	
REFERENCE BOOKS		
1.	Churchill (2008), <i>Complex Variable and Applications</i> , Tata McGraw Hill Publishing Company Ltd. New Delhi.	
2.	Swaminarayan (2005), <i>Theory of functions of Complex Variable</i> , S. Chand and Company, Meerut, India.	
3.	Tyagi B.S (2004), <i>Functions of Complex Variable</i> , 17th Edition, Pragati Prakasham Publishing Company Ltd, Meerut, New Delhi.	
E BOOKS		
1.	UG B.Sc. Mathematics 113 63 COMPLEX ANALYSIS 8718.pdf	
MOOC		
1.	https://nptel.ac.in/courses/111/103/111103070/	
2.	https://nptel.ac.in/courses/111/107/111107056/	
3.	https://nptel.ac.in/courses/122/103/122103012/	

COURSE TITLE	PROBABILITY AND STATISTICS				CREDITS	4				
COURSE CODE	MAA0209	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To expose the students about Complex analysis									
Course Objective	<ol style="list-style-type: none"> 1. To understand basic theoretical and applied principles of statistics. 2. Analyze statistical data using measures of central tendency, dispersion and location. 3. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Develop an understanding of the concept of population and samples. 2. Apply the basic probability for simple problems in real time. 3. Prove Bayes theorem and compute the conditional probabilities. 4. Derive the mean, variance and moment generating function for probability distributions. 5. Apply the methods of sampling 									
Prerequisites: Knowledge of Calculus and its types										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3

CO-1	2	-	2	3	2	2	-	2	-	3
CO-2	-	3	-	3	-	2	-	1	2	-
CO-3	3	2	3	3	3	2	2	3	2	-
CO-4	3	-	3	3	2	2	2	-	3	2
CO-5	3	2	-	3	-	2	2	3	1	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Measures of Central Tendency								(9L+3T=12)		
Introduction and Overview – Distinction between population and sample, and between population parameters and sample statistics –Frequency Distribution – Graphical and Tabular Representation of Data – Measures of Central Tendency (Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode, and their properties, Percentiles, Quartiles, Deciles) Self-Study: Measures of Central Tendency									CO BTL-3	
MODULE 2: Measures of Dispersion								(9L+3T=12)		
Measures of Dispersion (Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Variation, Coefficient of Mean Deviation, Coefficient of Quartile Deviation, Lorenz Curve, and Gini Coefficient) – Population moments and their sample counterparts – Skewness and Kurtosis – Correlation and Regression. Self-Study: Skewness and Kurtosis									CO-2 BTL-3	
MODULE 3: Probability Theory								(9L+3T=12)		
Elementary Probability Theory – Sample spaces and events –Probability axioms and properties - Counting techniques –Conditional probability – Theorem of Compound Probability – Bayes Theorem and Applications – Random Variable (Discrete and Continuous)									CO-3 BTL-3	
MODULE 4: Probability Distributions								(9L+3T=12)		
Probability Distributions – Expected values of Random Variables – Properties of commonly used discrete and continuous distributions – Binomial, Poisson, and Normal distributions (derivation of pmf/pdf, mean, variance, moments, moment generating functions, problems) – Joint									CO-4 BTL-3	

distribution functions of random variable. Self-Study: Joint distribution functions of random variable.		
MODULE 5: SAMPLING		(9L+3T=12)
Principal steps in sample survey – Methods of sampling – SRSWR – SRSWOR – Stratified Sampling – Multistage Sampling – Sampling distribution of sample mean and sample proportion – Mean and standard error – Standard normal, chi-square, Student’s t and F distributions – Definitions and important properties (mean and variance).		CO-5 BTL-3
TEXT BOOKS		
1.	A.M. Gun, M.K. Gupta, and B. Dasgupta (2016), <i>Fundamentals of Statistics</i> , Volume I, World Press.	
REFERENCE BOOKS		
1.	Derek Rowntree (2018), <i>Statistics Without Tears: An Introduction for Non-Mathematicians</i> , Penguin.	
E BOOKS		
1.	https://onlinestatbook.com/Online_Statistics_Education.pdf	
MOOC		
1.	https://www.coursera.org/specializations/business-statistics-analysis	
2.	https://nptel.ac.in/courses/110/107/110107114/	

COURSE TITLE	OBJECT ORIENTED PROGRAMMING USING C++				CREDITS	4				
COURSE CODE	CAB0211	COURSE CATEGORY	PC	L-T-P-S	3-0-2-0					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To develop applications for a range of problems using object-oriented programming techniques.									
Course Objective	<ol style="list-style-type: none"> 1. To study the principles of data abstraction, inheritance and polymorphism. 2. To enable the students to understand the principles of virtual functions and polymorphism. 3. To demonstrate exception handling mechanisms. 									
Course Outcome	<p>Upon successful completion of this course, the student should be able to</p> <ol style="list-style-type: none"> 1. Identify and implement the simple Object-Oriented programming concepts using classes. 2. Develop applications using friend functions, constructors and overloading mechanisms. 3. Build re-usable code using Inheritance and Runtime Polymorphism. 4. Implement exception handling, streaming and file handling mechanisms. 5. Solve real time problem using templates and Standard Template Library (STL). 									
Prerequisites: Knowledge of C program										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	-	-	-	-	2	2	-

CO-2	-	3	2	-	3	-	-	-	2	3
CO-3	2	-	2	-	3	-	3	3	-	3
CO-4	-	3	2	-	-	-	3	-	3	1
CO-5	2	-	2	-	3	-	3	3	-	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Introduction to C++ and OOP

(6L+6P=12)

Object-Oriented Paradigm – Features of Object-Oriented Programming – C++ Fundamentals – Variables - Data types – Operators - Arrays - Strings – Default arguments -Inline Functions, Reference Variables and Pointers, Dynamic Memory Management. Introduction to C++ classes –Class Objects- Access Specifiers –Accessing Class Members- Defining Member functions–Arrays of Objects - Objects as Arguments.

LAB:

- (i) Search a given number in an array.
- (ii) Perform various string manipulation functions.
- (iii) Swap two numbers using call by value and call by reference (Using pointers and reference variables).
- (iv) Create a class to read and display student/account/employee details.
- (v) Handle multiple student/account/employee records using array of objects.

**CO-1
BTL-3**

MODULE 2: Functions and Compile-Time Polymorphism

(6L+6P=12)

Working with Friend functions and Friend Classes – Static Data and Member Functions -Constructors - Parameterized Constructors - Constructors with Default Arguments- Copy Constructors- Constructor overloading- Destructors. Polymorphism- Types of Polymorphism – Compile time and Runtime - Function Overloading - Rules of Operator Overloading- Overloading of Unary and Binary Operators as Member function/Friend function.

LAB:

- (i) Add two complex numbers using friend function.
- (ii) Calculate the area of different shapes using various constructor types.
- (iii) Find average of variables with different types using function overloading.

**CO-2
BTL-3**

<ul style="list-style-type: none"> (iv) Overload unary arithmetic operators using member and friend function. (v) Overload binary arithmetic operators using member and friend function. 	
MODULE 3: Inheritance and Run Time Polymorphism (6L+6P=12)	
<p>Inheritance- Types of Inheritance – Single, Multilevel, Hierarchical, Multiple, Hybrid, Multipath and Virtual base class - Accessing Overridden Function - Constructors and Destructors in derived classes. Understanding Runtime polymorphism - Memory Management operators, Pointers to objects, Virtual Functions (concept of VTABLE), pure virtual functions, Abstract Class.</p> <p>LAB:</p> <ul style="list-style-type: none"> (i) Manipulate employee/account/student information using various Inheritance types. (ii) Implement constructors and destructors in derived classes. (iii) Read and display book details using pointers to objects. (iv) Implement the concept of virtual and pure virtual functions. 	<p>CO-3 BTL-3</p>
MODULE 4: Exception Handling, Streams and Files (6L+6P=12)	
<p>Understanding of working and implementation of Exception Handling. Streams- Unformatted and formatted console I/O operations – Manipulators, User-Defined Manipulators - Implementation of Files, Writing and Reading Objects.</p> <p>LAB:</p> <ul style="list-style-type: none"> (i) Handle arithmetic and array index out of bounds exceptions. (ii) Read and display the given text using unformatted I/O operations. Create a user-defined manipulator function. (iii) Write details of n number of books to a file, then read and display the same. (iv) Handle two files simultaneously to copy/append the content of one file to another 	<p>CO-4 BTL-3</p>
MODULE 5: Templates and Standard Template Library (9L+6P)	
<p>Generic Programming with Templates - Function Templates- Function Templates with Multiple Arguments - Overloaded Function Templates - Class Templates - Class Templates with Multiple Arguments. Standard Template Library (STL) – Components of Standard Template Library -</p>	<p>CO-5 BTL-3</p>

Containers, Algorithms and Iterators -Implementation of Sequence and Associative containers for different Algorithms using Iterator.	
LAB:	
(i) Sort n numbers using function template.	
(ii) Perform stack operations using class template.	
(iii) Perform queue operations using containers in STL.	
(iv) Perform searching and sorting using algorithms in STL.	
TEXT BOOKS	
1.	K. R. Venugopal and Rajkumar Buyya (2017), <i>Mastering C++</i> , McGraw Hill Education, 2 nd Edition.
2.	Herbert Schildt (2017), <i>C++: The Complete Reference</i> , McGraw Hill Education, 4 th Edition.
REFERENCE BOOKS	
1.	Bjarne Stroustrup (2013), <i>The C++ Programming Language</i> , Addison-Wesley Professional, 4 th Edition.
2.	Nell Dale and Chips Weems (2015), <i>Programming and Problem Solving with C++</i> , Jones and Bartlett Learning, 5 th Edition.
3	Nicolai M. Josuttis (2012), <i>The C++ Standard Library: A Tutorial and Reference</i> , Addison Wesley, 2 nd Edition.
E BOOKS	
1.	http://fac.ksu.edu.sa/sites/default/files/ObjectOrientedProgramminginC4thEdition.pdf
MOOC	
1.	https://www.edx.org/course/introduction-c-microsoft-dev210x-5
2.	https://www.coursera.org/learn/c-plus-plus-a#syllabu

SEMESTER IV

COURSE TITLE	LINEAR ALGEBRA				CREDITS	4				
COURSE CODE	MAA0220	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To make the student understand the basic concepts of functional analysis									
Course Objective	To develop understanding in the domain of matrix theory, vector spaces, linear transformations as well as the principles underlying the subject.									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Analyze the basic concepts of matrices. Evaluate the types of matrices. Learn the concepts of base and dimension of vector space Apply the Gram-Schmidt process to construct an orthonormal set of vectors in an inner product space. Demonstrate competence with the basic ideas of Matrix theory and linear transformation Linear transformation. 									
Prerequisites: Basics Knowledge of matrices										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3

CO-1	2	2	2	1	-	-	-	2	-	3
CO-2	2	2	2	1	2	-	-	1	3	-
CO-3	2	2	3	1	2	-	-	-	3	-
CO-4	2	3	1	1	3	-	-	-	3	-
CO-5	2	2	3	1	3	-	-	3	-	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Matrices								(9L+3T=12)		
Introduction – Addition and Scalar Multiplication of Matrices – Product of Matrices – Transpose of a Matrix – Matrix Inverse – Symmetric and Skew - Symmetric Matrices. Self-Study: Inverse of Matrices								CO-1 BTL-3		
MODULE 2: Conjugate and Rank of Matrices								(9L+3T=12)		
Hermitian and Skew-Hermitian Matrices – Orthogonal and Unitary Matrices – Rank of a Matrix – Characteristic Roots and Characteristic Vectors of a Square Matrix. Self-Study: Characteristics Roots								CO-2 BTL-3		
MODULE 3: Vector Spaces								(9L+3T=12)		
Elementary Basic Concepts – Subspace of a Vector space - Homomorphism – Isomorphism - Internal and External direct sums - Linear span - Linear Independence and Bases. Self-Study: Homomorphism								CO-3 BTL-3		
MODULE 4: Dual Spaces								(9L+3T=12)		
Dual Spaces – Annihilator of a subspace - Inner Product Spaces – Norm of a Vector – Orthogonal Vectors - Orthogonal Complement of a subspace – Orthonormal set. Self-Study: Orthogonal set								CO-4 BTL-3		

MODULE 5: Linear Transformations		(9L+3T=12)
Algebra of Linear Transformations – Regular, Singular Transformations – Range of T – Rank of T - Characteristic Roots – Characteristic Vectors – Matrices.		CO-5 BTL-3
TEXT BOOKS		
1.	R.Balakrishnan and M. Ramabadran (2005), <i>Modern Algebra</i> , Vikas Publishing House Pvt. Ltd, New Delhi.	
2.	I.N. Herstein (2006), <i>Topics in Algebra</i> , John Wiley and Sons, New York.	
REFERENCE BOOKS		
1.	Surjeet Singh and Qazi Zameeruddin (2004), <i>Modern Algebra</i> , Vikas Publishing house Hill, New Delhi.	
2.	A.R.Vasishtha (2015), <i>Modern Algebra</i> , Krishna Prakashan Mandir, Meerut.	
E BOOKS		
1.	https://bookauthority.org/books/best-abstract-algebra-ebooks	
MOOC		
1.	https://nptel.ac.in/courses/111/106/111106135/	
2.	https://nptel.ac.in/courses/111/101/111101115/	
3.	https://nptel.ac.in/courses/111/108/111108066/	
4.	https://nptel.ac.in/courses/115/105/115105097/	

COURSE TITLE	REAL ANALYSIS			CREDITS	4
COURSE CODE	MAA0207	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description This course covers the fundamentals of mathematical analysis.

Course Objective Aimed at exposing there a number systems that underpin the development of real analysis and in understanding various physical phenomena.

COURSE OUTCOMES Upon completion of this course, the students will be able to

1. Evaluate real and complex number systems.
2. Derive set theory.
3. Obtain elements of points set topology.
4. Demonstrate covering and compactness.
5. Apply skills in finding the limits and continuity in metric spaces.

Prerequisites: Basics of real and complex numbers

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	-	1	-	-	2	3	3
CO-2	2	2	-	-	2	-	-	2	-	-
CO-3	2	-	2	-	-	-	2	-	3	3
CO-4	2	-	2	-	3	-	2	2	-	3

CO-5	2	2	3	-	2	-	-	3	3	2
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: The Real and Complex Number Systems (9L+3T=12)										
<p>Introduction -the field axioms, the order axioms –integers –the unique Factorization theorem for integers –Rational numbers –Irrational numbers – Upper bounds, maximum Elements, least upper bound –the completeness axiom –some properties of the supremum –properties of the integers deduced from the completeness axiom- The Archimedean property of the real number system –Rational numbers with finite decimal representation of real numbers –absolute values and the triangle inequality –the Cauchy-Schwarz inequality –plus and minus infinity and the extended real number system.</p> <p>Self-Study: –Rational numbers –Irrational numbers</p>									CO-1 BTL-3	
MODULE 2: Basic Notions of a Set Theory (9L+3T=12)										
<p>Notations –ordered pairs –Cartesian product of two sets – Relations and functions –further terminology concerning functions –one–one functions and inverse –composite functions –sequences –similar sets-finite and infinite sets –countable and uncountable sets –uncountability of the real number system –set algebra –countable collection of countable sets.</p> <p>Self-Study: Composite functions</p>									CO-2 BTL-3	
MODULE 3: Elements of Point Set Topology (9L+3T=12)										
<p>Elements of point set topology: Euclidean space R^n–open balls and open sets in R^n. The structure of open sets in R^n–closed sets and adherent points–The Bolzano – Weierstrass theorem –the Cantor intersection Theorem.</p>									CO-3 BTL-3	
MODULE 4: Covering and Compactness (9L+3T=12)										
<p>Covering –Lindal of covering theorem –the Heine Borel covering theorem – Compactness in R^n–Metric Spaces –point set topology in metric spaces – compact subsets of a metric space –Boundary of a set.</p> <p>Self-Study: Boundary of a set.</p>									CO-4 BTL-3	
MODULE 5: Limits and Continuity in Metric Spaces (9L+3T=12)										

Convergent sequences in a metric space –Cauchy sequences –Completeness sequences –complete metric Spaces. Limit of a function –Continuous functions –continuity of composite functions. Continuous complex valued and vector valued functions.		CO-5 BTL-3
TEXT BOOKS		
1.	T.M.Apostol (2011), <i>Mathematical Analysis</i> , Narosa Publishing Company, 2 nd Edition, Chennai.	
REFERENCE BOOKS		
1	R.R. Goldberg (2010), <i>Methods of Real Analysis</i> , John Wiley, New York.	
2.	G.F.Simmons (2017) <i>Introduction to Topology and Modern Analysis</i> , McGraw – Hill, New York.	
3	J.N.Sharma and A.R.Vasistha (2019), <i>Real Analysis</i> , Krishna Prakashan Media Ltd. New Delhi.	
E BOOKS		
1.	http://www.uop.edu.pk/ocontents/G.%20Bartle%20,%20R.%20Sherbert,%20%E2%80%9CIntroduction%20to%20Real%20Analysis.pdf	
2.	http://bayanbox.ir/view/6039605503262807876/Problems-In-Real-Analysis-A-Workbook-With-Solutions-Aliprantis.pdf	
MOOC		
1.	https://nptel.ac.in/courses/111/105/111105069/#	
2	https://nptel.ac.in/courses/111/106/111106053/	
3.	https://www.digimat.in/nptel/courses/video/111105098/	
4.	https://nptel.ac.in/courses/111/101/111101134/	

COURSE TITLE	COMPLEX ANALYSIS				CREDITS	4				
COURSE CODE	MAA0222	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	This course covers the fundamentals of complex analysis.									
Course Objective	To familiarize the students with fundamental theorems, singularity, residues in complex functions, integrations of complex functions, meromorphic functions and their applications.									
Course Outcome	Upon completion of this course, the students will be able to <ol style="list-style-type: none"> 1. Apply the integral value using Cauchy's theorem. 2. Compute Taylor's series and Laurent's series. 3. Apply residue theorem to compute integrals. 4. Find the calculus of residues. 5. Determine meromorphic functions. 									
Prerequisites: Knowledge in Calculus and its types										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	2	1	-	-	1	-	3
CO-2	2	3	-	2	-	-	-	-	2	-
CO-3	-	3	3	2	3	-	-	3	-	3
CO-4	2	-	3	2	2	-	-	3	3	-

CO-5	2	2	-	2	-	-	-	1	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Integral Theorems (9L+3T=12)										
Results based on Cauchy's theorem (I)-Zeros-Cauchy's Inequality – Liouville's theorem –Fundamental theorem of algebra –Maximum modulus theorem –Gauss mean value theorem –Gauss mean value theorem for a harmonic function on a circle. Self-Study: Gauss mean value theorem									CO-1 BTL-3	
MODULE 2: Taylor's Series & Laurent's Series (9L+3T=12)										
Results based on Cauchy's theorem (II)-Taylor's series –Laurent's series. Self-Study: Taylor's series									CO-2 BTL-3	
MODULE 3: Singularities and Residues (9L+3T=12)										
Isolated singularities (Removable Singularity, pole and essential singularity) –Residues –Residue theorem.									CO-3 BTL-3	
MODULE 4: Real Definite Integrals (9L+3T=12)										
Evaluation using the calculus of residues – Integration on the unit circle – Integral with $-\infty$ and $+\infty$ as lower and upper limits with the following integrals: i) $P(x)/Q(x)$ where the degree of $Q(x)$ exceeds that of $P(x)$ at least 2. ii) $(\sin ax).f(x)$, $(\cos ax).f(x)$, where $a>0$ and $f(z) \rightarrow 0$ as $z \rightarrow \infty$ and $f(z)$ does not have a pole on the real axis. iii) $f(x)$ where $f(z)$ has a finite number of poles on the real axis. Self-Study: Definite Integrals									CO-4 BTL-3	
MODULE 5: Meromorphic Functions (9L+3T=12)										
Theorem on number of zeros minus number of poles –Principle of argument-Rouche's theorem– Theorem that a function which is meromorphic in the extended plane is a rational function.									CO-5 BTL-3	

TEXT BOOKS	
1.	P. Durai Pandian and Laxmi Durai Pandian (2016), <i>Complex analysis</i> , Emerald Publishers.
REFERENCE BOOKS	
1.	Churchill (2016), <i>Complex Variable and Applications</i> , Tata Mc-Graw Hill Publishing Company Ltd, New Delhi.
2.	Swaminarayan (2008), <i>Theory of functions of Complex Variable</i> , S.Chand and Company. New Delhi.
3.	Tyagi B. S. (2009), <i>Functions of Complex Variable</i> , Pragati Prakasham Publishing Company Ltd, Meerut.
E BOOKS	
1.	Mathematical Analysis, Second Edition (ru.ac.bd)
MOOC	
1.	https://nptel.ac.in/courses/111/103/111103070/
2.	https://nptel.ac.in/courses/111/106/111106094/
3.	https://nptel.ac.in/courses/122/103/122103012/

COURSE TITLE	ADVANCED STATISTICS			CREDITS	4					
COURSE CODE	MAA0223	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	<ol style="list-style-type: none"> 1. Identify areas where ethical issues may arise in statistics. 2. Demonstrate preparedness to provide guidance in statistical design and analysis. 									
Course Objective	<ol style="list-style-type: none"> 1. Understand basic theoretical and applied principles of statistics needed to enter the job force. 2. Communicate key statistical concepts to non-statisticians. 3. Gain proficiency in using statistical software for data analysis 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Understand the basics of statistical inference 2. Constructed index numbers 3. Analyze the forecasting 4. Apply the basics of non-parametric tests in real time problems 5. design sample frameworks and carry out surveys 									
Prerequisites: Knowledge in Calculus and its types										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	3	1	-	2	1	-	3
CO-2	2	3	-	3	-	-	2	-	2	-
CO-3	-	3	3	3	3	-	2	3	-	3

CO-4	2	-	3	3	2	-	2	3	3	-
CO-5	2	2	-	3	-	-	2	1	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE1: Statistical Inference (9L+3T=12)										
Point Estimation – Properties of a good estimator – Basic principles of Ordinary Least Square, Maximum Likelihood Method, Method of Moments – Interval estimation – Confidence level and Confidence interval – Testing of hypothesis – Null and Alternative hypotheses – Type I and Type II errors – Power of a test – p-Value Self-Study: Testing of Hypotheses									CO-1 BTL-3	
MODULE 2: Index Numbers (9L+3T=12)										
Statistics in Practice –Economic Statistics in India – Role of Central Statistics Office – Price Indices – Consumer Price Index – Price Indices in India – Deflating a Series – Selection of Items – Selection of a Base Period – Quality Changes – Quantity Indexes Self-Study: Price Indices									CO-2 BTL-3	
MODULE 3: Forecasting (9L+3T=12)										
Components of a Time Series: Trend Component – Cyclical Component – Seasonal Component – Irregular Component – Smoothing Methods: Moving Averages – Weighted Moving Averages – Exponential Smoothing Averages – Trend Projection – Trend and Seasonal Components: Multiplicative Model – Calculating Seasonal Indexes – Deseasonalising the Time Series – Using Depersonalized Time Series to Identify Trend – Seasonal Adjustments – Models Based on Monthly Data – Cyclical Component .									CO-3 BTL-3	
MODULE 4: Non-Parametric Methods (9L+3T=12)										
Sign Test: Small-Sample Case – Large-Sample Case – Hypothesis Test About a Median – Mann Whitney-Wilcoxon Test – Kruskal-Wallis Test – Rank Correlation.									CO-4 BTL-3	

MODULE 5: Sample Survey		(9L+3T=12)
<p>Terminology used in Sample Surveys – Types of Surveys and Sampling Methods – Survey Errors: Non-sampling Error – Sampling Error – Simple Random Sampling: Population Mean – Population Total – Population Proportion – Determine Sample Size – Stratified Random Sampling: Population Mean – Population Total – Population Proportion – Determining Sample Size – Cluster Sampling: Population Mean – Population Total – Population Proportion – Determining Sample Size – Systematic Sampling.</p> <p>Self-Study: Sample Survey</p>		<p>CO-5 BTL-3</p>
TEXT BOOKS		
1.	David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Jeffrey D. Camm, and James J. Cochran (2019), <i>Statistics for Business and Economics</i> , Cengage, 13 th Edition.	
2.	A.M. Gun, M.K. Gupta and B. Dasgupta (2016), <i>Fundamentals of Statistics</i> , Volume I, World Press.	
3.	A.M. Gun, M.K. Gupta, and B. Dasgupta (2016), <i>Fundamentals of Statistics</i> , Volume II, World Press.	
REFERENCE BOOKS		
1.	Lind, Marchal, and Wathen (2017), <i>Basic Statistics for Business and Economics</i> , 7 th Edition, McGraw Hill Education.	
E BOOKS		
1.	https://www.coursera.org/specializations/business-statistics-analysis	
2.	https://www.coursera.org/specializations/social-science	
3.	https://nptel.ac.in/courses/110/107/110107114/	
MOOC		
1.	https://www.coursera.org/courses?query=statistics	
2	https://www.edx.org/learn/statistics	
3	https://www.udemy.com/topic/statistics/	

COURSE TITLE	INTRODUCTION TO DATA SCIENCE			CREDITS	4					
COURSE CODE	CAB0225	COURSE CATEGORY	PC	L-T-P-S	3-1-0-0					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	Fundamental coursework on the standards and practices for collecting, organizing, managing, exploring, and using data.									
Course Objective	<ol style="list-style-type: none"> To use applied statistical knowledge to analyze data, derive data summaries, build predictive models, and make scientific inference. To interpret modeling results and communicate their findings to both a general and a technical audience. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Develop relevant programming abilities Demonstrate skill in data management. Execute statistical analyses with professional statistical software Develop the ability to build and assess data-based models. Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively 									
Prerequisites: Basics of forces										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	2	3	-	2	2	-	3

CO-2	-	2	-	3	1	-	2	1	2	-
CO-3	1	2	-	3	-	-	2	3	2	3
CO-4	-	3	2	2	3	-	2	-	3	-
CO-5	2	3	-	2	1	-	2	2	-	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Introduction to Data Science										(9L+3T=12)
Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues									CO-1 BTL-3	
MODULE 2: Data Collection and Data Pre-Processing										(9L+3T=12)
Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization									CO-2 BTL-3	
MODULE 3: Exploratory Data Analytics										(9L+3T=12)
Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.									CO-3 BTL-3	
MODULE 4: Model Development										(9L+3T=12)
Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In -sample Evaluation – Prediction and Decision Making.									CO-4 BTL-3	
MODULE 5: Model Evaluation										(9L+3T=12)
Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction									CO-5 BTL-3	

by using Ridge Regression – Testing Multiple Parameters by using Grid Search.	
TEXT BOOKS	
1.	David Dietrich, Barry Heller and Beibei Yang (2013), <i>Data Science and Big data Analytics: Discovering, Analyzing, Visualizing and Presenting Data</i> , Indianapolis, IN: Wiley
2.	Jojo Moolayil (2016), <i>Smarter Decisions: The Intersection of IoT and Data Science</i> , PACKT.
REFERENCE BOOKS	
1.	Cathy O’Neil and Rachel Schutt (2013), <i>Doing Data Science</i> , O’Reilly Media.
2.	Pethuru Raj and Ganesh Chandra Deka (2014), <i>Handbook of Research on Cloud Infrastructures for Big Data Analytics</i> , IGI Global, United States.
E BOOKS	
1.	(PDF) The Field Guide to Data Science (researchgate.net)
MOOC	
1.	Introduction to Data Science Coursera
2.	A Crash Course in Data Science Coursera

SEMESTER V

COURSE TITLE	NUMERICAL ANALYSIS			CREDITS	4
COURSE CODE	MAA0301	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%
Course Description	To make the student understand the basic concepts of numerical analysis				
Course Objective	<ol style="list-style-type: none"> 1. To find different numerical techniques 2. To relate algebraic and differential equations 3. To recall skills in solving problem using numerical techniques 4. To explain the forward difference problems 5. To find predictor corrector problems. 				
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Compute the solutions of algebraic and transcendental equations numerically 2. Determine the solutions of system of equations using direct and indirect methods 3. Apply the linear interpolation methods for equal and unequal intervals. 4. Evaluate differentiation and integration numerically 5. Compute the solutions of ordinary differential equations numerically <p>numerical solution of ordinary differential equations.</p>				
Prerequisites: Basics of Mathematics					
CO, PO AND PSO MAPPING					

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	3	-	-	1	-	-	3
CO-2	2	-	2	3	-	-	1	-	-	3
CO-3	2	-	2	3	-	-	1	-	-	3
CO-4	2	-	2	3	-	-	1	-	-	3
CO-5	2	-	2	3	-	-	1	-	-	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: INTRODUCTION TO NUMERICAL ANALYSIS (6L+6P=12)										
Introduction to numerical analysis – The solution of algebraic and transcendental equations – Bisection method – Iteration method – Regula-Falsi method- Newton- Raphson method. Self-Study: Transcendental equations LAB: Bisection method - Newton- Raphson method.								CO-1 BTL-3		
MODULE 2: LINEAR SYSTEM OF EQUATIONS (6L+6P=12)										
Linear System of Equations– Gauss elimination method – Gauss-Jordan method– Iterative methods – Jacobi method – Gauss-Seidal method. Self-Study: Linear system of equations LAB: Gauss Elimination method –Gauss-Jordan method.								CO-2 BTL-3		
MODULE 3:FINITE DIFFERENCES (6L+6P=12)										
Finite differences –Interpolation - Introduction – Gregory-Newton interpolation formulae – Interpolation with unequal intervals – Lagrange’s interpolation formula. Self-Study: Interpolation LAB: Trapezoidal rule -Simpson’s one third rule – Simpson’s three-eighth rule.								CO-3 BTL-3		
MODULE 4:NUMERICAL DIFFERENTIATION AND INTEGRATION (6L+6P=12)										

<p>Numerical differentiation and integration – Newton’s formulae to compute the derivative – Numerical integration – A general quadrature formula – Trapezoidal rule -Simpson’s one third rule – Simpson’s three-eighth rule. Self-Study: Numerical Differentiation LAB: Trapezoidal rule -Simpson’s one third rule</p>	<p>CO-4 BTL-3</p>
<p>MODULE 5:NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION (6L+6P=12)</p>	
<p>Numerical solution of ordinary differential equation – Taylor series method –Euler’s method – Runge-Kutta methods – Adam’s Moulton Method – Milne’s Predictor corrector method. Self-Study: Ordinary Differential Equations LAB: Euler’s method – Runge-Kutta methods</p>	<p>CO-5 BTL-3</p>
<p>TEXT BOOKS</p>	
<p>1.</p>	<p>P. Kandasamy, K.Thilagavathy, K. Gunavathy (2013), <i>Numerical Methods</i>, S. Chand & company limited, 2nd Revised Edition New Delhi.</p>
<p>2.</p>	<p>S.S Sastry (2012), <i>Introductory Methods of Numerical Analysis</i>, PHI Learning Private Limited, New Delhi.</p>
<p>REFERENCE BOOKS</p>	
<p>1.</p>	<p>Kalyan Mukherjee (2011), <i>Numerical Analysis</i>, New Central Book Agency(P) Limited, India.</p>
<p>2.</p>	<p>S.Baskar, S.Ganesh (2020), <i>Introduction to Numerical Analysis</i>, Independently Published.</p>
<p>E BOOKS</p>	
<p>1.</p>	<p>http://www.ikiu.ac.ir/public-files/profiles/items/090ad_1410599906.pdf</p>
<p>2.</p>	<p>https://www.e-booksdirectory.com/listing.php?category=407</p>
<p>MOOC</p>	
<p>1.</p>	<p>https://www.coursera.org/courses?query=numerical%20analysis</p>

2.	https://www.classcentral.com/course/intro-to-numerical-analysis-13684
3.	https://onlinecourses.swayam2.ac.in/cec20_ma11/preview

COURSE TITLE	STATICS AND DYNAMICS			CREDITS	4					
COURSE CODE	MAA0306	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	Learn the conditions under which an object or a structure subjected to time-invariant (static) forces is in equilibrium.									
Course Objective	<ol style="list-style-type: none"> 1. To enable the students to realize the nature of forces and resultant forces when more than one force acts on a particle. 2. To know about the conditions of equilibrium of couples and coplanar forces. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Analyze the various law of forces. 2. Obtain resolution and components of forces. 3. Evaluate parallel forces moment and couple. 4. Sketch the Path of a projectile 5. Differentiate between Radial and transverse components of velocity and acceleration 									
Prerequisites: Basics of forces										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	-	3	-	-	2	-	3
CO-2	-	2	-	-	1	-	-	1	2	-

CO-3	1	2	-	-	-	-	-	3	2	3
CO-4	-	3	2	-	3	-	1	-	3	-
CO-5	2	3	-	-	1	-	1	2	-	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Law of Forces								(9L+3T=12)		
<p>Forces acting at a point – Parallelogram law-triangle law –Converse of Triangle law-Polygon Law of Forces- Lame’s Theorem. Self-Study: Forces</p>								CO-1 BTL-3		
MODULE 2: Resolution and Components of Forces								(9L+3T=12)		
<p>Resolution of forces- Components of a force- Resultant of any number of Coplanar forces acting at a point- Conditions of equilibrium. Parallel Forces and Moments –Resultant of two parallel forces (Like and unlike)- Conditions of equilibrium of three coplanar forces- Moment of a force- Geometrical Representation-Sign of the moment- Unit of moment – Varignon’s Theorem on couples-Equilibrium of two couples- Equivalence of two couples. Self-Study: Moments</p>								CO-2 BTL-3		
MODULE 3: Forces Acting on a Rigid Body								(9L+3T=12)		
<p>Moment of a force about a point- Varignon’s Theorem - Coplanar forces acting on a rigid body – Theorem on three coplanar forces in equilibrium. Reduction of a system of coplanar forces to a single force and a couple - necessary & sufficient conditions of equilibrium only – Equation to the line of action of the resultant.</p>								CO-3 BTL-3		
MODULE 4: Projectiles								(9L+3T=12)		
<p>Path of a projectile-Greatest height-time of flight – Range -range on an inclined plane through the point of projection-Maximum range. Self-Study: Projectiles</p>								CO-4 BTL-3		

MODULE 5: Central Orbits		(9L+3T=12)
Radial and transverse components of velocity and acceleration – a real velocity of central orbits -Differential equation of central orbit in polar coordinates only.	CO-5 BTL-3	
TEXT BOOKS		
1.	A.V. Dharmapadam (2016), <i>Statics</i> , S.Viswanathan Printers and Publishing Pvt., Ltd. Chennai.	
2.	M.K. Venkataraman (2016), <i>Dynamics</i> , 11th Ed. Agasthiar Publications, Trichy	
REFERENCE BOOKS		
1.	P. Duraipandian and Laxmi Duraipandian (2005), <i>Mechanics</i> , S.Chand and Company Ltd. New Delhi.	
2.	P. P. Gupta (2008), <i>Statics</i> , Kedal Nath Ram Nath, Meerut.	
E BOOKS		
1.	https://www.ecourses.ou.edu/cgi-bin/ebook.cgi?topic=st	
2.	https://www.r-statistics.com/2009/10/free-statistics-e-books-for-download/	
MOOC		
1.	https://nptel.ac.in/courses/112/105/112105164/	
2.	https://nptel.ac.in/courses/122/102/122102004/	
3.	https://www.khanacademy.org/science/ap-physics-1	

COURSE TITLE	OPERATIONS RESEARCH			CREDITS	4
COURSE CODE	MAA0307	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description To expose the students to the basics of descriptive statistics.

Course Objective To familiarize students with the basic concepts, models and techniques for effective decision making, model formulation and applications

Course Outcome

Upon completion of this course, the students will be able to

1. Demonstrate the basic concepts and application of operations research in various fields.
2. Obtain the solution of LPP by simplex method.
3. Find the solution of LPP using Big M Two phase method.
4. Determine an understanding of duality in LPP.
5. Calculate the optimum solution of transportation problems.

Prerequisites: Knowledge of algebra

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	3	2	-	-	2	-	3
CO-2	-	3	-	3	-	-	3	1	3	-
CO-3	2	-	3	3	3	-	3	-	3	-
CO-4	2	3	-	3	-	-	3	3	-	2

CO-5	2	-	2	3	3	-	3	-	2	1
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Basics of Operations Research & Formulation of L.P.P										(9L+3T=12)
<p>Basics of O.R – Definition of O.R – Characteristics of O.R – Scientific methods in O.R –Necessary of O.R in Industry – O.R and Decision Making – Scope of O.R in Modern Management–Uses and limitations of O.R. Linear Programming Problem – Formulation of L.P.P. Self-Study: Basics of O.R</p>										CO-1 BTL-3
MODULE 2: Linear Programming Problem -Simplex method										(9L+3T=12)
<p>Graphical solutions of L.P.P – Problems. Simplex Method – Problems. Self-Study: Linear Programming Problem</p>										CO-2 BTL-3
MODULE 3: Big-M & Two-Phase Method										(9L+3T=12)
<p>Charne’s Penalty Method (or) Big – M Method – Two Phase Simplex method – Problems.</p>										CO-3 BTL-3
MODULE 4: Duality In L.P.P										(9L+3T=12)
<p>Duality in L.P.P – Concept of duality – Duality and Simplex Method – Problems.</p>										CO-4 BTL-3
MODULE 5: Transportation Model										(9L+3T=12)
<p>The transportation Problems – Basic feasible solution by L.C.M – NWC-VAM- optimum solutions – unbalanced Transportation problems. Self-Study: Optimum solutions.</p>										CO-5 BTL-3
TEXT BOOKS										

1.	Kantiswarup, P. K. Gupta and Man Mohan (2008), <i>Operations Research</i> , S. Chand and Sons Education Publications, New Delhi.
2.	S. Dharani Venkata Krishnan. (2014), <i>Operations Research Principles and Problems</i> , Keerthi publishing house PVT Ltd. Chennai.
REFERENCE BOOKS	
1.	Prem Kumar Gupta and D. S. Hira (2014) <i>Operations Research</i> , S. Chand & Company Ltd. New Delhi.
E BOOKS	
1.	https://nptel.ac.in
2.	http://ebooks.lpude.in.operation research
MOOC	
1.	https://nptel.ac.in/courses/111/102/111102012/
2.	https://nptel.ac.in/courses/111/104/111104027/

COURSE TITLE	DISCRETE MATHEMATICS			CREDITS	4					
COURSE CODE	MAA0308	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To make the student understand the basic concepts of Insurance									
Course Objective	1. Prepare students to develop mathematical foundations to understand, create mathematical arguments and focuses on the Formal languages, Automata, Lattices, Boolean Algebra and Graphs									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> Analyze the mathematical logical operations. Demonstrate an understanding of relations and functions. Determine formal languages and automata. Analyze about partially ordered sets, Boolean algebra, lattices and their types. Acquire the knowledge of basis in graphs 									
Prerequisites: Knowledge of functions and relations										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	-	3	1	-	1	-	-	2	-	3
CO-2	2	2	-	-	2	-	-	1	3	-
CO-3	2	-	3	-	-	-	1	1	3	2

CO-4	-	2	3	-	3	-	-	-	3	-
CO-5	2	3	-	-	3	-	1	3	-	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE1: Mathematical logic										(9L+3T=12)
Connectives, well-formed formulas, Tautology, Equivalence of formulas, Tautological-implications, Duality law, Normal forms, Predicates, Variables, Quantifiers, Free and bound Variables. Theory of inference for predicate calculus. Self-Study: Tautology									CO-1 BTL-3	
MODULE 2: Relations and Functions (9L+3T=12)										
Composition of relations, Composition of functions, Inverse functions, one-to- one, onto, one-to-one& onto functions, Hashing functions, Permutation function, Growth of functions. Algebra -structures: Semi groups, Free semi groups, Monoids. Self-Study: Functions									CO-2 BTL-3	
MODULE 3: Formal Languages and Automata										(9L+3T=12)
Regular expressions, Types of grammar, Regular grammar and finite state automata, Context free and sensitive grammars. Self-Study: Formal Languages									CO-3 BTL-3	
MODULE 4: Lattices and Boolean Algebra										(9L+3T=12)
Partial ordering, Poset, Lattices, Boolean algebra, Boolean functions, Theorems, Minimization of Boolean functions (Karnaugh Method only). Self-Study: Boolean Algebra									CO-4 BTL-3	
MODULE 5: Graphs										(9L+3T=12)
Directed and undirected graphs, Paths, Reachability, Connectedness, Matrix representation, -Euler paths, Hamiltonian paths, Trees, Binary trees - theorems, and applications.									CO-5 BTL-3	

TEXT BOOKS	
1.	J. P Tremblay and R.P Manohar (2017), <i>Discrete Mathematical Structures with Applications to Computer Science</i> , Mc. Graw Hill.
REFERENCE BOOKS	
1.	Oscar Levin (2016), <i>Discrete Mathematics</i> , Northern Colorado.
E BOOKS	
1.	mth202.pdf (iitk.ac.in)
MOOC	
1.	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.] https://nptel.ac.in/courses/106/106/106106094/
2.	https://nptel.ac.in/courses/111/107/111107058/

COURSE TITLE	THREE-DIMENSIONAL ANALYTICAL SOLID GEOMETRY				CREDITS	4				
COURSE CODE	MAA0309	COURSE CATEGORY	PC	L-T-P-S	3-1-0-0					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To enable students to deepen the knowledge in various concepts of Analytical Solid Geometry.									
Course Objective	<ol style="list-style-type: none"> 1. To understand the basic concepts of three-dimensional object like Plane 2. To understand the concepts of three-dimensional object like Straight lines 3. To understand the concepts of three-dimensional object like Sphere 4. To understand concepts of three-dimensional object like Cone 5. To perceive the concept of three-dimensional object like Cylinder 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Obtain equation of Plane 2. Determine the shortest distance between straight lines 3. Find equation of Sphere 4. Derive a condition for the general equation of the second degree to represent a cone 5. Classifying the right circular cylinder and enveloping cylinder 									
Prerequisites: Basics of Analytical Solid Geometry										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	-	1	2	-	-	3	3	-
CO-2	2	2	-	1	2	-	-	3	3	-
CO-3	2	-	-	1	-	-	-	3	3	-
CO-4	2	3	-	1	-	-	-	3	3	-

CO-5	2	-	3	1	-	-	-	3	3	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: PLANE										(9L+3T=12)
General equation of a plane – Equation of a plane in the normal form – Angle between planes – Plane through three given points – Equation of a plane through the line of intersection of two planes.										CO-1 BTL-3
MODULE 2: STRAIGHT LINE										(9L+3T=12)
Symmetrical form of a straight line – Image of a point with respect to a plane – Image of a line with respect to a plane – Length and equation of the shortest distance between two skew lines - Coplanar lines.										CO-2 BTL-3
MODULE 3: SPHERE										(9L+3T=12)
Equation of the sphere – Length of the tangent – Tangent plane – Section of a sphere by a plane – Orthogonal spheres – Equation of a sphere through a given circle.										CO-3 BTL-3
MODULE 4: CONE										(9L+3T=12)
Equation of a cone with a given vertex and a given guiding curve - Equation of a cone with its vertex at the origin - Condition for the general equation of the second degree to represent a cone - Right circular cone – Enveloping cone - Tangency of a plane to a cone.										CO-4 BTL-3
MODULE5: CYLINDER										(9L+3T=12)
Equation of a cylinder with a given generator and a given guiding curve - Right circular cylinder - Enveloping cylinder – Enveloping cylinder as a limiting form of an enveloping cone.										CO-5 BTL-3
TEXT BOOKS										
1.	T. K. ManickaVachagom Pillay (2011), <i>Analytical Geometry (Three Dimensions)</i> , S. Viswanathan Printers and Publishers Pvt. Ltd. Chennai.									
REFERENCE BOOKS										
1.	P. R. Vittal (2014), <i>Coordinate Geometry</i> . Margham Publishers, Chennai, Reprint									
2.	P. Duraipandian and Lakshmi Duraipandian (2011), <i>Analytical Geometry – 3D</i> , Emerald Publishers, Chennai.									
E BOOKS										

1.	https://www.amazon.in/Textbook-Analytical-Geometry-Three-Dimensions/dp/812240300X
2.	https://ebook.mediadata.website/a-textbook-of-analytical-geometry-of-three-dimensions-2nd.pdf
MOOC	
1.	https://www.doubtnut.com/iit-solutions/chapter-three-dimensional-geometry--topic-plane-1
2.	https://edurev.in/studytube/Introduction-to-Three-Dimensional-Geometry--Class-/e4532cc8-3146-40cd-8e56-d79c03d3c7f7_v

SEMESTER VI

COURSE TITLE	NUMBER THEORY				CREDITS	4				
COURSE CODE	MAA0319	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To study of the integers, their additive and multiplicative structures and their properties that set them apart from other rings.									
Course Objective	To enhance the knowledge in the basic concepts of number theory, fundamental definitions, theorems									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Acquire the knowledge of basis in number theory. 2. Analyze and apply the concepts of divisibility and primes 3. Describe the fundamental theorem of Arithmetic. 4. Demonstrate an understanding on the theory of congruence. 5. Prove fermatas theorem. 									
Prerequisites: Knowledge of elements number theory										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	2	2	-	2	-	-	2	3	3
CO-2	2	3	3	-	3	-	-	2	2	3
CO-3	2	2	2	-	2	-	-	3	3	3

CO-4	2	3	3	-	3	-	1	3	3	3
CO-5	2	2	3	-	3	-	1	3	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Early Number Theory										(9L+3T=12)
Peano's Axiom - Mathematical Induction - The Binomial Theorem - Early Number Theory. Self-Study: Introduction to Number Theory									CO-1 BTL-3	
MODULE 2: Divisibility Theory in Integers										(9L+3T=12)
Divisibility Theory in Integers - The Division Algorithm - The G.C.D. - Euclidean Algorithm - Extended Euclidean Algorithm - The Diophantine Equation $ax + by = c$ Self-Study: The Division Algorithm									CO-2 BTL-3	
MODULE 3: Primes and their Distributions										(9L+3T=12)
Primes and their Distributions - The fundamental Theorem of Arithmetic - The sieve of Eratosthenes - The Gull Conjecture. Self-Study: Primes									CO-3 BTL-3	
MODULE 4: The Theory of Congruence										(9L+3T=12)
The Theory of Congruence - Basic Properties of Congruence - Special Divisibility test – Linear Congruence- Chinese Remainder Theorem-Prime modulus- Power residues.									CO-4 BTL-3	
MODULE 5: Fermat's Theorem										(9L+3T=12)
Fermat's Theorem - Fermat's factorization method - The Little theorem - Wilson's theorem.									CO-5 BTL-3	
TEXT BOOKS										

1.	David M. Burton (2000), <i>Elementary Number theory</i> - Brown Publishers, Dubuque, Iowa.
2.	Neville Robinns, (2017), <i>Beginning Number Theory</i> , Narosa Publication House Pvt. Ltd, 2 nd Edition, Delhi.
REFERENCE BOOKS	
1.	Ivan Nivan and H (2001), <i>An Introduction to theory of Numbers</i> , Zuckerman, Wiley.
2.	S.Kumaravelu and Susheela Kumaravelu(2002), <i>Elements of Number Theory</i> , Raja Sankar offset Printers.
E BOOKS	
1.	https://www.e-booksdirectory.com/listing.php?category=138
2.	https://www.kobo.com/us/en/ebooks/number-theory
MOOC	
1.	https://nptel.ac.in/courses/111/103/111103020/
2.	https://nptel.ac.in/courses/111/101/111101137/

COURSE TITLE	GRAPH THEORY				CREDITS	4				
COURSE CODE	MAA0320	COURSE CATEGORY	PC	L-T-P-S	3-1-0-1					
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME										
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%	5%	5%	50%					
Course Description	To make the student understand the basic concepts of Graph Theory									
Course Objective	<ol style="list-style-type: none"> 1. To introduce students with the fundamental concepts in Graph Theory. 2. To translate real life situations to diagrammatic representations. 									
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Demonstrate an understanding on basics concepts of graph theory. 2. Develop problem solving skills and thereby solve real life problems. 3. Analyze the nature of acyclic connected graphs. 4. Determine a minimal spanning tree for a given weighted graph. 5. Develop an understanding on planar graphs and coloring. 									
Prerequisites: Knowledge of mathematical proof technique and basic linear algebra.										
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	2	-	2	-	3	-	-	-	2	3
CO-2	2	-	2	2	-	-	-	3	-	3
CO-3	2	-	2	2	3	-	-	-	3	3
CO-4	2	-	1	2	-	-	3	-	2	2

CO-5	2	-	3	2	1	-	3	-	2	-
1: Weakly related, 2: Moderately related and 3: Strongly related										
MODULE 1: Basic Concepts										(9L+3T=12)
Definition of graph and examples – incidence and degree – subgraphs – complement of a graph – intersection graphs and line graphs – isomorphism – operation on graphs. Self-Study: Graphs										CO-1 BTL-3
MODULE 2: Connectivity of a Graph										(9L+3T=12)
Paths and cycles – connectedness and connectivity – components of a graph – cut points and bridges – blocks – Menger’s theorem – matrices related to a graph. Self-Study: Paths & Cycles										CO-2 BTL-3
MODULE 3: Trees and Properties										(9L+3T=12)
Trees – characteristics of trees – center of a tree – spanning tree in graph – minimum spanning tree algorithm – diameter of graph – average distance of graph. Self-Study: Trees										CO-3 BTL-3
MODULE 4: Various Graphs										(9L+3T=12)
Eulerian graphs – Konigsberg bridge problem – Hamiltonian graphs – chordal graph – weighted graph – Cayley graph, hypercube network and their properties.										CO-4 BTL-3
MODULE 5: Planarity and Colourability										(9L+3T=12)
Planarity – colourability – chromatic number – five colour theorem – four colour problem – matching – independent sets and coverings – perfect graphs. Self-Study: Planarity										CO-5 BTL-3
TEXT BOOKS										

1.	Junming Xu (2001), <i>Topological Structure and Analysis of Interconnection Networks</i> , Kluwer Academic Publishers, The Netherlands.
2.	Douglas B. West (2010), <i>Introduction to Graph Theory</i> , Prentice Hall of India, Second Edition.
REFERENCE BOOKS	
1.	Arumugam and Ramachandran (2017), <i>Invitation to Graph Theory</i> , New gamma publishing house, Palayamkottai.
2.	Narsingh Deo (2016), <i>Graph Theory with Applications to Engineering & Computer Science</i> , Dover publications, New York.
E BOOKS	
1.	https://b-ok.asia/book/3289235/25da6f
MOOC	
1.	https://www.coursera.org/learn/graphs
2.	https://www.coursera.org/specializations/data-structures-algorithms

COURSE TITLE	PROJECT						CREDITS	12		
COURSE CODE	MAB0321	COURSE CATEGORY			PC	L-T-P-S	0-0-24-0			
Version	1.0	Approval Details				LEARNING LEVEL	BTL-3			
ASSESSMENT SCHEME										
CIA	80%					ESE	20%			
Course Outcome	<p>Upon completion of the project, the students will be able to</p> <ol style="list-style-type: none"> 1. Identify the problem and work for the real life needs of the society 2. Derive practical solutions to the societal problem 3. Apply the importance of Engineering concepts and its relevant application 									
CO, PO AND PSO MAPPING										
CO	PO-1	PO-2	P O -3	P O- 4	P O- 5	PO-6	PO-7	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	3	2	2	3	3	3	3
CO-2	3	2	-	3	2	2	3	3	3	3
CO-3	3	-	-	3	-	2	3	3	3	3
1: Weakly related, 2: Moderately related and 3: Strongly related										
PROJECT										
<p>In this project, each individual is expected to design and develop practical solutions to real life problems related to Industry and Information Technology research. Software usage should be followed during the development. The theoretical knowledge gained from the subject in the current and previous semesters should be applied to develop effective solutions to various applications. At the end of the project the individual should submit a complete report of the project work carried out. Assessment is made as follows</p>										
Assessment Model										
Review / Exam		Weightage			Rubrics					
First Review		10%			Presentation(5%)+Viva-Voce(5%)					
Second Review		20%			Presentation(10%)+Viva-Voce(10%)					
Third Review & Demo		35%			Presentation(10%)+Viva-Voce(10%)+Demo(15%)					
Report		15%			Report to be submitted in soft binding					
Final Viva-Voce		20%			Presentation(10%)+Viva-Voce(10%)					
TOTAL		100%			100%					