Department of Applied Mathematics
Delhi Technological University,
(Formerly Delhi College of Engg.)
Bawana Road, Delhi – 42.

Integrated B.Sc. And M.Sc. Mathematics

I Year: First Semester

Teaching Scheme					Contact Hours/Week			Exam Duration (h)		Relative Weights (%)				
S. No.	**Subject Code**	**Course Title**	**Course Type**	**Credit**	**L**	**T**	**P**	**Theory**	**Practical**	**CWS**	**PRS**	**MTE**	**ETE**	**PRE**
1	IMSMA 101	Calculus-I	DCC 1	4	3	1	0	3	0	25	-	25	50	-
2	IMSMA 103	Analytical Geometry	DCC 2	4	3	1	0	3	0	25	-	25	50	-
3	IMSMA 105	Abstract Algebra-I	DCC 3	4	3	1	0	3	0	25	-	25	50	-
4	IMSMA 107	Mathematics-I	GEC 1	4	3	1	0	3	0	25	-	25	50	-
5	IAEC*	AEC	AEC 1	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
6	ISEC	ISEC Elective 1	SEC 1	2	0	0	4	0	3	-	50	-	-	50
7	IVAC*	VAC	VAC 1	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
Total				**22**										
I Year: Second Semester														
1	IMSMA 102	Calculus-II	DCC 4	4	3	1	0	3	0	25	-	25	50	-
2	IMSMA 104	Real Analysis-I	DCC 5	4	3	1	0	3	0	25	-	25	50	-
3	IMSMA 106	Ordinary Differential Equations	DCC 6	4	3	1	0	3	0	25	-	25	50	-
4	IMSMA 108	Mathematics-II	GEC 2	4	3	1	0	3	0	25	-	25	50	-
5	IAEC*	AEC	AEC 2	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
6	ISEC	ISEC Elective 2	SEC 2	2	0	0	4	0	3	-	50	-	-	50
7	IVAC*	VAC	VAC 2	2	2/1/0	0	0/2/4	3/3/0	0/2/3	25/15/0	0/25/50	25/20/0	50/40/0	0/0/50
Total				**22**										

*TO BE FLOATED CENTRALLY

IMSMA 109	Programming Fundamentals	ISEC Elective 1
IMSMA 111	Basic IT Tools	

IMSMA 110	MATLAB Programming	ISEC Elective 2
IMSMA 112	Advanced Spreadsheet Tools	

FIRST SEMESTER

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 101:	**L**	**T**	**P**	NIL
Calculus-I	3	1	0	

Course Objective: To acquire knowledge in calculus of single variable

Course Outcome (CO):

CO1	Describe the properties of a single variable function that may lead to the concept of differentiation.
CO2	Describe the approximation of single variable function and discuss the extremum of the function.
CO3	Analyze the characteristics of different curves in cartesian and polar coordinate system.
CO4	Evaluate indefinite and definite integrals using various techniques and apply it to determine the area.
CO5	Apply the integral to calculate lengths of curves, and determine the surface area and volume of solids of revolution.

S. No.	Contents	Contact Hours
1.	Functions of Single variable, Limits, Continuity and Derivative of a function, Successive differentiation, Leibnitz Rule.	08
2.	Maclaurin's and Taylor's series expansion, Point of inflexion, Maxima and Minima. Applications in estimation of error and approximation.	09
3.	Asymptotes, Curve tracing (Cartesian & polar), Derivative of an arc, curvature, radius of curvature.	10
4.	Indefinite and definite integrals, Reduction formulae, Area under the curve.	09
5.	Lengths of curves, Surface of a solid of revolutions, Volume of a solid of revolutions.	09
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/ Reprint
1.	“Calculus” by Howard Anton, Wiley publications	2015
2.	"Calculus and Analytic Geometry" by George B. Thomas Jr., Ross L. Finney, Pearson Education India	2010
3.	“Differential Calculus” by Gorakh Prasad, Pothishala Pv Ltd.	2017
4.	“Advanced Engineering Mathematics” by R.K.Jain and S.R.K. Iyengar, Narosa; 1st edition	2002

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 103	**L**	**T**	**P**	Knowledge of two-dimensional geometry
Analytical Geometry	3	1	0	

Course Objective: To develop knowledge on the three dimensional geometry that may help the students to view and understand the three dimensional object very clearly.

Course Outcome (CO):

CO1	Describe the co-ordinates with reference to three-dimensional space and apply it to understand the fundamental concepts.
CO2	Analyze the equation of a plane and apply it to understand the geometry of the planes.
CO3	Formulate the parametric equation of a straight line that may require in different branches of mathematics.
CO4	Describe the sphere as a ball in three-dimensional space and apply it to study the different properties of a sphere.
CO5	Define quadric surfaces and study a particular quadric surface known as cone. Describe a general equation of second degree that represents a cone.

S. No.	Contents	Contact Hours
1.	Rectangular Cartesian Co-ordinates, Distance between two points, Co-ordinates of a point dividing the join of two points in a given ratio, Projections, Direction Cosines, Direction ratios, Angle between two straight lines, Lagrange's identity.	09
2.	A first degree equation represents a plane, Equation of planes in different forms, Planes passing through three given points, Angle between two planes, Distance of a point from a plane, Position of the origin, Plane through the intersection of two intersecting planes.	09
3.	Equation of a straight line, Equation of a straight line in symmetrical form, Straight line passing through two given points, Plane through a given straight line, Condition of co-planarity of two straight lines, Distance of a point from a straight line, Shortest distance between two skew lines.	09
4.	Equation of a sphere, Equation of a sphere on a diameter with given extremities, Equation of a circle, Intersection of two spheres, Spheres through a given circle, A straight line and a sphere, Equation of the tangent plane at a point, Condition of tangency.	09
5.	Quadric surfaces, Definition of the cone, Cone with its vertex at the origin, Condition for the general equation of the second degree to represent a cone, General equation of a cone containing the axes, Equation of the cone with the origin as vertex and a given curve as base.	09
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/ Reprint
1.	J. G. Chakravorty and P. R. Ghosh, Advanced Analytical Geometry, U. N. Dhur and Sons Pvt. Ltd., Fifth Edition	1994
2.	W. H. McCrea, Analytical Geometry of Three Dimension, Dover Publication,	2006
3.	D. M. Y. Sommerville, Analytical Geometry of Three Dimension, Cambridge University Press	2016
4.	A. Mukherjee and N K Bej, Analytical Geometry of Two and Three Dimension, Third Edition, Books and Allied Pvt. Ltd.	2009
5.	Robert J. T. Bell, An elementary treatise on coordinate geometry of three dimension, Ingram Short title.	2018

Details of Course:

Course Title	Course Structure			Pre-Requisite
IMSMA 105	**L**	**T**	**P**	NIL
Abstract Algebra-I	**3**	**1**	**0**	

Course Objective: To acquire knowledge of fundamentals of Groups, Rings and Matrix Theory.

Course Outcome (CO):

CO1	Apply properties of numbers and different operations on it.
CO2	Describe the different columns of a matrix as a vector and analyse it in terms of eigenvalues and eigenvectors.
CO3	Analyze the properties of groups and apply it to study different types of groups.
CO4	Use tests to identify the subgroups and understand different properties of cyclic groups.
CO5	Describe the concepts of rings and other different algebraic structure.

S. No.	Contents	Contact hours
1.	Properties of numbers, Modular Arithmetic, Mathematical Induction, Equivalence relations, Functions and permutations.	9
2.	Elementary row/column transformations, Rank of a matrix, Inverse of a Matrix, Solutions of system of linear equations, linear Independence and dependence, Eigenvalues and Eigenvectors	9
3.	Introduction to Groups, symmetric groups, Dihedral groups, Matrix Groups, Quaternion groups, Group of Congruence classes. Group Properties.	9
4.	Subgroups tests, Examples of subgroups, Order of group and order of an element, Cyclic groups and its properties.	9
5.	Ring, Subring Tests, Examples of Subrings, Zero Divisors, Integral domain, Field, Ideals and properties of ideals.	9
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/ Reprint
1.	N. S. Gopalakrishnan, University Algebra, New Age International Publishers	2017
2.	I. N. Herstein, Topics in Algebra(2nd Edition), Wiley Eastern Limited	2019
3.	Joseph A. Gallian, Contemporary Abstract Algebra (4th Ed.), Narosa Publishing House.	2017
4.	D. S. Dummit and R. M. Foote, Abstract Algebra (3rd Edition), John Wiley and Sons.	2009
5.	Khanna and Bhamri, A course in Abstract Algebra(5thEdition), Vikas Publishing House.	2017

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 107: GEC – I	**L**	**T**	**P**	Knowledge of set theory
Mathematics – I	3	1	0	

Course Objective: To gain knowledge in the field of calculus of function of single variable and multi-variable.

Course Outcome (CO):

CO1	Understanding the concept of differential calculus in one dimension.
CO2	Describe the characteristic of the function in two variables.
CO3	Explain the nature of the curve in cartesian and polar coordinate.
CO4	Describe the introductory concept of integral calculus and explain the integral where either upper limit or lower limit or the integrand is not defined.
CO5	Apply double and triple integral to obtain surface area and the volume generated.

S. No.	Contents	Contact Hours
1.	Limit and Continuity of functions of a single real variables, Differentiability of functions, Successive differentiation, Rolle's Theorem, Lagrange's Mean value theorem, Taylor's theorem with Lagrange's form of remainder, Taylor's series, Maclaurin's series.	09
2.	Limit and Continuity of functions of two or more variables. Taylor's theorem for two variables, Partial derivatives, total derivative and differentiability, Chain rule for one and two independent parameters, Maxima and Minima, Method of Lagrange's multiplier.	09
3.	Some important curves, their equations and shapes, Tangent and Normals, Curvature, Asymptotes, Curve Tracing.	08
4.	Basic Methods of Integration, Reduction Formulae, Definite Integral as a limit of sum, Sequence and series of functions: Power Series, Improper Integral, Gamma and Beta Function.	09
5.	Double integral, Iterated or repeated integral, change of order of integration. Triple integral. Cylindrical and spherical coordinates. Change of variables in double integrals and triple integrals. Transformation of double and triple integrals (problems only). Determination of volume and surface area by multiple integrals (problems only).	10
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/ Reprint
1.	James Stewart, Multivariable Calculus, Concepts and Contexts, 2nd Ed., Brooks /Cole, Thomson Learning, USA.	2005
2.	M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.	2007
3.	G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi.	2010
4.	E. Marsden, A. J. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer (SIE).	2005
5.	G. Prasad, Textbook of Integral Calculus and Elementary Differential Equations, Pothishala Pvt. Ltd.	2017

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 109: SEC-1	**L**	**T**	**P**	NIL
Programming Fundamentals	0	0	4	

Course Objective: The objective of the course is to understand the basic principles of programming languages and provide design & development basic programming skills. This course also introduces problem-solving methods and program development.

Course Outcome (CO):

CO1	Design algorithmic solutions for use on computers and approach the programming task using procedural and Object-Oriented Programming techniques.
CO2	Write constructs for console input and output, apply basic operators, and perform sequential Processing, utilize the basic control.
CO3	Apply decision structures, loops, storage class, and functions.
CO4	Apply data in arrays, pointers, and data files.
CO5	Develop effective and efficient programs in C and C++.

S. No.	Contents	Contact Hours
1.	Introduction: Concepts of algorithm, flow chart, Basics of Computer Languages, Compilers, Interpreter, Programming Environments and Debugging. Introduction to C programming - Data types, Expressions and Operators-Arithmetic, unary, logical, bitwise, relational, assignment, comma operators. Data conversions. Input/Output statements.	08
2.	Control statements: While, do-while, for statements, nested loops, if else, switch, break, Continue, and goto statements, Iterations. Concept of subprograms. Functions: Storage class -Scope and extent of variables, Argument types- actual, formal, dummy. Function definition, declaration, prototype. Recursion.	08
3.	Pre-processor directives: headers and library functions, macros. Array: Array representation, Operations on array elements, using arrays, multidimensional arrays. Strings, operations on strings. Structures & Unions: Declaration and usage of structures and Unions, typedef.	08
4.	Pointers: Pointer and address arithmetic, pointer operations and declarations, pointer and arrays, pointer to structure. Call by value, call by reference. Dynamic memory allocation.	10
5.	File Handling: Declaration of files, types of files File pointer. File input/ output and usage. Object Oriented Programming: OOPS concepts, OOP languages- C++, Python etc.	10
	Total	**44**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/ Reprint
1.	C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall 2nd Edition. ISBN-13 - 978-0131103627	1988
2.	C Programming for Beginners - The C Guru	2016
3.	Let us C by Kanetkar, Y BPB Publications, 15th edition .	2016
4.	Programming in ANSI C by E Balagurusamy , McGraw Hill Education (India) Private Limited Sixth Edition. ISBN-13 : 978-1259006821	2013

List of Experiments

1. WAP creates variables of numeric data types and performs arithmetic operations on them.
2. WAP to declare variables of string datatype and perform different operations on them.
3. Write a program to reverse a number.
4. Compute the sum of the first n terms of the following series. S= 1+1/2+1/3+1/4 + ….
5. Check if the given string is palindrome or not.
6. WAP to check if a number is prime or not.
7. WAP to generate Fibonacci series using recursion and iteration.
8. WAP to swap two numbers using pointers.
9. WAP to merge two sorted arrays.
10. WAP to add two complex numbers by passing structure to a function.
11. Create a class Employee that stores employees details. Include the following member functions: printName() and printSalary()

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 111: SEC-1	**L**	**T**	**P**	NIL
Basic IT Tools	0	0	4	

Course Objective: The objective of the course is to enable students to develop IT skills that are a prerequisite in today's work environment and equip them with basic computing skills that will enhance their employability in general. This will help them to analyze and present information in a meaningful manner.

Course Outcome (CO):

CO1	Apply word-processor to generate documents with appropriate formatting, layout, review and referencing.
CO2	Manage data in worksheets and workbooks and analyze it using spreadsheet functions and inbuilt formulas.
CO3	Draw analysis on data using spreadsheets to make decisions.
CO4	Make meaningful representations of data in the form of charts and pivot tables.
CO5	Manage data in database tables and use the same for generating queries, forms and reports.

S. No.	Contents	Contact Hours
1.	Software Skills: Basics of MATLAB, Mathematica, LaTeX: General Structure of LaTeX File, Images, Tables and Equations in LaTeX, Beamer Presentations. Basics of Excel.	10
2.	Word Processing - Creating and saving your document, displaying different views, working with styles and character formatting, working with paragraph formatting techniques using indents, tabs, alignment, spacing, bullets and numbering and creating borders; Page setup and sections: Setting page margins, orientation, headers and footers, end notes and foot notes, creating section breaks and page borders; Working with tables: Creating tables, modifying table layout and design, sorting, inserting graphics in a table, table math, converting text to table and vice versa; Word Processing II - Create newspaper columns, indexes and table of contents, Spell check your document using inbuilt and custom dictionaries, checking grammar and style , using Thesaurus and finding and replacing text; Create bookmarks, captions and cross referencing, adding hyperlinks, adding sources and compiling and bibliography; Mail merge: Creating and editing your main document and data source, sorting and filtering merged documents and using merge instructions like ask, fill-in and if-then-else; Linking and embedding to keep things together.	12
3.	Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving from selected cells, handling operators in Formulae, Functions: Mathematical, Logical, statistical, text, financial, Date and Time functions, Using Function Wizard. Formatting a Worksheet: Formatting Cells – changing data alignment, changing date, number, character or currency format, changing font, adding borders and colors, Printing worksheets, Charts and Graphs – Creating, Previewing, Modifying Charts.	12

4.	Presentations - Creating, Opening and Saving Presentations, Creating the Look of Your Presentation, Working in Different Views, Working with Slides, Adding and Formatting Text, Formatting Paragraphs, Creating & using Master Slide, Checking Spelling and Correcting Typing Mistakes, Making Notes Pages and Handouts, Drawing and Working with Objects, Adding Clip Art and other pictures, Designing Slide Shows, Running and Controlling a Slide Show, Printing Presentations. Working in Different Templates Inserting an animation o Inserting a sound o Inserting a movie file o Managing slide show and animation, Providing Aesthetics to Slides & Printing, Enhancing Text Presentation, Working with Color and Line Style, Adding Movie and Sound, Adding Headers, Footers and Notes,	10
	Total	**44**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/ Reprint
1.	Joan Lambert, Microsoft Office 2016, 1st Edition, Microsoft Press. 2015	2016
2.	Stefan Kottwitz, LaTeX Cookbook, Packt Publishing. 2015	2015
3.	Stormy Attaway, Matlab: A Practical Introduction to Programming and Problem Solving. 2016	2016
4.	Stefan Wolfram, The Mathematica Book, Wolfram Media Inc. 2004	2004
5.	Linda Foulkes, " Learn Microsoft Office 2019: A comprehensive guide to getting started with Word, PowerPoint, Excel, Access, and Outlook", Packt Publishing	2008

List of Experiments

1. Perform basic arithmetic task on MATLAB
2. Prepare your resume in LATEX
3. Create a document in Word on a topic of your choice. Format the document with Various fonts (minimum 10, maximum 12) and margins (minimum 1.5, maximum 3). The document should include a bulleted or numbered list, table containing name, address, basic pay, department as column heading, a picture of lion using clip art gallery, an example of word art, header with student name & date, a footer with pagination.
4. Create a document with the text given below and save it as First Write in it a paragraph about yourself in 200 words. Do the following - Count the occurrences of the word "My" in the above document, Replace "My" with "Yours" in the entire document, Underline the text "Yours", make an auto correct entry for My and it should be replaced by Yours.
5. Use the document saved earlier and perform the page setting as follows - a. Top Margin 1.3", b. Bottom margin 1.4", c. Left margin 1.30", d. Right margin 1.30", e. Gutter margin 1.2", f. Header 0.7", g. Footer 0.7", h. Paper size executive, i. Orientation landscape

6. Below is given a letter and some addresses. This letter is to be sent to all these Addresses. User mail merge Addresses are: 1) Amit, H No 424 sector 8D, Lajpat Nagar, New Delhi, 2) Rohit, H No 444, Sector 125C, Chandigarh,3) Jyoti, H NO 550, Sector 16A, Gomti Nagar, Lucknow
   To
   <<Name>>
   <<Address>>

   Dear <<Name>>

   You are advised to appear for an interview on the <<Date>>at 9:00 A.M with your original documents.

   Yours Sincerely
   ABC Limited, New Delhi.

7. Set up a new presentation of three slides.
   1. On the master slide: a) Apply a theme of your choice to the master slide., b) Include an automated page number in the bottom left of the footer, c) Place a clipart image of a pen or pencil as a logo in the top right corner.
   2. Add the following text in slide 1 - Heading: Hothouse Design (Red, 25 point, Arial font, Left Aligned)
   3. On the second slide type the following text where font="Arial" size="20" Earlier in the year we started to analyze the sales profile for the stationery business stream within Hothouse. The areas of initial investigation were selected as the management of our sales team, our customer base, website effectiveness, and an analysis of our most successful product lines.
   4. On the third slide where font="Arial" size="20" Possible timings for these bonuses include: Weekly, Monthly, Quarterly and Annually.

8. Set up a new presentation consisting of 3 slides - 1. on the first slide a) Type Telephone Analysis for the title, using any word Art option. b) Insert any appropriate image below the title and apply an Animation effect to the Image. c) Insert a Sound from the Clip Organizer.
   2. on the second slide: a) create a pie chart using the following data:
   Call type - Minutes
   International - 1640
   Peak Rate- 7842
   Cheap Rate- 1543
   Internal- 16805
   b) Insert the chart title “Telephone Analysis”.
   3. on the third slide: Enter the following text: (font style="Times new roman", font size= "24") As you can see that our vast majority of calls are internal. These figures are the Average values per day for all departments, using a monitoring period of 2 weeks.
   4. Use the same transitional effect between each slide and Play a slide show.

9. Set up a new presentation consisting of 4 slides
   1. On the first slide - a) Include an automated slide number left aligned., b) Enter the heading New Website., c) Enter the sub heading Proposed Web Pages., d) Insert any appropriate image below the sub heading and apply an Animation effect to the image. e) Create the following hyperlink http://www.google.com on the image, f) Insert a Sound from the Clip Organizer.
   2. On the second slide: a) create a pie chart using the following data:
   Type of Trip 2008 Dives
   Go deep 2512
   Wreck Week 12680
   Shark Experience 940
   Cave Dives 353
   3. On the third slide: Enter the following text: (font style=Times New Roman, font size= 24), During the development of this new website, we have realized that the proposed design brief may need to be amended.
   4. On the fourth slide: Insert a Movie from a File on Your Computer
   5. Use a picture as background in all your slides.
   6. Use the same transitional effect between each slide and play a slide show.

SECOND SEMESTER

Details of Course:

Course Title	Course Structure			Pre-Requisite
IMSMA 102:	**L**	**T**	**P**	NIL
Calculus-II	**3**	**1**	**0**	

Course Objective: To acquire knowledge in calculus of several variables.

Course Outcome (CO):

CO1	Analyze the characteristic of the function of the two or more variables.
CO2	Describe the approximation of the function of two variables and analyse the optimization properties of two and three variables.
CO3	Apply the techniques of the integral calculus to determine the surface area and volume.
CO4	Describe the concept of vector differential calculus and relate it with their physical interpretation.
CO5	Illustrate the integration with vectors in the integrand and apply it to solve some physical problems.

S. No.	Contents	Contact Hours
1.	Definition of functions of two or more variables, Partial differentiation, Euler's theorem, Total derivative.	9
2.	Taylor's Expansion, Maxima-Minima, Lagrange's method of multipliers, Applications in estimation of error and approximation.	9
3.	Double integral (Cartesian and polar co-ordinates), change of order of integration, triple integrals (Cartesian, cylindrical and Spherical co-ordinates), Applications to area and volume.	9
4.	Scalar and vector point functions, gradient, directional derivative, divergence, curl and their interpretations.	9
5.	Line integral, surface integral and volume integral, Applications to work done by the force, Green's, Stoke's and Gauss divergence theorems.	9
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication
1.	"Calculus" by Howard Anton, Wiley publications	2015
2.	"Calculus and Analytic Geometry" by George B. Thomas Jr., Ross L. Finney, Pearson Education India	2010
3.	"Integral Calculus" by Gorakh Prasad, Pothishala Pv Ltd.	2015
4.	"Advanced Engineering Mathematics" by R.K.Jain and S.R.K. Iyengar, Narosa; 1st edition	2002

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 104:	**L**	**T**	**P**	NIL
Real Analysis-I	3	1	0	

Course Objective: To acquire knowledge of real-valued functions, sequences, series and derivatives

Course Outcome (CO):

CO1	Understanding the various properties of the real number
CO2	Define sequences and describe its properties.
CO3	Define series and discuss its convergence.
CO4	Describe the pointwise convergence and uniform convergence for sequence and series of functions.
CO5	Explain different mean value theorems that may lead to the development of calculus.

S. No.	Contents	Contact Hours
1.	Real numbers, real-valued functions, countable sets, Cantor set, completeness axiom, Archimedean property, Dedekind cut.	8
2.	Sequences, limit, convergence, bounded and monotone sequences, operations on convergent and divergence sequences, Bolzano-Weirstrass theorem, Cauchy sequences.	10
3.	Series of real numbers, convergence and divergences, positive term series, tests of series, alternating series, conditional and absolute convergences.	9
4.	Sequence and series of functions, pointwise convergence of sequence of functions, uniform convergence, convergence and uniform convergence of series of functions	9
5.	Derivatives, Rolle's theorem, the law of means, fundamental theorem of calculus	9
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/Reprint
1.	R. R. Goldberg, Methods of Real Analysis, Second Edition, John Wiley & Sons, Inc., New York.	1976
2	T. M. Apostol, *Mathematical Analysis*, Second Edition, Pearson Education. ISBN: 9780201002881.	1974
3	R. G. Bartle, D. R. Sherbert, "Introduction to Real Analysis", John Wiley & Sons.	1992
4	W. Rudin, "Principles of Mathematical Analysis", McGraw Hill International.	1980
5	S. C. Malik and Savita Arora, "Mathematical Analysis", New Age International Private Limited; 1st edition.	2017
6	K. A. Ross, "Elementary Analysis", Undergraduate Texts in Mathematics, Springer, 2013.	2013

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 106:	**L**	**T**	**P**	Basic knowledge of calculus
Ordinary Differential Equations	3	1	0	

Course Objective: To impart the knowledge of ordinary differential equations and to analyze and solve the physical problems.

Course Outcome (CO):

CO1	Understand the first-order linear and non-linear differential equations of different forms and its applications.
CO2	Familiarize with linear dependence and independence solutions, linear second order differential equations using different methods and applying its use in applications.
CO3	Solve the initial and boundary value problems of second order and applying its use in applications.
CO4	Solve the linear differential equations of higher order with constant and variable coefficients and simultaneous equations.
CO5	Acquire the knowledge to reduce linear differential equations to first order matrix system of homogenous and non-homogeneous equations and find the solution by matrix method.

S. No.	Contents	Contact Hours
1.	Order and degree of differential equations, Formation of differential equations, Ordinary differential equations of first order: linear differential equations(Leibnitz form), exact differential equations, Integrating factors, Non-linear differential equations: Bernoulli equation, Riccati equation, Clairaut's equations, Singular solutions, Initial value problem, Existence and Uniqueness of solutions, Applications of first order differential equations (Growth and decay problems, Newton's law of cooling, Orthogonal trajectories (in Cartesian and Polar coordinates)).	10
2.	Linear dependence and independence of solutions, The Wronskian, Linear differential equations of second order: complete integral in terms of a known integral, solution by changing independent variable, variation of parameters, Total differential equations,	9
3.	Second order linear homogeneous equations with constant coefficients, Initial value problems, Second order Sturm-Liouville boundary values problems, Application of second order differential equations (Simple Harmonic motion).	8
4.	Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Equations reducible to constant coefficients, Methods of undetermined coefficients and variation of parameters, Simultaneous linear equations.	9
5.	Review on matrix, system of linear equations, eigenvalues and eigenvectors, Reduction of linear differential equations to a first order matrix system, Solutions of linear system of homogeneous and non-homogeneous equations by matrix method.	9
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/Reprint
1.	Martin Braun, Differential equations and their applications, Springer, 4th Ed.	1993
2.	S. L. Ross, Introduction to Ordinary Differential Equations, John Wiley & Sons, 4th Ed.	1989
3.	C.H. Edwards and D.E. Penny, Differential equations and boundary value problems, Pearson Education.	2004
4.	Richard Bronson, Schaum's Outlines of Differential equations, 2nd Ed. , Tata McGraw-Hill	2004
5.	Shair Ahmad and Antonio Ambrosetti, A text book on ordinary differential equations, 2nd Ed. Springer	2015
6.	Dennis G. Zill: A first course on Differential equations, 11ed. Cengage India Pvt. Ltd.	2019

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 108: GEC – II	**L**	**T**	**P**	NIL
Mathematics-II	3	1	0	

Course Objective: To provide knowledge about the fundamental concepts of different useful topics of mathematics that may help in real life application..

Course Outcome (CO):

CO1	Describe the concept of matrix and apply it to study the eigenvalue problem.
CO2	Formulate the differential equation and use the concept of integrating factor to solve it.
CO3	Illustrate different form of differential equation.
CO4	Define Laplace transform and apply it to solve integral and differential equations.
CO5	Define vector function and apply it to determine line integral, surface and volume integral.

S. No.	Contents	Contact Hours
1.	Introduction to matrix, Rank of a matrix, Elementary transformation, Inverse of a matrix using elementary transformation, Consistency of linear system of equations, Eigenvalues and Eigenvectors of a matrix, Cayley Hamilton Theorem, Diagonalization of a matrix.	10
2.	Formation of differential equations, Solutions of a differential equation: Complete primitive, Particular and Singular Solution, Family of curves represented by ordinary differential equations, Exact equations, Necessary and sufficient condition, Integrating factor.	7
3.	Equations solvable by separation of variables, Homogeneous equations, Equations reducible to the homogeneous form, Linear equations, Equations reducible to the linear form, Bernoulli's equation.	8
4.	Introduction to infinite integrals. Linearity of Laplace transforms. Existence theorem for Laplace transforms. Laplace transforms of derivatives and integrals. Shifting theorems. Differentiation and integration of transforms. Convolution theorem. Solution of integral equations and systems of differential equations using Laplace transforms.	10
5.	Vector Function, Derivative of a vector function with respect to a scalar, Scalar and Vector Fields, Gradient of a scalar field, Directional Derivative, Divergence and Curl of a vector function, Integration of vectors, Work done, Circulation, Conservative vector field, Surface Integral, Volume Integrals, Green's Theorem, Stoke's Theorem, Gauss Divergence Theorem.	10
	Total	**45**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/Reprint
1.	Erwin kreyszig, Advanced Engineering Mathematics, Wiley-India, 10^{th} Edition	2017
2.	R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa, 5^{th} Edition	2016
3.	G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi.	2017
4.	G. Prasad, Textbook of Integral Calculus and Elementary Differential Equations, Pothishala Pvt. Ltd.	2017

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 110: SEC-2	**L**	**T**	**P**	NIL
MATLAB Programming	0	0	4	

Course Objective: The objective of the course is to introduce fundamentals of MATLAB programming and p mathematical operations in MATLAB.

Course Outcome (CO):

CO1	Explain the basics and built in functions of MATLAB.
CO2	Describe mathematical operations on arrays in MATLAB.
CO3	Explain the working of relational and logical operators, conditional statements and loops in MATLAB.
CO4	Construct and analyze different types of two-dimensional plots in MATLAB.
CO5	Solve Polynomial and Algebraic Equations in MATLAB.

S. No.	Contents	Contact Hours
1.	Introduction to MATLAB: Starting MATLAB, Working in the Command Window, Arithmetic Operations with Scalars, Elementary Math Built-in Functions, Defining Scalar Variables, Commands for Managing Variables.	10
2.	Arrays: One-Dimensional and Two-Dimensional Arrays, Array Addressing, Adding and Deleting Elements, Built-in Functions for Handling Arrays, Strings, Mathematical Operations with Arrays: Addition, Subtraction, Multiplication, and Division, Generation of Random Numbers.	10
3.	Relational and Logical Operators, Conditional Statements, Switch Case, Loops, Break and Continue commands. 2-D Plots: The plot command, fplot command, plotting multiple graphs in same plot, histograms.	12
4.	Polynomials and Symbolic Math: Polynomials, Curve Fitting, Solving Algebraic Equations, Differentiation, Integration.	12
	Total	**44**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/Reprint
1.	MATLAB: A Practical Introduction to Programming and Problem Solving; D. Attaway, Butterworth-Heinemann, 6th edition.	2022
2.	Beginning MATLAB and Simulink: From Beginner to Pro; S. Eshkabilov, Apress, 2nd edition.	2022
3.	MATLAB: An Introduction with Applications; A. Gilat, John Wiley & Sons Inc., 6th edition.	2017

List of Experiments

1	WAP for basic arithmetic operations with scalars in MATLAB.
2	WAP to demonstrate mathematical built-in functions in MATLAB.
3	WAP to create 1-D and 2-D arrays in MATLAB. Further, add and delete elements in the arrays.
4	WAP to perform mathematical operations (addition, subtraction, array multiplication, array division) on arrays in MATLAB.
5	WAP to demonstrate conditional statements and switch case in MATLAB.
6	WAP to demonstrate loops in MATLAB.
7	WAP to construct plots using the plot/fplot command in MATLAB.
8	WAP to construct histograms in MATLAB.
9	WAP to solve polynomials and algebraic equations in MATLAB.
10	WAP to demonstrate differentiation and integration in MATLAB.

Details of Course

Course Title	Course Structure			Pre-Requisite
IMSMA 112: SEC-2	**L**	**T**	**P**	NIL
Advanced Spreadsheet Tools	0	0	4	

Course Objective: The objective of the course is to enable the students to use Excel for advanced data analysis an them with automation skills on excel and make informed decision.

Course Outcome (CO):

CO1	Define meaningful representations of data in the form of charts and pivot tables.
CO2	Analyze data using spreadsheets and use interpretation to make decisions.
CO3	Generate word documents with appropriate formatting, layout, proofing.
CO4	Manage data for generating queries, forms and reports in a database.
CO5	Apply statistical testing techniques for data analysis

S. No.	Contents	Contact Hours
1.	Introduction - Templates, customized ribbon & quick access toolbars, Linking between worksheets, use of hyperlink, Shortcut keys & worksheet protection,]ntegrating excel with other tools: MS word, outlook, PowerPoint, Access, Power BI, Overview Google spreadsheet &it's features, Excel print option and settings.	10
2.	Advanced Excel Techniques - Advance formulas & functions: If, If-And, Sumif(), Sumifs(), Countif(), Countifs(), Date & Time functions etc., Data validation & listing: student attendance sheet, marksheet. Inventory management system, billing & EMI calc, V & H lookup, index & match formula, conditional formatting.	10
3.	Data Analysis & Decision Making - What-if analysis, goal seek, data tables, solver add-in. Problem-Solving using Solver (optimal product mix, workforce scheduling, transportation, capital budgeting, financial planning), Basic pivot table, advanced filter, slicer, dynamic and interactive charts, Graphical representation of data, Frequency distribution and its statistical parameters; Correlation and Regression Analysis, Dashboards.	12
4.	Excel Automation & Interactive Worksheets - Creating-recording and running Macro, assigning Macro to a command button, creation of a custom Macro button on quick, Access tool bar, basic VBA programming in excel, Making registration form, user for min excel using VBA with insert, update, search &delete operation.	12
	Total	**44**

Suggested Books:

S. No.	Name of Books/Authors/Publishers	Year of Publication/Reprint
1.	Excel 2016 Power Programming with VBA, Michae lAlexander, Dick Kusleika, Wiley.	2016
2.	MS Excel 2016, Data Analysis & Business Modelling, Wayne Winston, PHI.	2016
3.	Financial Analysis and Modelling Using Excel and VBA, Chandan Sengupta, Second Edition, Wiley Student Edition.	

List of Experiments

1 Overview templates, customized ribbon & quick-access toolbar.

2 Linking excel worksheet and integrating with: Sword &Power Point.

3 Overview Google spreadsheet & its features.

4 Use of advance excel formulas-I .

5 Use of advance excel formulas–II.

6 Preparation of worksheet using data-validation and listing

7 Preparation of worksheet based on conditional formatting & advance filter.

8 Decision making in worksheet using what-if analysis tool.

9 Use of pivot table and slicer.

10 Preparation of worksheet including Dashboard-dynamic & interactive charts.