

Title of the Course	:	Algebra and Trigonometry		
Category of the Course	:	CORE COURSE	Semester	: I
Course Code	:	U1R3MACC1	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	:	5	Total Inst. Hrs.	: 75

Objectives:

- Basic ideas on the Theory of Equations, Matrices and Number Theory.
- Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.
- To solve the Algebraic problems using the knowledge of equations
- To find the expansions of exponential functions, logarithmic functions, trigonometric functions, and hyperbolic trigonometric functions
- To apply the formulas for derivatives and integrals of the hyperbolic functions

Unit 1 : Reciprocal Equations (15 hours)

Reciprocal Equations-Standard form-Increasing or decreasing the roots of a given equation- Removal of terms, Approximate solutions of roots of polynomials by Horner's method – related problems

Unit II : Summation of Series (15 hours)

Summation of Series: Binomial– Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.

Unit III : Characteristic Equation (15 hours)

Characteristic equation –Eigen values and Eigen Vectors-Similar matrices - Cayley – Hamilton Theorem (Statement only) - Finding powers of square matrix, Inverse of a square matrix up to order 3, Diagonalization of square matrices - related problems.

Unit- IV: Expansions (15 hours)

Expansions of $\sin n\theta$, $\cos n\theta$ in powers of $\sin\theta$, $\cos\theta$ - Expansion of $\tan n\theta$ in terms of $\tan\theta$, Expansions of $\cos^n\theta$, $\sin^n\theta$, $\cos^m\theta\sin^n\theta$ –Expansions of $\tan(\theta_1+\theta_2+\dots+\theta_n)$ -Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in terms of θ - related problems.

Unit- V Hyperbolic Functions (15 hours)

Hyperbolic functions – Relation between circular and hyperbolic functions Inverse hyperbolic functions, Logarithm of complex quantities, Summation of trigonometric series - related problems.

Text Book:

1. W.S. Burnstine and A.W. Panton, Theory of equations
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007
3. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005
4. C. V. Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003

5. J. Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012.
 6. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.

Reference Books:

- 1) Algebra Vol I, TK. Manchivasogam Pillay and Others, SV Publications
- 2) Algebra Vol II, TK. Manchivasogam Pillay and Others, SV Publications
- 3) Trigonometry, TK. Manchivasogam Pillay and Others, SV Publications
- 4) Allied Mathematics, S.G. Vengatachalapathy
- 5) Trigonometry, S.Arumugam and Issac, New Gamma Publications.
- 6) Trigonometry, P.R.Vittal, Margham Publications.

Reference Books:

- Unit I: Chapter 6, sec 16-19, 30 [1]
 Unit II: Chapter 3, sec 1.3, 10, 14, chapter 4 sec 3, 5, 6 [1]
 Unit III: Chapter 2, sec 1, 14.1, 14.2, 14.3, 16 (page no. 110), 16.1, 16.2, 16.3, 16.4, sec 8 [2]
 Unit IV: Chapter 3 full [3]
 Unit V: Chapter 4 full [3]

e-Resources: <https://nptel.ac.in>

Outcomes:

The learners would have the ability to,

- | | | |
|-----|--|----|
| CO1 | Classify and Solve reciprocal equations | K3 |
| CO2 | Find the sum of binomial, exponential and logarithmic series | K2 |
| CO3 | Find Eigen values, eigen vectors, verify Cayley – Hamilton theorem and diagonalize a given matrix | K2 |
| CO4 | Expand the powers and multiples of trigonometric functions in terms of sine and cosine | K5 |
| CO5 | Determine relationship between circular and hyperbolic functions and the summation of trigonometric series | K5 |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Algebra and Trigonometry							Course Code: U1R3MACC1			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	1	3	-	-	-	3	2	1	1.4
CO2	2	1	3	1	-	-	3	2	1	1.4
CO3	3	1	3	1	-	-	3	2	1	1.5
CO4	3	1	3	-	-	-	3	2	1	1.4
CO5	3	1	3	-	-	-	3	2	1	1.4
							Mean Overall Score			1.4
							Result			Medium

3-Strong; 2-Medium; 1-Low

Title of the Course	: Differential Calculus		
Category of the Course	: CORE COURSE	Semester	: I
Course Code	: U1R3MACC2	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 5	Total Inst. Hrs.	: 75

Objectives:

- To extend student experience with functions
- To study the fundamental concepts of calculus
- To review and extend knowledge of trigonometry
- To develop and strengthen the student problem- solving skills
- To apply the tools of calculus to variety of problem situations

Unit I Successive Differentiation (15 hours)

Successive Differentiation – the n^{th} derivative – Standard Results – Trigonometrical transformations- Formation of equations involving derivatives- Leibnitz's formula for the n^{th} derivative of a product- Feynman's method of differentiation.

Unit II Partial Differentiation (15 hours)

Successive Partial derivatives, functions of function rule, Total differential coefficients- A special case- implicit Functions

Unit III Partial Differentiation (Continued) (15 hours)

Homogeneous functions – Partial derivatives of a function of two variables – Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers.

Unit IV Envelop (15 hours)

Method of finding the envelope – Another definition of envelope – Envelope of family of curves which are quadratic in the parameter.

Unit V Curvature (15 hours)

Curvature- Circle, radius and centre of curvature- Cartesian formula for the radius of the Curvature- The co-ordinate of the centre of curvature- Evolute and Involute- Radius of curvature in polar co-ordinates.

Text Books:

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2010.
3. M.J. Strauss, G.L. Bradley and K. J. Smith, Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.

Reference Books:

1. Calculus Vol I, TK. Manjivasogam Pillay and Others, SV Publications
2. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
3. T. Apostol, Calculus, Volumes I and II.
4. S. Goldberg, Calculus and mathematical analysis.

Reference Book:

Unit I: Chapter III full [1]

Unit II: Chapter VIII, sec1.1 to 1.5 [1]

Unit III: Chapter VII, sec 1,6, 1.7, sec 4, 5. [1]

Unit IV: Chapter X, sec 1.1 to 1.4 [1]

Unit V: Chapter X, sec 2.1-2.6 [1]

e-Resources:

1. <https://nptel.ac.in>
2. https://www.youtube.com/watch?v=27_2DmQ0ZSU&feature=youtu.be
3. https://www.whitman.edu/mathematics/calculus_online/chapter15.html

Outcomes:

The learners would have the ability to,

- | | | |
|-----|--|----|
| CO1 | Solve problems on successive differentiation and Leibnitz theorem. | K5 |
| CO2 | Find the partial derivative and total derivative coefficient | K2 |
| CO3 | Determine maxima and minima of functions of two variables and to use the Lagrange's method of undetermined multipliers | K2 |
| CO4 | Find the envelope of a given family of curves | K3 |
| CO5 | Find the evolutes and involutes and to find the radius of curvature using polar co-ordinates | K2 |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Differential Calculus							Course Code: U1R3MACC2			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	1	3	-	-	-	3	2	1	1.4
CO2	2	1	3	-	-	-	3	2	1	1.4
CO3	3	2	3	2	-	-	3	2	1	1.7
CO4	3	2	3	2	1	-	3	2	1	1.8
CO5	3	2	3	2	1	-	3	2	1	1.8
			Mean Overall Score							1.6
			Result							Medium

3-Strong; 2-Medium; 1-Low

Title of the Course	:	Numerical Methods with applications		
Category of the Course	:	DSE COURSE	Semester	: I
Course Code	:	U1R3MADSE1:1	Nature of the Course	: Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	:	3	Total Inst. Hrs.	: 60

Objectives:

- To make the students to aware of the problems in numerical processing
- To develop appropriate numerical methods to approximate a function
- To perform an error analysis for various numerical methods
- To analyze and evaluate the accuracy of common numerical methods
- To apply numerical methods to obtain approximate solutions to mathematical problems

Unit I - Algebraic & Transcendental equations (12 hours)

Introduction - Bisection Method – Iteration method - Method of False Position - Newton Raphson Method –Solution of simultaneous linear algebraic equations : Gauss Jacobi-Gauss Seidel method.

Unit II –Finite Differences (12 hours)

First and higher order differences - Forward and backward differences - Properties of operator - Differences of a polynomial – Factorial polynomial- Error propagation Operator E and E^{-1} Relation among δ, E, A and D -summation of series.

Unit III – Interpolation (12 hours)

Newton's forward – backward interpolation formula-Gauss forward-backward interpolation formula -Bessel's formula- Divided differences-Newton's divided difference formula-Lagrange's interpolation formula-Inverse interpolation.

Unit IV - Numerical differentiation & Integration (12 hours)

Introduction - Numerical differentiation –Errors in Numerical differentiation – The cubic spline method - Numerical Integration using Trapezoidal rule & Simpson's $1/3^{\text{rd}}$, $3/8^{\text{th}}$ rules - Theory and Problems.

Unit V - Numerical Solution of ODE (12 hours)

Introduction - Solution by Taylor Series Method - Picard's method of successive approximations - Euler's method - Modified Euler's Method – Runge Kutta 2^{nd} and 4^{th} order methods – predictor – Corrector method – Adams Moulton method – Milne's method.

Text Book :

- [1] “Introductory Methods of Numerical Analysis” - S.S.Sastry, Prentice Hall of India Pvt. Limited, 1995.

Unit I: Chapter 2- 2.1 to 2.5, Chapter 6- 6.4

Unit II: Chapter 3-3.3-3.5

Unit III:Chapter 3- 3.6,3.7.1,3.11, 3.9-3.9.1,3.12

Unit IV:Chapter 5-5.1,5.2, 5.4-5.4.1,5.4.2,5.4.3

Unit V: Chapter 7- 7.1-7.6 (Except 7.4.1)

References:

- 1) “Numerical Analysis” - S.Narayanan& Others S.Viswanathan Publishers, 1994.
- 2) “Numerical Methods” - A.Singaravelu, Meenachi Agency, June 2000.
- 3) Kandasamy, P. K.Thilagavathy,andK.Gunavathy- "NumericalMethods",S.Chand&CompanyLtd.,Edn.2006.

e-Resources:

1. <https://youtu.be/pUDeeE-ugyc>
2. <https://perhuman.files.wordpress.com/2014/07/metodos-numericos.pdf>

Outcomes:

The learners would have the ability to,

CO1	Obtain numerical solutions of algebraic and transcendental equations.	K5
CO2	Acquire the knowledge of Finite differences	K3
CO3	Learn about various interpolating and extrapolating methods to find numerical solutions.	K2
CO4	Use results and techniques involving Simpson’s 1/3, 3/8 rules by using Trapezoidal rule	K3
CO5	Solve the ODE by using Taylor’s, Picard’s & Euler’s Methods.	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Numerical Methods with applications							Course Code: U1R3MADSE1:1			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	3	3	2	3	3	2	1	2.5
CO2	2	3	2	2	3	3	3	2	1	2.3
CO3	3	2	1	3	2	3	2	3	1	2.2
CO4	1	2	3	2	3	3	1	3	2	2.2
CO5	3	3	3	1	3	3	3	1	3	2.5
							Mean Overall Score			2.3
							Result			High

3-Strong; 2-Medium; 1-Low

Title of the Course	: Mathematical Statistics		
Category of the Course	: DSE COURSE	Semester	: I
Course Code	: U1R3MADSE1:2	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 4
Credits	: 3	Total Inst. Hrs.	: 60

Objectives:

- To Provide some basic statistical tools, statistical decision theory and statistical inference, useful for the future research
- The student will see the Central Limit Theorem (CLT) arise from experimental data
- To specify and test the fit of multiple time series model specifications for the same data
- To forecast the future values of the time series
- To identify the nature of the phenomenon represented by sequence of observation

Unit I – Statistics- Introduction and Presentation of Data (12 hours)

Definition of statistics - importance and scope of statistics - limitations of statistics - statistical data - primary and secondary data - frequency distribution - discrete and continuous frequency distribution - histogram - frequency polygon.

Unit II - Measures of Averages (12 hours)

Definition - requisites - Arithmetic Mean - Geometric Mean - Harmonic Mean -Median - Mode. (definition, merits & demerits, graphical location, problems based on raw, discrete and continuous frequency distribution)

Unit III – Measures of Dispersion (12 hours)

: Definition - range - Quartile Deviation - Mean Deviation - Standard Deviation and Coefficient of Variation (Definition, Merits and Demerits, problems based on Raw, Discrete and Continuous Frequency Distribution)-Concept of Skewness and Kurtosis.

Unit IV - Time series (12 hours)

Concept - components of a time series - trend - periodic changes - irregular component - analysis of time series - additive and multiplicative models - uses of times series - measurement of trend - graphical method - semi average - methods of curve fitting by principles of least squares - growth curves and fitting - moving averages - measurement of seasonal fluctuations - simple averages - ratio to trend - ratio to moving average - link relative methods - related problems.

Unit V - Correlation and Regression (12 hours)

Correlation : scatter diagram - correlation coefficient - Karl Pearson - limits for correlation coefficients - probable error - properties of correlation - Rank correlation - limits for rank correlation coefficient spearman rank correlation coefficient (Related Problems).

Regression : Lines of regression - regression curves - regression coefficients - properties of regression coefficients (Related Problems).

Text Books:

[1] “Fundamentals of Mathematical Statistics” - S.C.Gupta, V.K.Kapoor - Sultan Chand & sons - New Delhi,1994.

[2] “Fundamentals of Applied Statistics” - S.C.Gupta, V.K.Kapoor - Sultan Chand & Sons - New Delhi,2007.

Unit I : Chapter 1 : Sec. 1.2 , 1.4 and 1.5 [1]& Chapter 2 : Sec. 2.1 and 2.2 [1]

Unit II : Chapter 2 : Sec. 2.3 - 2.9 [1]&

Unit III : Chapter 3 : Sec. 3.1 – 3.7, 3.8.1, 3.13 - 3.14 [1]

Unit IV : Chapter 2 : Sec. 2.1 - 2.5.4. [2]

Unit V : Chapter 3 : Sec. 3.1 - 3.4, 3.6, 3.9, 3.10 [2]

Reference Books:

[1] “Fundamentals of Mathematical Statistics” by S.C Gupta and V.K Kapoor.

[2] “Fundamentals of Applied Mathematical Statistics” by S.C. Gupta and V.K. Kapoor.

e-Resources:

1. <https://www.youtube.com/watch?v=nE67uQPfRbl&feature=youtu.be>
2. <https://libguides.reading.ac.uk/mathematics/e-resources>

Outcomes:

The learners would have the ability to,

CO1	Calculate and apply measures of location and measures of dispersion for grouped & ungrouped data.	K5
CO2	Calculate and apply the measures of Averages and Dispersion.	K5, K3
CO3	Compute Correlation coefficients and to estimate Regression Analysis.	K5
CO4	Deals with consistency of data and independence of Attributes.	K2
CO5	Use the variation in Time series.	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Mathematical Statistics							Course Code: U1R3MADSE1:2			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	1	3	3	1	3	2	3	1	2.2
CO2	3	3	3	2	3	2	3	2	3	2.7
CO3	2	1	3	3	2	3	2	2	3	2.3
CO4	3	2	3	1	3	3	2	1	2	2.2
CO5	2	3	3	1	3	2	2	3	1	2.2
							Mean Overall Score			2.3
							Result			High

3-Strong; 2-Medium; 1-Low

Title of the Course	:	Quantitative Aptitude – I			
Category of the Course	:	SE COURSE	Semester	:	I
Course Code	:	U1R3MASEC1:1	Nature of the Course	:	Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	:	2
Credits	:	2	Total Inst. Hrs.	:	30

Objectives:

- To study about Percentage
- To develop analytical thinking of Profit and Loss
- To educate the students in computational skills of Simple and Compound Interest
- To know about basic concepts of Average
- To make the students prepare for competitive examinations by using Ratio and Proportion

Unit I: Percentage

Basic concepts of percentage – Important formulae and simple problems only.

Unit II: Profit and Loss

Profit (Gain) and Loss – Short Cut methods – Simple Problems only.

Unit III: Simple and Compound Interest

Formula for simple interest – Relation between amount and price – Simple problems on simple interest – Compound interest – Some important rules- Only simple problems based on Compound interest.

Unit IV: Average

Basic concepts of Average – Related Problems.

Unit V: Ratio and Proportion

Definition of ratio – Comparison of ratio – Components and dividendo rule – variations – Related problems – Definition of proportion – Fourth proportional – Third proportional – Mean Proportional – Related problems only.

Text Book:

[1] “Quantitative Aptitude for Competitive Examinations”, by Dr. R.S. Aggarwal, S.Chand & Sons, New Delhi, Reprint 2011.

Unit I: Chapter 10 fully.

Unit II: Chapter 11 Fully.

Unit III: Chapter 21 and 22 Fully

Unit IV: Chapter 6 Fully

Unit V: Chapter 12 Fully

Reference Books:

[1] Quantitative Aptitude, Naresh Sharma, Anjali Kaushik – Variety Books Publishers
Distributions

[2] Quantitative Methods, D.C. Sanchati, S. Chand & Sons, New Delhi.

e – Resources:

1. <https://leverageedu.com/blog/problems-on-ages/>
2. <https://amsp.org.uk/resource/11-16-resources-ratio>

Outcomes:

The learners would have the ability to,

CO1	Learn the techniques for solving Aptitude problems.	K4
CO2	Appear for all Competitive examinations conducted by Central and State Government.	K5
CO3	Understood the concept of Mathematics with emphasis on analytical ability.	K2
CO4	Acquire the knowledge of Ratio and Proportion.	K1
CO5	Infer the problems on simple and compound interest.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;

K6 - Create

Title of the Course	: Basic Mathematics		
Category of the Course	: SE COURSE	Semester	: I
Course Code	: U1R3MASEC1:2	Nature of the Course	: Skill Development
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

- To develop the aptitude of Reasoning
- To Guess & Check the Problems quickly
- To prepare for Competitive & Entrance Examinations in various fields
- To Study about the Numbers
- To know about the Discount in Bank

Unit – I : Problems on Numbers and Ages

Problems on Numbers – Consecutive Numbers – Fraction of Numbers – worked out Problems on Ages.

Unit – II : Time & Work, Time & Distance

Relation between time and work – Problems – Formulae - Relation between time and Distance – Worked out problems.

Unit – III : Area

Definition – Formulae – Results on Quadrilateral – Area on Square, Rectangle, Triangle, Rhombus, Parallelogram – Applications.

Unit – IV : Volume and Surface Area

Definitions – Formulae – Problems on cuboid, cube, cylinder, cone, sphere & Hemisphere – simple Applications only.

Unit – V : True Discount & Banker's Discount

Important concepts – Formulae – Problems – Definitions – Banker's Discount – Problems.

Text Book:

[1] “Quantitative Aptitude for Competitive Examination” – R.S.Aggarwal – S. Chand & Sons – New Delhi –seventh edition – 2006.

Unit – I : Chapter 7 & 8
Unit – II : Chapter 15 & 17
Unit – III : Chapter 24
Unit – IV : Chapter 25
Unit – V : Chapter 32 & 33

Reference Book:

[1] “Quantitative Aptitude and Reasoning” – R.V.Praveen , Phi Second Edition - 2012.

[2] “Quantitative Methods” , D.C. Sanchati, S. Chand & Sons – New Delhi .

[3] Quantitative Aptitude , Naresh Sharma, Anjali Kaushik, variety book publishers distributors.

e – Resources:

1. <https://www.khanacademy.org/math/cc-seventh-grade-math/cc-7th-geometry/cc-7th-area-volume-surface-area/v/crates-in-boxcar>
2. <https://www.javatpoint.com/aptitude/true-discount-and-banker-discount>

Outcomes:

The learners would have the ability to,

CO1	Apply the short cut methods to solve the Problems	K3
CO2	Obtain the knowledge of Time and Distances.	K1
CO3	Formulate the area of a parallelogram.	K5
CO4	Compute the volume of a cuboid.	K1
CO5	Interpret the use of banker's discount.	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;

K6 - Create

Title of the Course	: Data Analytics by using SPSS		
Category of the Course	: SE COURSE	Semester	: I
Course Code	: U1R3MASEC1:3P	Nature of the Course	: Employability
Marks	: CIA:40+Ext:60= 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

- To provide concepts used in routines in SPSS on the following problems
- Understand how to start SPSS
- Enter, modify and analyze data
- Define a variety of statistical variables
- Work with multiple data sources

List of Topics:

1. Mean, Standard deviation, Variance.
2. Bar diagram, Line diagram, Pie chart and Histogram.
3. Co efficient of correlation.
4. Regression equation of X on Y.
5. Regression equation of Y on X.
6. Application of t-test for one sample problem.
7. Application of t-test for two sample problems.
8. Application of t-test for testing the significance of Correlation Coefficient.
9. One-tailed and Two-tailed tests.
10. Application of analysis of variance.

Text Books:

1. SPSS for You, A. Rajathi& P. Chandran, MJP Publications, Edition – 2010.

Reference Books:

1. SPSS 17.0 for Researches, Gupta & Hitesh Gupta, International Book Home, Pvt., Ltd., 2014.

e- Resources:

1. <https://youtu.be/cjTgyRUaD1s>
2. <https://www.lib.sfu.ca/find/research-tools/spss-resources>
3. <https://libguides.marquette.edu/spss#s-lg-box-687220>

Outcomes:

The learners would have the ability to,

CO1	Analyze statistical data using measures of central tendency, dispersion and location.	K4
CO2	Calculate and interpret the correlation between two variables.	K5
CO3	Interpret results of analysis of variance tests.	K2
CO4	Develop the simple linear regression equation for a set of data.	K6
CO5	Evaluate the simple linear regression equation for a set of data.	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;

K6 - Create

Title of the Course	:	Bridge Mathematics		
Category of the Course	:	FOUNDATION COURSE	Semester	: I
Course Code	:	U1R3MAFC	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	:	2	Total Inst. Hrs.	: 30

Objectives:

- To bridge the gap and facilitate transition from higher secondary to tertiary education;
- To instill confidence among stakeholders and inculcate interest for Mathematics
- To introduce the fundamental principles
- To understand the concepts of Calculus
- To gain the working knowledge Permutations

Unit 1 : Algebra

(6 hours)

Algebra: Binomial theorem, General term, middle term, problems based on these concepts

Unit II : Sequences and Series

(6 hours)

Sequences and series (Progressions). Fundamental principle of counting. Factorial n.

Unit III : Permutations and Combinations

(6 hours)

Permutations and combinations, Derivation of formulae and their connections, simple applications, combinations with repetitions, arrangements within groups, formation of groups.

Unit IV : Trigonometry

(6 hours)

Trigonometry: Introduction to trigonometric ratios, proof of $\sin(A+B)$, $\cos(A+B)$, $\tan(A+B)$ formulae, multiple and sub multiple angles, $\sin(2A)$, $\cos(2A)$, $\tan(2A)$ etc., transformations sum into product and product into sum formulae, inverse trigonometric functions, sine rule and cosine rule

Unit V: Calculus

(6 hours)

Calculus: Limits, standard formulae and problems, differentiation, first principle, uv rule, u/v rule, methods of differentiation, application of derivatives, integration - product rule and substitution method.

Text Book:

1. NCERT class XI and XII text books.
2. Any State Board Mathematics text books of class XI and XII

e-Resources:
<https://nptel.ac.in>

Course Learning Outcome

After completion of this course successfully, the students will be able to

- CLO1 Prove the binomial theorem and apply it to find the expansions of any $(x + y)^n$ and also, solve the related problems K5
- CLO2 Find the various sequences and series and solve the problems related to them. Explain the principle of counting K3
- CLO3 Find the number of permutations and combinations in different cases. Apply the principle of counting to solve the problems on permutations and combinations K3
- CLO4 Explain various trigonometric ratios and find them for different angles, including sum of the angles, multiple and submultiple angles, etc. Also, they can solve the problems using the transformations K4
- CLO5 Find the limit and derivative of a function at a point, the definite and indefinite integral of a function. Find the points of min/max of a function. K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Bridge Mathematics							Course Code: U1R3MAFC			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	1	1	1	1	1	1	1	1	1	1.0
CO2	2	1	1	2	2	1	2	1	1	1.4
CO3	2	1	1	2	2	1	2	1	1	1.4
CO4	1	1	1	1	1	1	2	1	1	1.1
CO5	1	1	1	1	1	1	2	1	1	1.1
		Mean Overall Score								1.2
		Result								Medium

3-Strong; 2-Medium; 1-Low

Title of the Course	:	Analytical Geometry(2D and 3D)		
Category of the Course	:	CORE COURSE	Semester	: II
Course Code	:	U2R3MACC3	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	:	5	Total Inst. Hrs.	: 75

Objectives:

- Necessary skills to analyze characteristics and properties of two- and three-dimensional geometric shapes.
- To present mathematical arguments about geometric relationships.
- To solve real world problems on geometry and its applications.
- To develop logical and systematic computational skills
- To understand and apply the concepts cone and cylinder

Unit I: Diameter (15 hours)

Pole, Polar - conjugate points and conjugate lines – diameters – conjugate diameters of an ellipse - semi diameters- conjugate diameters of hyperbola.

Unit II: Polar Coordinates (15 hours)

Polar coordinates: General polar equation of straight line – Polar equation of a circle given a diameter, Equation of a straight line, circle, conic – Equation of chord, tangent, normal. Equations of the asymptotes of a hyperbola.

Unit III: System of Planes (15 hours)

System of Planes-Length of the perpendicular–Orthogonal projection.

Unit IV: Representation of Line (15 hours)

Representation of line–angle between a line and a plane – co – planar lines–shortest distance between two skew lines –length of the perpendicular–intersection of three planes.

Unit V: Equation of Sphere (15 hours)

Equation of a sphere-general equation-section of a sphere by a plane-equation of the circle- tangent plane- angle of intersection of two spheres- condition for the orthogonality-radical plane.

Text Books:

1. S. L. Loney, Co-ordinate Geometry.
2. Robert J. T. Bell, Co-ordinate Geometry of Three Dimensions.
3. William F. Osgood and William C. Graustein, Plane and Solid Analytic Geometry, Macmillan Company, New York, 2016.

Reference Books:

1. Duraipandian and Chatterjee, “Analytical Geometry” S.Chand& Co, June 1997.
2. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9th Edition, 2010.
3. Robert C. Yates, Analytic Geometry with Calculus, Prentice Hall, Inc., New York, 1961.

e- Resources:

1. <https://nptel.ac.in>
2. <https://www.khanacademy.org/math/geometry-home/analytic-geometry-topic>
3. https://csumec.merlot.org/teacher_resources/trigresources.htm

Outcomes:

The learners would have the ability to,

CO1	Find pole, polar for conics, diameters, conjugate diameters for ellipse and hyperbola	K3
CO2	Find the polar equations of straight line and circle, equations of chord, tangent and normal and to find the asymptotes of hyperbola	K2
CO3	Explain in detail the system of Planes	K2
CO4	Explain in detail the system of Straight lines	K5
CO5	Explain in detail the system of Spheres	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Analytical Geometry (2D and 3D)							Course Code: U2R3MACC3			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	2	2	2	1	-	-	3	2	1	1.4
CO2	2	2	2	1	-	-	3	2	1	1.4
CO3	3	2	2	1	-	-	3	2	1	1.5
CO4	3	2	3	1	-	-	3	2	1	1.6
CO5	3	2	3	1	-	-	3	2	1	1.6
		Mean Overall Score								1.5
		Result								Medium

Title of the Course	: Integral Calculus		
Category of the Course	: CORE COURSE	Semester	: II
Course Code	: U2R3MACC4	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 5	Total Inst. Hrs.	: 75

Objectives:

- To introduce the fundamental principles, concepts and knowledge in the areas of integral calculus
- Knowledge on integration and its geometrical applications, double, triple integrals and improper integrals.
- Knowledge about Beta and Gamma functions and their applications.
- To gain the working knowledge of definite integrals
- To inculcate the basics of integration and their applications

Unit 1 : Evaluation of Reduction Formulae (15 hours)

Reduction formulae -Types, integration of product of powers of algebraic and trigonometric functions, integration of product of powers of algebraic and logarithmic functions - Bernoulli's formula, Feynman's technique of integration.

Unit II : Multiple integrals (15 hours)

Multiple Integrals - definition of double integrals - evaluation of double integrals – double integrals in polar coordinates - Change of order of integration.

Unit III : Triple integral (15 hours)

Triple integrals –applications of multiple integrals - volumes of solids of revolution - areas of curved surfaces–change of variables - Jacobian.

Unit IV: Beta and Gamma Functions (15 hours)

Beta functions - Definition - properties of Beta function - Gamma function - Definition - properties of Gamma function - relations between Beta and Gamma functions-Improper integrals.

Unit V: Applications of Integral Calculus (15 hours)

Geometric and Physical Applications of Integral calculus.

Text Books.

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. D. Chatterjee, Integral Calculus and Differential Equations, Tata-McGraw Hill Publishing Company Ltd.
4. P. Dyke, An Introduction to Laplace Transforms and Fourier Series, Springer Undergraduate Mathematics Series, 2001 (second edition).

Reference Books:

- 1) H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
- 2) G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
- 3) Shanti Narayan, "Differential & Integral Calculus" S. Chand & company ltd Reprint 1994.

e-Resources:

1. <https://nptel.ac.in>
2. https://youtu.be/ksS_yOK1vtk
3. https://www.youtube.com/watch?v=9_m36W3cK74

Outcomes:

The learners would have the ability to,

CO1	Determine the integrals of algebraic, trigonometric and logarithmic functions and to find the reduction formulae	K3
CO2	Evaluate double and triple integrals and problems using change of order of integration	K5
CO3	Solve multiple integrals and to find the areas of curved surfaces and volumes of solids of revolution	K6
CO4	Explain beta and gamma functions and to use them in solving problems of integration	K5
CO5	Explain Geometric and Physical applications of integral calculus	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Integral Calculus							Course Code: U2R3MACC4			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	1	3	-	-	-	3	2	1	1.4
CO2	3	1	3	-	-	-	3	2	1	1.4
CO3	3	1	3	-	-	-	3	2	1	1.4
CO4	3	1	3	-	-	-	3	2	1	1.4
CO5	3	1	3	-	2	1	3	2	1	1.8
		Mean Overall Score								1.5
		Result								Medium

Title of the Course	: Quantitative Aptitude- II		
Category of the Course	: S E Course	Semester	: II
Course Code	: U2R3MASEC2:1	Nature of the Course	: Entrepreneurship
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

- To develop the aptitude of reasoning
- To understand the problem quickly
- To calculate the number of permutations of n objects taken r at a time
- To analyze and complete the series
- To learn of conveying a message through signals

UNIT I : H.C.F and L.C.M

H.C.F – Split method – Division method – HCF of more than two numbers – HCF of decimals – HCF of fractions – Common multiple – L.C.M – Method of prime factors – LCM of decimals and fractions .

UNIT II :Problems of Calendar

Odd days – Ordinary year – Leap year – Counting of odd years .

UNIT III :Permutation and Combination

Permutation – Factorial notation – Combination – Arrangements – Fundamental principles of counting .

Unit IV: Series Completion, Coding and Decoding

Number series – Alphabet series – Letter series – Letter Coding – Coding – Decoding – Number Coding .

Unit V: Time and Distances

Bodies moving in the same direction – Bodies moving in the Opposite direction – Average speed.

Text Books:

1. “ Quantitative Aptitude and Reasoning “ – **R.V. Praveen**, Second Edition, 2013.

Unit I : Chapter 1

Unit II : Chapter 28

Unit III : Chapter 2

Unit IV : Chapter 3 and Chapter 4

Unit V : Chapter 29

Reference Books:

1. “Quantitative Aptitude For Competitive Examinations”, Dr. R. S. Aggarwal – S. Chand & Sons, New Delhi, 2011.
2. “Quantitative Aptitude”, Naresh Sharma, Anjali Kaushik – Variety Books Publishers Distributions.

e – Resources:

1. <https://www.tutorialspoint.com/quantitative Aptitude/apptitude hcf lcm quiz.htm>
2. <https://examsdaily.in/time-and-distance-problems-with-solutions-pdf>

Outcomes:

The learners would have the ability to,

CO1	Be familiar with the common multiples	K1
CO2	Prepare for competitive and entrance examinations in various fields	K3
CO3	Use factorial notation to represent the number of permutations of a set of objects	K5
CO4	Analyze the Decode the messages	K4
CO5	Describe the motion of the object with complete accuracy	K5

**K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate;
K6 – Create**

Title of the Course	:	Statistics with R			
Category of the Course	:	S E Course	Semester	:	II
Course Code	:	U2R3MASEC2:2	Nature of the Course	:	Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	:	2
Credits	:	2	Total Inst. Hrs.	:	30

Objectives

- To learn the open source platform
- To be familiar with the workspace in R
- To understand the Arithmetic and Logarithms concepts
- To interact with Vectors
- To work with matrices in R-programming

List of Topics:

Diagrammatic and Graphical Representation:

1. Simple Bar Diagram
2. Multiple Bar Diagram
3. Line Diagram
4. Pie Diagram
5. Histogram and Frequency Curve

Measures of Central Tendency:

6. Arithmetic Mean
7. Median
8. Mode

Measures of Dispersion:

9. Mean Deviation
10. Standard Deviation

Reference Books:

[1] “The Book of R - A First Course in Programming and Statistics”, Tilman M. Davies, William Pollock publisher 2016.

Reference Books:

[2] “R Fundamentals and Programming Techniques”, Thomas Lumley, R Core Development Team and UW Dept of Biostatistics, 2006.

[3] “Hands-On Programming with R”, Garrett Golemund, O’Reilly Media publication, 2014.

e-Resources:

1. <https://youtu.be/mqaffQZ-U3M>
2. https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf

Outcomes:

The learners would have the ability to,

CO1	Understand the basics in R-Programming	K2
CO2	Handle big data analysis using R- Programming	K3
CO3	Apply R- Programming for vectors	K3
CO4	Appreciate the statistical perspective in R- Programming	K4
CO5	Create the R- Programming documentations	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Title of the Course	: Bio Statistics		
Category of the Course	: S E Course	Semester	: II
Course Code	: U2R3MASEC2:3	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

- To update and expand the basic knowledge of Biostatistics.
- To review the basic concepts and knowledge in collection of Data
- To develop the skills pertinent to practice Measures of central tendency.
- To understand the concepts of Measures of Dispersion.
- To understand the basic concepts of coefficient of Correlation

Unit I: Introduction to Biostatistics

Biostatistics: Definition- Application of Biostatistics - Role of Statistics – Characteristics – Limitations of statistics.

Unit II: Diagrams and Graphical representations

Diagrams: Simple bar diagram – Multiple Bar diagram – Pie diagram.

Graphical Representation: Histogram – Frequency Curve – Polygon.

Unit III: Measures of Central Tendency

Arithmetic mean - Median - Mode - Geometric mean, Harmonic Mean (definition simple problems only)

Unit IV: Measures of Dispersion

Measures of Dispersion: Definition - Characteristics - Range – Quartile Deviation - Mean derivation - Standard deviation - Coefficient of variation (definition simple problems only)

Unit V: Correlation

Definition – Karl Pearson’s coefficient of correlation – Spearman Rank correlation.(definition simple problems only)

Text Books:

[1] “**Biostatistics**” - P.N. Arora, P.K.Malhan, Himalaya Publishing House.(2014).

[2] “**Business mathematics and statistics**”–PA. Navanitham, Jai Publishers..

Unit I : Chapter 1, Sec. 1.1 -1.5, 1.11 – 1.13[1]

Unit II: Chapter 6, Part II – Pg no. 98 – 118, 124 – 137 [2]

Unit III: Chapter 7, Part II Pg. no. 159 – 260 [2]

Unit IV: Chapter 8, Part II Pg. No. 305 – 368 [2]

Unit V : Chapter 12, Part II Pg. no. 503 - 522[2]

Reference Books:

1. “Introduction to Biostatistics”, Sokal and Rohlf, Toppan Co., Japan.
2. “Primer of Biostatistics”, Stanton A. Clantz, The McGraw Hill Inc., New York.

e- Resources:

1. <https://www.cuemath.com/data/measures-of-dispersion/>
2. <https://www.statisticshowto.com/probability-and-statistics/correlation-coefficient-formula/>

Outcomes:

The learners would have the ability to,

CO1	Understand the basic concept of statistics.	K2
CO2	Apply statistical measures which are used to analyze the data.	K3
CO3	Acquire knowledge on measures of central tendency and dispersion.	K5
CO4	Prepare reports to conclude the findings in Correlation.	K4
CO5	Develop computational skill and logical thinking in formulating industry oriented problems as a mathematical problem and finding solutions to these problems	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Title of the Course	: R- Programming-Practical		
Category of the Course	: ELECTIVE COURSE:3	Semester	: II
Course Code	: U2R3MAEC2:1P	Nature of the Course	: Employability
Marks	: CIA:40+Ext:60= 100	Hrs/Week	: 4
Credits	: 3	Total Inst. Hrs.	: 60

Objectives

- To learn the open source platform
- To be familiar with the workspace in R
- To understand the Arithmetic and Logarithms concepts
- To interact with Vectors
- To work with matrices in R-programming

List of Topics:

Diagrammatic and Graphical Representation:

1. Simple Bar Diagram
2. Multiple Bar Diagram
3. Line Diagram
4. Pie Diagram
5. Histogram and Frequency Curve
6. Box Plot
7. Scatter Diagram

Measures of Central Tendency:

8. Arithmetic Mean
9. Median
10. Mode
11. Geometric Mean
12. Harmonic Mean

Measures of Dispersion:

13. Range
14. Quartile Deviation
15. Mean Deviation
16. Standard Deviation

Reference Books:

[1] “The Book of R - A First Course in Programming and Statistics”, Tilman M. Davies, William Pollock publisher 2016.

Reference Books:

[2] “R Fundamentals and Programming Techniques”, Thomas Lumley, R Core Development Team and UW Dept of Biostatistics, 2006.

[3] “Hands-On Programming with R”, Garrett Golemund, O’Reilly Media publication,

2014.

e-Resources:

3. <https://youtu.be/mqaffQZ-U3M>
4. https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf

Outcomes:

The learners would have the ability to,

CO1	Understand the basics in R-Programming	K2
CO2	Handle big data analysis using R- Programming	K3
CO3	Apply R- Programming for vectors	K3
CO4	Appreciate the statistical perspective in R- Programming	K4
CO5	Create the R- Programming documentations	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: R- Programming							Course Code: U2R3MAEC2:1P			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	2	3	1	3	3	3	2	2.5
CO2	3	3	3	2	3	1	3		3	2.5
CO3	3	1	3	3	2	3	1	2	3	2.3
CO4	3	2	3	1	3	3	3	1	2	2.3
CO5	3	3	2	1	1	3	3	3	1	2.2
		Mean Overall Score								2.3
		Result								High

Title of the Course	:	Discrete Mathematics		
Category of the Course	:	ELECTIVE COURSE	Semester	: II
Course Code	:	U2R3MAEC2:2	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 4
Credits	:	3	Total Inst. Hrs.	: 60

Objectives

- To understand the theory logic and technique of and algebraic system.
- Apply the knowledge and skills obtained to investigate.
- Able to understand have to Communicate Mathematical ideas.
- Make effective use of appropriate technology.
- To Attempt questions related to enumeration in various competitive Examination.

Unit I: Mathematical Logic (15 hours)

Introduction- Statements and Notations- Connectives- Normal forms- The theory of Inferences for Statement calculus.

Unit II: Predicate calculus and Inference Theory (15 hours)

The Predicate calculus- Predicates, statement functions, variables and quantifier, Predicate formulas, Free and Bound variables, Universe of discourse, Inference Theory- Valid formulas, Equivalences, Theory of inferences for the Predicate calculus, formulas involving more than one quantifier.

Unit III: Lattices and Boolean Algebra (15 hours)

Introduction- Lattices as partially ordered sets- Boolean Algebra- Boolean functions- Representation and minimization of Boolean functions.

Unit IV: Combinatorics (15 hours)

Permutations – Combinations – Permutations with Repetitions Combinations with Repetition – Permutations of sets with Indistinguishable objects-Miscellaneous problem on permutations and combinations- Binomial Identities.

Unit V: Recurrence Relations (15 hours)

Formulation - Solving by iteration method-Solving Recurrence Relations- Solving Linear Homogeneous Recurrence Relations of order two- Solving Linear Homogeneous Recurrence Relations-Generating functions.

Text Books:

- [1] “ Discrete Mathematical Structures with applications to computer science”, J.P. Tremblay and R. Manohar, McGraw Hill, 1987.
 [2] “ Discrete Mathematics”, N.Chandrasekaran and M.Umaparvathi, PHI Learning Private Limited, New Delhi, 2010.

Unit I : Chapter 1: Sec 1.1, 1.2- Except 1.2.5, 1.3- Except 1.3.5, 1.3.6, 1.4- Except 1.4.4 [1]

Unit II : Chapter 1: Sec 1.5, 1.6 full [1]

Unit III: Chapter 2: Sec 2.3, 2.4, 2.6 –Except 2.6.2 [1]

Unit IV : Chapter3: Sec 3.1 to 3.6, 3.7.1 [2]

Unit V : Chapter 6: Sec 6.1 to 6.6 [2]

[1] “Application Oriented Algebra” by James L.Fisher, Dun Donnelly Publisher.
[2] “Elements of Discrete Mathematics”, C.L. Liu, second edition. McGraw Hill.

1. <https://nptel.ac.in>
2. <https://www.zib.de/groetschel/teaching/WS1314/BondyMurtyGTWA.pdf>

The learners would have the ability to,

CO1	Learn core idea in logic , permutations and combinations counting principles.	K2
CO2	Use generating functions to solve a variety of combinatorial problems.	K2
CO3	Apply the mathematical ideas for solving the problems.	K3
CO4	Acquire the knowledge of basics of Boolean algebra.	K5
CO5	Solve systems of recurrence relations and algorithm.	K3

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Discrete Mathematics							Course Code: U2R3MAEC2:2			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	2	3	1	-	3	3	1	1.9
CO2	3	3	2	3	1	-	3	3	1	2.0
CO3	3	3	2	3	2	-	3	3	1	2.2
CO4	3	3	2	3	1	-	3	3	1	2.1
CO5	3	3	2	3	2	-	3	3	1	2.2
		Mean Overall Score								2.1
		Result								High

Title of the Course	:	A Prime on Divisibility and Number Sequences		
Category of the Course	:	SE COURSE	Semester	: II
Course Code	:	U2R3MASEC3	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	:	2	Total Inst. Hrs.	: 30

Objectives

- To connect number theory to the real world
- To examine the solution for the problem
- To apply the strategies to solve routine and non- routine problems
- To develop problem solving skills and to gain self assess knowledge
- To determine which concepts and procedures are needed to complete the problem

Unit I - Introduction & Congruences

What is Number Theory? - Terms and Symbols - Odd and Even Numbers - The Remainder symbol - other divisors - The congruence symbol - Using congruences - A test for divisibility by 13 - Using negative remainders.

Unit II - Elementary and Remaining Cases

Introduction - Divisibility by 2, 5, 4 - A generalization. Introduction - Divisibility by 9, 11 - More general results - Divisibility by 101 - Divisibility by 7 and 13 - Divisibility by 27 and 37 - Other Divisors - concluding remarks - Divisibility by 7 - Another formulation - searching for new rules - divisibility by 17, 53, 11.

Unit III –The Method of differences

Introduction - what is a pattern? - Number sequences - sequences in mathematics - terms and symbols - polynomial sequences - introduction - a symbolic apparatus.

Unit IV - Exponential Sequences

Sequences of the form $\{a^n\}$ - The sequence $\{(-1)^n\}$ - The sequence $\{z^n\}$ - The sequence $\{2^n\}$ - The sequences $\{3^n\}$ - Mixed sequences - seeking an explanation.

Unit V –Square root

Closeness – Sum of square roots - A Square roots spiral – A random sequence – Worked out problems.

Text Books:

- [1] **FIRST STEPS IN NUMBER THEORY** –ShaileshShirali - Universities press.
- [2] **A prime on number sequences** –ShaileshShirali - Universities press.

- Unit I :** Chapter 1 & 2 All sections [1]
Unit II: Chapter 3, 4, 5 All sections [1]
Unit III: Chapter 1, 2, 3 All sections [2]
Unit IV: Chapter 5 All sections [2]
Unit V : Chapter 14 All sections [2]

Reference Books :

- [1] “ElementaryNumber theory” – David .M.Burton – Tata McGraw – Hill - Edition
- [2] “First steps in number theory – A prime on divisibilityA prime on number sequences” - ShaileshShirali - Universities press.

e-Resources:

1. <https://www.math.upenn.edu/~mlazar/math170/notes04.pdf>
2. <https://www.arvindguptatoys.com/arvindgupta/primenumbers.pdf>

Outcomes:

The learners would have the ability to,

- | | | |
|-----|--|----|
| CO1 | Acquire the knowledge of Number theory and Congruence. | K3 |
| CO2 | Understand general results of Divisibility's. | K2 |
| CO3 | Develop problem solving skills and to gain self assess knowledge of method of differences. | K6 |
| CO4 | Know about the knowledge of mixed sequences. | K2 |
| CO5 | Understand the concept of square root. | K2 |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Discrete Mathematics							Course Code: U2R3MAEC3			
Course Outcomes (COs)	Programme Outcomes (POs)						Programme Specific Outcomes (PSOs)			Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	
CO1	3	3	2	3	1	-	3	3	1	1.9
CO2	3	3	2	3	1	-	3	3	1	2.0
CO3	3	3	2	3	2	-	3	3	1	2.2
CO4	3	3	2	3	1	-	3	3	1	2.1
CO5	3	3	2	3	2	-	3	3	1	2.2
							Mean Overall Score			2.1
							Result			High

Title of the Course	: Vector Calculus and Fourier Series		
Category of the Course	: CORE COURSE	Semester	: III
Course Code	: U3R3MACC5	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 5	Total Inst. Hrs.	: 75

Objectives:

- To give a systematic study of Vector Calculus and Fourier Series.
- To understand the basic concepts of vector differentiation and integration.
- Using the vector identities, directional derivatives and divergence of a vector point function are evaluated easily.
- To learn the techniques of calculus and its applications in finding line integral, surface integral and volume integrals.
- The Fourier series has many applications in electrical engineering, Vibration analysis, Optics, signal and image processing etc.

Unit I - Vector differentiation and Integration (15 hours)

Vector function – Limit and Continuity of a vector function- Derivative of a vector function with respect to a scalar – Curves in space – Velocity and Acceleration – Integration of Vector functions.

Unit II –Gradient, Divergence and Curl (15 hours)

Partial derivatives of vectors – The vector differential operator ∇ - Gradient of a scalar field – Definition – Level Surfaces – Directional derivative of a scalar point function – Tangent plane and normal to a level surface – Divergence of a vector point function – The Laplacian operator ∇^2 - Important vector identities.

Unit III –Green’s, Gauss’s and Stoke’s Theorem (15 hours)

Line Integrals – Surface Integrals – Volume Integrals – Green’s theorem in the plane – The divergence theorem in the plane- The divergence theorem of the Gauss – Green’s Theorem – Stoke’s theorem (without proof) – Related problems.

Unit IV - Fourier series (15 hours)

Definition - To determine the value of a_0 , a_n , and b_n , Fourier Series expansion of periodic functions with period 2π , Fourier series- Even and Odd Functions – Properties of Odd and Even functions.

Unit V - Fourier series - Half range (15 hours)

Definition - Development in Cosine Series - Development in Sine series - Formulas problems of Half range Fourier Sine series and Half range Cosine series - Change of interval.

Text Books:

[1] “Vector Calculus” by J. N. Sharma and A.R. Vasishtha published by Krishna PrakashanMandir(1984) Co., 9th Edition.

[2] “Calculus Vol III” by T.K. ManicavachagomPillay and S. Narayanan, S.V Publications(2011)

Unit I : Chapter I- All sections [1]

Unit II: Chapter I- Sec 1 to 11 [1]

Unit III :Chapter III – Sec 2 to 9 [1]

Unit IV :Chapter 6 – Sec 1, 2, 3, 3.1, 3.4 [2]

Unit V : Chapter 6 - Sec 4, 5.1,5.2, 6, 6.1 [2]

Reference Books:

- 1) “Vector Algebra and Analysis”, T.K. Manicavachagom Pillay and S. Narayanan, S.V Publications
- 2) “Allied Mathematics” - S.G.Venkatachalapathy - Margham Publications
- 3) “Engineering Mathematics” - by Babu Ram
- 4) “Mathematics – III” - A.Singaravelu

e-Resources:

4. https://www.whitman.edu/mathematics/calculus_online/chapter15.html
5. https://www.whitman.edu/mathematics/calculus_online/chapter16.html
6. <https://nptel.ac.in>

Outcomes:

The learners would have the ability to

- | | | |
|-----|--|----|
| CO1 | Using the vector identities, directional derivatives and divergence of a vector point function are evaluated easily. | K3 |
| CO2 | The Fourier series has many applications in electrical engineering, Vibration analysis, Optics, signal and image processing etc. | K3 |
| CO3 | Learn Fourier series, Bessel's inequality, term by term differentiation and integration of Fourier series | K2 |
| CO4 | Know about applications of Fourier transforms to boundary value problems. | K3 |
| CO5 | Familiarize with Fourier transforms of functions | K4 |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Vector Calculus and Fourier Series						Course Code: U3R3MACC5					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	3	3	3	2	1	3	2.4
CO2	2	1	3	1	2	3	3	2	3	2	2.2
CO3	3	2	3	1	2	2	3	2	1	1	2.0
CO4	1	2	3	2	3	2	3	2	2	3	2.3
CO5	3	1	2	3	1	3	3	2	1	2	2.1
		Mean Overall Score									2.2
		Result									High

Title of the Course	: Differential Equations and Laplace Transforms		
Category of the Course	: CORE COURSE	Semester	: III
Course Code	: U3R3MACC6	Nature of the Course	: Entrepreneurship
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 5	Total Inst. Hrs.	: 75

Objectives

- To study the methods used to solve differential equation of first order
- To understand the method of solving second order differential equations.
- To solve differential equations as well as methods based on the use of Laplace transforms.
- To find the solution of PDE first order.
- To learn standard types of PDE second order.

Unit I: ODE –First Order

(15 Hours)

Type F: Exact differential equations – Sufficient condition – practical rule for solving an exact differential equation – Rules for finding integrating factors - Equations solvable for dy/dx – equations solvable for y – Exact equation solvable for x – Clairaut's form – equations that do not contain x explicitly – equations that do not contain y explicitly – Equations homogeneous in x and y .

Unit II: ODE – Second Order

(15 Hours)

Definition – the operator D – Complementary function of a linear equation with constant coefficients – Particular integral – General method of finding P.I. – Special methods for finding P.I. such as e^{ax} , $\cos ax$, $\sin ax$, x^m , $e^{ax}\cos bx$, $e^{ax}\sin bx$

UNIT III: Laplace Transform

(15 Hours)

Definition – Sufficient conditions for the existence of the Laplace transform – Laplace transform of periodic function- Some general theorem – Evaluating certain integrals - The inverse Laplace transform – Solving ODE using Laplace transform with constant coefficients, Solving system of Differential equations, Solving differential equation containing variable coefficients and Solving certain DE involving integrals.

UNIT IV: PDE First Order

(15 Hours)

Classification of integrals – Singular integral - Derivative of PDE – By elimination of constants – By elimination of an arbitrary function – Lagrange's method – Special method: Standard forms I: $F(p, q) = 0$, II: $F(x, p, q) = 0$, III: $F_1(x, p) = F_2(y, q)$, IV: Clairaut's form, V: Equations reducible to the standard form, VI: Charpit's method.

UNIT V : PDE Second Order

(15 Hours)

Some useful results – Linear differential equations with constant coefficients- Auxillary equation – Working rule for finding C.F. – Example of Type- I.

TEXT BOOKS :

- [1].S. Narayanan, "Differential Equations", S. Viswanathan Publishers, 2011.
 [2]. M.D. Raisinghania, "Ordinary& Partial Differential Equations", S. Chand& Co.

Unit I: Chapter II Sections 6.1 -6.4 and Chapter IV: Sections 1-4 (1).

Unit II: Chapter V Sections 1-4 (1).

Unit III: Chapter IX All Sections Except section 2 & 9 (1).

Unit IV: Chapter XII All Sections (1).

Unit V: Chapter IV Sections 4.1-4.5(2).

Reference Books:

1. M.L.Khanna, " Differential Calculus", Jaiprakashnath and Co., Meerut – 2004.
2. M.K.Venkataraman, "Engineering Mathematics", S.V. Publication, 1985, Revised Edit.

e- Resources:

1. <https://www.math.cmu.edu/~wn0g/noll/2ch6a.pdf>
2. <https://www.vyssotski.ch/BasicsOfInstrumentation/LaplaceTransform.pdf>

OUTCOME The learners would have the ability to

CO1	Extract the solution of differential of first order ODE by Homogeneous methods.	K2
CO2	Solve the second order ODE by using special method.	K2
CO3	Apply the Laplace Transform to solve ODE with constant coefficients.	K5
CO4	Form partial differential equations.	K3
CO5	Use Differential equations as a powerful tool in solving problems in physical and social science	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Differential Equations and Laplace Transforms						Course Code: U3R3MACC6					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	3	2	3	2	1	3	2.5
CO2	2	2	3	1	3	3	3	2	1	3	2.3
CO3	3	2	3	1	3	3	2	2	1	2	2.3
CO4	3	2	3	2	3	2	3	2	1	3	2.4
CO5	3	1	2	3	3	3	3	2	1	3	2.3
										Mean Overall Score	2.4
										Result	High

Title of the Course	: Data Analysis using SageMath		
Category of the Course	: SE COURSE	Semester	: III
Course Code	: U3R3MASEC4:1	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

- To use the free open source mathematics software system
- To build on top of many existing open source packages like Maxima, R etc
- To directly access the combined packages via interfaces.
- To further develop software that is useful for academician, industrialist and scientists.
- To trained the students to become part of the developer community

Unit I: Analysis (6 hours)

Limit, sequence, series, evaluation of sum, power series, derivative, partial derivative, integral, solution of ordinary differential equations, displaying solution of ordinary differential equations.

Unit II: Matrices (6 hours)

Solving linear systems, vector computations, reduction of a square matrix, spaces of vectors and matrices, basis for range and null space, Eigen values and Eigen vectors, diagonalization and similarity transformation.

Unit III: Polynomials (6 hours)

Creating polynomials on different rings, basic operations on polynomials, Euclidean division and computation of the greatest common divisor of polynomials, factorization and roots of polynomials.

Unit IV: Derivatives (6 hours)

Solving Equations in SageMath - 2D plotting with SageMath – 3D plotting with SageMath- Calculus of one variable with SageMath- Applications of derivatives

Unit V: Integration (6 hours)

Integration with SageMath – Improper Integral using SageMath– Application of Integration using SageMath- Limit and Continuity of real valued functions – Partial Derivative with SageMath – Local Maximum and Minimum.

Text book:

1. Computational Mathematics with SageMath – Paul Zimmermann et. al., SIAM, 2018.

Reference books:

1. 'AN INTRODUCTION TO SAGE PROGRAMMING', Razvan A. Mezei, John Wiley & Sons, Inc., Hoboken, New Jersey.
2. 'SAGE - BEGINNER'S GUIDE', Craig Finch, Packt Publishing (2011).

e-Resources:

1. https://spada.uns.ac.id/pluginfile.php/174218/mod_resource/content/1/sagebook-ba6596d.pdf
2. <http://euclid.trentu.ca/math/sb/1101Y/Winter-2022/sagebook-ba6596d.pdf>

Outcomes:

The learners would have the ability to

CO1	Solve mathematical problems of mathematical analysis using SageMath	K3
CO2	Ability to solve mathematical problems of linear algebra using SageMath	K2
CO3	Develop and solving skills of inequality	K5
CO4	Acquire the knowledge of solving polynomial by using SageMath	K4
CO5	Evaluate the solution of ordinary differential equations by using SageMath	K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Data Analysis using SageMath						Course Code: U3R3MASEC4:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	3	3	2	2	1	3	2.3
CO2	2	1	3	1	3	2	3	3	1	2	2.1
CO3	3	2	3	1	3	3	2	2	1	3	2.3
CO4	1	2	3	2	3	2	3	3	1	1	2.1
CO5	3	1	2	3	3	3	3	2	1	3	2.4
		Mean Overall Score									2.2
		Result									High

Title of the Course	:	Computational Mathematics		
Category of the Course	:	SE COURSE	Semester	: III
Course Code	:	U3R3MASEC4:2	Nature of the Course	: Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	:	2	Total Inst. Hrs.	: 30

Objectives:

- To learn core ideas in computational mathematics.
- To learn about pigeonhole principle.
- To become familiar with fundamental combinatorial structures.
- To be familiar with Binomial Coefficients.
- To know about special counting sequences.

Unit I: Permutation and Combination (6 Hours)

Four Basic Counting Principles – Permutations of Sets – Combination (subsets) of sets – Permutation of Multisets.

Unit II: The Pigeonhole Principle (6 Hours)

Pigeonhole Principle-Simple form – Pigeonhole Strong form – The theorem of Ramsey.

Unit III: Generating Permutations and Combinations (6 Hours)

Generating Permutations – Inversion in Permutations – Generating Combinations.

Unit IV: Binomial Coefficients (6 Hours)

Pascal's Triangle – The Binomial Theorem – Unimodality of Binomial Coefficients.

Unit V: Special Counting Sequences (6 Hours)

Catalan Numbers – Different Sequences and Stirling Numbers – Partition Numbers.

Text Books:

[1] "Introductory Combinatorics", by Richard A. Brualdi, 5th edition, China Machine Press.

Unit I: Chapter 2 – sec 2.1 to 2.4

Unit II: Chapter 3– sec 3.1 to 3.3

Unit III: Chapter 4 – sec 4.1 to 4.3

Unit IV: Chapter 5 – sec 5.1 to 5.3

Unit V: Chapter 8 – sec 8.1 to 8.3

Reference Books:

[1] "Graph Theory and Combinatorics" by Dr.D.S.Chandrasekharaiah – Bangalore prism books, 2005.

[2] "Graph Theory " – Harray . F – Addison - Wesley - 1969.

[3] "Graph Theory with Applications to Engineering and Computer" – NarasingaDeo – Prientice Hall of India Pvt. Ltd. – New Delhi - 2000.

1. [Combinatorial Algorithms: Theory and Practice - PDF Free Download \(epdf.tips\)](#)
2. whitman.edu/mathematics/cgt_online/cgt.pdf

CO1	Understand the ideas of Combinatorics.	K2
CO2	Study about pigeonhole Principle.	K3
CO3	Study about Pascal's triangle.	K4
CO4	Acquire the knowledge generating permutation and counting technique.	K4
CO5	Work with different sequences and stirling numbers.	K2

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Computational Mathematics						Course Code: U3R3MASEC4:2					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	1	1	3	2	2	3	2.2
CO2	2	3	1	2	3	3	1	2	3	3	2.4
CO3	1	3	3	1	2	3	3	2	3	1	2.4
CO4	3	2	2	1	3	3	3	1	2	3	2.3
CO5	2	3	1	1	3	3	3	3	1	3	2.3
		Mean Overall Score									2.3
		Result									High

Title of the Course	:	SEQUENCES AND SERIES		
Category of the Course	:	CORE COURSE	Semester	: IV
Course Code	:	U4R3MACC7	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 6
Credits	:	5	Total Inst. Hrs.	: 90

Objectives:

- To understand the concept of convergence and divergence in sequences.
- To test for convergency series by using Cauchy's theorem.
- To discuss behaviour of absolutely convergent series.
- To derive Binomial, Exponential and logarithmic series.
- To compute summations of series and recurring series.

UNIT I : Sequences

(18 Hours)

Sets, Sequences – Limit of a Sequence – Aggregate – Upper and lower bound Dedikind's theorem – upper and lower bound of an aggregate – Bounded sequences – The upper and lower limits of a sequence – Cauchy's general principle of convergence – Monotonic sequence – a monotonic sequence always tend to a limit – Finite or Infinite.

Unit II: Test for Convergency of Series

(18 Hours)

Convergence of infinite series, Geometric series – some general theorems concerning infinite series – series of positive terms – Comparison tests – Convergent of the given series – Cauchy's condensation test- D'Alembert's Ratio test.

Unit III: Cauchy's test

(18 Hours)

Cauchy's root test –Raabe's test – Absolutely convergent series – Absolutely convergent series and Conditionally convergent series – An absolutely convergent series is convergent - Series whose terms are alternately positive and negative.

Unit IV: Binomial, Exponential and Logarithmic series

(18 Hours)

Binomial theorem for a Rational index – some important particular cases of Binomial expansion – sign of terms in Binomial expansion – Application of Binomial expansion to the summation of series - Exponential theorem - summation - Logarithmic series which can be summed up by the Logarithmic series, modification of logarithmic series, Euler's constant.

Unit V : Summation of Series

(18 Hours)

Application of Partial Fractions - Summation of series whose general term is given – Sum to n terms of the given series - Summation by difference series - Successive difference Series - Recurring series - The generating functions - sum to n terms of a given recurring series

Text Book:

[1] T.K.Manicavachagam Pillai, T.Natarajan, K.S.Ganapthy, "Algebra Vol.I", S.Viswanathan Pvt. Limited, Chennai, 2004.

Unit I :Chapter II Sec: 4 to 7

Unit II :Chapter II Sec: 8 to 16

Unit III :Chapter II Sec: 17 to 24

Unit IV :Chapter III Sec: 5 to 10 & Chapter IV Sec. 2, 3, 5 to 9

Unit V :Chapter V Sec: 2 to 7

Reference Books :

- 1) M.K.Singal&Asha Rani Singal, "A first course in Real Analysis", R.Chand& Co., 1999.
- 2) 'A guide to Mathematics', L.R.Dhanda, Kalyani Publishers.
- 3) Dr.S.Arumugam, "Sequences & Series", New Gamma Publishers.

e-Resources:

1. <http://www.cmat.edu.uy/~marclan/TM/Algebra%20i%20-%20Bourbaki.pdf>
2. <https://www.math.stonybrook.edu/~aknapp/download/b2-alg-inside.pdf>

Outcomes: The Learners would have the ability to

CO1	Know the properties of convergent and divergent sequence.	K2
CO2	Understand and apply test for convergency of series	K2
CO3	Understand and to apply the method of difference to sum the finite series and to extend its use to infinite series	K2
CO4	Know how to use Binomial, Exponential and Logarithmic series.	K3
CO5	Acquire the knowledge of the generating function	K4

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

CO/PO Mapping:

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: SEQUENCES AND SERIES						Course Code: U4R3MACC7					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	2	3	2	3	3	2	2	1	3	2.4
CO2	2	3	3	2	3	2	3	3	2	2	2.5
CO3	3	2	3	1	3	3	3	2	1	3	2.4
CO4	2	2	3	2	3	2	3	3	2	3	2.5
CO5	3	2	2	3	3	2	3	2	1	3	2.4
										Mean Overall Score	2.4
										Result	High

Title of the Course	: Classical Algebra and Theory of Numbers		
Category of the Course	: CORE COURSE	Semester	: IV
Course Code	: U4R3MACC8	Nature of the Course	: Skill Development
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 5	Total Inst. Hrs.	: 75

Objectives:

- To give a systematic study of Theory of Equations
- To Study and apply various properties of and relating to the integers including the Well-Ordering Principle and greatest common divisors.
- To identify certain number theoretic functions and their properties.
- To understand the concept of congruence and use various results related to congruences.
- Identify how number theory is related to and used in cryptography.

Unit I: Theory of Equations (15 hours)

Introduction-Remainder theorem- An equation with real coefficients and imaginary roots- An equation with rational coefficients irrational roots- Relation between roots & coefficients of Polynomial Equations

Unit II: Theory of Equations cntd (15 hours)

Symmetric functions – Sum of the r^{th} Powers of the Roots- Newton's theorem on the sum of the power of the roots-Transformations of Equations

Unit III: Inequalities (15 hours)

Inequalities – elementary principles – Geometric & Arithmetic means – Weirstrass inequalities – Cauchy inequality – Applications to Maxima & Minima.

Unit IV: Theory of Numbers (15 hours)

Theory of Numbers – Prime & Composite numbers – divisors of a given number N – Euler's Function $\phi(N)$ and its value – Integral part of a real number- The highest power of a prime p contained in $n!$.

Unit V: Theory of Numbers (15 hours)

Congruences – Divisibility of a number by 3,9,11 from the properties of congruences- Numbers in Arithmetical Progression- Fermat's, Generalisation of Fermat's theorem-Wilson's & Lagrange's Theorems.

Text Books:

1. T.K. Manickavasagam Pillai & others, Algebra Volume I, S.V. Publications – Revised Edition.
2. T.K. Manickavasagam Pillai & others, Algebra Volume II, S.V. Publications –Revised Edition.

Unit – I : Chapter 6 Section 1-11 of (1)

Unit – II : Chapter 6 Section 12-15 of (1)

Unit – III : Chapter 4 of (2)

Unit – V : Chapter 5 Section 12-18 of (2)

3. "Higher Algebra", H.S. Hall and S.R. Knight, Prentice Hall of India, New Delhi.
4. "Number Theory", Hari Kishan, Krishna's Publications, 12th edition 2017.
5. "Allied Mathematics" - S.G.Venkatachalapathy - Margham Publications

1. <https://nptel.ac.in/courses/111/101/111101137/>
2. <http://math.hawaii.edu/~jb/math618/Nation-LatticeTheory.pdf>

CO1	Acquire the knowledge of Theory of equations.	K2
CO2	Understand the concepts transformations of equations	K2
CO3	Develop and solving skills of inequality	K5
CO4	Know about applications of Number theory	K3
CO5	Familiarize with Congruence and Divisibility	K4

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Classical Algebra and Theory of equations						Course Code: U4R3MACC8					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	3	2	3	2	1	3	2.3
CO2	2	1	3	1	3	3	3	1	1	2	2.0
CO3	3	2	3	1	3	3	2	2	1	2	2.2
CO4	1	2	3	2	3	3	3	2	1	3	2.3
CO5	3	1	2	3	3	3	3	2	1	3	2.4
		Mean Overall Score									2.2
		Result									High

Title of the Course	:	Introduction to GeoGebra		
Category of the Course	:	SE COURSE	Semester	: IV
Course Code	:	U4R3MASEC5:1	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	:	2	Total Inst. Hrs.	: 30

Objectives:

- To explore linear and non linear graphs
- To extend into 3D graphs
- To model the exercise based on examination
- To explore some of the tools in geogebra classic
- To work through some of the problems involving graphs

UNIT I : Introduction to Geogebra

(6 hours)

Installing Geogebra- Installation with internet access – Installation without internet access- Save the accompanying files – Background information about geogebra – Geogebra's user interface – Basic use of tools – Drawing versus geometric construction – Saving geogebra files- Drawings, constructions and drag test - Rectangle construction – Triangle construction.

UNIT II: Functions in Geogebra

(6 hours)

Constructing Tangents to a circle – Exploring parameters of a Quadratic Polynomial – Using Sliders to modify parameter – Exports of pictures to the clipboard – Inserting pictures into a text processing documents

UNIT III: Graphics View

(6 hours)

Drawing tools for symmetric figures – Enhancing the construction- Resizing and Reflecting a picture –Distorting a picture – Exploring properties of reflections – Inserting text into the graphics views – Rotation of a polygon

UNIT IV : Dynamic Worksheets

(6 hours)

Combining spreadsheets view & Graphics view – Record to spreadsheet – Relative copy and linear Equations – Best fit line – Creating static Instructional materials – Inserting pictures into a text processing document – Creating dynamic worksheets – Reducing the size of the geogebra window

UNIT V: Practice Block

(6 hours)

Area relations of similar geometric figures – Visualizing the angle sum in a triangle – integer addition on the number line – Tangram puzzle

Text Book :

1. "Introduction to GeoGebra" - Judith and Markus Hahenwarter, Nov 2011

Unit I : Chapter 1-3

Unit II : Chapter 4-6

Unit III : Chapter 7-9

Unit IV : Chapter 10-12

Unit V : Chapter 13

Reference Book:

1. “An introduction to GeoGebra”, Steve Phelps, University of Cincinnati, 2011.

e-Resources:

1. <http://www.geogebra.org>
2. <http://math4allages.wordpress.com/geogebra>

Outcomes:

The learners would have the ability to,

CO1	Recall and strengthen the knowledge of Rectangle construction	K1
CO2	Be familiar with the Geogebra functions	K4
CO3	Extend the ideas to graphic views and begin for optimal small group discussions	K5
CO4	Understand the Geogebra demonstration	K2
CO5	Practice the track test with all Geogebra applets	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

CO/PO Mapping:

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Introduction to GeoGebra						Course Code: U4R3MASEC5:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	3	3	3	2	1	3	2.4
CO2	2	1	3	1	3	3	2	2	2	2	2.1
CO3	3	2	3	1	3	3	3	3	1	3	2.5
CO4	1	2	3	2	3	3	2	2	1	2	2.1
CO5	3	1	2	3	3	3	3	2	1	2	2.3
		Mean Overall Score									2.3
		Result									High

Title of the Course	: Theory of Games and Decision theory		
Category of the Course	: SE COURSE	Semester	: IV
Course Code	: U4R3MASEC5:2	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	: 2	Total Inst. Hrs.	: 30

Objectives:

- To solve two-person zero sum game
- To understand the concepts of Dominance property
- To analyze the applications of Linear programming
- To learn about decision theory
- To apply the Roll back techniques in the real situations

Unit I: **Game Theory** (6 hours)

Two –Person – zero – Sum Game, Payoff matrix, Saddle point, Value of the Game-Problems. Methods for solving game without Saddle point – Problems, Algebraic method of solve a 3×3 game.

Unit II : **Graphical method** (6 hours)

Graphical method to solved a $2 \times n$ (or) $n \times 2$ game – Problems – Dominance property – Modified dominance property – Problems.

Unit III: **Linear Programming** (6 hours)

Applications to solve a game – Simple problems – Solving the game using the method of Approximation problems.

Unit IV: **Decision Theory** (6 hours)

Decision criteria- The maximum or Minimum criteria – Problems. The expected value / Laplace Criteria the minimum regret / Savage criterion – The Hurwitz Criterion – Problems.

Unit V: **Decision under Risk** (6 hours)

The Expected Monetary value (EMV) criterion and the Expected Opportunity Loss (EOL) criterion- Expected Value of Perfect Information (EVP)- Problems, Decision trees – Roll-back Technique.

Text Book:

[1] “Operations Research methods and Applications”, P. Mariyappan, New Century Book House Pvt. Ltd. Chennai, 2002.

Unit I: Chapter 11, Sections: 11.1 to 11.3.

Unit II: Chapter 11, Sections: 11.4 to 11.5.

Unit III: Chapter 11, Sections: 11.6.

Unit IV: Chapter 11, Sections: 11.7.

Unit V: Chapter 11, Sections: 11.8 to 11.9.

Reference Books:

[1] “Operations Research”, V.K. Kapoor, Sultan Chand & sons Ltd.

[2] “ Operations Research”, Hamdy A. Taha, Prentice Hall of India, 2002.

e-Resources:

1. <https://docs.ufpr.br/~volmir/Math486.pdf>
2. <https://kanchiuniv.ac.in/coursematerials/Game%20theory.pdf>

The learners would have the ability to,

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Title of the Course: Theory of Games and Decision theory						Course Code: U4R3MASEC5:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	3	3	3	3	1	2	3	2.5
CO2	3	2	2	3	1	3	3	3	3	3	2.6
CO3	3	1	2	3	2	3	2	3	3	1	2.3
CO4	3	3	3	3	1	3	3	3	3	3	2.8
CO5	3	3	3	3	3	1	3	2	3	2	2.6
		Mean Overall Score									2.6
		Result									High

Title of the Course	:	Mathematics for Competitive Examination – I		
Category of the Course	:	SE COURSE	Semester	: IV
Course Code	:	U4R3MASEC6:1	Nature of the Course	: Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 2
Credits	:	2	Total Inst. Hrs.	: 30

Objectives

- To introduce the concept of Mathematics with emphasis on analytical ability
- To educate the students in computational skill
- To make the students prepare for competitive examinations
- To be better equipped in a relative sense as for as preparation for entrance examinations involving placement opportunities
- To educate the knowledge of Quantitative Aptitude

Unit I –Square Roots, Cube Roots, Surds & Indices (7 hours)

Introduction – important formula - the square roots and cube roots of the numbers – formulae for indices and surds –laws of indices and surds.

Unit II - Percentage, Profit and Loss (6 hours)

Basic concepts - important formula - profit and loss - short cut methods - simple problems.

Unit III - Ratio and Proportion (5 hours)

Introduction - Definition of ratio - compounding of ratio - comparison of ratio - properties of ratio - equal ratio - proportion - continued proportion - fourth proportional - Third proportional - mean proportional - direct proportion - inverse proportion - use of proportion in geometry.

Unit IV– Partnership (5 hours)

Introduction - simple partnership - compound partnership - working partner - sleeping partner - monthly equivalent investments.

Unit V - Simple and Compound Interest (7 hours)

Introduction - formula for simple interest - relation between amount and price - simple problems on simple interest - compound interest - some important rule - simple problems based on compound interest.

Text Book:

[1] “Quantitative Aptitude for Competitive Examination” – R.S.Aggarwal – S. Chand & Sons – New Delhi –Seventh edition – 2006.

Unit – I : Chapter 5 & 9

Unit – II : Chapter 10 & 11

Unit – III : Chapter 12

Unit – IV : Chapter 13

Unit – V : Chapter 21 & 22

[1] ‘Quantitative Aptitude for Competitive Examinations’ by R.S.Aggarwal – S.Chand& sons, New Delhi 2006.

[2]‘Quantitative methods’ by D.C. Sonchati, S.Chnad& sons Delhi.

1. <https://testbook.com/objective-questions/mcq-on-quantitative-aptitude--5eea6a1039140f30f369e7e7>
2. <https://www.non-engineer.com/post/quant-formulas-cat>

CO1	Analyze real life problems and find solutions	K4
CO2	Prepare for Competitive & Entrance Examinations for better job opportunity	K2
CO3	Know the application of ratio and proposition.	K2
CO4	Develop the business thinking	K6
CO5	Enrich the knowledge and problem solving technique	K5

CO/PO Mapping :

Title of the Course: Mathematics for Competitive Examination - I						Course Code: U4R3MASEC6:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	1	3	3	2	2	1	3	2.1
CO2	2	1	3	2	3	3	2	2	2	2	2.2
CO3	3	3	3	1	3	3	3	3	2	3	2.5
CO4	3	2	3	2	1	3	2	2	1	2	2.3
CO5	3	3	2	3	3	3	3	2	1	2	2.5
		Mean Overall Score									2.3
		Result									High

Title of the Course	:	DATA ANALYSIS USING SPSS – PRACTICAL		
Category of the Course	:	SE COURSE	Semester	: IV
Course Code	:	U4R3MASEC6:2P	Nature of the Course	: Entrepreneurship
Marks	:	CIA:40+Ext:60= 100	Hrs/Week	: 2
Credits	:	2	Total Inst. Hrs.	: 30

Objectives:

- To provide concepts used in routines in SPSS on the following problems.
- To understand how to start SPSS.
- To enter, modify and analyze the data.
- To define a variety of statistical variables.
- To work with multiple data source

List of Practical:

1. Mean, Median, Mode, Standard deviation, (pg. 49 to 53) (03 Hours)
2. Skewness and Kurtosis.(pg. 54 to 56) (03 Hours)
3. Bar diagram, Line diagram, Pie chart and Histogram.
(pg.77 to 81,85 to 89, 95 to 104) (03 Hours)
4. Coefficient of correlation and Rank correlation.
(pg. 187 to 188, 201 to 203) (03 Hours)
5. Regression equation of X on Y and Y on X.(pg. 211 to 214) (03 Hours)
6. Application of t-test for One sample test.(pg. 112 to 126) (03 Hours)
7. Application of t-test for Two sample test. (pg. 112 to 126) (03 Hours)
8. Application of paired t- test.(pg. 112 to 126) (03 Hours)
9. Chi-Square test for Goodness of fit.(pg. 233 to 237) (03 Hours)
10. Application of analysis of variance: One way and Two way classification.
(pg. 154 to 174) (03 Hours)

Text Book:

[1] “SPSS for you” by A.Rajathi & MJP P. Chandran, Publisher, Edition- 2010

Reference Book:

- 5) “SPSS 17.0 for Researchers” by Gupta and Hitesh Gupta – International Book Home Pvt. Ltd

e-Resources:

1. https://students.shu.ac.uk/lits/it/documents/pdf/analysing_data_using_spss.pdf
2. https://www.westga.edu/academics/research/vrc/assets/docs/spss_basics.pdf

Outcomes: The learners would have the ability to

- | | | |
|------------|---|----|
| CO1 | Analyze statistical data using measures of central tendency, dispersion and location. | K4 |
| CO2 | Analyze statistical data using frequency distributions and cumulative frequency distributions | K4 |
| CO3 | Calculate and interpret the correlation between two variables. | K2 |
| CO4 | Know the association between the attributes. | K3 |
| CO5 | Interpret results of analysis of variance tests. | K4 |

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: DATA ANALYSIS USING SPSS - PRACTICAL						Course Code: U4R3MASEC6:2P					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	3	2	3	3	2	1	3	2.3
CO2	2	1	3	1	2	3	3	2	3	2	2.1
CO3	3	2	3	2	1	2	1	2	1	3	2.3
CO4	1	2	3	2	3	2	3	2	2	3	2.2
CO5	2	1	3	3	1	2	3	3	1	2	2.3
		Mean Overall Score									2.2
		Result									High

Title of the Course	: Mechanics		
Category of the Course	: CORE COURSE	Semester	: V
Course Code	: U5R3MACC9	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 6
Credits	: 5	Total Inst. Hrs.	: 75

Objectives

- To understand the basic concepts of forces, moments, couple, friction law virtual displacement and work
- To develop the skills in formation of suitable mathematical models and problems solving techniques
- To describe the relation between mass and inertia
- To calculate force and impulse given mass, velocity and time
- To develop logical deduction and interpretation of Impulsive force and Impact.

UNIT I: Forces and Equilibrium of a particle under three or more forces. (15 hours)

Forces & Equilibrium - Forces – Resultant of two forces – Three forces related to a triangle –Equilibrium of a particle under three or more forces.

UNIT II : **Moment, Couples and Equilibrium of three forces acting on a rigid body** (15 hours)

Forces on a rigid body - **Moment** – Equivalent systems of forces- Parallel forces – Varignon's Theorem- Forces along a Triangle – Couples –Equilibrium of a rigid body under three coplanar forces – Reduction of coplanar forces into a force & a couple .

UNIT III :**Friction** (15 hours)

Friction – Laws of Friction – Coefficient of Friction, Angle & **Cone of Friction** –Limiting equilibrium of a particle on a rough inclined plane, Tilting of a body - Simple Problems.

UNIT IV: **Projectile** and Simple Harmonic motion (15 hours)

Simple Harmonic motion – Simple Pendulum – Load suspended by an elastic string – **Projectile – Maximum height reached , range , time of flight – Projectile up / down an inclined plane .**

UNIT V: **Impulsive force and Impact** (15 hours)

Impulsive force – conversion of linear momentum – Impact of a sphere & a plane - Direct & Oblique Impact of two smooth spheres –Kinetic energy and Impulse

Text Books:

[1] P.Duraipandiyan, “**Mechanics (Vector Treatment)**”, S.Chand& Co. -June 1997

UNIT I : Chapter 2 & Chapter 3 Section 3.1

UNIT II : Chapter 4 Section 4.1 , 4.3 to 4.9 & Chapter 5 Section 5.1

UNIT III : Chapter 2 Section 2.1 , Chapter 3 Section 3.2 , Chapter 5 Section 5.2

UNIT IV : Chapter 12 sections 12.1 to 12.3 & Chapter13

UNIT V : Chapter 14

Reference Books:

[1] M.K.Venkataraman, “**Statics**”, Agasthiyar Publications, 2002.

[2] A.V.Dharmapadham, “**Statics**”, S. Viswanathan Publishers Pvt Ltd, 1979.

[3] S.L. Lony, “**Elements of Statics and Dynamics**”, Part-I, A.I.T. Publishers,1991.

e-Resources:

1. <https://physics.appstate.edu/faculty-staff/labs-and-demonstrations/online-resources>
2. <https://asmedigitalcollection.asme.org/appliedmechanicsreviews/article-abstract/54/2/93/401290/The-Role-of-Friction-in-Mechanical-Joints?redirectedFrom=fulltext>

Outcomes:

The learners would have the ability to,

CO1	Relate force and motion	K3
CO2	Study Simple Harmonic Motion, Projectiles, Impulsive force and Impact.	K1
CO3	Develop mathematical formulation of the physics aspects of the problems	K5
CO4	Determine the properties of a system will be in a condition of impending motion	K4
CO5	Understand the concept of impulse to reduce the force impact	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

CO/PO Mapping:

Title of the Course: Mechanics						Course Code: U5R3MACC9					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	2	3	2	1	3	3	2	1	3	2.3
CO2	3	2	1	3	2	3	3	1	3	3	2.4
CO3	3	2	3	1	2	2	3	2	3	1	2.2
CO4	3	1	3	2	3	3	2	2	3	2	2.4
CO5	3	2	3	3	1	1	3	2	3	2	2.3
		Mean Overall Score									2.3
		Result									High

Title of the Course	: Abstract Algebra		
Category of the Course	: CORE COURSE	Semester	: V
Course Code	: U5R3MACC10	Nature of the Course	: Entrepreneurship
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 6
Credits	: 5	Total Inst. Hrs.	: 75

Objectives:

- To educate the basic concepts of Modern Algebra
- To determine whether a group is cyclic or abelian
- To help the student attach meaning to the abstract concept of algebra
- To use algebra as a tool for representing and solving a variety of practical problems
- To calculate with cosets fluently

Unit I-Groups (12 hours)

Introduction –Definition and Examples – Elementary Properties of Group – Equivalent definitions of a group – **Permutation Groups** – Subgroups – **Cyclic groups** – Order of an element.

Unit II- Normal Subgroups And Homomorphism (12 hours)

Cosets and Lagrange's Theorem – Normal subgroups and Quotient groups – Isomorphism – Homomorphism.

Unit III-Rings (12 hours)

Definition and Examples – Elementary Properties of rings – Isomorphism – Types of rings – Characteristics of a ring – Subrings – Ideals – **Quotient rings – Maximal and Prime ideals – Homomorphism of rings.**

Unit IV- Field (12 hours)

Field of quotients of an integral domain- Ordered integral domain- Unique factorization domain(U.F.D)- Euclidean domain- Every P.I.D is a U.F.D.- Polynomial Rings- Polynomial Rings over U.F.D.- Polynomials over $\mathbb{Q}$.

Unit V- Vector Spaces (12 hours)

Introduction- Definition and Examples- Basis and Dimension- Rank and Nullity- Matrix of a Linear Transformation.

Text Books

[1] S.Arumugam & A.Thangapandi Isaac, "Modern Algebra", scitech Publication (2003).

- Unit I** : Chapter III sections 3.0 to 3.7
Unit II : Chapter III sections 3.8 to 3.11
Unit III : Chapter IV sections 4.1 to 4.10
Unit IV : Chapter IV sections 4.11 to 4.18
Unit V : Chapter V sections 5.0, 5.1, 5.6 to 5.8

References

- 1) T.K.Manicavasagam Pillai, T.Natarajan, K.S.Ganapathy, Algebra, Vol.I, S.Viswanathan Pvt. Limited, Chennai, 2004.
- 2) M.L. Santiago, Modern Algebra, Tata McGraw Hill, 2003.

e-Resources:

1. <https://resources.saylor.org/wwwresources/archived/site/wp-content/uploads/2011/04/Field-mathematics.pdf>
2. <http://math.hawaii.edu/~jb/math618/Nation-LatticeTheory.pdf>

Outcomes:

The learners would have the ability to,

CO1	Recognize technical terms groups, permutation groups and cyclic groups.	K1
CO2	Acquire the knowledge of normal subgroups	K4
CO3	Understand the elementary properties of rings	K6
CO4	Formulate and develop unique factorization domain	K4
CO5	Describe the properties of Distributive lattices.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

CO/PO Mapping:

Title of the Course: Abstract Algebra						Course Code: U5R3MACC10					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	3	3	3	1	3	1	3	2	3	2.5
CO2	3	1	3	2	3	3	3	2	1	3	2.4
CO3	3	3	3	3	2	3	3	2	3	1	2.6
CO4	3	2	3	1	3	3	3	1	2	2	2.3
CO5	3	3	3	1	3	3	3	3	1	1	2.4
		Mean Overall Score									2.4
		Result									High

Title of the Course	: Real Analysis		
Category of the Course	: CORE COURSE	Semester	: V
Course Code	: U5R3MTCC11	Nature of the Course	: Entrepreneurship
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 4	Total Inst. Hrs.	: 75

Objectives:

- To familiarize the fundamentals of Real analysis
- To understand the basic facts about set theory and the set of real numbers.
- To include Axioms of real number system
- To develop a deeper and more rigorous understanding of calculus including Defining terms
- To prove theorems about functions, sequences, series, limits, counting, derivative, and Riemann integrals

Unit I : Real Number system

(15 hours)

The field axioms - The order axioms - The rational numbers -The irrational numbers - Upper bounds, maximum elements, least upper bounds (supremum) – The completeness axioms – Some properties of the Supremum – Absolute values and the triangle inequality – The Cauchy-Schwarz inequality – Finite and infinite sets – Countable and uncountable sets – Set algebra – Countable collection of countable sets.

Unit II : Elements of Point Set Topology

(15 hours)

Introduction - Euclidean space $\mathbb{R}^n$ – Open balls and open sets in $\mathbb{R}^n$ – The structure of open sets in $\mathbb{R}^1$ – Closed sets – Adherent points, accumulation points – closed sets and adherent points – The Bolzano – Weierstrass theorem – the Cantor intersection theorem – The Lindelof covering theorem.

Unit III : Continuous functions of Metric spaces

(15 hours)

Metric spaces – Point set Topology in Metric spaces – Compact subset of a Metric spaces – Boundary of a set – Convergence Sequence in a Metric Space - Cauchy Sequences – Complete Metric Spaces – Continuous Function – examples of Continuous function – Continuity and inverse images of open or closed set – Function Continuous on compact set – connectedness – Components of Metric space – Arc wise connectedness – Uniform Continuity – Discontinuity of a real valued functions.

Unit IV: Derivatives

(15 hours)

Introduction – Definition of Derivative – Derivatives and Continuity – Algebra of Derivatives - Rolle's Theorem – Mean Value theorem for Derivative – Intermediate Value Theorem – Taylor's Formula with remainder.

Unit V: Riemann Integrability

(15 hours)

Riemann Integration – Definition – Darboux's Theorem - Necessary and sufficient condition for Integrability – Integrability of Continuous and Monotonic functions – Integral Function – Properties of Integral function – Continuity and Derivability of Integral Function – Fundamental theorem of Calculus – First Mean Value Theorem – Second Mean Value Theorem.

Text Books:

[1] "Mathematical Analysis", Tom. M. Apostol, Nirosha Publishing house Pvt. Ltd, 2002

[2] “A course of Mathematical Analysis”, Shanthi Narayan, S.Chand Co., 2014.

Chapter 2 : 2.11 – 2.15.

Unit III: Chapter 3: 3.13 – 3.16.

Chapter 4: 4.1 – 4.4, 4.8, 4.11 – 4.13, 4.16 - 4.19, 4.22.

Unit IV: Chapter 5: 5.1 – 5.5, 5.9 – 5.12

Unit V: Chapter 6: 6.1 – 6.9 [2]

1. "Methods of Analysis", Gold Berge, Richar. R, Oxford and IBHP Publishing co. New Delhi.
2. "Real Analysis", H.L. Royden, P.M. Fitzpatrick, PHI Learning Pvt. Ltd, 2010.

1. <https://youtu.be/C2qIoHkhEuM>
2. <https://tutorial.math.lamar.edu/classes/calci/MeanValueTheorem.aspx>

The learners would have the ability to,

CO1	Emphasize the proofs development defines the counting of a function and uniform continuity of a function.	K4
CO2	Understand the knowledge of types of discontinuities.	K2
CO3	Acquire the knowledge of Daurboux's theorem on derivative.	K4
CO4	Use results and techniques involving mean value theorems to solve a variety of problems.	K3
CO5	Understand the concepts of fundamental theorem of integral calculus.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

CO/PO Mapping :

Title of the Course: Real Analysis						Course Code: U5R3MTCC11					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	2	3	2	3	3	3	2	2	3	2.6
CO2	2	2	3	3	3	3	2	2	2	2	2.4
CO3	3	2	3	1	3	3	3	3	1	3	2.3
CO4	1	2	3	2	3	3	2	2	1	2	2.2
CO5	3	1	2	3	3	3	3	2	1	2	2.3
		Mean Overall Score									2.3
		Result									High

Title of the Course	: Operations Research		
Category of the Course	: CORE COURSE	Semester	: V
Course Code	: U5R3MACC12	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 4
Credits	: 4	Total Inst. Hrs.	: 60

Objectives

- To introduce Operation Research, Linear programming formation and role of Computer in OR
- To develop computational skill and logical thinking in formulating industry oriented problems as a mathematical problem and finding solutions to these problems
- To introduce concepts of slack and surplus variables
- To improve the skills of solving very common problems which we come across in various fields like transportation, Sequencing Problems and industries with machines
- To introduce Network and to find critical path
- To introduces The inventory Decisions and objectives of Scientific inventory control

UNIT I: **Linear Programming Problem** (12 hours)

Introduction to OR – An overview of OR – Mathematical Formulation of linear Programming problem – Graphical Solution – Simplex Methods for $<$, $=$, $>$ constraints. Concept of Duality - Primal and Dual Problems-Duality-Dual Simplex Method.

UNIT II: **Transportation problem** (12 hours)

Introduction - LP Formulation of Transportation problem –Solution of Transportation problem – Finding an initial basic Feasible solution - Test for Optimality – MODI Method - Stepping Stone Method – Unbalanced Transportation problem..

UNIT III: **Assignment problem** (12 hours)

Introduction – Mathematical Formulation of problem –Solution Methods of Assignment - Unbalanced Assignment problem - Travelling salesman problem.

UNIT IV: **Network** (12 hours)

Introduction Network: Basic components- Logical sequencing – Rules of Network Construction – Concurrent Activities - Critical Path Analysis – Probability Consideration in PERT- Distinction between PERT and CPM.

UNIT V :**Inventory control** (12 hours)

Introduction- Types of inventories- Reasons for carrying Inventories - The inventory Decisions- objectives of Scientific inventory control - Cost Associated with Inventories- Factors Affecting inventory control- An inventory control Problem- The concept of EOQ- Deterministic inventory Problems with and without shortages- problems of EOQ with price breaks.

Text Book:

[1] Kanti Swarup, Gupta.P.K, & Manmohan,” Operations Research”, Sultan Chand &Co, Sixteenth edition-2012,Reprint 2013.

Unit I: Chapter I Sec:1.1,1.2,1.4 to1.6 ,Chapter II sec: 2.2 , 2.3 ,Chapter III Sec:3.2 to 3.5 and Chapter IV Sec:4.1,4.3,4.4 Chapter V Sec: 5.1 to 5.4, 5.7 and 5.9.

Unit II: Chapter X Sections 10.1 to 10.16 Except (10.11,10.12).

Unit V: Chapter IXX Sections 19.1 to 19.12.

[3] Hadley, G. *Linear Programming*, Narosa Publishing House, New Delhi, 2002.

2. [https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jun/4_06-11-2021_16-06-34_OPERATIONS%20RESEARCH%20TECHNIQUES\(20MAT22C5\).pdf](https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jun/4_06-11-2021_16-06-34_OPERATIONS%20RESEARCH%20TECHNIQUES(20MAT22C5).pdf)

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Title of the Course: Operations Research						Course Code: U5R3MACC12					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	3	3	3	1	1	3	3	2	3	2.5
CO2	3	3	1	2	3	3	2	2	3	2	2.4
CO3	3	3	3	3	2	2	3	2	3	3	2.7
CO4	3	2	2	1	3	3	2	1	2	1	2.0
CO5	3	3	3	1	3	3	3	3	1	2	2.5
		Mean Overall Score									2.4
		Result									High

Title of the Course	:	Numerical Methods with MATLAB(Practical)		
Category of the Course	:	DSE COURSE	Semester	: V
Course Code	:	U5R3MADSE5:1P	Nature of the Course	: Employability
Marks	:	CIA:40+Ext:60= 100	Hrs/Week	: 5
Credits	:	4	Total Inst. Hrs.	: 75

Objectives:

To enable the students to

- Apply Computer theory and algorithmic aspects in various situations.
- Design and debug the programs.
- Develop program skills independently themselves.

LIST OF PRACTICALS

1. Linear Interpolation.
2. Linear regression
3. Curve fitting
4. Trapezoidal rule of integration.
5. Simpson's 1/3 rule of integration.
6. Newton – Raphson method for solving equations.
7. Gauss elimination method of solving simultaneous equations.
8. Gauss – Seidal method of solving simultaneous equations.
9. R-K Fourth order method of solving differential equations
10. Lagrange's method of interpolation

Text Books:

[1] “APPLIED NUMERICAL METHODS USING MATLAB”, By Won Young Yang, Wenwu Cao, Tae – Sang Chung, John Morris, A John Wiley and sons Inc Publications.

E-Resources:

1. <https://www.mccormick.northwestern.edu/documents/students/undergraduate/introducti-on-to-matlab.pdf>
2. <http://www.uop.edu.pk/ocontents/A%20Guide%20to%20MATALB.pdf>

The learners would have the ability to,

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Title of the Course: Numerical Methods with MATLAB						Course Code: U5R3MADSE5:1P					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	2	3	1	3	3	3	2	1	3	2.3
CO2	2	3	3	2	3	3	2	3	2	2	2.4
CO3	2	2	3	1	3	2	3	3	1	3	2.1
CO4	3	2	3	2	3	3	2	2	1	2	2.4
CO5	3	1	2	2	3	3	3	2	1	2	2.2
		Mean Overall Score									2.3
		Result									High

Title of the Course	: Introduction to Machine Learning		
Category of the Course	: DSE COURSE	Semester	: III
Course Code	: U5R3MADSE5:2	Nature of the Course	: Entrepreneurship
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 3	Total Inst. Hrs.	: 45

Objectives:

- The primary objective of the course is to understand Supervised Learning and Unsupervised Learning.
- Gain knowledge on Data Representation and Model Evaluation.
- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty

Unit I: Introduction

(9 hours)

Introduction: Why Machine Learning? - Why Python? - Scikit-learn - Essential Libraries and Tools. Supervised Learning: Classification and Regression.

Unit II: Algorithm

(9 hours)

Supervised Machine Learning Algorithms : K-Nearest Neighbors – Decision Trees. Unsupervised Learning and Preprocessing: Types of Unsupervised Learning - Preprocessing and Scaling: Different kinds of preprocessing.

Unit III: Reduction and Clustering

(9 hours)

Dimensionality Reduction, Feature Extraction and Manifold Learning: Principal Component Analysis – Clustering : K-Means – Agglomerative - DBSCAN. Representing Data and Engineering Features: Categorical Variables: One hot encoding – Numbers can encode categorical.

Unit IV: Features

(9 hours)

Automatic Feature Selection: Univariate statistics – Model based feature selection – Iterative feature selection. Model Evaluation: Cross-Validation: Cross validation in scikit-learn – Stratified k-fold cross validation and other strategies. Grid Search: Simple Grid search.

Unit V: Metrics and Scoring

(9 hours)

Evaluation Metrics and Scoring : Metrics for Binary Classification: Confusion Matrices. Algorithm Chains and Pipelines: Parameter Selection with Preprocessing - Building Pipelines - Using Pipelines in Grid Searches.

Text Books:

1. [Sarah Guido](#) and [Andreas Müller](#), Introduction to Machine Learning with Python-A Guide for Data Scientists, O'Reilly Media, 2016.
2. VikramKamath, [Introduction to Machine Learning Using Python](#), March 2018.
3. Sebastian Raschka, *“Python Machine Learning”*, First Edition, [PACKT], 2015.

Reference Books:

1. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, Chapman & Hall/CRC, 2nd Edition, 2014.
2. Kevin Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Tom M Mitchell, “Machine Learning”, McGraw Hill Education, 2013.

Web References:

1. https://in.pycon.org/2011/static/files/talks/11/Introduction_To_ML_Partial_2.pdf
2. <https://machinelearningmastery.com/machine-learning-in-python-step-by-step/>
3. <http://www.r2d3.us/visual-intro-to-machine-learning-part-1/>
4. <https://nptel.ac.in/courses/106106139>

Outcomes:

The learners would have the ability to,

CO1	Understand the concept of machine learning and the tools used in python and to explore different supervised learning techniques.	K2
CO2	Understand Supervised and Unsupervised Algorithms and different kinds of pre-processing and scaling methods.	K2
CO3	Analyze the data and represent data Engineering features, one hot encoding method, PCA.	K4
CO4	Perform training, testing and evaluation of the designed ML model.	K4
CO5	Develop a model for a given application	K6

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Introduction to Machine Learning						Course Code: U5R3MADSE5:2					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	2	2	1	1	3	3	2	1	3	2.1
CO2	3	2	1	2	2	3	2	1	3	3	2.2
CO3	3	2	3	1	2	2	1	2	3	1	2.0
CO4	3	1	3	2	2	3	1	2	3	2	2.2
CO5	2	2	3	3	1	1	2	3	3	2	2.2
		Mean Overall Score									2.1
		Result									High

Title of the Course	:	Fuzzy Mathematics		
Category of the Course	:	DSE COURSE	Semester	: V
Course Code	:	U5R3MADSE6:2	Nature of the Course	: Skill Development
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	:	3	Total Inst. Hrs.	: 75

Objectives

- To introduce the comparative study of fuzzy and crisp set
- To acquire knowledge of fuzzy relations
- To provide the knowledge of membership functions
- To compare classical logic and fuzzy logics
- To learn how to convert fuzzy to crisp

Unit I: Fuzzy Sets And Classical Sets (15 hours)

Basic definitions – Classical sets – Representation of a fuzzy set – Fuzzy measures – Cardinality of fuzzy set – Special α -cuts of a fuzzy set – Normalized fuzzy set – Height of a fuzzy set – Basic Theoretic operation of fuzzy sets – Algebraic operations on fuzzy sets – Logical operations on fuzzy sets.

Unit II: Fuzzy Relations And Classical Relations (15 hours)

Cartesian product – Crisp relation – Operations on crisp relations – Composition operator – Fuzzy Relations – Fuzzy Cartesian product and composition – Equivalence relations – Binary relation on a fuzzy set – Properties of binary relations.

Unit III: Membership Functions (15 hours)

Features of the membership function – Fuzzification – Membership functions shapes – Assignment of membership function to fuzzy variables – Evaluation of membership function.

Unit IV: Classical Logic And Fuzzy Logic (15 hours)

Classical predicate logic – logical connectives – Tautologies – Contradictions – Equivalence – Logical proofs – Fuzzy logic – Approximate Reasoning.

Unit V: Fuzzy To Crisp Conversions (15 hours)

Introduction – Defuzzification techniques – Lambda cuts – Defuzzification method-applications – Comparison and evaluation of defuzzification methods.

Text Book:

[1] 'Fuzzy Logic and Neural networks', M.Amirthavalli, Published by Scitech 2004.

Unit I: Chapter 2

Unit II: Chapter 3

Unit III: Chapter 4

Unit IV: Chapter 5

Unit V: Chapter 7

Reference Books:

[1] 'Fuzzy sets and Fuzzy logic', George J.Klir and Bo Yuan, Prentice Hall of India, New Delhi, 1995.

[2] 'Introduction to Fuzzy sets and Fuzzy logic', M.Ganesh – PHI Private Limited.

e-Resources:

1. <https://www.mdpi.com/books/pdfdownload/book/1028>
2. <https://cours.etsmtl.ca/sys843/REFS/Books/ZimmermasnnFuzzySetTheory2001.pdf>

Outcomes:

The learners would have the ability to,

CO1	Gain the knowledge of fuzzy sets.	K2
CO2	Discuss the types of operations on classical sets and fuzzy sets.	K2
CO3	Identify fuzzy relations, binary fuzzy relations & fuzzy equivalence relations.	K4
CO4	Apply the fuzzy models to natural science and technical fields.	K3
CO5	Acquire the Knowledge of Comparison and evaluation of defuzzification methods	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

CO/PO Mapping :

Title of the Course: Fuzzy Mathematics						Course Code: U5R3MADSE6:2					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	3	3	3	2	1	3	2.3
CO2	2	2	3	1	3	3	3	2	2	2	2.3
CO3	3	3	3	2	3	3	3	3	1	3	2.5
CO4	3	2	3	2	3	3	2	2	1	2	2.4
CO5	3	2	2	3	3	3	3	2	2	2	2.5
		Mean Overall Score									2.4
		Result									High

Title of the Course	: Combinatorial Mathematics		
Category of the Course	: DSE COURSE	Semester	: V
Course Code	: U5R3MADSE6:1	Nature of the Course	: Entrepreneurship
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 3	Total Inst. Hrs.	: 75

Objectives:

- To learn core ideas in combinatorial mathematics.
- To learn about countable sets combinations.
- To become familiar with fundamental combinatorial structures.
- To be familiar with convolution and counting technique.
- To find n^{th} order relations.

Unit I: Principles of Counting – I (15 Hours)

The Rules of sum and product- The sum Rule, The product rule- Permutations- Combinations- Binomial and Multinomial Theorems- Combinations with Repetitions.

Unit II: Principle of Counting - II (15 Hours)

Catalan Numbers, Problem of Catalan Numbers - Ramsey Numbers; Introduction , theorem on Ramsey Number with Examples- Strilling Numbers; Introduction- Strilling Numbers of First kind and second kind- Bell Numbers.

Unit III: Principles of Counting - III (15 Hours)

The Pigeonhole principle; Generalization theorem –Principle of inclusion- Exclusion: Principle of inclusion for n sets; Generalization theorem- Problems.

Unit IV: Generating Functions (15 Hours)

Ordinary generation function; Generating functions, Properties and Problems of ordinary generating function- Convolution of sequences-summation using convolution, problems of convolution of sequences- A counting Technique: Problems of a counting Technique- Partitions of integer.

Unit V: Recurrence Relations (15 Hours)

First- order Relations: Problems of first order Relations- Second –order linear Homogeneous Relations - Problems of Second-order Linear Homogenous Relations - Third and higher-order Linear Homogeneous Relations and Problems.

Text Books:

[1] “Graph Theory and Combinatorics” by Dr.D.S.Chandrasekharaiah – Bangalore prism books, 2005.

Unit I: Chapter 5 – sec 5.1,5.2,5.3(5.3.1,5.3.2)

Unit II: Chapter 5– sec 5.4-5.6

Unit III: Chapter 6 – sec 6.1,6.2

Unit IV: Chapter 7 – sec 7.1(7.1.1,7.1.2,7.1.3)

Unit V: Chapter 8 – sec 8.1-8.3

Reference Books:

[1] “Graph Theory ” – Harray . F – Addison - Wesley - 1969.

[2]“Graph Theory with Applications to Engineering and Computer” – NarasingaDeo – Prientice Hall of India Pvt. Ltd. – New Delhi - 2000.

e-Resources:

1. [Combinatorial Algorithms: Theory and Practice - PDF Free Download \(epdf.tips\)](#)

2. whitman.edu/mathematics/cgt_online/cgt.pdf

Outcomes: The learners would have the ability to,

CO1	Understand the ideas of Combinatorics.	K2
CO2	Study Ramsey numbers and strilling numbers.	K3
CO3	Study about pigeonhole principle.	K4
CO4	Acquire the knowledge generating function and counting technique.	K4
CO5	Use recurrence relations to solve problems of first, second and higher order linear homogeneous relations.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Combinatorial Mathematics						Course Code: U5R3MADSE6:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	2	3	2	1	1	3	3	2	3	2.3
CO2	3	3	1	2	3	3	1	2	3	3	2.5
CO3	1	3	3	1	2	3	3	2	3	1	2.4
CO4	3	2	3	1	3	3	3	1	2	3	2.4
CO5	2	3	3	1	3	3	3	3	1	3	2.5
		Mean Overall Score									2.4
		Result									High

Title of the Course	:	Internship	Semester	:	V
Category of the Course	:	Core Course	Nature of the Course	:	Employability
Course Code	:	U5R3MAINT	Hrs/Week	:	--
Marks	:	100	Total Inst. Hrs.	:	--
Credits	:	2			

Title of the Course	:	Linear Algebra			
Category of the Course	:	CORE COURSE	Semester	:	VI
Course Code	:	U6R3MACC13	Nature of the Course	:	Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	:	5
Credits	:	4	Total Inst. Hrs.	:	75

Objectives

- To study the algebraic structure of vector spaces.
- To understand several important concepts in linear algebra, linear independence of vectors, subspaces bases and dimension of vector spaces..
- To study mathematical methodologies and models.
- To develop mathematical skills and enhance thinking power of students.

UNIT I: Vector Spaces

(15 Hours)

Vector space– Linear Independence and Basis- Rank of a Matrix- Change of Basis.

UNIT II: Linear Transformations

(15 Hours)

Linear Transformations- Algebra of linear Transformations- Matrix of a Linear Transformations- Dual Spaces-Linear Transformations on Direct sums.

UNIT III: Single Linear Operator

(15 Hours)

Polynomial Rings- Modules and Minimal Polynomials- Triangularization- Canonical Forms- Semi- simple Linear operators.

UNIT IV: Inner Product Spaces

(15 Hours)

Inner products- Adjoint Operator- Hermittian Form.

UNIT V: Bilinear Form

(15 Hours)

Bilinear Form – Symmetric Bilinear Form- Skew-Symmetric Bilinear Form.

Text Book:

[1] “LINEAR ALGEBRA”, Surjeetsingh, vikas publishing house pvt ltd, new edition 2015.

Unit I: Chapter 2

Unit II: Chapter 3

Unit III: Chapter 5

Unit IV: Chapter 6

Unit V: Chapter7

Reference Books:

[1] Linear Algebra, Seymour lipschutz, Ph.D.,Marc Lipson, Ph.D., Tata McGraw Hill Education Private Limited New Delhi, Edition 2005.

[2] Linear Algebra, S.K. Jain, A.D. Gunawardena, Thomson Asia Pte Ltd.,

1. mathstat.dal.ca/~selinger/linear-algebra/downloads/LinearAlgebra.pdf
2. <https://home.iitk.ac.in/~aralal/MTH102/la.pdf>

CO1	Know and recall core knowledge of the syllabus (To measure this outcome, questions etc.)	K2
CO2	Understand basic concepts.	K2
CO3	Analyze the problem	K4
CO4	Apply the appropriate concept.	K3
CO5	Apply core concepts to new situations	K3

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: Linear Algebra						Course Code: U6R3MACC13					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	1	3	3	3	2	3	2.7
CO2	3	3	1	2	3	3	3	2	3	3	2.6
CO3	3	3	3	1	2	3	3	2	3	1	2.2
CO4	3	2	3	1	3	3	3	1	2	3	2.4
CO5	3	3	3	1	3	3	3	3	1	3	2.6
		Mean Overall Score									2.5
		Result									High

Title of the Course	: COMPLEX ANALYSIS		
Category of the Course	: CORE COURSE	Semester	: VI
Course Code	: U6R3MACC14	Nature of the Course	: Skill Development
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 4	Total Inst. Hrs.	: 75

Objectives:

- Demonstrate an understanding of the fundamental concepts of complex analysis.
- Demonstrate an understanding of the application of the theory both to other mathematical areas and to physics and engineering.
- Prove the basic results relating to analytic and harmonic functions.
- Apply the theory learnt in the course to solve a variety of problems at an appropriate level of difficulty.
- To develop clear thinking and analyzing capacity of students for research

Unit I: Analytic Functions

(15 Hours)

Introduction- Functions of a complex variable- Limits- Theorems on Limits- Continuous functions- Differentiability- The Cauchy- Riemann equations- Analytic functions- Harmonic functions.

Unit II: Bilinear Transformations and power series

(15 Hours)

Introduction- Elementary transformations- Bilinear transformations- Cross ratio- Fixed points of Bilinear transformations- Power series- Elementary Functions.

Unit III: Complex Integration

(15 Hours)

Introduction - Definite integral – Cauchy's Theorem- Cauchy's integral formula- Higher Derivatives.

Unit IV: Series Expansions

(15 Hours)

Introduction- Taylor's series- Laurant's series – Zeroes of Analytic functions- Singularities.

Unit V: Calculus of Residues

(15 Hours)

Introduction – Residues- Cauchy's Residue Theorem- Evaluation of Definite integrals.

Text Book:

[1] "Complex Analysis", S. Arumugam, A. Thangapandi Issac and A. Somasundaram, SCITECH Publications, Reprint 2014.

Unit I: Chapter 2: sec 2.0 to 2.8

Unit II: Chapter 3: sec 3.0 to 3.4 and Chapter 4: sec 4.3 and 4.4.

Unit III: Chapter 6 , full

Unit IV: Chapter 7 full

Unit V: Chapter 8 Full

Reference Books:

[1] "Complex Analysis", T.K. Manichavasagam Pillai and others, S.V Publications

e – Resources:

- Outcomes:** The learners would have the ability to,

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes:

Title of the Course: COMPLEX ANALYSIS						Course Code: U6R3MACC14					
Course Outcome s (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of Cos
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 1	PSO 2	PSO 4	PSO 5	
CO1	3	2	3	3	1	3	3	3	2	2	2.5
CO2	3	3	2	2	3	3	3	2	3	3	2.7
CO3	3	3	3	3	1	1	1	1	3	2	2.4
CO4	3	2	1	1	3	1	1	1	2	3	1.8
CO5	3	3	3	1	3	3	3	1	3	3	2.6
		Mean Overall Score									2.4
		Result									High

Title of the Course	:	Project work		
Category of the Course	:	CORE COURSE	Semester	: VI
Course Code	:	U6R3MACC15PW	Nature of the Course	: Skill Development
Marks	:	100	Hrs/Week	: 6
Credits	:	4	Total Inst. Hrs.	: 75

Title of the Course	: Programming in C++		
Category of the Course	: DSE COURSE	Semester	: VI
Course Code	: U6R3MADSE7:1P	Nature of the Course	: Employability
Marks	: CIA:40+Ext:60= 100	Hrs/Week	: 5
Credits	: 3	Total Inst. Hrs.	: 45

Objectives

- To gain Basic knowledge in C++ Programming such as Tokens, Expressions, Control Structure, Classes and Objects
- To solve problems in C++ using different numerical methods
- To make the mathematical calculations simpler
- To give the awareness of the object oriented programming
- To make applications using C++ programs

LIST OF PRACTICALS

1. Write a class to represent a vector (a series of float values). Include member functions to perform the following tasks: To create the vector, To modify the value of a given element, To multiply by a scalar value, To display the vector in the form (10, 20, 30,...). Write a program to test your class.
2. Create a class FLOAT that contains one float data member. Overload all the four arithmetic operators so that they operate on the objects of FLOAT.
3. Write a program which shows the days from the start of year to date specified. Hold the number of days for each month in an array. Allow the user to enter the month and the day of the year. Then the program should display the total days till the day.
4. Write a program to include all possible binary operator overloading using friend function.
5. Write a program to read an array of integer numbers and sort it in descending order. Use read data, put data, and array max as member functions in a class.
6. Write a program to read two character strings and use the overloaded '+' operator to append the second string to the first.
7. Develop a program Railway Reservation System using Hybrid Inheritance and Virtual Function.
8. Using overloaded constructor in a class write a program to add two complex numbers.
9. Create a class MAT of size (m, n). Define all possible matrix operations for MAT type objects.
10. Write a program that determines whether a given number is a prime number or not and then prints the result using polymorphism.
11. Write a program to illustrate the dynamic initialization of constructors.
12. Write a program to illustrate the use of pointers to objects.
13. Write a program to illustrate how to construct a matrix of size m x n.
14. Write a program to arrange the given data in ascending / descending order using various sorting algorithms.
15. Write a program to find the biggest /smallest number in the given data using various search algorithms.

Text Books:

1. **“Object–Oriented Programming with C++”**, E. Balaguruswamy, Sixth Edition, Tata McGraw-Hill Publishing Company Limited.
2. **“Programming in C & C++”**, Pooja Srivastava, Khanna Publishing House, First Edition 2014.

Reference Books

1. **“Object Oriented Programming with C++”** by S.S.Vinod Chandra, New age.
2. **“C++ Programming”**, D.S. Malik,

e -Resources:

1. <https://nptel.ac.in/courses/106/105/106105151/>
2. https://youtu.be/1rJZb_Ugc4E

Outcomes:

The learners would have the ability to,

CO1	Understand and apply the C++ structure, tokens, expressions, control structures.	K2, K3
CO2	Ability to declare various prototyping, friend and virtual functions.	K3
CO3	Create Classes, objects, arrays of objects, constructors, and Destructors.	K3, K4
CO4	Analyze over loading operators and inheritance.	K4
CO5	Deliberate files, pointers and templates. Create, design and develop quality programs in C++.	K4, K5

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

PROGRAM SPECIFIC OUTCOMES

Title of the Course: Programming in C++						Course Code: U6R3MADSE7:1P					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	3	3	3	1	3	3	2	1	3	2.5
CO2	3	2	1	3	2	3	3	1	3	3	2.4
CO3	3	2	3	3	2	2	3	2	3	1	2.4
CO4	3	1	3	3	3	3	2	3	3	2	2.6
CO5	3	2	3	3	1	3	3	3	3	2	2.6
		Mean Overall Score									2.5
		Result									High

Title of the Course	: Introduction to Data Science		
Category of the Course	: DSE COURSE	Semester	: VI
Course Code	: U6R3MADSE7:2	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 3	Total Inst. Hrs.	: 45

Objectives

- To introduce the concepts, techniques and tools in Data Science
- To understand the various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling and effective communication.
- To understand machine algorithm and types of modeling process.
- To learn the Hadoop concept.
- To acquire the knowledge of prediction of diseases.

UNIT I: Introduction (12 hours)

Benefits and uses – Facets of data – Data science process – Big data ecosystem and data science

UNIT II : The Data science process (12 hours)

Overview – research goals - retrieving data - transformation – Exploratory Data Analysis – Model building

UNIT III : Algorithms (12 hours)

Machine learning algorithms – Modeling process – Types – Supervised – Unsupervised - Semi-supervised

UNIT IV: Introduction to Hadoop (12 hours)

Hadoop framework – Spark – replacing Map Reduce– No SQL – ACID – CAP – BASE – types

UNIT V: Case Study (12 hours)

Prediction of Disease - Setting research goals - Data retrieval – preparation - exploration - Disease profiling - presentation and automation

Text Books:

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016

Reference Books:

1. Roger Peng, “The Art of Data Science”, lulu.com 2016.
2. MurtazaHaider, “Getting Started with Data Science – Making Sense of Data with Analytics”, IBM press, E-book.
3. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools”, Dreamtech Press 2016.
4. Annalyn Ng, Kenneth Soo, “Numsense! Data Science for the Layman: No Math Added”, 2017,1st Edition.

Title of the Course	: Astronomy		
Category of the Course	: SE COURSE	Semester	: VI
Course Code	: U6R3MADSE8:1	Nature of the Course	: Employability
Marks	: CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	: 3	Total Inst. Hrs.	: 45

Objectives

- To provide working knowledge about the universe
- To increase the scientific awareness among the students on Astronomy
- To promote widespread access to the universal knowledge through the excitement of astronomy and sky – observing experiences
- To empower astronomical communities in developing Countries
- To educate the student in the field of advanced science and technology

UNIT I - Spherical Trigonometry - Celestial Sphere (9 hours)

Relevant properties of a sphere & relevant formulae for spherical trigonometry (All without proof) - Celestial sphere - Diurnal motion, Cardinal points, Sidereal Time, Latitude of a place, relation between them.

UNIT II –Earth (9 hours)

Dip of the horizon - Effects of Dip - Twilight - Duration of Twilight - Astronomical refraction - Law's of refraction - Tangent & cosine's formula - properties & simple problems applying them.

UNIT III - Kepler's Law & Time (9 hours)

Kepler's Law of Planetary motion (statement only) - Verification of laws in the case of earth - Newton's deductions from them - Three anomalies of the Earth and relation between them - Time - Equation of time - mean time, true time, effects of equation of time seasons.

UNIT IV - Years and Calendar (9 hours)

Different kinds of Years and Calendar - Conversion of time, relation between them - Geocentric Parallax - Aberration of light - simple problems in the above.

UNIT V –Moon (9 hours)

Sidereal month, Synodic month phases of moon, age of the moon, summer and winter, full moon - motions of planet (assuming that orbits are circular) - eclipses.

Text Books:

[1] S.Kumaravelu and Prof.SusheelaKumaravelu, "Astronomy", SKV Publications, 2004.

Unit I :Chapter 1 & 2

Unit II :Chapter 3, Sec. 5, 6 & Chapter 4

Unit III :Chapter 6 and Chapter 7, Sec. 1 & 2

Unit IV :Chapter 7, Sec. 3, 4 , Chapter 5 & Chapter 9

Unit V : Chapter 12 and Chapter 13.

[1] “An introduction to Astrophysics” by Bidynath Basu, Pragathi Prakasam (1981).
G.V. Ramachandran “Astronomy”

1. <https://d3bxy9euw4e147.cloudfront.net/oscms-ga/media/documents/Astronomy-LR.pdf>
2. [http://staff.ustc.edu.cn/~xuey/IAC/000 Introduction to Astronomy and Cosmology.pdf](http://staff.ustc.edu.cn/~xuey/IAC/000%20Introduction%20to%20Astronomy%20and%20Cosmology.pdf)

CO1	Understand the basic terms used in Astronomy.	K2
CO2	Study the different position on Earth.	K4
CO3	Apply the Knowledge of Kepler's Laws and Equations of Time.	K3
CO4	Understand the concepts different kinds of Years and Calendar	K2
CO5	Acquire the Knowledge about Eclipses and Phases of moon.	K3

Relationship matrix for Course outcomes, Programme outcomes /Programme Specific Outcomes

Title of the Course: Astronomy						Course Code: U6R3MADSE8:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	3	3	3	1	3	1	3	2	3	2.5
CO2	1	3	3	2	3	3	2	2	3	1	2.3
CO3	3	3	1	3	2	3	1	2	3	3	2.3
CO4	3	2	3	1	3	2	3	1	2	3	2.3
CO5	3	3	3	1	3	2	3	3	1	3	2.5
		Mean Overall Score									2.4
		Result									High

Title of the Course	:	Graph Theory and its Applications		
Category of the Course	:	DSE COURSE	Semester	: III
Course Code	:	U6R3MADSE8:2	Nature of the Course	: Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 5
Credits	:	3	Total Inst. Hrs.	: 75

Objectives

- To determine a mathematical graph, identifying the vertices and edges.
- To determine which graphs have Euler circuits.
- To able to represent real life situation with mathematical graphs.
- To recognize patterns that arise in various graph problems.
- To introduce students to study advanced methods from structural graph theory.

Unit I - Graphs - Paths and Circuits

(15 Hours)

Definition of a graph – Application of graphs finite & infinite graphs - incidence, degree, isolated & pendent vertices – Null graph - isomorphism - sub graphs - walks, paths & circuits - connected & disconnected graphs - components - Euler graphs - Operations on Graphs - More on Euler graphs - Hamiltonian paths & circuits.

Unit II - Trees and Fundamental Circuits

(15 Hours)

Trees - properties of trees - pendent vertices in a tree - distances & centres in a tree - Rooted & binary trees - Spanning trees - fundamental circuits - finding all spanning trees of a graph - spanning trees in a weighted graph.

Unit III - Cut-sets & Cut-vertices

(15 Hours)

Cut sets – Some properties of a cut set - all cut set in a graph - fundamental circuits & cut sets - connectivity & separability - Edge connectivity, vertex connectivity, separable graph.

Unit IV - Matrix Representation of Graphs

(15 Hours)

Incidence matrix – Sub matrices - Circuit Matrix - Fundamental Circuit Matrix and rank of the circuit matrix - cut set matrix - adjacency matrix

Unit V – Coloring and Partition

(15 Hours)

Chromatic Number - Chromatic partitioning - Chromatic polynomial.

Text Book:

[1] “Graph Theory with applications to Engineering and Computer Science”, NarsinghDeo, Prentice Hall of India, New Delhi, 1997.

Unit I : Chapter 1, Sec. 1.1 to 1.5 & Chapter 2, Sec. 2.1, 2.2, 2.4 to 2.9.

Unit II : Chapter 3, Sec. 3.1 - 3.5, 3.7 - 3.10.

Unit III: Chapter 4, Sec. 4.1 to 4.5.

Unit IV: Chapter 7, Sec. 7.1 to 7.4, 7.6, 7.9.

Unit V :Chapter 8, Sec. 8.1 to 8.3.

Reference Books:

[1] “Basic Graph Theory” - K.R.Parthasarathy, Tat McGraw Hill Publishing Company, New Delhi, 1994.

[3] “A first look at Graph theory” – G. T. John clark, Derek Allan Holten – World scientific publishing company, 1995.

2. (PDF) Introduction to Graph Theory and Its Applications (researchgate.net)

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Title of the Course: Graph Theory and its Applications						Course Code: U6R3MADSE8:2					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	3	1	1	3	3	2	3	2.4
CO2	3	3	1	2	3	3	3	2	3	3	2.6
CO3	3	3	3	1	2	3	1	2	3	1	2.1
CO4	1	2	3	1	2	3	3	1	2	3	2.1
CO5	3	1	3	1	3	3	3	3	1	3	2.4
		Mean Overall Score									2.3
		Result									High

Title of the Course	:	Mathematics For Competitive Examination - II		
Category of the Course	:	SEC COURSE	Semester	: VI
Course Code	:	U6R3MASEC7:1	Nature of the Course	: Employability
Marks	:	CIA:25+Ext:75= 100	Hrs/Week	: 3
Credits	:	2	Total Inst. Hrs.	: 45

Objectives:

- To develop the aptitude of Reasoning
- To understand the Time and work
- To calculate area and volume of the shapes
- To Study about the Numbers.
- To know about the Discount in Bank.

Unit – I : Problems on Numbers and Ages (9 hours)

Problems on Numbers – Consecutive Numbers – Fraction of Numbers – worked out Problems on Ages.

Unit – II : Time & Work, Time & Distance (9 hours)

Relation between time and work – Problems – Formulae - Relation between time and Distance – Worked out problems.

Unit – III : Area (9 hours)

Definition – Formulae – Results on Quadrilateral – Area on Square, Rectangle, Triangle, Rhombus, Parallelogram – Applications.

Unit – IV : Volume and Surface Area (9 hours)

Definitions – Formulae – Problems on cuboid, cube, cylinder, cone, sphere & Hemisphere – simple Applications only.

Unit – V : True Discount & Banker's Discount (9 hours)

Important concepts – Formulae – Problems – Definitions – Banker's Discount – Problems.

Text Book:

[1] “Quantitative Aptitude for Competitive Examination” – R.S.Aggarwal – S. Chand & Sons – New Delhi –Seventh edition – 2006.

Unit – I	:	Chapter 7 & 8
Unit – II	:	Chapter 15 & 17
Unit – III	:	Chapter 24
Unit – IV	:	Chapter 25
Unit – V	:	Chapter 32 & 33

[1] “Quantitative Aptitude and Reasoning” – R.V.Praveen –Phi – Second Edition - 2012.
 [2] “Quantitative Methods” – D.C. Sanchati – S. Chand & Sons – New Delhi .
 [3] Quantitative Aptitude - Naresh Sharma, Anjali Kaushik - variety book publishers distributors.

1. <https://fightexam.com/arun-sharma-quantitative-aptitude-pdf/>
2. <https://sarkaribook.in/rakesh-yadav-7300-pdf/>

The learners would have the ability to,

CO1	Guess & Check the Problems quickly	K2
CO2	Prepare for Competitive & Entrance Examinations in various fields.	K3
CO3	Know the application of Volume and Surface Area.	K4
CO4	Analyze real life problems and find solutions	K4
CO5	Understand the true and banker's discount.	K2

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Title of the Course: Mathematics For Competitive Examination - II						Course Code: U6R3MASEC7:1					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	3	3	3	2	3	3	2.6
CO2	2	3	3	1	3	3	2	2	2	2	2.3
CO3	3	2	3	1	3	3	2	3	1	3	2.2
CO4	1	3	3	2	3	3	3	2	1	2	2.4
CO5	3	1	3	3	3	3	3	2	1	2	2.4
		Mean Overall Score									2.4
		Result									High

Title of the Course	:	Introduction to LATEX-Practical		
Category of the Course	:	SE COURSE	Semester	: VI
Course Code	:	U6R3MASEC7:2P	Nature of the Course	: Employability
Marks	:	CIA:40+Ext:60= 100	Hrs/Week	: 3
Credits	:	2	Total Inst. Hrs.	: 45

Objectives:

- To learn the basic functions of Latex
- To explore some of the more advanced features available.
- To develop their skills in order to more fully utilize its functions in particular using Bibtex to help manage their references in relation to the Latex document.
- To Typeset complex mathematical formulae.
- Main objective for typesetting to journal articles.

Unit – I Text, Symbols and Commands (6 hours)

Command names and arguments – Environments-Declarations – Lengths – Special characters – Fine-tuning text – Word division.

Unit-II Document Layout and Organization (6 hours)

Document class – Page style – Parts of the document – Table of contents.

Unit – III Displayed Text (6 hours)

Changing font – Centering – indenting.

Unit – IV Listing the Text (6 hours)

Lists – Generalized lists -Theorem like declarations – Tabulator stops-Boxes – Tables.

Unit – V Mathematical Formulas (6 hours)

Mathematical environments - Main elements of Math mode -Mathematical symbols – Additional elements – Fine tuning Mathematics– Beyond standard latex.

Text Book:

1. Kopka, H., Daly, P.W. (2003) *A Guide to LATEX*, Fourth Edition, London: Addison Wesley.
2. Lamport, L.(1994). *Latex: A document preparation system*. Addison Wesley Professional.

Reference Book:

1. Mittelbach, F.(2007). *The Latex Graphics Companion* (2nd ed.). Addison-Wesley Professional.
2. Mittelbach, F., Goossens, M., Braams, J., Carlisle, D., Rowley, C.(2004). *The Latex Companion*. Addison-Wesley Professional.

e – Resources: <https://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf>

Outcomes:

The learners would have the ability to,

CO1	Typeset mathematical formulae using LaTeX	K2
CO2	Use the preamble of LaTeX file to define document class and layout options	K3
CO3	Use nested list and enumerate environments within a document	K3
CO4	Use tabular and array environments within LaTeX document	K3
CO5	Use various methods to either create or import graphics into a LaTeX document	K3

K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

CO/PO Mapping :

Title of the Course: Introduction to LATEX						Course Code: U6R3MASEC7:2P					
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO1	PSO2	PSO4	PSO5	
CO1	3	1	3	2	2	3	3	2	3	1	2.3
CO2	2	3	3	1	3	3	2	2	2	2	2.3
CO3	3	2	3	1	2	3	2	3	1	3	2.3
CO4	1	3	3	2	3	3	3	2	1	2	2.3
CO5	3	1	3	3	2	3	3	2	1	3	2.4
		Mean Overall Score									2.3
		Result									High