

**PG AND RESEARCH DEPARTMENT OF  
MATHEMATICS**

**SYLLABUS (2023 – 2024)**

**B.Sc. MATHEMATICS**



**(For the candidates admitted in the academic year 2023-2024)**  
**HOLY CROSS COLLEGE (AUTONOMOUS)**  
**TIRUCHIRAPPALLI - 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**

**Programme Outcomes (POs)**

- PO 1** - Demonstrate ability and attitude to acquire knowledge and skills in the advancing global scenario to apply them effectively and ethically for professional and social development.
- PO2** - Involve in research and innovative endeavors and share their findings for the wellbeing of the society.
- PO3** - Work effectively in teams and take up leadership in multi-cultural milieu.
- PO4** - Act with moral, ethical and social values in any situation.
- PO5** - Excel as empowered woman to empower women
- PO6** - Participate in activities towards environmental sustainability goals as responsible citizens.
- PO7** - Pursue higher studies in the related fields of Science, Humanities and Management.
- PO8** - Promote analytical, logical, technological and computational skills to become professionals in various fields.
- PO9** - Apply the mathematical techniques and software tools to draw the solution in complex and dynamic multidisciplinary scenario.

**Programme Specific Outcomes (PSOs)**

- PSO 1** – Reinforce the mathematical aspects and reasoning for changing technologies.
- PSO 2** – Investigate and apply precise and intricate mathematical techniques to solve real world problems.
- PSO 3** – Demonstrate spatial, abstract relationship, ability to perceive, visualize and generalize numeric and non- numeric patterns to explore and expertise in diverse fields.

(For the Candidates admitted in the academic year 2023-2024)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)**  
**UG COURSE PATTERN - TANSCHÉ**  
**B.Sc. MATHEMATICS**

Sem	Part	Subject	Code	Hours	Credits	Marks
I	I	Language - General Tamil/ Hindi/ French	U23TL1GEN01/ U23HN1HIN01/ U23FR1FRE01	6	3	100
	II	General English –I	U23EL1GEN01	6	3	100
	III	Core Course 1: Algebra & Trigonometry	U23MA1CCT01	5	5	100
		Core Course 2: Differential Calculus	U23MA1CCT02	5	5	100
		Elective 1(Generic): Allied Physics I	U23PH1ECT01	4	3	100
	IV	SEC 1(NME 1)		2	2	100
		Foundation Course: Bridge Mathematics	U23MA1FCT01	2	2	100
		Value Education		-	-	-
			<b>Total</b>		<b>30</b>	<b>23</b>

Sem	Part	Subject	Code	Hours /Week	Credits	Marks
II	I	Language – General Tamil/ Hindi/ French	U23TL2GEN02/ U23HN2HIN02/ U23FR2FRE02	5	3	100
	II	General English	U23EL2GEN02	5	3	100
	III	Core Course 3: Analytical Geometry (Two & Three Dimensions)	U23MA2CCT03	6	5	100
		Core Course 4: Integral Calculus	U23MA2CCT04	5	5	100
		Elective 2(Generic): Allied Physics II	U23PH2ECT02	4	3	100
	IV	SEC 2(NME 2)		2	2	100
		SEC 3: Sustainable Rural Development and Student Social Responsibility	U23RE2SET03	2	2	100
		Massive Open Online Course (MOOC)	U23EX2ONC01	-	2(Extra credits)	100
		Value Education		1	-	-
		Internship / Field Work / Field Project 30 hours	U23EX2INT01		2(Extra credits)	100
		<b>Total</b>		<b>30</b>	<b>23+4</b>	<b>700+ 200</b>

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
III	I	Language	Tamil Paper III/ Hindi Paper III/ French Paper III		3	3	100
	II	English	English Paper III		3	3	100
	III	Major Core – 7	Dynamics	U22MA3MCT07	5	4	100
		Major Core – 8	Optimization Techniques – I	U22MA3MCT08	5	4	100
		Major Elective - 1	Major Elective – 1		4	3	100
		Allied – 4	Properties of Matter, Optics and Sound	U22PH3ALT05	4	2	100
	IV	Major Skill Based Elective(MSBE) - 1	Aptitude Mathematics-I	U22MA3SBT01	2	1	100
		Non Major Elective – I	Non Major Elective – I	-	2	2	100
		Gender Studies	Gender Studies	U22WS3GST01	1	1	100
		Value Education	Ethics II/ Bible Studies II/ Catechism II	U22VE4LVE02/ U22VE4LVB02/ U22VE4LVC02/	1	-	-
	VI		Service Oriented Course	-	-	-	-
			Online Course	U22EX3ONC02	-	1(Extra credit)	100
			Internship / Field Work / Field Project 30 Hours – ExtraCredit	U22EX3INT03	-	2(Extra credits)	100
		<b>Total</b>			<b>30</b>	<b>23+1+2</b>	<b>900+ 200</b>

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
IV	I	Language	Tamil Paper IV/ Hindi Paper IV/ French Paper IV		3	3	100
	II	English	English Paper IV		3	3	100
	III	Major Core – 9	Abstract Algebra	U22MA4MCT09	5	4	100
		Major Core – 10	Optimization Techniques –II	U22MA4MCT10	4	4	100
		Major Elective –2	Major Elective –2		4	3	100
		Allied – 5	Allied Physics Practicals	U22PH4ALP07	4	2	100
		Allied – 6	Modern Physics, Electricity and Electronics	U22PH4ALT08	4	2	100
	IV	Non Major Elective – 2	Non Major Elective – 2		2	2	100
		Value Education	Ethics II/ Bible Studies II/ Catechism II	U22VE4LVE02/ U22VE4LVB02/ U22VE4LVC02/	1	1	100
	V	Extension Activity	RESCAPES	U22EX4RES02	-	1(Extra credit)	-
	VI		Service Oriented Course	U22EX4SOC01	-	2(Extra credits)	-
			Internship / Field Work / Field Project 30 Hours -Extra Credit	U22EX4INT04	-	2(Extra credits)	100
		<b>Total</b>			<b>30</b>	<b>24+1+2+2</b>	<b>900+100</b>

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
V	III	Major Core – 11	Linear Algebra	U21MA5MCT11	4	3	100
		Major Core – 12	Real Analysis- I	U21MA5MCT12	4	4	100
		Major Core – 13	Graph Theory	U21MA5MCT13	4	3	100
		Major Core – 14	Differential Equations, Laplace Transforms and Fourier Series	U21MA5MCT14	4	3	100
		Major Core – 15	Statistical Packages	U21MA5MCT15	4	3	100
		Major Elective – 3	Major Elective – 3	-	4	3	100
	IV	Major Skill Based Elective (MSBE)–2	Aptitude Mathematics- II	U21MA5SBT02	2	1	100
		Non Major Elective – 3	Non Major Elective –3	-	3	3	100
		Value Education	Ethics III / Bible Studies III / Catechism III	U21VE6LVE03/ U21VE6LVB03/ U21VE6LVC03	1	-	-
			Online Course	U21OC5ECT01	-	2(Extra Credits)	100
			Internship / Field Work / Field Project 30 Hours -Extra Credit	U21SP5ECC05		2 (Extra Credits)	100
		<b>Total</b>		<b>30</b>	<b>23+2+2</b>	<b>900+ 100</b>	

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
VI	III	Major Core – 16	Real Analysis – II	U21MA6MCT16	5	5	100
		Major Core – 17	Complex Analysis	U21MA6MCT17	5	4	100
		Major Core – 18	Fuzzy Set Theory	U21MA6MCT18	5	4	100
		Major Core – 19	Discrete Mathematics	U21MA6MCT19	5	4	100
		Major Elective –4	Major Elective –4		4	3	100
	IV	Skill Based Course (SBC) – 3	Research Methodology	U21DS6SBC03	2	1	100
		Non Major Elective (NME)– 4	Non Major Elective – 4	-	3	3	100
		Value Education	Ethics III / Bible Studies III / Catechism III	U21VE6LVE03/ U21VE6LVB03/ U21VE6LVC03	1	-	100
	V	Extension Activity	RESCAPES – Impact Study of Project	-	-	4(Extra Credits)	100
			Internship / Field Work / Field Project 30 Hours – Extra Credit	U21SP6ECC06		2(Extra Credits)	100
		<b>Total</b>		<b>30</b>	<b>24+4+2</b>	<b>900+100</b>	
		<b>GRAND TOTAL</b>		<b>180</b>	<b>140+20=160</b>	<b>5400+600</b>	

**LIST OF ALLIED/ELECTIVE (GENERIC) COURSES OFFERED BY THE DEPARTMENT**

S.NO	Sem	Part	Component	Title	Code	Hours	Credits	Marks
1.	I	III	Allied 1	Allied Mathematics - I (for Physics students)	U23MA1ALT01	5	3	100
2.	I	III	Allied 1	Mathematics – I (for Chemistry Students)	U23MA1ALT02	6	3	100
3.	I	III	Elective -1 (Generic)	Statistical Methods and its Applications (for B.C.A and Computer Science students)	U23MA1ECT01	4	3	100
4.	I	III	Elective -1 (Generic)	Basic Mathematics (for B.Voc. Software Development students)	U23MA1ECT02	4	4	100
5.	II	III	Allied 2	Allied Mathematics - II (for Physics students)	U23MA2ALT03	5	3	100
6.	II	III	Allied 2	Mathematics – II (for Chemistry Students)	U23MA2ALT04	6	3	100
7.	II	III	Elective –2 (Generic)	Numerical Methods (for B.C.A and Computer Science students)	U23MA2ECT03	4	3	100
8.	II	III	Elective -2 (Generic)	Statistics for Data Analytics (for B.Voc. Software Development students)	U23MA2ECT04	4	4	100
9.	III	III	Allied 4	Differential Calculus and Trigonometry (for Chemistry students)	U22MA3ALT15	4	2	100
10.	III	III	Allied 4	Discrete Mathematics (for B.C.A and Computer Science students)	U22MA3ALT16	4	2	100



11.	IV	III	Allied 5	Algebra and Integral Calculus (for Chemistry students)	U22MA4ALT17	4	2	100
12.	IV	III	Allied 6	Analytical Geometry of Three Dimensions, Vector Calculus and Differential Equations (For Chemistry students)	U22MA4ALT18	4	2	100
13.	IV	III	Allied 5	Operations Research (For BBA Students)	U22MA4ALT19	4	2	100
14.	IV	III	Allied 5	Mathematics for Biologist (For Bioinformatics Students)	U22MA4ALT20	4	2	100

**LIST OF SKILL ENHANCEMENT (NME) COURSES OFFERED BY THE DEPARTMENT**

Sem	Part	Component	Title	Code	Hours	Credits	Marks
I	IV	Skill Enhancement Course 1 (Non Major Elective 1)	Mathematics for Competitive Examinations	U23MA1SET01	2	2	100
II	IV	Skill Enhancement Course 2 (Non Major Elective 2)	Data Analysis using Excel	U23MA2SET02	2	2	100

**LIST OF MAJOR ELECTIVE COURSES OFFERED BY THE DEPARTMENT**

<b>Sem</b>	<b>Part</b>	<b>Component</b>	<b>Title</b>	<b>Code</b>	<b>Hours</b>	<b>Credits</b>	<b>Marks</b>
III	III	Major Elective -1	Quick Mathematics - I	U22MA3MET01	4	3	100
IV	III	Major Elective-2	Quick Mathematics - II	U22MA4MET02	4	3	100
V	III	Major Elective -3	R Programming/ Verbal Reasoning	U21MA5MET07/ U21MA5MET08	4	3	100
VI	III	Major Elective -4	Python Programming/ Non-Verbal Reasoning	U21MA6MET09/ U21MA6MET10	4	3	100

**LIST OF NME COURSES OFFERED BY THE DEPARTMENT**

<b>Sem</b>	<b>Part</b>	<b>Component</b>	<b>Title</b>	<b>Code</b>	<b>Hours</b>	<b>Credits</b>	<b>Marks</b>
III	IV	Non Major Elective – 1	Statistics and Numerical Methods	U22MA3NMT01	2	2	100
IV	IV	Non Major Elective – 2	Statistics with R	U22MA4NMT02	2	2	100
V	IV	Non Major Elective – 3	Statistics – I	U21MA5NMT03	3	3	100
VI	IV	Non Major Elective – 4	Statistics – II	U21MA6NMT04	3	3	100

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**B.Sc. MATHEMATICS**  
**First Year-Semester– I**

<b>Course Title</b>	<b>CORE COURSE I: ALGEBRA &amp; TRIGONOMETRY</b>
<b>Code</b>	<b>U23MA1CCT01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the basic ideas on the theory of equations, matrices and number theory. To make the students to acquire Knowledge to find expansions of trigonometry functions, solve theoretical and applied problems.

### COURSE OBJECTIVES

1. To understand about algebraic equations.
2. To understand summation of Binomial, exponential, logarithmic and approximation.
3. To understand the techniques for solving matrices.
4. To evaluate the expansion of Trigonometric function.
5. To understand hyperbolic function and their properties.

### ALGEBRA

#### UNIT I: THEORY OF EQUATIONS

**15 HRS**

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.

**Extra Reading/ Keywords:** *Descartes' rule of signs, Rolles' theorem Strum's Theorem, Newton's method of divisors*

#### UNIT II: SUMMATION USING BINOMIAL, EXPONENTIAL AND LOGARITHMIC SERIES

**15 HRS**

Binomial – Exponential –Logarithmic series (Theorems without proof) – Approximations - related problems.

**Extra Reading/Keywords:** *Covariance between two binomials, Bernoulli distribution, Poisson distribution, Antilogarithm*

### UNIT III: MATRICES

15 HRS

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.

**Extra Reading/Keywords:** *Non Diagonalization matrix, Reduction of quadratic form to canonical form by orthogonal transformation*

### TRIGONOMETRY

#### UNIT IV: EXPANSIONS OF TRIGONOMETRIC FUNCTIONS

15 HRS

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  $\theta$  - related problems.

**Extra Reading/ Keywords:** *Taylor series, Inverse trigonometric functions, Asymptotic expansion*

#### UNIT V: HYPERBOLIC FUNCTIONS

15 HRS

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

**Extra Reading/Keywords:** *Hyperbolic angle, Inverse hyperbolic Cotangent, Secant, Cosecant*

**Note: Texts given in the Extra Reading / Keyword must be tested only through assignment and seminar.**

### TEXTBOOKS

1. Treatment and content as in **Algebra Volume I** by T.K.Manicavachagom Pillay, T.Natarajan, K.S.Ganapathy (2012), S.Viswanathan (Printers and publishers),Chennai, For Units II & III

**UNIT I :** Chapter 6–Sections 16,17,18,19,30

**UNIT II :** Chapter 3– Sections 5 –10,14, Chapter 4

- 2.Treatment and content as in **Algebra Volume II** by T.K.Manicavachagom Pillay, T.Natarajan, K.S.Ganapathy, (2011),S.Viswanathan Printers and Publishers), Chennai, For Unit III.

**UNIT III:** Chapter 2 – Sec 16, 16.1, 16.2, 16.3 and 16.4

3. Treatment and Content as in **Trigonometry** by S. Narayanan and T.K.Manicavachagom Pillay (2015), S.Viswanathan (Printers and Publishers), Chennai. For Units IV&V.

**UNIT IV :** Chapter III (Formation of equations excluded)

**UNIT V :** Chapter IV , Chapter V –Sections 5, 5.1 and 5.2

## SUGGESTED READINGS

1. W.S. Burnstine and A.W. Panton, Theory of equations.
2. Arumugam, Thangapandi Issac, (2005) **Theory of Equations and Trigonometry**, New Gamma Publishing House, Delhi.
3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007
4. G.B. Thomas and R.L. Finney, Calculus, 9th Ed., Pearson Education, Delhi, 2005
5. C. V. Durell and A. Robson, Advanced Trigonometry, Courier Corporation, 2003
6. J. Stewart, L. Redlin, and S. Watson, Algebra and Trigonometry, Cengage Learning, 2012.
7. Calculus and Analytical Geometry, G.B. Thomas and R. L. Finny, Pearson Publication, 9<sup>th</sup> Edition, 2010.
8. Balasubrahmanyam P., Venkatachary P.R., Venkataraman G.R. (1992), **Text Book on Trigonometry** Published by Roc House & Sons, Chennai.

## WEB REFERENCES

1. <https://nptel.ac.in>
2. <https://learn.careers360.com/maths/binomial-theorem-and-its-simple-applications-chapter/#:~:text=The%20binomial%20theorem%20is%20used,of%20equations%20in%20higher%20powers.>
3. <https://timefliesedu.com/2019/12/17/examples-of-real-life-arithmetic-sequences/>
4. <https://math.stackexchange.com/questions/123/real-world-uses-of-hyperbolic-trigonometric-functions>
5. <https://math.stackexchange.com/questions/29197/applied-math-finding-roots>

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level(K1-K5)
CO-1	Enumerate the notion of theory of equations, matrices and trigonometric functions.	K1
CO-2	Demonstrate the properties of equations, nature of the series and expansions of trigonometric and hyperbolic functions.	K2
CO-3	Utilize the concepts of theory of equations, matrices and expansions of trigonometric functions to solve problems.	K3
CO-4	Infer the solutions for real life problem using theory of equations and trigonometric functions.	K4
CO-5	Determine the problems on theory of equations, summation of Binomial, Exponential and Logarithmic series and examine the expansions of Trigonometric functions and Hyperbolic functions to evaluate problems	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

**PO-CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	M	M	M	L	H	M	H
<b>CO-2</b>	H	H	H	M	H	L	H	H	H
<b>CO-3</b>	H	H	H	H	H	M	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

**PSO-CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

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**First Year - Semester – I**

<b>Course Title</b>	<b>CORE COURSE II : DIFFERENTIAL CALCULUS</b>
<b>Code</b>	<b>U23MA1CCT02</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/Week</b>	<b>5</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To inculcate the basic skills of successive differentiation, partial differentiation and their applications. Also, impart the basic knowledge on the notions of envelopes, radius of curvature, center of curvature, evolutes and involutes to solve the related problems.

### COURSE OBJECTIVES

1. To understand the methods of successive differentiation of various functions and formation of equations using derivatives.
2. To comprehend the different techniques in partial differentiation.
3. To compute the maximum and minimum values of a function.
4. To discuss the methods of finding the envelope.
5. To apply differentiation for finding radius, center of curvature, evolute and involute.

### UNIT I: SUCCESSIVE DIFFERENTIATION

**15 HRS**

Introduction – The  $n^{\text{th}}$  derivatives of Standard results – Fractional expressions – Trigonometrical transformation – Formation of equations involving derivatives – Leibnitz formula for the  $n^{\text{th}}$  derivative of a product.

**Extra Reading/ Keywords:** *Application of Leibnitz formula in practical problems*

### UNIT II: PARTIAL DIFFERENTIATION

**15 HRS**

Partial derivatives – Successive partial derivatives – Function of a function rule – Total differential coefficient – A special case – Implicit Functions.

**Extra Reading/Key words:** *Euler's equation of motion, change of variables, transformation*

### UNIT III: PARTIAL DIFFERENTIATION (CONTINUED)

**15 HRS**

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

**Extra Reading/Key words:** *Errors and approximation, Taylor's expansion of  $f(x,y)$*

#### UNIT IV: ENVELOPE

15 HRS

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

**Extra Reading/Key words:** *Tangent and normal, Linear Asymptotes*

#### UNIT V: CURVATURE

15 HRS

Definition of Curvature – Circle, Radius and Centre of Curvature – Evolutes and Involutives – Radius of Curvature in Polar Co-ordinates.

**Extra Reading/Key words:** *Pedal equation of a curve, Chord of curvature*

#### TEXT BOOK

Treatment and content as in

S. Narayanan and T. K. Manickavasagam Pillay, Calculus Volume – I, S. Viswanathan (Printers and Publishers) Pvt. Ltd.

Unit-I: Chapter III – 1.1-1.6, 2.1, 2.2

Unit-II: Chapter VIII – 1.1 – 1.5

Unit-III: Chapter VIII – 1.6, 1.7, 4, 4.1, 5

Unit-IV: Chapter X – 1.1-1.4

Unit-V: Chapter X – 2.1-2.6

#### SUGGESTED READINGS

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, 3<sup>rd</sup> Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
4. R. Courant and F. John, Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc., 1989.
5. T. Apostol, Calculus, Volumes I and II. Wiley publications, 1975

.

#### WEB REFERENCE

1. <https://unacademy.com/content/jee/study-material/mathematics/successive-derivative-of-a-function/#:~:text=Successive%20differentiation%20is%20a%20process,y%20with%20respect%20to%20x.>
2. <https://www.khanacademy.org/math/multivariable-calculus/multivariable-derivatives/partial-derivative-and-gradient-articles/a/introduction-to-partial-derivatives>
3. <https://www.taylorfrancis.com/chapters/mono/10.1201/9781420022605-13/envelope-family-curves-yu-animov>
4. <https://www.intmath.com/applications-differentiation/8-radius-curvature.php>
5. <https://nptel.ac.in>

**Note:** *Learners are advised to use latest edition of books.*



## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Recognize the concept of differentiation and partial differentiation.	K1
CO-2	Interrupt the various methods for solving problems in differentiation and partial differentiation.	K2
CO-3	Examine maximum and minimum values of a function, the envelope of family of curves, radius and centre of curvature, evolute and involute.	K3
CO-4	Appraise the techniques in differentiation to infer the solution to real life problems.	K4
CO - 5	Evaluate the problems on successive differentiation, partial differentiation, envelope, Radius and Centre of the curvature.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5 = Evaluate)

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	M	L	H	H	H
CO-2	H	H	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO - 5	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO - 5	H	H	H

(For the Candidates admitted in the academic year 2023-2024)  
**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**I UG - First Year - Semester – I**

<b>Course Title</b>	<b>NON MAJOR ELECTIVE 1: MATHEMATICS FOR COMPETITIVE EXAMINATIONS</b>
<b>Code</b>	<b>U23MA1SET01</b>
<b>Course Type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours / Week</b>	<b>2</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to build a strong conceptual foundation in understanding an idea about numbers, average, ratio and proportion, percentages, partnership, time and work principles and develop problem solving techniques.

### COURSE OBJECTIVES

1. To understand the practical knowledge and skills to effectively use of numbers and simplification using formulae and rules in mathematical calculations.
2. To understand average, LCM and HCF of 2 or more numbers.
3. To understanding the role of data visualization in assessing and solving challenges related to age and percentages.
4. To evaluate profit and loss, ratio and proposition.
5. To acquire a comprehensive understanding of the applications of time and work principles in real-life scenarios and ability to solve partnership problems

#### UNIT I: NUMBER SYSTEM

**6 HRS**

Number System – Simplification using formulae and rules

**Extra Reading/Key words:** *History of numbers, Algebraic numbers.*

#### UNIT II: AVERAGE

**6 HRS**

H.C.F and L.C.M. of numbers – Average

**Extra Reading/Key words:** *Histogram, Ogives*

**UNIT III: AGES AND PERCENTAGE** **6 HRS**

Problems on Ages – Percentage.

**Extra Reading/Key words:** *Calendars, Line chart.*

**UNIT IV: PROFIT AND RATIO** **6 HRS**

Profit and Loss -Ratio and Proportion

**Extra Reading/Key words:** *Business, Metric measures.*

**UNIT V: PARTNERSHIP AND TIME** **6 HRS**

Partnership - Time and Work.

**Extra Reading/Key words:** *Tie-ups, Clocks.*

**Note: Texts given in the Extra Reading /Key Word: must be tested only through assignment and seminars.**

**TEXT BOOK**

Aggarwal R.S. (2012), Objective Arithmetic for Competitive Examinations, S.Chand and Company Ltd., Ram Nagar, New Delhi.

Unit I: Chapters 1 and 4

Unit II: Chapters 2 and 6

Unit III: Chapters 8 and 10

Unit IV: Chapters 11 and 12

Unit V: Chapters 13 and 15

**SUGGESTED READINGS**

1. Aggarwal R.S., OBJECTIVE ARITHMETIC (SSC and Railway exam special) (Revised edition 2018 and reprint 2020), S.Chand and Company Ltd., Ram Nagar, New Delhi.
2. Competition Success Review for Bank Probationary Officer's Exam.
3. Competition Success Review for MBA Entrance Examinations.
4. Aggarwal R.S., Mathematics for CDS,(reprint 2020), S.Chand and Company Ltd., RamNagar, New Delhi.

**WEB REFERENCES**

1. [https://www.smartkeeda.com/Quantitative\\_Aptitude/Arithmetic/Average\\_Level\\_1/newest/all/passage/Average\\_Quiz\\_11](https://www.smartkeeda.com/Quantitative_Aptitude/Arithmetic/Average_Level_1/newest/all/passage/Average_Quiz_11).
2. <https://www.math-only-math.com/worksheet-on-word-problems-on-hcf-and-lcm.html>.
3. <https://byjus.com/govt-exams/age-problems/>.
4. <https://ugcportal.com/raman-files/Time%20and%20Work.pdf>.

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1 – K5)
CO - 1	Recognize the various shortcut techniques in aptitude mathematical concepts	K1
CO - 2	Derive short cut methods for calculating LCM, HCF, ages, percentage, profit, loss, ratio and proportion.	K2
CO - 3	Construct different methods and strategies to solve problems involving numbers, average, HCF and LCM, time, work, and partnership.	K3
CO - 4	Analyze ethical considerations and problem-solving strategies to address potential challenges and dilemmas that arise in practical life problems related to the number system, ages and percentages, profit and loss, ratio and proportion, partnership, time and work.	K4
CO - 5	Estimate problem solving strategies that arise in real life problems related to the Number system, Ages, Percentages, Profit and loss, Ratio and proportion, partnership, time and work.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5= Evaluate)

## PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	M	M	M	L	H	H	H
CO2	H	H	H	M	H	M	H	H	H
CO3	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

	PSO1	PSO2	PSO3
CO1	M	H	M
CO2	H	H	H
CO3	H	H	H
CO4	H	H	H
CO5	H	H	H

(For the Candidates admitted in the academic year 2023-2024 )  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**First Year - Semester – I**

<b>Course Title</b>	<b>FOUNDATION COURSE : BRIDGE MATHEMATICS</b>
<b>Code</b>	<b>U23MA1FCT01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/Week</b>	<b>2</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To bridge the gap and facilitate transition from higher secondary to tertiary education and to instill confidence among stakeholders and inculcate interest for Mathematics.

**COURSE OBJECTIVES**

1. To understand binomial theorem and apply them to find the general term and middle term.
2. To understand arithmetic and geometric progression and the principle of counting and applying it to various situations
3. To understand the concept of permutation and combinations and use the strategies to solve real life problems.
4. To analyze the various trigonometric identities, their relationship and applications.
5. To understand different methods of Differentiation, Integration and apply calculus as a tool to solve every day real life problems.

**UNIT I: ALGEBRA**

**6 HRS**

Algebra: Binomial theorem, General term, middle term, problems based on these concepts  
**Extra Reading/Keywords:** *Pascal's Triangle*

**UNIT II: SEQUENCES AND SERIES**

**6 HRS**

Sequences and series (Progressions). Fundamental principle of counting. Factorial n.  
**Extra Reading/Keywords:** *Infinite Series and logarithmic series*

**UNIT III: PERMUTATIONS AND COMBINATIONS**

**6 HRS**

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

**Extra Reading/Keywords:** *Mathematical Induction*

**UNIT IV: TRIGONOMETRY****6 HRS**

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

**Extra Reading/Keywords:** *Law of sine, Law of cosine, Law of tangent*

**UNIT V: CALCULUS****6 HRS**

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.

**Extra Reading / Keywords:** *Continuity, tangent and slope*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through assignment and seminar.

**TEXT BOOKS**

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

**SUGGESTED READINGS**

1. Elementary Calculus, Vol. I, V.I. Smirnov, Addison – Wesley Publish Company, Inc
2. Differential and Integral Calculus, N. Piskunov, Mir Publishers, Moscow.
3. Discrete and Combinatorial Mathematics, by Ralph P. Grimaldi, Pearson Education Asia.
4. Algebra and Trigonometry - Marshall D. Hestenes, Richard O. Hill, Jr.
5. Trigonometry - S.L.Loney

**WEB REFERENCES**

1. <https://nptel.ac.in>
2. [https://www.brainkart.com/subject/Maths-11th-std\\_324/](https://www.brainkart.com/subject/Maths-11th-std_324/)
3. [https://www.shaalaa.com/textbook-solutions/tamil-nadu-board-samacheer-kalvi-solutions-class-11th-mathematics-volume-1-and-2-answers-guide\\_353](https://www.shaalaa.com/textbook-solutions/tamil-nadu-board-samacheer-kalvi-solutions-class-11th-mathematics-volume-1-and-2-answers-guide_353)
4. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-11-maths>

*Note: Learners are advised to use latest edition of books.*

**COURSE OUTCOMES**

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Recognize the basics of algebra, sequence and series and Calculus	K1
CO-2	Demonstrating the concepts of permutation combination and Trigonometry	K2
CO-3	Apply the various techniques to solve real life problems on calculus, algebra and trigonometry.	K3
CO-4	Analyze the solution through trigonometry, derivatives, permutation and combinations.	K4
CO-5	Determine problems on Algebra, sequences and series, permutations and combinations and examine trigonometric functions and calculus to solve problems.	K5

(K1 = Remember, K2 = Understand, K3 = Apply, K4 = Analyze, K5 = Evaluate)

**PO –CO MAPPING**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO1</b>	H	M	L	M	-	-	H	H	H
<b>CO2</b>	H	H	M	L	L	L	H	H	H
<b>CO3</b>	H	H	H	H	M	M	H	H	H
<b>CO4</b>	H	H	H	H	M	M	H	H	H
<b>CO5</b>	H	H	H	H	H	H	H	H	H

**PSO-CO MAPPING**

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	H	M	M
<b>CO2</b>	H	H	H
<b>CO3</b>	H	H	H
<b>CO4</b>	H	H	H
<b>CO5</b>	H	H	H

(For the Candidates admitted in the academic year 2023-2024)

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – I**

<b>Course Title</b>	<b>ALLIED I: ALLIED MATHEMATICS - I (FOR PHYSICS STUDENTS)</b>
<b>Code</b>	<b>U23MA1ALT01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/Week</b>	<b>5</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To give an in-depth knowledge of matrices, calculus and trigonometry and inculcate the habit of problem solving.

### COURSE OBJECTIVES

1. To evaluate eigen values and eigen vectors using Cayley Hamilton theorem.
2. To understand about successive differentiation and evaluation using Leibnitz methods and Jacobians.
3. To understand the properties of definite integrals and applying reduction formula for a specific standard integrals and Bernoulli's formula.
4. To Evaluate ordinary differential equation with constant coefficient.
5. To evaluate the expansions of trigonometric functions as multiple of  $\theta$  and a series of powers of  $\theta$

### UNIT I : ALGEBRA

**15 HRS**

Characteristic equation of a square matrix – Evaluation of Eigen values and Eigen vectors – Cayley–Hamilton theorem (without proof) - Simple problems – Application of eigen values and vectors.

**Extra Reading/Keywords:** *Cayley matrix algebra, Hessenberg method, Algebraic Multiplicity*

### UNIT II: DIFFERENTIATION

**15 HRS**

Successive Differentiation: The  $n^{\text{th}}$  derivatives of Standard result - Trigonometrical transformation of functions - Formation of equations involving derivatives – Leibnitz formula for the  $n^{\text{th}}$  derivative of a product - Related problems – Application of differentiation in business management.

**Extra Reading/Key words:** *Application of Leibnitz formula in practical problems*

### UNIT III: INTEGRATION

**15 HRS**

Properties of definite integrals - Integration by parts - Reduction formulae for standard integrals - Simple problems only ( $\int_0^{\frac{\pi}{2}} \sin^n x dx$  ,  $\int_0^{\frac{\pi}{2}} \cos^n x dx$  ,  $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx$  - Bernoulli's formula- Simple problems only-Application in fluid force and pressure.

**Extra Reading/Key words:** *Integration of irrational trigonometric functions and irrational fractions.*



#### UNIT IV : DIFFERENTIAL EQUATION

15 HRS

Introduction- Solutions of Differential Equations -Formation of Differential Equations-The operator D- Complementary function of a linear equation with constant coefficients- Particular integral- Application of Differential Equation in population growth.

**Extra Reading/ Keywords:** *Non-linear differential equation , Separable equations, IVP*

#### UNIT V: EXPANSIONS OF TRIGONOMETRIC FUNCTION

15 HRS

Expansions of  $\text{Cos}n\theta$ ,  $\text{Sinn}\theta$ ,  $\text{Tann}\theta$  where  $n$  is a positive integer (excluding formation of equations); Expansions of  $\text{Cos}^n\theta$ ,  $\text{Sin}^n\theta$  in a series of sines and cosines of multiples of  $\theta$ , ( $\theta$  in radians) and expansion of  $\text{Cos}\theta$ ,  $\text{Sin}\theta$ ,  $\text{tan}\theta$  in a series of powers of  $\theta$  (Formation of equations excluded) – Application of trigonometric functions in flight engineering.

**Extra Reading/ Keywords:** *Taylor series, Inverse trigonometric functions, Asymptotic expansion*

**Note :** Texts given in the Extra Reading/Key Word must be tested only through assignment and seminar.

#### TEXT BOOKS

Treatment and content as in

1. Narayanan.S, Manicavachagom Pillay. T.K, (2011), **Ancillary Mathematics – Volume I**, S.Viswanathan (Printers and publishers),Chennai for Unit I

**UNIT I** : Chapter 3 : Sec 3.4

2. Treatment and content as in Narayanan.S,Manicavachagom Pillay.T.K,**Calculus (Vol I)**

**UNIT II:** Chapter III fully.

3. Treatment and content as in Narayanan.S,Manicavachagom Pillay.T.K,**Calculus (Vol II)** by S. Narayanan and T.K. Manicavachagom Pillay for Unit III

**UNIT III:** Chapter I - Sections 11, 12, 13(13.3 – 13.5) & 15.1

4. Narayanan.S , Manicavachagom Pillay.T.K(2015), “**Differential Equations and its applications**”, S.Viswanathan (Printers and publishers),Chennai for Unit IV

**UNIT IV:**Chapter I -1, 2 & 3

Chapter V-Sections 1-4

5. Treatment and Content as in **Trigonometry** by S. Narayanan and T.K. Manicavachagom Pillay(2015), S.Viswanathan (Printers and publishers),Chennai. For Unit V.

**UNIT V:** Chapter III : Sections 1 - 4

#### SUGGESTED READINGS

1. Aggarwal.S,(2000), **Algebra-I**, S.Chand & Company (Pvt) Ltd., New Delhi.
2. Balasubrahmanyam P., Venkatachary P.R., Venkataraman G.R.(1992), **Text Book on Trigonometry**, Published by Roc House & Sons, Chennai.
3. Narayanan.S,Manicavachagom pillay.T.K,(2006), **Trigonometry**, S.Viswanathan(Printers and Publishers),Chennai.
4. Narayanan.S, Manicavachagom pillay. T.K,(2006), **Ancillary Mathematics –Volume II**, S.Viswanathan(Printers and Publishers),Chennai.

#### WEB REFERENCES

1. <https://www.cpp.edu/~manasab/eigenvalue.pdf>
2. <https://www.mathnasium.com/real-life-applications-of-trigonometry>
3. [https://fl01000126.schoolwires.net/cms/lib/FL01000126/Centricity/Domain/261/FDWK\\_3ed\\_Ch07\\_pp378-433.pdf/](https://fl01000126.schoolwires.net/cms/lib/FL01000126/Centricity/Domain/261/FDWK_3ed_Ch07_pp378-433.pdf/)
4. <https://www.embibe.com/exams/application-of-differential-equations/>
5. [http://www.ebookbou.edu.bd/Books/Text/SOB/MBA/mba\\_2306/Unit-08.pdf](http://www.ebookbou.edu.bd/Books/Text/SOB/MBA/mba_2306/Unit-08.pdf)
6. <https://www.toppr.com/guides/physics/mechanical-properties-of-fluids/pressure-and-its-application/>
7. <https://prezi.com/ea9ucm5ctssa/applications-of-trigonometry-in-flight/>

*Note: Learners are advised to use latest edition of books.*

### COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Recall the properties of matrices for solving the system of equations and standard forms of differentiation and integration and the identities of trigonometric functions.	K1
CO-2	Outline the concepts of Algebra, Calculus and trigonometry to interpret results on the same.	K2
CO-3	Make use of the procedure for solving problems in differentiation, integrals and expansions of trigonometric functions.	K3
CO-4	Examine the Eigen value and Eigen vectors using Cayley Hamilton theorem, inspect differential equations, integrals and trigonometric functions.	K4
CO-5	Determine the problem solving skills with practical application related to Algebra, Differentiation ,Integration and Trigonometric functions	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze,K5-Evaluate)

### PO – CO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	M	L	H	H	H	H	H
CO2	H	H	H	L	H	H	H	H	H
CO3	H	H	H	M	H	M	H	H	H
CO4	H	H	H	M	H	M	H	H	H
CO5	H	H	H	H	H	H	H	H	H

### PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

(For the Candidates admitted in the academic year 2023-2024)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – I**

<b>Course Title</b>	<b>ALLIED I: MATHEMATICS - I (FOR CHEMISTRY STUDENTS)</b>
<b>Code</b>	<b>U23MA1ALT02</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/Week</b>	<b>6</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To acquire knowledge in differentiation and some of its applications, to understand partial differentiation, to expand trigonometric functions and to learn the relation between hyperbolic functions

### COURSE OBJECTIVES

1. To understand successive differentiation and Leibnitz theorem
2. To apply differentiation for finding maxima and minima.
3. To understand PDE and Euler's theorem.
4. To evaluate the expansion of trigonometry function.
5. To understand Hyperbolic function and inverse hyperbolic functions

### UNIT I: DIFFERENTIAL CALCULUS

**15 HRS**

Logarithmic Differentiation- Differentiation of implicit functions- Successive differentiation-  $n^{\text{th}}$  derivative of standard functions – Leibnitz theorem (without proof) - Application to simple problems

**Extra Reading/ Keywords:** *Application of Leibnitz formula in practical problems*

### UNIT II: APPLICATIONS OF DIFFERENTIATION

**15HRS**

Conditions for maxima and minima (for single variable) - Increasing and decreasing functions (only conditions and simple problems).

**Extra Reading/ Keywords:** *Use of increasing and decreasing functions in marketing, Velocity and acceleration*

### UNIT III: PARTIAL DIFFERENTIATION

15HRS

Introduction to Partial Differentiation - Partial Differentiation – Euler’s Theorem - Partial derivatives of a function of two functions

**Extra Reading/ Keywords:** *Euler’s equation of motion, Heat equation, Wave equation*

### UNIT IV: EXPANSIONS OF TRIGONOMETRIC FUNCTIONS

15 HRS

Expansions of  $\text{Cos}n\theta$ ,  $\text{Sinn}\theta$ ,  $\text{tann}\theta$  where  $n$  is a positive integer (excluding formation of equations); Expansions of  $\text{Cos}^n\theta$ ,  $\text{Sin}^n\theta$  in a series of sines and cosines of multiples of  $\theta$ , ( $\theta$  in radians) and expansion of  $\text{Cos}\theta$ ,  $\text{Sin}\theta$ ,  $\text{tan}\theta$  in a series of powers of  $\theta$  – Approximations and limits.

**Extra Reading/ Keywords:** *Taylor series, Inverse trigonometric functions, Asymptotic expansion*

### UNIT V: HYPERBOLIC FUNCTIONS

15 HRS

Hyperbolic functions – Inverse hyperbolic functions, separation into real and imaginary parts - Logarithm of complex numbers – General value of logarithm.

**Extra Reading/ Keywords:** *Hyperbolic angle, Inverse hyperbolic Cotangent, Secant, Cosecant*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars

### TEXT BOOKS

1. Treatment and Content as in S. Narayanan and T. K. Manicavachagom Pillay, (2013)

**Calculus – Volume I**, S. Viswanathan Printers & Publishers Pvt. Ltd., for Units I, II & III

**UNIT I:** Chapter II: Sections 4.1, 4.2, 5;

Chapter III Sections 1.1-1.3, 2.1 & 2.2

**UNIT II:** Chapter V: Section 1.1, 1.2, 1.3 (statement only with simple problems)

Chapter IV: Section 2.1, 2.2

**UNIT III:** Chapter VIII

2. Treatment and Content as in **Trigonometry** by S. Narayanan and T.K. Manicavachagom

Pillay (2015), S. Viswanathan (Printers and publishers), Chennai. for Units IV & V.

**UNIT IV:** Chapter III (Formation of equations excluded)

**UNIT V:** Chapter IV, Chapter V - Sections 5, 5.1 & 5.2

### SUGGESTED READINGS

1. Kandasamy.P, Thilagavathy.K (2006), Mathematics Volume I, S.Chand & Company, New Delhi.

2. Arumugam, Thangapandi Issac, (2005) Theory of Equations and Trigonometry, New Gamma Publishing House, Delhi.

3. Vittal P.R. and Malini (2000), Calculus, Margham Publications, Chennai – 17. Third edition Reprint 2010.

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



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For the Candidates admitted in the academic year 2023-2024)

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**

**First Year - Semester – I**

<b>Course Title</b>	<b>ELECTIVE 1(GENERIC): STATISTICAL METHODS (For B.C.A and Computer Science students)</b>
<b>Code</b>	<b>U23MA1ECT01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To understand the various methods of collection of data and representing them through diagrams/graphs and apply measures of central tendency and to analyze the characteristics of data by using relevant statistical tools.

**COURSE OBJECTIVES**

1. To understand various methods of collection of data and representing them through Graphs and diagrams
2. To apply various measures of central tendency.
3. To relate two kinds of data through correlation and fit it into a linear regression curve.
4. To evaluate Index numbers using Laspeyre's, Fisher's Methods, Aggregate Expenditure Method and family Budget method.
5. To analyze time series with respect to different variation.

**UNIT I: COLLECTION, PRESENTATION OF DATA AND MEASURES OF CENTRAL TENDENCY** **12 HRS**

Definition of Statistics – Statistical data – Primary and secondary – Collection, classification and tabulation of data - Diagrammatic and graphical representation - Measures of Central Tendency – Mean, Median, Mode- Application of Data collection in Medical field.

**Extra Reading/ Keywords:** *Business statistics, Descriptive statistics, Economics*

**UNIT II: DISPERSION, SKEWNESS AND KURTOSIS** **12 HRS**

Dispersion – calculation of Mean Deviation, Quartile deviation, standard deviation, coefficient of variation and moments for frequency distributions- concept of skewness and kurtosis and their measures- Application of Dispersion in Machine Learning.

**Extra Reading/ Keywords:** *Grouped data, Gaussian Distribution, Laplace distribution*

**UNIT III : CORRELATION AND REGRESSION** **12 HRS**

Simple Correlation – rank correlation - Concurrent Deviation – Linear regression.(Error analysis in chapter 12 omitted)- Application of Correlation in Forecasting.

**Extra Reading/ Keywords:** *Least squares method, Multiple regression, Karl Pearson's method, Spearman's ranking method, Scatter diagram*

#### **UNIT IV : INDEX NUMBERS**

**12 HRS**

Index Numbers- Uses – Types – Laspeyre’s-Paasche’s-Fisher’s and Bowley’s index (other methods in weighted aggregate type omitted) -Tests of Consistency (Unit and Circular tests omitted)-Chain and fixed base index-Base shifting (Splicing and deflating indexes omitted) – Cost of Living Index – Aggregate Expenditure Method – Family Budget Method – Application of index numbers in Marketing field.

**Extra Reading/ Keywords:** *Policonomics, Order reversal test, Time and factor test, Weighted index numbers, Zero-based budget, Cash-Only budgeting*

#### **UNIT V : ANALYSIS OF TIME SERIES**

**12 HRS**

Analysis of time series- Uses- Mathematical model- Secular Trend (all types)- Seasonal Variation(Ratio to trend and ratio to moving averages methods omitted)- Cyclical Variation – Irregular Variation- Application of Time series in Census analysis.

**Extra Reading/ Keywords:** *Forecasting, Analysis of economic and industrial time series, Measuring Seasonality*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminar.**

#### **TEXT BOOK**

Treatment and content as in Pillai R.S.N , Bagavathi .V (2007), Statistics, Chandand Company, New Delhi.

UNIT I: Chapter 1,2,4,6,7,8 & 9

UNIT II: Chapters 10 and 11

UNIT III: Chapter 12 and 13(Omit “Error Analysis” in Chapter 12)

UNIT IV: Chapter 14

UNIT V: Chapter 15

#### **SUGGESTED READINGS**

1. SC Gupta, Kapoor VK,(2020), **Fundamentals of Mathematical Statistics**, Sultan Chand & Sons, 12<sup>th</sup> Edition
2. Chaudhary Ray, Sharma (2017), **Mathematical Statistics**, Ram Prasad Publications, Agra.
3. Gupta Vikas, Gupta S.C., Gupta Sanjeev Kumar(2019), **Problems and Solutions in Mathematical Statistics**, Sultan Chand & Sons,
4. Gupta.S.P (2006), **Statistical Methods**, Sultan Chand & Sons ,New Delhi.5.
5. Sharma J.K, (2006), **Business Statistics**, Dorling Kindersley, (India) Pvt Ltd, Licensees of Pearson Education in South Asia.

#### **WED REFERENCES**

1. <https://study.com>
2. <https://www.quora.com> ; <https://towardsdatascience.com>
3. <https://www.ijcsjournal.com>
4. <https://www.yourarticlelibrary.org>
5. <https://towardsdatascience.com>

**Note: Learners are advised to use latest edition of books.**



## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Recall various methods of collection of data, classify, tabulate and interpret the data through diagrams and graphs	K1
CO-2	Illustrate various measures of central tendency, dispersion, skewness and kurtosis	K2
CO-3	Apply an appropriate types of Index Numbers and Compute index number by Laspeyre's, Fisher's methods, expenditure method and family Budget method	K3
CO-4	Compare two kinds of data whether they are related by Correlation technique and Analyze the Time Series Models with respect to different variation	K4
CO-5	Asses the data in real life problem and validate the data through central tendency, dispersion, correlation, Index number and Time Series	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

### PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	L	H	H	M	M	M	H	H	H
CO-2	M	M	M	M	M	M	H	H	H
CO-3	M	M	M	L	H	M	H	H	H
CO-4	M	M	M	L	H	M	H	H	H
CO-5	H	H	H	H	H	H	H	H	H

### PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	M	H	H
CO-2	M	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

(For the Candidates admitted in the academic year 2023-2024)

**HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (LOCF)**  
**First Year - Semester - I**

<b>Course Title</b>	<b>ALLIED I -BASIC MATHEMATICS (for B.Voc. Software Development students)</b>
<b>Code</b>	<b>U23MA1ECT02</b>
<b>Course Type</b>	<b>Theory</b>
<b>Semester</b>	<b>I</b>
<b>Hours/Week</b>	<b>4</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To understand the fundamental knowledge about matrices and solve them by elementary operations, Differentiate and integrate the functions to acquire the knowledge of problem solving ability, understanding and applying algebraic and transcendental equations using numerical methods.

### COURSE OBJECTIVES

1. To understand the elementary operations of matrices and rank of a matrix.
2. To find the solution of simultaneous system of linear equations.
3. To enumerate and understand the differentiation formulae.
4. To spell out and understand the integration formulae.
5. To apply algebraic and transcendental equations using numerical methods.

### UNIT I: ELEMENTARY OPERATIONS OF MATRIX THEORY AND RANK OF A MATRIX 12 HRS

Matrix - Operations (scalar multiplication, addition, subtraction and multiplication) of matrices -Rank of a matrix - Application of matrices to Cryptography.

**Extra Reading/Keywords:** *Orthogonal matrices*

### UNIT II: SOLVING SIMULTANEOUS SYSTEM OF LINEAR EQUATIONS 12 HRS

Symmetric matrix - Inverse matrix -Solution of Simultaneous equations - Application of matrices in computer graphics

**Extra Reading / Keywords:** *System of non homogeneous linear equations*

### UNIT III: DIFFERENTIATION

12 HRS

Definition – Standard forms of differential coefficient of  $x^n$ ,  $e^x$ ,  $\log_e x$ ,  $\sin x$ ,  $\cos x$ ,  $\tan x$  –  
General theorems on differential coefficients – Product Rule – Quotient Rule –  
Application of differentiation in medical science.

**Extra Reading / Keywords:** *Successive Differentiation*

### UNIT IV: INTEGRATION

12 HRS

Definition - Standard Formulae - Integrate Scalar multiplication, addition and subtraction of functions of  $x$  with respect to  $x$  – Definite integral – Applications of Integral Calculus in Engineering.

**Extra Reading/Keywords:** *Integration of irrational functions*

### UNIT V: SOLVING ALGEBRAIC AND TRANSCENDENTAL EQUATIONS USING NUMERICAL METHODS

12 HRS

Introduction-Bisection method – Method of False Position – Iteration method (Acceleration of convergence omitted)– Newton Raphson method (Generalized Newton's method omitted) – Applications of Newton Raphson method.

**Extra Reading /Keywords:** *Ramanujan's method*

**Note: Texts given in the Extra reading / Keywords must be tested only through Assignment and Seminars.**

### TEXTBOOKS

1. T.K.Manicavachagom, Pillay, T. Natarajan, K.S. Ganapathy, S. Algebra, Volume - II, Viswanathan Publishers Pvt Ltd (2013)

**UNIT I:** Chapter 2-Sections 1–5, 7, 11-13

**UNIT II:** Chapter 2-Sections 6, 8 10

2. S.Narayanan, T.K.Manicavachagom Pillay, Calculus Volume-I, S.Viswanathan Publishers Pvt Ltd.(2013).

**UNIT III:** Chapter 2 - Sections 1, 2.1-2.6, 3.1 - 3.4, 3.6

3. S.Narayanan, T.K.Manicavachagom Pillay, Calculus Volume-II, S.Viswanathan Publishers Pvt Ltd.(2013).

**UNIT IV:** Chapter 1 - Sections 1.1, 1.2, 2 -4

4. S.S. Sastry, Introductory methods of Numerical Analysis, 5<sup>th</sup> edition, PHI learning private limited.(2013).

**UNIT V:** Chapter 2- Sections 2.1-2.5

### SUGGESTED READINGS

1. S. Narayanan, R. Hanumantha Rao, T.K. Manicavachagom Pillay, Ancillary Mathematics Volume - I, S.Viswanathan Publishers Pvt Ltd (2012).
2. A.Ginzburg, Calculus Problems and Solutions (2003)
3. A.R.Vasishtha and S.K.Sharma, Integral Calculus , Krishna Prakashan Mandir, Meerut,(1990).
4. Shanthi Narayan, Differential Calculus, Shyam Lal Charitable Trust, New Delhi, (1993).
5. P.Kandasamy, K.Thilagavathi and K.Gunavathi, Numerical Methods, S.Chand & Company Ltd, New Delhi, (2012).



## PSO-CO MAPPING

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	H	M	M
<b>CO2</b>	H	H	H
<b>CO3</b>	H	H	H
<b>CO4</b>	H	H	H
<b>CO5</b>	H	H	H

(For the Candidates admitted in the academic year 2023-2024)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**First Year-Semester– II**

<b>Course Title</b>	<b>CORE COURSE 3: ANALYTICAL GEOMETRY (TWO &amp; THREE DIMENSIONS)</b>
<b>Code</b>	<b>U23MA2CCT03</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/ Week</b>	<b>6</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

## CONSPECTUS

To enable the students to understand the characteristics and properties of two and three dimensional geometry and apply it in solving the real world problems. To construct geometrical shapes using geogebra software.

## COURSE OBJECTIVES

1. To understand various form of equation of straight line.
2. To derive the general equation of a circle.
3. To understand the standard forms of the equation of the planes and find the angle between two planes.
4. To derive the equation of a sphere.
5. To construct geometrical shapes using Geogebra.

### UNIT I: STRAIGHT LINE

**18 HRS**

Various form of Equation of straight line - points of intersection of two straight lines - angle between two straight lines - condition for two lines to be parallel and perpendicular.

**Extra Reading/ Keywords:** *pair of straight lines – equation of bisector of angles between lines.*

### UNIT II: CIRCLE:

**18 HRS**

General equation of a circle - Length of the tangent - The equation of the tangent at  $(x_1, y_1)$  on the circle-Intersection of the line  $y = mx + c$  and the circle.

**Extra Reading/ Keywords:** *Pole and Polar - Equation of Pair of Tangents - Orthogonal Circles*

**UNIT III: THE PLANE****18 HRS**

The plane - the general equation of the plane - Several forms of equations of planes - angle between the planes - equation of the plane through the line intersection of two given planes - length of perpendicular - The equation of the plane bisecting the angle between the planes  $a_1x + b_1y + c_1z + d_1 = 0$  and  $a_2x + b_2y + c_2z + d_2 = 0$ .

**Extra Reading/ Keywords:** *Three dimension coordinate space, Normal vector, Plane embedded in three dimensional Euclidean space, Plane of rotation, plane of incidence.*

**UNIT IV: THE SPHERE****18 HRS**

Equation of a sphere - Length of the tangent from a point - The plane section of a sphere - equation of a circle on a sphere-Intersection of two spheres -.The equation of the tangent to the sphere  $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$  at point  $(x_1, y_1)$ .

**Extra Reading/ Keywords:** *Equation of sphere in diameter form, Interior and exterior of sphere, Non- Coplanar points*

**UNIT V: GEOGEBRA****18 HRS**

The GeoGebra Interface - GeoGebra menu - Construction tools.

**Extra Reading/ Keywords:** *Probability and Statistics using geogebra.*

**List of Practicals**

1. Construct a straight line in 2D
2. Construct a circle in 2D
3. Construct the plane in 3D
4. Construct the sphere in 3D
5. Construct a tangent on a circle in 2D
6. Construct intersection of two planes in 3D

**Note: Texts given in the Extra Reading / Keyword must be tested only through assignment and seminar.**

**TEXT BOOKS:**

1. Treatment and content as in Manicavachagom Pillay. T.K, Natarajan T ( 2014) , “**A Text Book of Analytical Geometry**” (Part I – Two Dimensions) , Viswanathan S (Printers and publishers),Chennai for Units I & II.

**UNIT I: Chapter 2: Sections 1- 9.2****UNIT II: Chapter 4: Sections 1-9.2**

2. Treatment and content as in Manicavachagom Pillay. T.K, Natarajan T ( 2016) , “**A Text Book of Analytical Geometry**” (Part II – Three Dimensions) , Viswanathan S (Printers and publishers),Chennai for Units III , IV

**UNIT III: Chapter 2: Sections 1-11****UNIT IV: Chapter 4: Sections 1-8**

3. Treatment and content as in Gerrit Stols, “**GeoGebra in 10 Lessons**” ,University of Pretoria, South Africa

**UNIT V: Lessons 1 - 6**





## PSO-CO MAPPING

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**First Year - Semester – II**

<b>Course Title</b>	<b>CORE COURSE 4: INTEGRAL CALCULUS</b>
<b>Code</b>	<b>U23MA2CCT04</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/Week</b>	<b>5</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To inculcate the basic skills on integration and its geometrical applications, double, triple integrals. Also impart the basic knowledge on beta and gamma functions and their applications to multiple integrals.

### COURSE OBJECTIVES

1. To understand the fundamental concepts of integration.
2. To solve the problems involving double integrals.
3. To determine the solutions of triple integral problems.
4. To apply beta and gamma functions to resolve multiple integrals.
5. To implement the concept of integration in solving geometrical problems.

### UNIT I: INTEGRATION

**15 HRS**

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.

**Extra Reading/ Keywords:** *Feynman Integration*

### UNIT II: DOUBLE INTEGRALS

**15 HRS**

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

**Extra Reading/ Keywords:** *Computation of moment of inertia & centriods*

### UNIT III: TRIPLE INTEGRALS

15 HRS

Triple integrals –applications of multiple integrals - change of variables - Jacobian.

**Extra Reading/ Keywords:** *Triple integrals in cylindrical and spherical coordinates*

### UNIT IV: BETA AND GAMMA FUNCTIONS

15 HRS

Beta and Gamma functions – infinite integral - definitions–recurrence formula of Gamma functions – properties of Beta and Gamma functions- relation between Beta and Gamma functions.

**Extra Reading/ Keywords:** *Theorems of pappus or Guldin*

### UNIT V: APPLICATIONS OF INTEGRAL CALCULUS

15 HRS

Geometric Applications of Integral calculus-Area under plane curves-Area of closed curve- Approximate integration- volumes of solid of revolution.

**Extra Reading/ Keywords:** *Physical applications of integration.*

### DIGITAL DEMONSTRATION USING SAGEMATH

1. Find the area under the curve using SageMath  
<http://matrix.skku.ac.kr/Cal-Book/part1/CS-Sec-6-1-Sol.html>
2. Evaluate the integral of trigonometric functions using SageMath.  
<http://matrix.skku.ac.kr/Cal-Book/part1/CS-Sec-7-2-Sol.html>
3. Evaluate the given double integral expression using SageMath.  
<http://matrix.skku.ac.kr/Cal-Book/part2/CS-Sec-14-1-Sol.html>
4. Evaluate the triple integral of an expression using SageMath.  
<http://matrix.skku.ac.kr/Cal-Book/part2/CS-Sec-14-5-Sol.html>
5. Evaluate multiple integrals by change of variables using SageMath.  
<http://matrix.skku.ac.kr/Cal-Book/part2/CS-Sec-14-7-Sol.html>

**Note:** Texts given in the Extra Reading /Key Word: must be tested only through assignment and seminars.

### TEXT BOOK

Treatment and content as in

S. Narayanan and T. K. Manickavasagam Pillay, **Calculus Volume – II**, S. Viswanathan (Printers and Publishers) Pvt. Ltd.

Unit-I: Chapter 1 - 13,14 &15.1

Unit-II: Chapter 5 - 1, 2 & 3

Unit-III: Chapter 5 - 4,5

Chapter 6-1&2

Unit-IV: Chapter 7- 2,3,4,5&6

Unit-V: Chapter 2- 1.1,1.2,2.1,2.2 & 3



## PSO – CO MAPPING

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H

(For Candidates admitted from the academic year 2023-24 onwards)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – II**

<b>Course Title</b>	<b>ALLIED 2 : Allied Mathematics – II (For Physics Students)</b>
<b>Code</b>	<b>U23MA2ALT03</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/Week</b>	<b>5</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students to understand Laplace and inverse Laplace transformations, ordinary and partial differential equations and Fourier series. Also enable them to inculcate the habit of problem solving.

### COURSE OBJECTIVES

1. To understand the fundamental concepts of Laplace transforms.
2. To apply Inverse Laplace transform for solving differential equation with constant coefficient.
3. To understand the concept of ordinary differential equation and find its solution.
4. To illustrate first and second order partial differential equation and their applications.
5. To evaluate full range and half range Fourier series.

#### UNIT I: LAPLACE TRANSFORMS

**15 HRS**

Laplace transforms of the functions  $t$ ,  $e^{-at}$ ,  $\cos at$ ,  $\sin at$ ,  $t^n$ ,  $e^{-at}\cos bt$ ,  $e^{-at}\sin bt$ ,  $e^{-at}t^n$ ,  $f'(t)$ ,  $f''(t)$ ,  $f^n(t)$  (where  $n$  is a positive integer).

**Extra Reading/Key words:** *Laplace transform of Bessel function and Error function, Mellin transform, Borel transform.*

#### UNIT II: INVERSE LAPLACE TRANSFORMS

**15 HRS**

Inverse transforms relating to the above standard functions - solution of ordinary differential equations with constant coefficients.

**Extra Reading/Key words:** *Inverse Laplace transform of Heaviside function and Dirac delta function, Mellin's inverse formula, Post's inversion formula.*

**UNIT III: DIFFERENTIAL EQUATIONS****15 HRS**

Equations of first order and the first degree –Variable separable – Homogeneous and non-homogeneous equations-Linear differential equations with constant coefficients –Particular integrals for  $e^{ax}$ ,  $\sin ax$  &  $\cos$  .

**Extra Reading/ Key words:** *Non linear differential equation, Separable equations*

**UNIT IV: PARTIAL DIFFERENTIAL EQUATIONS****15 HRS**

Formation of equations by eliminating arbitrary constants and arbitrary functions – Definition of General, Particular, Complete and Singular integrals –Solutions of first order equations in their standard forms-  $F(p, q) = 0$ ,  $F(x, p, q) = 0$ ,  $F(y, p, q) = 0$ ,  $F(z, p, q) = 0$ ,  $F(x, p) = F(y, q)$ ,  $z = px + qy + (p, q)$  - Second order linear partial differential equations with constant coefficients (simple problems only)

**Extra Reading/Keywords:** *Canonical form of parabolic, Hyperbolic and Elliptic functions*

**UNIT V: FOURIER SERIES****15 HRS**

Full Range Fourier series – Half range cosine and sine series (Excluding change of intervals).

**Extra Reading / Keywords:** *Fourier series on a square, Least squares property, Fast Fourier transform.*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through Assignment and Seminars.

**TEXT BOOKS****For Units I, II, III, IV and V**

Treatment and content as in Narayanan.S, Manicavachagom Pillay.T.K (2013), “**Calculus–Volume III**”, S.Viswanathan (Printers and publishers),Chennai.

Unit I: Chapter 5: Sections 1,2,4,5

Unit II: Chapter 5: Sections 6 – 8

Unit III: Chapter 1: Sections 2.1 – 2.3

Chapter 2: Sections 1– 4, 4(a) & 4(b) (only simple problems)

Unit IV: Chapter 4: Sections 1-3 & 5 (5.5 excluded)

Unit V: Chapter 6: Sections 1 - 5.2

**For Unit IV:**

Treatment and content as in Dr.M.K.Venkataraman, “**Engineering Mathematics**” (Third Year, Part-B), 12<sup>th</sup> edition (1995), The National Publishing Company, Chennai.

Unit IV: Chapter 2: Sections 13 – 19 (Second order linear partial differential equations with constant coefficients only)

### SUGGESTED READINGS

1. Arumugam.S,Thangapandi Issac. A, Somasundaram.A,(2002), “**Engineering Mathematics**”, Vol **III**, SciTech Publishers, Chennai
2. ZafarAhsan (2006),“**Differential Equations and their Applications**”, Prentice Hall of India Ltd, New Delhi.
3. Narayanan.S, Manicavachagom Pillay.T.K,(2006), “**Differential Equations**”, S.Viswanathan (Printers and publishers),Chennai.
4. William F.French (2013), “**Elementary Differential Equations**”, Thomson Learning publishers, USA.
5. Shepley L.Ross (2010), “**Differential Equations**”, Wiley India Edition, third edition.

### WEB REFERENCES

1. [https://sist.sathyabama.ac.in/sist\\_coursematerial/uploads/SMT1401.pdf](https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMT1401.pdf)
2. [https://howellkb.uah.edu/public\\_html/DEtext/Part4/Inverse\\_Laplace.pdf](https://howellkb.uah.edu/public_html/DEtext/Part4/Inverse_Laplace.pdf)
3. <http://www.math.toronto.edu/~selick/B44.pdf>
4. [http://ddeku.edu.in/Files/2cfa4584-5afe-43ce-aa4b-ad936cc9d3be/Custom/PDE%20Chapter\\_2\\_and\\_3\\_PDE.PDF](http://ddeku.edu.in/Files/2cfa4584-5afe-43ce-aa4b-ad936cc9d3be/Custom/PDE%20Chapter_2_and_3_PDE.PDF)
5. [https://sist.sathyabama.ac.in/sist\\_coursematerial/uploads/SMTA1401.pdf](https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMTA1401.pdf)

*Note: Learners are advised to use latest edition of books.*

### COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Recognize the concepts of Laplace transforms, Inverse Laplace transforms, Differential Equations, First and Second Order Partial Differential Equations and Fourier Series.	K1
CO-2	Describe the various properties of Laplace transforms and Inverse Laplace transforms and types in solving ordinary and partial differential equations.	K2
CO-3	Demonstrate the idea of Laplace Transforms, Inverse Laplace transforms, Ordinary and Partial differential equations, Fourier series in solving real life application problems.	K3
CO-4	Identify the appropriate tools to solve real world problems in the field of physics and engineering and interpret the solution.	K4

(K1-Remember, K2-Understand,K3-Apply,K4-Analyze)



**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	M	M	L	L	H	H	H
<b>CO-2</b>	H	H	H	M	M	M	H	H	H
<b>CO-3</b>	H	H	H	M	M	M	H	H	H
<b>CO-4</b>	H	H	H	H	M	M	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – II**

<b>Course Title</b>	<b>ALLIED 2 : Mathematics – II (For Chemistry Students)</b>
<b>Code</b>	<b>U23MA2ALT04</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/Week</b>	<b>6</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the basic concepts of three dimensional geometry, Differential equations, Vector differentiation and integration.

### COURSE OBJECTIVES

1. To understand the standard forms of the equation of the planes and find the angle between two planes.
2. To illustrate different forms of straight line and find the shortest distance between two lines.
3. To evaluate differential equations using variable separable method.
4. To apply the idea of gradient, curl and divergence of vectors in vector differentiation.
5. To analyze line integral, surface integral and volume integral using vector integration .

### UNIT I: THE PLANE

**18 HRS**

The plane – The general equation of the plane – Standard forms of equations of planes – Angle between the planes- Equation of the plane through the line intersection of two given planes.

**Extra Reading/ Keywords:** *Hyperbolic plane, Euclidean plane.*

### UNIT II: THE STRAIGHT LINE & COPLANAR LINES

**18 HRS**

Different forms of equations of a straight line – The plane and the straight line – Coplanar lines – The condition that two given straight lines should be coplanar – The shortest distance between two given lines.

**Extra Reading/ Keywords:** *Angle between the planes , Symmetrical form of equation of line*

### UNIT III: DIFFERENTIAL EQUATIONS

**18 HRS**

Equations of first order and first degree-Variable separable method - Homogeneous and non-homogeneous equations-Linear differential equations with constant coefficients - Particular integrals for  $e^{ax}$ ,  $\sin ax$  &  $\cos ax$  .

**Extra Reading/ Keywords:** *Non linear differential equation , Separable equations*

#### **UNIT IV: VECTOR DIFFERENTIATION**

**18 HRS**

Derivatives of vector functions – Velocity and acceleration – Differential operators – Directional derivatives, gradient, divergence and curl – Solenoidal and Irrotational vectors.

**Extra Reading/ Keywords:** *Vector calculus, Closed surface*

#### **UNIT V: VECTOR INTEGRATION**

**18 HRS**

Line integrals – Work done by a force – Conservative field – Surface and Volume integral – Integral theorems(without proof) – Gauss divergence theorem – Stoke's theorem–Green's theorem ( simple problems only).

**Extra Reading/ Keywords:** *Scalar field, Vector field, Curl theorem*

**Note: Texts given in the Extra Reading /Keyword must be tested only through assignment and seminar.**

#### **TEXT BOOKS**

##### **For UNITS I & II:**

1. Treatment and content as in T.K. Manicavachagom Pillay, T. Natarajan (2016), A Text book of **Analytical Geometry (Part II – Three Dimensions)** Viswanathan .S (Printers and publishers),Chennai.

UNIT I: Chapter II : Sections 1- 9

UNIT II: Chapter III: Sections 1- 8 ( omit 8.1 & 8.2)

##### **For UNIT III :**

2. Treatment and content as in S. Narayanan and T.K. Manicavachagom Pillay(2013), **Calculus VolumeIII** –Viswanathan publishers.

Unit III: Chapter 1: Sections 2.1 – 2.3,

Chapter 2: Sections 1 – 4,4(a) & 4(b)(only simple problems)

##### **For UNITS IV & V:**

3. Treatment and content as in Dr. P. R. Vittal, Dr. V. Malini, (Reprint2016) **Vector Analysis**, Margham Publications, Chennai.

Unit IV: Chapter 1

Unit V: Chapter 2

#### **SUGGESTED READINGS**

1. Duraipandian .P, Laxmi Duraipandian & D. Mahilan(2004), “**Analytical Geometry-Three Dimensional**”, Emerald Publishers, Chennai.

2. T. K. Manickavasagam Pillay and Others(2004), “**Vector Calculus**”, S.Viswanathan Publications.

3. S. Shanti Narayan(1966), “**A Prescribed Text of Vector Calculus**”, S. Chand and Co.,New Delhi.

4. K. Viswanatham & S. Selvaraj(1999), “**Vector Analysis**”, Emerald Publishers, Chennai.

5. P. Duraipandian, Laxmi Duraipandian(2003), “**Vector Analysis**”, Emerald Publishers, Chennai.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H

(For Candidates admitted from the academic year 2023-24 onwards)  
**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – II**

<b>Course Title</b>	<b>ELECTIVE 2(GENERIC): NUMERICAL METHODS (for BCA and B.Sc. Computer Science students)</b>
<b>Code</b>	<b>U23MA2ECT03</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students know about different methods of solving numerical equations, methods of interpolation, numerical differentiation and integration.

### COURSE OBJECTIVES

1. To understand various methods for solving algebraic and transcendental equations
2. To understand the system of simultaneous equations and finding the solution of a system of linear equations using numerical methods.
3. To analyze numerical solution to ordinary differential equations using direct method.
4. To evaluate polynomial using interpolation for equal and unequal intervals.
5. To understand numerical differentiation and evaluate finite integrals using Trapezoidal and Simpson's rule.

### UNIT I: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

**12 HRS**

Introduction - Bisection Method - Method of False Position -Iteration Method – Newton Raphson Method.

**Extra Reading/ Keywords:** *Descartes' rule of signs, Methods for complex roots*

### UNIT II: SOLUTION OF LINEAR SYSTEMS OF EQUATIONS

**12 HRS**

Introduction – Gaussian elimination, Gauss – Jordan, Gauss -Seidel and Gauss Jacobi methods.

**Extra Reading/ Keywords:** *LU Decomposition of matrices, Matrix Norms.*

### UNIT III: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

**12 HRS**

Introduction – Solution by Taylor's series, Euler's method, Modified Euler's method, Runge-Kutta method.

**Extra Reading/ Keywords:** *Picard's method, Adams – Bashforth method.*

#### UNIT IV: INTERPOLATION

12 HRS

Introduction -Finite Differences, Forward and Backward differences only, Newton's formula for interpolation, Central Difference Interpolation formulae- Gauss central Difference formulae, Interpolation with unevenly spaced points, Lagrange's interpolation formula.

**Extra Reading/ Keywords:** *Stirling's formula, Bessel's formula.*

#### UNIT V: NUMERICAL DIFFERENTIATION AND INTEGRATION

12 HRS

Introduction - Numerical differentiation, Numerical integration – Trapezoidal rule, Simpson's 1/3-rule.

**Extra Reading/ Keywords:** *Simpson's 3/8 rule, Boole's and Weddle's rule.*

**Note: Texts given in the Extra Reading /Key Words must be tested only through assignment and seminars.**

#### TEXT BOOK

S.S. Sastry (Fifth Edition, May 2017), Introductory Methods of Numerical Analysis, New Age Publishing Company.

UNIT I: Chapter 2 - Sec. 2.1 to 2.5

UNIT II: Chapter 7- Sec.7.5, 7.5.1, 7.5.3, 7.6

UNIT III: Chapter 8 - Sec 8.1, 8.2, 8.4, 8.4.2, 8.5.

UNIT IV: Chapter 3 - Sec. 3.1, 3.3, 3.3.1, 3.3.2, 3.6, 3.7, 3.7.1, 3.9, 3.9.1.

UNIT V: Chapter 6 - Sec. 6.1, 6.2, 6.4, 6.4.1 and 6.4.2.

#### SUGGESTED READINGS

1. A. Singaravelu (2008), Engineering Mathematics - Numerical Methods, Meenakshi Publishers, Chennai
2. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram (2010), Numerical Methods, Scitech Publishers, Chennai
3. Dr. M.K. Venkataraman (2017), Numerical Methods in Science and Engineering, National Publishing House, Chennai.

#### WEB REFERENCES

1. <https://kanchiuniv.ac.in/coursematerials/Numerical%20-%20Algebraic%20equations.pdf>
2. [https://math.libretexts.org/Bookshelves/Applied\\_Mathematics/Applied\\_Finite\\_Mathematics\\_\(Sekhon\\_and\\_Bloom\)/02%3A\\_Matrices/2.02%3A\\_Systems\\_of\\_Linear\\_Equations\\_and\\_the\\_Gauss-Jordan\\_Method](https://math.libretexts.org/Bookshelves/Applied_Mathematics/Applied_Finite_Mathematics_(Sekhon_and_Bloom)/02%3A_Matrices/2.02%3A_Systems_of_Linear_Equations_and_the_Gauss-Jordan_Method)
3. <https://www.pnw.edu/wp-content/uploads/2020/03/Lecture-Notes-10-5.pdf>
4. <https://atozmath.com/example/CONM/NumInterPola.aspx?q=LI&q1=E1>
5. [https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032250571912siddharth\\_bhatt\\_engg\\_Numerical\\_Differentiation\\_and\\_Integration.pdf](https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032250571912siddharth_bhatt_engg_Numerical_Differentiation_and_Integration.pdf)

**Note: Learners are advised to use latest edition of books.**

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO – 1	Recalls the concepts of Algebraic and Transcendental Equations, Differentiation, Integration and Ordinary differential equations.	K1
CO – 2	Explains the numerical methods to solve the linear system of algebraic and transcendental equations, ordinary differential equations, interpolation, numerical differentiation and integration and system of linear simultaneous equations with illustrations.	K2
CO – 3	Makes use of the numerical methods in solving the linear system of algebraic and transcendental equations, ordinary differential equations, interpolation, numerical differentiation and integration.	K3
CO – 4	Interprets the solution to the realistic problems which involves the differential equations by the developed numerical methods, interpolation, numerical differentiation and integration.	K4

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze)

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	M	L	H	H	H
CO-2	H	H	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	M	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H



(For Candidates admitted in the academic year 2023-24)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – II**

<b>Course Title</b>	<b>ELECTIVE 2(GENERIC) :STATISTICS FOR DATA ANALYTICS B.Voc. (SOFTWARE DEVELOPMENT)</b>
<b>Code</b>	<b>U23MA2ECT04</b>
<b>Course Type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/Week</b>	<b>4</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the concept of various methods of collection of data and representing them through diagrams and graphs, function of a random variable, test of significance for small and large samples.

### COURSE OBJECTIVES

1. To understand various methods of collection of data and representing them through diagrammatic representation.
2. To describe the concept of random variables.
3. To demonstrate the properties of distribution, marginal probability distribution and conditional probability distribution.
4. To apply test of hypothesis for large samples.
5. To evaluate test statistic for small samples using  $t$ ,  $F$  and chi-square test.

### UNIT-I: STATISTICS AND DATA ANALYTICS

**12 HRS**

Role of statistics and the data analysis Process - Collection of Data - Primary and Secondary data – Classification and tabulation of data- Diagrammatic and graphical representation of data (Excluded: Ogive curve & Graph of time series).

**Extra Reading /Keywords:** *Measures of central tendency and dispersion*

### UNIT-II: RANDOM VARIABLES

**12 HRS**

Discrete and continuous random variable - cumulative distributive function - properties of distribution function - function of a random variable

**Extra Reading /Keywords:** *Dispersion, skewness and kurtosis for continuous probability distributions*

**UNIT-III: TWO DIMENSIONAL RANDOM VARIABLES** **12 HRS**

Two dimensional random variable - joint probability function - marginal probability distribution - conditional probability distribution -Independent random variables.

**Extra Reading /Keywords:** *Expectation of random variables*

**UNIT-IV: TEST OF HYPOTHESIS FOR LARGE SAMPLES** **12HRS**

Large Samples – definitions, test of hypothesis – test for a specified mean- test for equality of two means – test for a specified proportion – test for equality of two proportions – test for specified standard deviation of the population– test for equality of two standard deviations.

**Extra Reading /Keywords:** *Sampling from finite population*

**UNIT-V:TEST OF HYPOTHESIS USING FOR SMALL SAMPLES** **12 HRS**

**t Test:** Uses of t - Test for a specified mean, Test of significance for the difference between two population means when population S.D's are not known.

**F Test:** Test of Equality of two population variances

**Chi-Square Test:** Chi square Test – definition, additive property, Pearson's Statistics, Uses of Chi-square test- test of independence of attributes (**Exclude test for a specified population variance, test of goodness of fit**)

**Extra Reading /Keywords:** *Null and Alternative hypothesis*

**Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.**

**TEXT BOOKS**

**1. Roxy Peck, Chris Olsen, Jay Devore, (2008) „INTRODUCTION TO STATISTICS ANDDATA ANALYSIS PROCESS”, (Third Edition) Thomson Corporation, USA.**

UNIT I: Chapter 1(1.1, 1.2, 1.3)

**2.Treatment and content as in Pillai R.S.N, Bagavathi .V (2007) STATISTIC, S Chand and Company, New Delhi**

UNIT I: Chapter 4, 6, 7, 8 (Omit page: 107 - 118).

**3.Treatment and content as in Vittal .P.R (2020), MATHEMATICAL STATISTICS, Margham Publishers, Chennai.**

UNIT II : Chapter 2(upto page 2.16)

UNIT III : Chapter 2(from page 2.17-2.35)

UNIT IV : Chapter 24 (Omit page :24.44– 24.62)

UNIT V : Chapter 25 (Omit pages: 25.33 -25.45), Chapter 26 (Omit pages : 26.14 -26.29)  
Chapter 27 (Omit pages: 27.5 -27.17)

**SUGGESTED READINGS**

1. J.N. Kapur, H.C Saxena (2003), **Mathematical Statistics**, S. Chand and Company Ltd,New Delhi
2. S. G. Venkatachalapathy, Dr. H. Premraj (2015), **Statistical Methods**, Margham publications, Chennai.
3. Arora .S, Sumeet Arora (2002), **Comprehensive Statistical Methods**, S. Chand and CompanyLtd, New Delhi.
4. Gupta Vikas, Gupta S.C., Gupta Sanjeev Kumar (2019), **Problems and Solutions in Mathematical Statistics**, Sultan Chand & Sons.

5. Gupta. S.P (2006), **Statistical Methods**, Sultan Chand & Sons, New Delhi.5.
6. Sharma J.K, (2006), **Business Statistics**, Dorling Kindersley, (India) Pvt Ltd Licensees of Pearson Education in South Asia.

### WEB REFERENCES

1. <https://homework.study.com/learn/descriptive-statistics-questions-and-answers.html>
2. <https://www.khanacademy.org/math/engageny-alg-1/alg1-2/alg1-2a-center/v/statistics-intro-mean-median-and-mode>
3. [https://www.probabilitycourse.com/chapter3/3\\_1\\_6\\_solved3\\_1.php](https://www.probabilitycourse.com/chapter3/3_1_6_solved3_1.php)
4. <https://testbook.com/objective-questions/mcq-on-two-dimensional-random-variables--5eea6a0f39140f30f369e661>
5. [https://webstor.srmist.edu.in/web\\_assets/srm\\_mainsite/files/2018/TwoDimensionalRandomVariable-Unit-2.pdf](https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/2018/TwoDimensionalRandomVariable-Unit-2.pdf)
6. <http://faculty.webster.edu/woolflm/ttest.html>
7. <https://egyankosh.ac.in/bitstream/123456789/14032/1/Unit-7.pdf>

*Note: Learners are advised to use latest edition of books.*

### COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Recall the concepts of collection and presentation of statistical data, function of a random variables, testing the hypothesis for large samples and small samples using t Test, F Test and Chi-square test.	K1
CO-2	Illustrate various types of data and presenting data through diagrams and graphs, characterization of random variables, test of hypothesis for large and small samples	K2
CO-3	Apply the concepts of random variables, various tests of hypothesis for large and small samples in real life problems.	K3
CO-4	Examine the various hypothesis tests of mean and standard deviation of population for large and small samples, test of independence of attributes in Chi-square.	K4

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze)

**PO – CO MAPPING**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO1</b>	H	H	H	M	H	M	H	H	H
<b>CO2</b>	H	H	H	M	M	M	H	H	H
<b>CO3</b>	H	H	H	M	H	H	H	H	H
<b>CO4</b>	H	H	H	M	H	H	H	H	H

**PSO – CO MAPPING**

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	H	M	M
<b>CO2</b>	H	M	H
<b>CO3</b>	H	H	H
<b>CO4</b>	H	H	H

(For Candidates admitted in the academic year 2023-24)  
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**PG AND RESEARCH DEPARTMENT OF**  
**MATHEMATICS CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**First Year - Semester – II**

<b>Course Title</b>	<b>SKILL ENHANCEMENT COURSE 2 (NON MAJOR ELECTIVE 2): DATA ANALYSIS USING EXCEL</b>
<b>Code</b>	<b>U23MA2SET02</b>
<b>Course Type</b>	<b>Theory</b>
<b>Semester</b>	<b>II</b>
<b>Hours/Week</b>	<b>2</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To improve the ability of the students in working with MS-EXCEL to use in their day-to-day life.

### COURSE OBJECTIVES

1. To understand the Excel interface
2. To understand the fundamental arithmetic formulae, graphical displays, table construction, workbook, and worksheet formatting, and shortcut keys.
3. To explore the various data filtering capabilities, graphing and charting techniques in Excel.
4. To impart Data Processing skill in MS Excel
5. To develop the Data Analysis and Data Visualization skill

### UNIT I: CREATING BASIC EXCEL WORKSHEETS

**6 HRS**

Understanding the excel interface –Moving between cells- Selecting cells and Ranges – Entering and editing text in cells – Using autofill and Flash fill –Copying and moving data between cells- Inserting and deleting rows, columns and cells- Creating and managing multiple work sheets.

**Extra Reading/Key words:** *Using and Creating Templates*

### UNIT II: FORMATTING AND PRINTING EXCEL WORKSHEETS

**6 HRS**

Applying and customizing themes – Applying worksheet back ground – Resizing rows and columns – applying cell borders and shading – Formatting cells using styles – Using conditional formatting – Setting up headers and footers – Printing a worksheet.

**Extra Reading/Keywords:** *Applying theme-Customizing theme*

### **UNIT III: CREATING EXCEL FORMULAS AND FUNCTIONS**

**6 HRS**

Writing basic formulas- copying and moving formulas-Insert functions-Perform math calculations- Evaluate a conditions with an IF function.

**Extra Reading/Key words:** *Calculating loan terms, Quick analysis feature*

### **UNIT IV:STORING AND MANAGING DATABASES IN EXCEL**

**6 HRS**

Entering data base data in Excel – Converting between a range and a table – Sorting a table – filtering a table – Add a Total row to a table

**Extra Reading/Keywords:** *Creating Queries, Restrict data entry with validation rules*

### **UNIT V: CREATING CHARTS TO PRESENT THE DATA VISUALLY**

**6 HRS**

Creating a chart – Moving and Resizing a chart –Switching rows and columns – Modifying data range for a chart – Changing the axis scale-Applying chart style –Adding ,Removing and formatting chart elements.

**Extra Reading / Keywords:** *Creating picture chart , Gantt chart*

**Note: Texts given in the Extra Reading /Key Word must be tested only through Assignment and Seminars.**

### **TEXT BOOK**

Treatment and content as in Faithe Wempen (2016), “ Microsoft Office 2016 At Work For Dummies” Wiley India Pvt Ltd , New Delhi

Unit I :Chapter 7

Unit II: Chapter 9

Unit III :Chapter 8

Unit IV :Chapter 10

Unit V: Chapter 11

### **SUGGESTED READINGS**

1. Excel: Quick Start Guide - From Beginner to Expert, by William Fischer , Kindle Edition.
2. Introduction to Computers with MS-Office 2000, By Alexis Leon & Mathews Leon Tata McGraw –Hill, 2001.
3. Bernd Held., 2016, Microsoft Excel Functions & Formulas, Third Edition, Mercury Learning & Information.
4. John Walkenbach, 2016, MS Excel 2016 Bible, First Edition, Wiley & Sons.
5. Curtis Frye (2015), Microsoft Excel 2016 Step by Step, First Edition, Microsoft press.

## WEB REFERENCES

1. [https://www.tutorialspoint.com/excel\\_data\\_analysis/excel\\_data\\_analysis\\_tutorial.pdf](https://www.tutorialspoint.com/excel_data_analysis/excel_data_analysis_tutorial.pdf)
2. <https://dibru.ac.in/wp-content/uploads/2023/08/MS-Excel-and-its-Applications-in-Business.pdf?2023111320>
3. [https://josephscollege.ac.in/lms/Uploads/pdf/material/Advance\\_Excel\\_Notes.pdf](https://josephscollege.ac.in/lms/Uploads/pdf/material/Advance_Excel_Notes.pdf)
4. [https://www.mcrhrdi.gov.in/4th\\_mesfc2022/material/Microsoft%20Office\(Ms-Excel%202016\).pdf](https://www.mcrhrdi.gov.in/4th_mesfc2022/material/Microsoft%20Office(Ms-Excel%202016).pdf)

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Understand Working and use of MS-Excel at work place	K1
CO-2	Make use of MS-Excel for data feeding and formatting	K2
CO-3	Apply the various tools in MS –Excel for Data Visualization	K3
CO-4	Analyse and apply the appropriate Charts and functions in MS –Excel for the real world data	K4

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze)

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	M	M	H	H	H
CO-2	H	H	H	M	M	M	H	H	H
CO-3	H	H	H	H	H	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	M	H	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H

(For Candidates admitted in the academic year 2022-23)

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>MAJOR CORE 7: DYNAMICS</b>
<b>Code</b>	<b>U22MA3MCT07</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To enable the students to know about the different types of motions of particles, projectiles, impulsive forces and collision elastic bodies.

**COURSE OBJECTIVES**

1. To understand the laws of motions and motion of a particles.
2. To understand projectile and evaluation of its characteristics.
3. To evaluate the motion of the projectile and its applications in real life problems.
4. To understand impulsive forces, different types of impact and behavior of elastic bodies in practical problems.
5. To understand the concept of simple harmonic motion and its applications.

**UNIT I: THE LAWS OF MOTION**

**15 HRS**

Momentum – Newton’s Laws of Motion – Absolute units of forces – Conservation of linear momentum – Motion of a particle on planes – Motion of connected particles - Application of the laws of motion.

**Extra Reading/ Keywords:** *Kinetic Energy, Angular momentum, Equation of motion, Conservation of angular momentum*

**UNIT II: PROJECTILE ON HORIZONTAL PLANE**

**15 HRS**

Projectiles – Path of a projectile – Characteristics of the motion of a projectile – Greatest height – Time of flight - Horizontal range – Maximum horizontal range – Directions of projection – Velocity of the projectile– Simple problems - Application of Projectile.

**Extra Reading/Keywords:** *two trajectories with given speed and range*



### UNIT III: PROJECTILE ON INCLINED PLANE

15 HRS

Motion of a projectile on an inclined plane – Range on an inclined plane – Time of flight – Greatest distance from the inclined plane – Maximum range on an inclined plane – Directions of projection on an inclined plane– Enveloping parabola–Simple problems - Application of projectile on an inclined plane.

**Extra Reading/ Keywords:** *Central force and central orbit*

### UNIT IV: IMPULSIVE FORCES

15 HRS

Impulsive forces – Impact of two bodies – Motion of a shot and gun – Collision of elastic bodies –Fundamental laws of impact – Impact of a smooth sphere on a fixed plane – Direct impact – Oblique impact – Simple problems - Application of Impulsive forces.

**Extra Reading/ Keywords:** *Dissipation of energy due to impact, Compression and restitution, Impact of a particle on a rough plane*

### UNIT V: SIMPLE HARMONIC MOTION

15 HRS

Simple harmonic motion in a straight line – Definitions – General solution of a simple harmonic motion equation – Composition of two simple harmonic motions – Simple problems - Application of Simple harmonic motion.

**Extra Reading/ Keywords:** *Loss or gain in the number of oscillations, S.H.M. 'S on a curve, simple pendulum, simple equivalent pendulum.*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars**

### TEXT BOOK

Treatment and content as in Venkatraman .M.K. (2009), **Dynamics**, Agasthiar Publications, Trichy-2.

Unit: I – Chapter IV – 4.1 to 4.18, 4.20 to 4.23

Unit: II – Chapter VI – 6.1 to 6.11

Unit: III – Chapter VI – 6.12 to 6.17

Unit: IV – Chapter VII – 7.1 to 7.5, Chapter VIII - 8.1 to 8.8

Unit: V – Chapter X – 10.1 to 10.3, 10.6, 10.7

### SUGGESTED READINGS

1. Raisinghania M.D (2006), **Dynamics**, S.Chand & Company Ltd, New Delhi.
2. Venkatachalapathy .S.G (2002), **Mechanics**, Margham Publication, Chennai.
3. Viswanatha Naik .K, Kasi M.S (2001), **Dynamics**, Emerald Publishers, Chennai.
4. P.Duraipandian and Laxmi Duraipandian (1985), **Mechanics**, S.Chand and CompanyLtd,Ram Nagar, New Delhi - 55.
5. A.V. Dharmapadham (2006), **Dynamics**, S. Viswanathan Printers & Publishers Pvt Ltd.,
6. M.L. Khanna (2004), **Dynamics**, Jai Prakash Nath and Company.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)  
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**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>MAJOR CORE 8: OPTIMIZATION TECHNIQUES –I</b>
<b>Code</b>	<b>U22MA3MCT08</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours/Week</b>	<b>5</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to convert any real life situation into a mathematical model and solve them using an appropriate techniques of Operations Research.

### COURSE OBJECTIVES

1. To understand LPP and finding solution by graphical method.
2. To evaluate of solution of LPP by Big M method and two phase method.
3. To understand various methods of transportation problem and obtaining the initial basic feasible solution.
4. To understand the Hungarian method to solve the assignment problem.
5. To understand sequencing problem and obtaining the sequence of processing n jobs through two machine and k machines.

### UNIT I: LINEAR PROGRAMMING PROBLEM

**15 HRS**

Introduction to OR – Linear Programming Problem –Mathematical formulation of the problem – Illustration on Mathematical Formulation of LPPs - Graphical solution method – Some exceptional cases - General Linear Programming Problem - Canonical and standard forms of LPP- Application of Linear programming in Industries.

**Extra Reading/ Keywords:** *Iso-Profit approach, Slack and surplus variables.*

### UNIT II: SIMPLEX ALGORITHM

**15 HRS**

The Simplex Method – Simplex Algorithm – Artificial variables – Charne’s Method of penalties (Big –M method) – Two Phase Simplex method– Applications of Two Phase Simplex method - Application of Simplex method in the Radio therapy treatment.

**Extra Reading/Key words:** *Revised simplex method, Dual simplex method.*

### UNIT III: TRANSPORTATION PROBLEM

15 HRS

Transportation Problem - Initial basic feasible solution – North west corner rule – Row minima method - Column minima method - Matrix minima Method - Vogel's approximation method – Optimal solution - u-v method – Degeneracy –Unbalanced Transportation problem– Application of Transportation problem in Business.

**Extra Reading /Key words:** *Duality in transportation problem, Stepping stone solution method.*

### UNIT IV: ASSIGNMENT PROBLEM

15 HRS

Assignment Problem - Hungarian method - Unbalanced assignment problem – Travelling Sales man Problem– Application of Assignment problem in Education.

**Extra Reading/Key words:** *Typical Assignment Problem, Dual of the Assignment problem*

### UNIT V: SEQUENCING PROBLEM

15 HRS

Introduction to Sequencing problem – Problem of Sequencing –Basic terms used in sequencing- processing n jobs through two machines –processing n jobs through k machines– Application of Job sequencing problem in Engineering.

**Extra Reading / Key words:** *Processing 2 jobs through k machines, crew scheduling.*

**Note: Texts given in the Extra Reading/Key Word must be tested only through assignment and seminars.**

### TEXT BOOK

Kanti Swarup, P. K. Gupta & Man Mohan, (2009), **Operations Research**, Sultan Chand and Sons Educational Publishers, New Delhi.

UNIT I: Chapter 2, Chapter 3: 3.1-3.5

UNIT II: Chapter 4: 4.1, 4.3, 4.4 (Sec 4.2 omitted)

UNIT III: Chapter 10:10.1 –10.3, 10.5, 10.8-10.13, 10.15

UNIT IV: Chapter 11: 11.1 to 11.4, 11.7

UNIT V: Chapter 12: 12:1-12:5

### SUGGESTED READINGS

1. Taha H.A(2002), **Operations Research: An introduction** (Seventh edition), Pearson Prentice Hall,
2. P. K. Gupta, D.S. Hira, (2001), **Problems in Operations Research**, S. Chand Publishers & Co., New Delhi.
3. G. Srinivasan (II Edition), **Operations Research**, PHI Learning Private Limited.
4. R. Panner selvam, (II Edition), **Operations Research**, PHI Learning Private Limited.
5. P. R. Vittal, V. Malini, **Operations Research**, Maragatham Publications.
6. Sundaresan. V, Ganapathy Subramanian. K.S. and Ganesan.K(2002), **Resource Management Techniques**, A.R. Publications.

### WEB REFERENCES

1. <https://towardsdatascience.com/applications-of-linear-programming-problem-lpp-385bc3bb9621>
2. <https://www.scirp.org/journal/paperinformation.aspx?paperid=72195>
3. <https://www.slideshare.net/ShivangiGarg22/33123753-application-of-transportation-model-in-business-main>
4. <https://www.hindawi.com/journals/aor/2018/8958393/>
5. <https://www.tandfonline.com/doi/full/10.1080/21693277.2015.1035461>

**Note: Learners are advised to use latest edition of books.**

### **COURSE OUTCOMES**

<b>CO No.</b>	<b>Course Outcomes</b>	<b>Cognitive Level (K1 – K5)</b>
<b>CO –1</b>	Recognize the formulation of LPP and solve LPP by Graphical, Simplex, Big M Method and Two Phase Method.	<b>K1</b>
<b>CO –2</b>	Discuss the initial basic feasible solutions of Transportation problem using North-West Corner Rule, Row Minima, Column Minima, Matrix Minima and Vogel’s Approximation method.	<b>K2</b>
<b>CO –3</b>	Solve the Assignment and Travelling Salesman Problem using Hungarian Algorithm and Sequencing problems.	<b>K3</b>
<b>CO –4</b>	Analyzing the real life applications of transportation problems, travelling sales man problem, Two-Phase Simplex method, Job sequencing problems and Linear programming problems.	<b>K4</b>
<b>CO –5</b>	Evaluate LPP adopting Graphical, Simplex, Big M, Two Phase method, Design optimization models for some real life problems in current scenario.	<b>K5</b>

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)**

### **PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	L	L	M	L	M	H	H
<b>CO-2</b>	H	H	H	M	H	M	M	M	L
<b>CO-3</b>	H	M	M	L	M	M	H	M	M
<b>CO-4</b>	H	H	M	M	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

### **PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	M	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	M
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)  
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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>MAJOR ELECTIVE 1 – QUICK MATHEMATICS –I</b>
<b>Code</b>	<b>U22MA3MET01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours/Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students competent enough to succeed in competitive examinations, enhance the employability skills and also improve aptitude, problem solving, logical and verbal reasoning questions.

### COURSE OBJECTIVES

1. To understand the idea of series completion and analogical reasoning accurately.
2. To understand the method of finding the given message using coding and decoding and illustrate blood relations problems.
3. To understand the concept of puzzle and jumbled problems.
4. To apply the idea of Venn diagrams to study the relations and concept of word formation.
5. To evaluate alpha numeric sequence puzzle and number ranking and time sequence test

### UNIT I: SERIES COMPLETION AND ANALOGY

**12 HRS**

Number series - alphabet series - Alpha-Numeric series - Continuous pattern series - Direct/Simple Analogy – Choosing the analogous pair – Double Analogy – Choosing a similar word - Detecting analogies–Multiple-word Analogy–Number Analogy–Alphabet Analogy.

**Extra Reading/ Keywords:** *Logical reasoning, Image based Analogy, Calendar and Clock test*

**UNIT II : CODING – DECODING AND BLOOD RELATIONS** **12 HRS**

Letter Coding – Direct letter coding–Number / Symbol Coding–Matrix Coding–Substitution –Deciphering message, number and symbol codes–Jumbled Coding–Blood relations  
–Deciphering Jumble dupdescriptions – Relation Puzzle – Coded Relations.

**Extra Reading/Keywords:** *Human relations, Odd man out*

**UNIT III : PUZZLE TEST** **12 HRS**

Classification type questions – Seating and placing arrangements – Comparison type questions – Sequential order of things –Selection based on given conditions - Family based puzzles–Jumbled problems.

**Extra Reading/Keywords:** *Logical Sequence of words*

**UNIT IV: LOGICAL VENN DIAGRAM AND ALPHABET TEST** **12 HRS**

Logical Venn diagram- Alphabetical order of words –Letter word problems – Rule Detection – Alphabetical Quibble – Word formation by Unscrambling letters – Word Formation using letters of a given word.

**Extra Reading/Keywords:** *Sequential out put tracing, Direction sense test*

**UNIT V: ALPHA NUMERIC SEQUENCE PUZZLE AND TESTS** **12 HRS**

Alpha Numeric Sequence puzzle-Number test –Ranking test–Time Sequence tests

**Extra Reading/Keywords:** *Number puzzle, puzzle coding*

**Note: Texts given in the Extra Reading/Key Word must be tested only through assignment and seminars.**

**TEXT BOOK**

Treatment and content as in Dr.R.S.Aggarwal (Revised edition 2018), “**A Modern Approach to Verbal and Non-Verbal Reasoning**”, S.Chand and Company Ltd, New Delhi, Reprint 2020.

Unit I : Chapter 1 &2

Unit II: Chapter 4 & 5

Unit III: Chapter 6

Unit IV: Chapter 9 & 10

Unit V: Chapter 11 & 12

**SUGGESTED READINGS**

1. Praveen R.V(2012),“**Quantitative Aptitude and Reasoning**”,PHI Pvt Ltd.
2. Edgar Thorpe (2012), “**Course in Mental Ability and Quantitative Aptitude**”, Third Edition, Mc Graw Hill Education.
3. Aggarwal R.S(2012),“**Objective Arithmetic for Competitive Examinations**”, S.Chand and Company Ltd., Ram Nagar, New Delhi.
4. Disha Experts(2018),” Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams 2<sup>nd</sup> Edition, Disha Publications.
5. BS Sijwalii(2018), Analytical & Logical Reasoning For CAT & Other Management Entrance Tests, Arihant Publications India limited.





**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>MAJOR SKILL BASED ELECTIVE 1: APTITUDE MATHEMATICS–I</b>
<b>Code</b>	<b>U22MA3SBT01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours/ Week</b>	<b>2</b>
<b>Credits</b>	<b>1</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To make the students know about arithmetic facts related to numbers, ratios, percentages etc., and develop problem solving techniques.

**COURSE OBJECTIVES**

1. To understand number system and simplification of numbers using formulae and rules.
2. To understand the problems on averages and evaluation of LCM and HCF.
3. To understand the problems on ages, percentage and collection of data through diagrammatic representation.
4. To understand the problems on profit, loss, ratio and proportion.
5. To apply time and work to real life problems and evaluate partnership problems.

**UNIT I: NUMBER SYSTEM**

**6 HRS**

Number System –Simplification using formulae and rules

**Extra Reading / Keywords:** *History of numbers, Algebraic numbers.*

**UNIT II: AVERAGE**

**6 HRS**

Averages - L.C.M and H.C.F of 2 or more numbers

**Extra Reading/Keywords:** *Histogram, Ogives*

**UNIT III: AGES AND PERCENTAGE**

**6 HRS**

Problems on ages – Percentage

**Extra Reading / Keywords:** *Calendars, Line chart.*

**UNIT IV: PROFIT AND RATIO****6 HRS**

Profit and Loss – Ratio and Proportion

**Extra Reading / Keywords:** *Business, Metric measures.***UNIT V: PARTNERSHIP AND TIME****6 HRS**

Partnership –Time and Work

**Extra Reading / Keywords:** *Tie-ups, Clocks.***Note: Texts given in the Extra Reading / Key Word: must be tested only through assignment and seminars.****TEXT BOOK**Aggarwal R.S.(2012), **Objective Arithmetic for Competitive Examinations**, S.Chand and Company Ltd., Ram Nagar, New Delhi.

Unit I: Chapters 1 and 4

Unit II: Chapters 2 and 6

Unit III: Chapters 8 and 10

Unit IV: Chapters 11 and 12

Unit V: Chapters 13 and 15

**SUGGESTED READINGS**

1. Aggarwal R.S., Objective Arithmetic (SSC and Railway exam special) (Revised edition 2018 and reprint 2020), S.Chand and Company Ltd., Ram Nagar, New Delhi.
2. Competition Success Review for Bank Probationary Officer's Exam.(2022)
3. Competition Success Review for MBA Entrance Examinations.(2022)
4. Aggarwal R.S., Mathematics for CDS,(reprint 2020), S.Chand and Company Ltd., RamNagar, New Delhi.
5. Objective Mathematics, Dr.A.N.Das,(2010), Second edition, Arunabha Sen, Kolkata

**WEB REFERENCES**

1. <https://opentextbc.ca/intermediatealgebraberg/chapter/3-7-numeric-word-problems/>
2. <https://careerdoost.in/aptitude-questions/average-problems>
3. <https://www.learncbse.in/application-of-percentage/>
4. <https://www.hitbullseye.com/Profit-and-Loss-Examples.php>
5. <https://www.indiabix.com/aptitude/partnership/>

**Note: Learners are advised to use latest edition of books.**

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recognize the various shortcut techniques in aptitude mathematical concepts.	K1
CO – 2	Derive short cut methods on evaluation of LCM, HCF, ages, percentage, profit, loss, ratio and proportion.	K2
CO – 3	Illustrate the different techniques on time, work and partnership	K3
CO – 4	Categorize the problem arising in real life situations to establish skill techniques to infer the solution.	K4
CO - 5	Evaluate number system with basic formula, ages and percentage, profit and loss, ratio and proportion, partnership, time and work using practical life problems and various competitive examinations.	K5

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

### PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	M	L	H	H	H
CO-2	H	H	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H

### PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	M	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

(For Candidates admitted in the academic year 2022-23)

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>NON MAJOR ELECTIVE 1: STATISTICS AND NUMERICAL METHODS</b>
<b>Code</b>	<b>U22MA3NMT01</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours/ Week</b>	<b>2</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to know about the various characteristics of statistical distributions with mathematical techniques. To know about different methods of solving algebraic and transcendental equations using numerical methods.

### COURSE OBJECTIVES

1. To understand Binomial, Poisson distribution and their properties.
2. To understand normal distribution and their properties.
3. To analyze the large samples and evaluate test of hypothesis.
4. To understand various methods for solving algebraic and transcendental equations.
5. To apply finite difference to evaluate polynomial using interpolation for equal and unequal intervals.

### UNIT I: DISCRETE DISTRIBUTIONS

**6 HRS**

Binomial distribution – Definition - Binomial frequency distribution – Moments - Recurrence formula for moments - Moment generating function - Additive property - Mode. Poisson distribution – Definition - Properties - Poisson frequency distribution – Moments - Recurrence formula for moments - Moment generating function – Mode **(Simple Problems only –Derivations - Poisson distribution as limiting form of binomial distribution excluded)**

**Extra Reading/ Keywords:** *Skellam distribution, Poisson approximation, Wald method, Hypergeometric distribution.*

**UNIT II: CONTINUOUS DISTRIBUTION** **6 HRS**

Normal Distribution – Definition – Moments - Moment generating function  
- Linearity property -Mean deviation - Mode - Properties of normal distribution. **(Derivation , Points of inflection and normal probability integral are excluded – Simple problems only)**

**Extra Reading/ Keywords:** *Central limit theorem, Bernstein's theorem, Brownian motion*

**UNIT III: TEST OF HYPOTHESIS FOR LARGE SAMPLES** **6 HRS**

Large samples – Definitions - Test of hypothesis – Test for a specified mean, Test for equality of two means- Test for a specified proportion - Test for equality of two proportions.

**Extra Reading/Key words:** *Test of hypothesis for population proportion, systematic samples, purposive samples, cluster random samples.*

**UNIT IV: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS:**  
**6 HRS**

Introduction - Bisection Method -Iteration Method - Newton -Raphson Method.

**Extra Reading/ Keywords:** *Descartes' rule of signs, Methods for complex roots*

**UNIT V: INTERPOLATION** **6 HRS**

Introduction -Finite Differences, Forward and Backward differences only, Newton's formula for interpolation, Interpolation with unevenly spaced points – Lagrange's interpolation formula.

**Extra Reading/ Keywords:** *Stirling's formula, Bessel's formula.*

**Note: Texts given in the Extra Reading /Keywords must be tested only through assignment and seminar.**

**TEXT BOOK**

1. Vittal .P.R (2002), **Mathematical Statistics**, Margham Publishers, Chennai.

Unit I : Chapters 12 and 13 (Derivations - Poisson distribution as limiting form of binomial distribution excluded)

Unit II: Chapters 16 (Derivation , Points of inflection and normal probability integral are excluded)

UNIT III: Chapter 24(upto sec 24.35)

2. S. S. Sastry, **“Introductory Methods of Numerical Analysis”**, New Age Publishing Company, Fifth Edition, November 2013.

UNIT IV: Chapter 2 - Sec. 2.1 to 2.5

UNIT V: Chapter 3 - Sec. 3.1, 3.3, 3.3.1, 3.3.2, 3.6, 3.7, 3.7.1, 3.9, 3.9.1

## SUGGESTED READINGS

1. Arora .S,Sumeet Arora (2002),**Comprehensive Statistical Methods**, S.Chand and Company Ltd, New Delhi.
2. Gupta .S.C, Kapoor.V.K(2002), **Funtamentals of Mathematical Statistics**, Sultan Chand& Sons, New Delhi.
3. Gupta .S.P (2006), **Statistical Methods**, Sultan Chand & Sons, New Delhi.
4. Dr. M.K. Venkataraman(2017), “**Numerical Methods in Science and Engineering**”, National Publishing House, Chennai.
5. A.Singaravelu (2008), “**Engineering Mathematics -Numerical Methods**”, Meenakshi Publishers, Chennai
6. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram (2010), “**Numerical Methods**”, Scitech Publishers ,Chennai

## WEB REFERENCES

1. <https://static1.squarespace.com/static/55624f9fe4b0077f89b6ed3d/t/5574e56ee4b0af3076142f69/1433724270410/7-Stat-large-sample-hypothesis.pdf>
2. [https://saylordotorg.github.io/text\\_introductory-statistics/s12-02-large-sample-tests-for-a-popul.html](https://saylordotorg.github.io/text_introductory-statistics/s12-02-large-sample-tests-for-a-popul.html)
3. [https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235420anoop\\_singh\\_Test\\_of\\_Significance\\_for\\_Large\\_and\\_Small\\_Samples.pdf](https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235420anoop_singh_Test_of_Significance_for_Large_and_Small_Samples.pdf)
4. <http://numericalmethods.eng.usf.edu/>
5. <https://nm.mathforcollege.com/>
6. <https://www.showme.com/sh/?h=bkzczGC>

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recognize the various statistical distributions and concepts in numerical methods.	K1
CO – 2	Illustrate the statistical distribution and testing of hypothesis and discuss various methods for solving numerical equations.	K2
CO – 3	Apply the concepts of testing of hypothesis for solving real life problems and various numerical techniques in computing solution for algebraic and transcendental equations.	K3
CO – 4	Categorize the problem arising in real life situations, to establish statistical distributions and use appropriate numerical methods to infer the solution.	K4



<b>CO – 5</b>	Predict the solution to the problems in real life situations related to sampling theory and appropriate numerical techniques.	<b>K5</b>
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**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)**

**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	M	L	L	M	H	H	H
<b>CO-2</b>	H	H	M	M	M	M	H	H	H
<b>CO-3</b>	H	H	H	H	H	H	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted from the academic year 2022-23 onwards)  
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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>ALLIED 4: DIFFERENTIAL CALCULUS AND TRIGONOMETRY (For Chemistry Students)</b>
<b>Code</b>	<b>U22MA3ALT15</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours/Week</b>	<b>4</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To acquire knowledge in differentiation and some of its applications, to understand partial differentiation, to expand trigonometric functions and to learn the relation between hyperbolic functions.

### COURSE OBJECTIVES

1. To understand successive differentiation and Leibnitz theorem
2. To apply differentiation for finding maxima and minima.
3. To understand PDE and Euler's theorem.
4. To evaluate the expansion of trigonometry function.
5. To understand Hyperbolic function and inverse hyperbolic functions.

#### UNIT I : DIFFERENTIAL CALCULUS

**12 HRS**

Logarithmic Differentiation- Differentiation of implicit functions – Successive differentiation–  $n^{\text{th}}$  derivative of standard functions – Leibnitz theorem (without proof) - Application of successive differentiation in chemical engineering.

**Extra Reading/Keywords:** *Application of Leibnitz formula in practical problems*

#### UNIT II: APPLICATIONS OF DIFFERENTIATION

**12 HRS**

Conditions for maxima and minima (for single variable) –increasing and decreasing functions(only conditions and simple problems).

**Extra Reading/ Keywords:** *Use of increasing and decreasing functions in marketing, Velocity and acceleration.*

**UNIT III: PARTIAL DIFFERENTIATION** **12 HRS**

Introduction to Partial Differentiation - Partial Differentiation – Euler’s Theorem – Partial derivatives of a function of two functions- Applications of Partial Differential Equations in Chemical Engineering.

**Extra Reading / Keywords:** *Euler’s equation of motion, Heat equation, Wave equation*

**UNIT IV: EXPANSIONS** **12 HRS**

Expansions of  $\cos^n \theta$ ,  $\sin^n \theta$  and  $\tan^n \theta$  (n being a positive integer) (formation of equations is excluded) – Expansions of  $\sin^n \theta$  and  $\cos^n \theta$  in a series of sines and cosines of multiples of  $\theta$  (n being a positive integer and  $\theta$  in radians) (only problems involving the above expansions)- Applications of Sine functions in simplest quantum mechanical treatments of molecules

**Extra Reading/ Keywords:** *Taylor series, Inverse trigonometric functions, asymptotic expansion*

**UNIT V: HYPERBOLIC FUNCTIONS** **12 HRS**

Hyperbolic functions - Inverse hyperbolic functions - Separation into real and imaginary parts. Application of hyperbolic functions in catenoid.

**Extra Reading / Keywords:** *Hyperbolic angle, Inverse hyperbolic Cotangent, Secant, Cosecant*

**Note: Texts given in the Extra Reading / Key Word must be tested only through assignment and seminar.**

**TEXT BOOKS**

Units I, II & III

1. Treatment and Content as in S. Narayanan and T. K. Manicavachagom Pillay (2013) **Calculus – Volume I**, S. Viswanathan Printers & Publishers Pvt.Ltd.,

**UNIT I:** Chapter II: Sections 4.1, 4.2, 5

Chapter III Sections 1.1-1.3, 2.1 & 2.2

**UNIT II:** Chapter V: Sections 1.1, 1.2, 1.3 (statement only with simple problems) Chapter IV: Section 2.1, 2.2

**UNIT III:** Chapter VIII

Units IV & V

1. Treatment and Content as in S. Narayanan and T. K. Manicavachagom Pillay (2004)

**Trigonometry**, S. Viswanathan Printers & Publishers Pvt.Ltd.,

**UNIT IV:** Chapter III: Sections 1-4.

**UNIT V:** Chapter IV: Sections 1 & 2

## SUGGESTED READINGS

1. Kandasamy.P, Thilagavathy.K (2006), Mathematics Volume I, S.Chand & Company, New Delhi.
2. Arumugam, Thangapandi Issac, (2005) Theory of Equations and Trigonometry, New Gamma Publishing House, Delhi.
3. Vittal P.R. and Malini (2000), Calculus, Margham Publications, Chennai – 17. Third edition Reprint 2010.
4. Vittal P.R (2004), Trigonometry, Margham Publications, Chennai.

## WEB REFERENCES

1. <https://ocw.mit.edu/ans7870/resources/Strang/Edited/Calculus/Calculus.pdf>
2. <https://sites.math.northwestern.edu/~mlerma/courses/math214-2-02f/notes/c2-all.pdf>
3. <http://www.knowledge-doj.com/papers/1927%20Elementary%20Trigonometry%20-%20Durell%20&%20Wright.pdf>
4. <https://people.math.wisc.edu/~angenent/Free-Lecture-Notes/free221.pdf>

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Underline the concept of differentiation, partial differentiation and identities of trigonometric functions.	K1
CO-2	Summarize the various methods for solving problems in differentiation, partial differentiation and expansions of trigonometric functions.	K2
CO-3	Make use of differentiation for finding maxima and minima, Euler's theorem for partial differentiation, Trigonometric identities for hyperbolic and inverse hyperbolic functions.	K3
CO-4	Classify the techniques for solving problems in differentiation, trigonometric, hyperbolic and inverse hyperbolic functions.	K4
CO-5	Estimate the solution for real life problem through the concept of successive differentiation, partial differentiation trigonometric, hyperbolic and inverse hyperbolic functions.	K5

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)**

**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	H	L	L	L	H	H	H
<b>CO-2</b>	H	H	H	L	L	M	H	H	H
<b>CO-3</b>	H	H	H	M	M	H	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)

**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year - Semester – III**

<b>Course Title</b>	<b>ALLIED 4:DISCRETE MATHEMATICS (for B.C.A and Computer Science students)</b>
<b>Code</b>	<b>U22MA3ALT16</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>III</b>
<b>Hours / Week</b>	<b>4</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To impart the basic features of Logic, Relations, Set theory and also to introduce the important features of Graph theory and the matrix representation of graph.

### COURSE OBJECTIVES

1. To understand the basic ideas to solve multitude of problems using logical reasoning.
2. To understand the basic concepts of product sets and relations
3. To understand the basic concepts of partially ordered sets and lattices.
4. To illustrate the paths and circuits with examples and explain connected and disconnected graphs.
5. To understand the concept of directed graphs.

### UNIT I: LOGIC

**12 HRS**

Propositional and Logical Operations, Conditional statements, Mathematical Induction- Application of Logical operator.

**Extra Reading/Key Words:** *Methods of proof in Logic, Counting*

### UNIT II: RELATIONS

**12 HRS**

Product Sets and Partitions -Relations-Paths and Properties of Relations – Equivalence relations - Application of Equivalence relations in finite state machine in the field of software engineering.

**Extra Reading/Key Words:** *Computer Representation of Relations, Functions.*

### UNIT III: ORDER RELATIONS AND STRUCTURES

**12 HRS**

Partially Ordered Sets - Extremal Elements of Partially Ordered Sets – Lattices - Application of Partially Ordered through Hasse diagram.

**Extra Reading/Key Words:** *Finite Boolean algebra, Functions on Boolean algebra*

**UNIT IV: GRAPHS****12 HRS**

Introduction–Paths and Circuits–Isomorphism, Subgraphs, Walks, Paths and Circuits, Connected & Disconnected - Application of Kruskal's Spanning Tree Algorithm.

**Extra Reading/Key Words:** *Operations on Graphs, Travelling salesman problem*

## UNIT V:DIRECTED GRAPHS

12 HRS

Introduction–Definitions and Basic Concepts–some types of digraphs-Directed Paths and Connectedness - Applications of directed and undirected graph.

**Extra Reading/Key Words:** *Fundamental circuits in digraphs, Adjacency matrix of a digraph, acyclic digraphs.*

**Note:** Texts given in the Extra Reading /Key Words must be tested only through assignment and seminars.

### TEXT BOOKS

For Units I,II and III Treatment and content as in

1. Bernard Kolman & Robert C. Busby by, Sharon Cutler Ross, **Discrete Mathematical Structures for Computer Science**, Prentice Hall of India, New Delhi 2005, Fifth edition for Units I,II,III.

UNIT I: Chapter 2: Sections 2-1-2.2,2.4

UNIT II : Chapter 4: Sections 4.1-4.5 (omitted Digraphs)

UNIT III : Chapter 6: Sections 6.1-6.3

For Units IV, V Treatment and content as in

2. Narsing Deo(2005), **Graph Theory with Applications to Engineering and Computer Science**, Prentice Hall of India Private Limited.

UNIT IV: Chapter 1 Sections 1.1-1.5, Chapter 2 Sections 2.1, 2.2, 2.4, 2.5

UNIT V: Chapter 9 (Sections-9.1, 9.2, 9.4)

### SUGGESTED READINGS

1. J.P. Tremblay & R. Manohar(2008), **“Discrete Mathematical Structures with Applications to Computer Science”**, Mc Graw-Hill International Edition.
2. S. Vastta, **“Discrete Mathematics”**, 3<sup>rd</sup> Edition, Wishwa Prakasam Publishers.
3. Stephen Witala, **“Discrete Mathematics” –a unified approach**, M.C. Graw Hill International Edition.
4. Singaravelu. A. Jeyaraman. M.P., **“Discrete Mathematics”**, Meenakshi Agency.
5. B.S. Vatsa, Suchi Vatsa, **“Discrete Mathematics”**, New Age International Limited, Publishers, Reprint 2012.

### WEB REFERENCES

1. <https://www.sciencedirect.com/topics/engineering/logical-operator>
2. <http://www.iro.umontreal.ca/~dift6221/demicheli4/fsm.4.ps.pdf>
3. <https://calcworkshop.com/relations/partial-order/>
4. [https://www.tutorialspoint.com/data\\_structures\\_algorithms/kruskals\\_spanning\\_tree\\_algorithm.htm](https://www.tutorialspoint.com/data_structures_algorithms/kruskals_spanning_tree_algorithm.htm)
5. <https://owlcation.com/stem/What-are-the-Basics-and-Real-World-Applications-of-Graph-Theory>





**PSO-CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	M	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>MAJOR CORE 9: ABSTRACT ALGEBRA</b>
<b>Code</b>	<b>U22MA4MCT09</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the concepts of relations and mappings, characteristics of Algebraic structures like Groups and Rings.

### COURSE OBJECTIVES

1. To recognize the relation and its types, functions and binary operations.
2. To discuss the concept of groups and its equivalence properties.
3. To understand normal groups, quotient groups, isomorphism and homomorphism.
4. To describe rings, its types, and elementary properties.
5. To understand the concept of ideals, Maximal prime ideals and homomorphism of rings.

### UNIT I: RELATIONS AND MAPPINGS

**15 HRS**

Relations - Equivalence Relations - Partial order - Functions - Binary Operations - Applications of equivalence relation.

**Extra Reading/ Keywords:** *Lattices , Hasse diagram*

### UNIT II: GROUPS

**15 HRS**

Definition and Examples - Elementary properties of a Group - Equivalent definitions of a Group - Permutation Groups - Subgroups - Cyclic Groups - Applications of cyclic groups.

**Extra Reading/ Keywords:** *Sylow groups, Galois theory*

### UNIT III: GROUPS (CONTINUATION)

15 HRS

Order of an element – Cosets and Lagrange's theorem - Normal Subgroups and Quotient Groups – Isomorphism – Homomorphisms - Applications of groups in physics and chemistry.

**Extra Reading/ Keywords:** *Counting Principle, Normalizer*

### UNIT IV: RINGS

15 HRS

Definition and examples - Elementary properties of rings - Isomorphism of rings – Types of rings – Characteristic of a ring - Subrings. Application of the ring theory in the segmentation of digital images.

**Extra Reading/ Keywords:** *Euclidean domain, polynomial rings*

### UNIT V: IDEALS

15 HRS

Ideals – Quotient rings – Maximal and prime ideals – Homomorphism of rings - Applications of principle ideal ring.

**Extra Reading/ Keywords:** *polynomial rings over UFD*

**Note: Texts given in the Extra Reading /Key Word: must be tested only through assignment and seminars.**

### TEXT BOOK

Treatment and Content as in S. Arumugam and A.Thangapandi Isaac, **MODERN ALGEBRA** (August 2003), Scitech Publications (India) Pvt Ltd Chennai.

UNIT I: Chapter 2 - Sec.2.1 to 2.5

UNIT II: Chapter 3 - Sec.3.1 to 3.6

UNIT III: Chapter 3 - Sec.3.7 to 3.11

UNIT IV: Chapter 4 - Sec 4.1 to 4.6

UNIT V: Chapter 4 - Sec 4.7 to 4.10

### SUGGESTED READINGS

1. Shanti Narayanan, “**A Text Book of Modern Abstract Algebra**”, Margham Publishers.
2. R. Balakrishnan & N. Ramabadran, “**A Text Book of Modern Algebra**”, StosiusInc/Advent Books Division.
3. M.L. Santiago, “**Modern Algebra**”, Tata McGraw-Hill Publishing Co. Ltd.
4. N.Herstein, “**Topics in Algebra**”, JohnWiley & Sons, Student 2<sup>nd</sup> edition.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)  
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**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>MAJOR CORE 10: OPTIMIZATION TECHNIQUES - II</b>
<b>Code</b>	<b>U22MA4MCT10</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To enable the students to convert any real life situation into a mathematical model and solve them game theory, queuing theory and network.

**COURSE OBJECTIVES**

1. To understand the concept of game theory.
2. To understand the concept of Poisson process and exponential distribution.
3. To understand inventory control theory and finding EOQ.
4. To evaluate the solution of Inventory problem with uncertain demand and probabilistic inventory problems.
5. To evaluate PERT and CPM.

**UNIT I: GAME THEORY**

**12 HRS**

Two person zero - Sum games - The Maximin and Minimax principle - Saddle points - Graphical solution of  $2 \times n$  and  $m \times 2$  games – Applications of Game theory in logic and computer science.

**Extra Reading/ Keywords:** *Arithmetic Method of  $n \times n$  games*

**UNIT II: QUEUEING THEORY**

**12 HRS**

Poisson process and exponential distribution - Classification of queues - Poisson queues -Applications of Queueing theory in logistics and transportation.

**Extra Reading/ Keywords:** *Non-Poisson Queueing systems*

### **UNIT III: INVENTORY CONTROL**

**12 HRS**

Types of inventory - Economic order quantity - Deterministic inventory problem - Applications of Inventory control in enterprises.

**Extra Reading/ Keywords:** *Multi-item Deterministic problems*

### **UNIT IV: MULTI-ITEM DETERMINISTIC PROBLEM**

**12 HRS**

Multi-item Deterministic problem - systems of inventory control (Q system and P system) - Applications of Multi-item deterministic problem in business.

**Extra Reading/ Keywords:** *Dynamic Order Quantity*

### **UNIT V: NETWORK SCHEDULING**

**12 HRS**

PERT - CPM time calculations in Networks - Critical Path method (CPM) - PERT calculation - Applications of Network scheduling in industries.

**Extra Reading/ Keywords:** *Time cost Optimization Algorithm, Resource allocation and scheduling*

**Note: Texts given in the Extra Reading /Key Word: must be tested only through assignment and seminars.**

### **TEXT BOOK**

Kantiswarup, P.K.Gupta and Manmohan (2017), “**OPERATIONS RESEARCH**”, Sultan Chand Publishers, Nineteenth edition.

UNIT - I: Chapter 17 (Sec 17.1 to 17.6)

UNIT - II: Chapter 21(Sec 21.1 to 21.9)(Upto Model III)

UNIT - III: Chapter 19(Sec 19.1-19.11)

UNIT - IV: Chapter 19 (Sec 19.13) & Chapter 20 (Sec 20:1-20:3)

UNIT V: Chapter 25(Sec 25:1– 25:8)

### **SUGGESTED READINGS**

1. H. Taha (IV Edition), “**Operations Research**”, Prentice Hall of India
2. P. K. Gupta, D. S. Hira, (2001), “**Problems In Operation Research**”, S.Chand ,New Delhi
3. G.Srinivasan (II Edition), “**Operations Research**”, PHI Learning Private Limited.
4. R.Panneerselvam, (II Edition), “**Operations Research**”, PHI Learning Private Limited.
5. P.R.Vittal, V.Malini, “**Operations Research**”, Margham Publications.





**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	M
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>MAJOR ELECTIVE 2: QUICK MATHEMATICS – II</b>
<b>Code</b>	<b>U22MA4MET02</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students know about the ability based on their skills of comprehend, analysis, problem solving skills, comprising of data and information which are depicted in visual form.

### COURSE OBJECTIVES

1. To understand the logical rules and analyze visual information and solve problems using visual reasoning.
2. To describe the concept of analogy and identifying logical patterns that establish a relationship between two given figures.
3. To identify the odd one among the various options based on their creative thinking and utilize their logical skills.
4. To evaluate the logical behind the given pattern and applying that logical reason to solve the incomplete pattern.
5. To analyse the concept of cubes and dice to solve the reasoning.

### UNIT I: SERIES

**12 HRS**

Five figure series - Three and four Figure Series - Choosing the missing Figure in a series.

**Extra Reading/ Keywords:** *Detecting the incorrect order in a series, Detecting the wrong figure in a series*

### UNIT II: ANALOGY

**12 HRS**

Choosing one element of a similarly related pair - Choosing the set of similarly related figures - Choosing the set of unrelated Figures from a group of sets of similarly related figures - Choosing the odd Relationship.

**Extra Reading/ Keywords:** *Detecting one element of each of the two related pairs*

### **UNIT III: CLASSIFICATION & ANALYTICAL REASONING**

**12 HRS**

Choosing the odd figure - Choosing a similar Figure - Finding figures with the same Characteristics - Analytical Reasoning

**Extra Reading/ Keywords:** *Mirror Images & Water Images*

### **UNIT IV: COMPLETION OF INCOMPLETE PATTERN**

**12 HRS**

Completion Of Incomplete Pattern - Figure Matrix - Paper folding

**Extra Reading/ Keywords:** *Paper Cutting, Grouping of identical Figures*

### **UNIT V: CUBES AND DICE**

**12 HRS**

Cubes and Dice - Counting the number of cubes / blocks in the given figure - Painting a stack of cubes - Coloring the six faces of a cube

**Extra Reading/ Keywords:** *Construction of boxes, Problems on Dice*

**Note: Texts given in the Extra Reading /Key Words must be tested only through assignment and seminars.**

### **TEXT BOOK**

Treatment and content as in Dr. R.S. Aggarwal (2012), **Verbal and Non-Verbal Reasoning**, Revised edition S. Chand and Company Ltd.

Unit I: Chapters 1 (Type 1, 2, 3)

Unit II: Chapters 2

Unit III: Chapters 3 and 4

Unit IV: Chapters 8, 9 and 10

Unit V: Chapter 14

### **SUGGESTED READINGS**

1. Praveen R.V(2012), “**Quantitative Aptitude and Reasoning**”, PHI Pvt Ltd.
2. Edgar Thorpe(2012), “**Course in Mental Ability and Quantitative Aptitude**”, Third Edition, McGraw Hill Education.
3. Aggarwal R.S(2012), “**Objective Arithmetic for Competitive Examinations**”, S. Chand and Company Ltd., Ram Nagar, New Delhi.
4. Disha Experts(2018), “**Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical &Critical) for Competitive Exams**”, 2<sup>nd</sup> Edition, Disha Publications.
5. BS Sijwalii(2018), “**Analytical & Logical Reasoning For CAT & Other Management Entrance Tests**”, Arihant Publications India limited.



PSO – CO MAPPING

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2022-23)  
**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>ALLIED 5: ALGEBRA AND INTEGRAL CALCULUS (For Chemistry Students)</b>
<b>Code</b>	<b>U22MA4ALT17</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students understand matrices, some methods of solving equations, the methods of integration and reduction formulae.

### COURSE OBJECTIVES

1. To understand about matrices and its operations.
2. To calculate rank of the matrices and consistency in system of equations applying rank.
3. To evaluate Eigen values and Eigen vectors using Cayley Hamilton theorem.
4. To evaluate integration of irrational functions.
5. To assess special type of integrals using reduction formula and knowledge about properties of definite integrals.

### UNIT I: MATRICES

**12 HRS**

Types of matrices - Operations between matrices - Matrix inversion method of solving equations - Application of matrices in describing molecular orbitals and electron configurations.

**Extra Reading/Keywords:** *Linear transformation, trace of a matrix*

### UNIT II: RANK OF A MATRIX

**12 HRS**

Rank of a matrix - Consistency in system of equations and solution using rank.(only statement of conditions and simple problems)- Application of rank of a matrix in analytical chemistry.

**Extra Reading/Keywords:** *Gauss Elimination, Gauss Jordan*

### UNIT III: EIGEN VALUES AND EIGEN VECTORS

**12 HRS**

Eigen values and Eigen vectors - Properties - Problems - Cayley – Hamilton theorem (statement only) and its applications - Diagonalisation of Matrices - Orthogonal Transformation-problems- Application of eigen values and eigen vectors in chemical engineering to analyze the stability of a system.

**Extra Reading/Keywords:** *Cayley matrix algebra, Hessenberg method, Algebraic multiplicity*

## UNIT IV: INTEGRATION

12 HRS

Introduction - Integration of irrational functions - Methods of integration of the following types only:

$$\int \frac{dx}{\sqrt{ax^2 + bx + c}}, \int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{ax^2 + bx + c} dx, \int (px + q)\sqrt{ax^2 + bx + c} dx$$

Integration by parts, Bernoulli's formula - Application of integration.

**Extra Reading/Keywords:** *Symbolic integration, Integration by substitution*

## UNIT V: REDUCTION FORMULAE

12 HRS

$$\int_0^{\frac{\pi}{2}} \sin^n x dx, \int_0^{\frac{\pi}{2}} \cos^n x dx, \int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx$$

Formulae to evaluate - Properties of definite integrals- Application of reduction formulae.

**Extra Reading/Keywords:** *Differentiation integration formulas, Reduction formula for tangent*

**Note:** Texts given in the Extra Reading / Key Word must be tested only through assignment and seminar.

## TEXT BOOKS

### For UNITS I, II & III

T.K.Manicavachagom Pillay, T.Natarajan & K S Ganapathy (2008), **Algebra- Volume II**, Viswanathan Publishers, Chennai.

**UNIT I:** Chapter2: Sections 1-8 & 10

**UNIT II:** Chapter2: Sections 11-15

**UNIT III:** Chapter 2: Section 16

### For UNITS IV & V

S. Narayanan and T. K. Manicavachagom Pillay, (2009) **Calculus – Volume II**, S.Viswanathan Printers & Publishers Pvt.Ltd.

**UNIT IV:** Chapter1:Section8 Cases (i)-(iii), Sections12, 15.1

**UNIT V:** Chapter1:Sections13.3-13.5, 11

## SUGGESTED READINGS

1. Aggarwal.S,(2000), “**Algebra –I**”, S.Chand & Company (Pvt) Ltd., New Delhi.
2. Kandasamy.P.Thilagavathy.K (2006), “**Mathematics Volume – I**”, S.Chand & Company, New Delhi.
3. Thomas and Finney (2006), “**Calculus**”, Pearson Education, 9<sup>th</sup> Edition.
4. David V.Widder (2003), “**Advanced Calculus**”, Prentice Hall of India, Delhi.
5. Piskunov.N(1996), “**Differential and Integral Calculus (Vol I & II)**”, Mir Publishers, Delhi
6. Schaums Outline series (2005) – “**Theory and Problems of Advanced Calculus**”.



## WEB REFERENCES

1. <https://www.math.stonybrook.edu/~aknapp/download/b2-alg-inside.pdf>
2. <https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf>
3. <https://slideplayer.com/slide/13867529/>
4. [https://www.brainkart.com/article/Rank-of-a-Matrix--Solved-Example-Problems\\_38883/](https://www.brainkart.com/article/Rank-of-a-Matrix--Solved-Example-Problems_38883/)
5. [file:///C:/Users/Maths162/Downloads/app\\_of\\_eignval\\_eignvec\\_HELM.pdf](file:///C:/Users/Maths162/Downloads/app_of_eignval_eignvec_HELM.pdf)
6. <https://byjus.com/maths/application-of-integrals/#:~:text=Like%20in%20the%20field%20of,the%20centre%20of%20gravity%20etc.>
7. [https://www.brainkart.com/article/Reduction-Formulae\\_41230/](https://www.brainkart.com/article/Reduction-Formulae_41230/)

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Outline the concept of matrices and integration and reduction formulae.	K1
CO-2	Demonstrate the various methods for solving problems in matrices and integration.	K2
CO-3	Make use of rank of a matrix to test for consistency in system of equations.	K3
CO-4	Examine Eigen values and Eigen vectors using Cayley Hamilton theorem.	K4
CO-5	Estimate the solution for real life problem through the concept of matrices and integration.	K5

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

## PO-CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	H	L	L	M	H	H	H
CO-2	H	H	H	M	M	M	H	H	H
CO-3	H	H	H	M	M	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H

## PSO-CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

(For Candidates admitted in the academic year 2022-23)  
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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>ALLIED 6: ANALYTICAL GEOMETRY OF THREE DIMENSIONS, VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS (For Chemistry Students)</b>
<b>Code</b>	<b>U22MA4ALT18</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to be familiar with the fundamental concepts of three dimensional geometry and to expose them the vector differential operator, vector differentiation and vector integration.

### COURSE OBJECTIVES

1. To understand the standard forms of the equation of the planes and solve the angle between the planes, line intersection of two given planes.
2. To understand coplanar lines, skew lines and evaluating shortest distance between two lines.
3. To evaluate differential equations using variable separable method.
4. To understand the curl and divergence of vectors and its application in chemical field.
5. To evaluate line integral surface integral and volume integral using vector integration and apply in real life problems.

### UNIT I: PLANES

**12 HRS**

The Plane - The general equation of the plane - Several forms of equations of planes - The equation of the planes passing through the points  $(x_1, y_1, z_1)$ ,  $(x_2, y_2, z_2)$ ,  $(x_3, y_3, z_3)$  - Direction cosines of the line which is perpendicular to a plane - Angle between the planes - Equation of a plane through the line intersection of two given planes - Applications of planes.

**Extra Reading/ Keywords:** *Planes bisecting the angles between planes.*

## UNIT II: COPLANAR LINES

12 HRS

The condition that two different straight lines should be coplanar - The shortest distance between two given lines - The equation of two skew lines in a simplified form - Applications of coplanar lines.

**Extra Reading/ Keywords:** *Angle between the planes, Symmetrical form of equation of line*

## UNIT III: DIFFERENTIAL EQUATIONS

12 HRS

Equations of first order and first degree -Variable separable method - Homogeneous and non-homogeneous equations - Linear differential equation of second order with constant coefficients - Particular integrals for  $e^{ax}$ ,  $\sin ax$  &  $\cos ax$ - Applications of differentiation.

**Extra Reading/ Keywords:** *Non linear differential equation, Separable equations, IVP*

## UNIT IV: VECTOR DIFFERENTIATION

12 HRS

Velocity – acceleration – scalar and vector fields – Gradient, Divergence and curl – Applications of vector differentiation.

**Extra Reading/ Keywords :** *Partial differentiation*

## UNIT V: VECTOR INTEGRATION

12 HRS

Line integral – Surface integral – Volume integral- Applications of vector integration.

**Extra Reading/ Keywords:** *Stokes theorem, Greens theorem*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.

## TEXT BOOKS

### For UNITS I & II:

Treatment and content as in T.K. Manicavachagom Pillay & T.Natarajan (2016), “A Prescribed Text of Analytical Geometry , Part II – Three Dimensions”, Viswanathan Publishers ,Chennai.

Unit I: Chapter II: Sections 1 –7, 9

Unit II: Chapter III: Sections 7, 8, 8.1 & 8.2

### For UNIT III:

Treatment and content as in S.Narayanan and T.K. Manicavachagom Pillay (2004), “ Calculus Volume III” –Viswanathan publishers.

Unit III: Chapter 1: Sections 2.1 – 2.3,

Chapter 2: Sections 1 – 4, 4(a) &4 (b) (only simple problems)

## For UNITS IV & V:

Treatment and content as in Dr.P.R.Vittal, Dr.V.Malini, (2016), “**Vector Analysis**”, Margham Publications.

Unit IV: Chapter 1

Unit V : Chapter 2 (only vector integrals – excluding integral theorems)

### SUGGESTED READINGS

1. Duraipandian . P, Laxmi Duraipandian &D.Mahilan(2004), “**Analytical Geometry-Three Dimensional**”, Emerald Publishers, Chennai.
2. Zafar Ahsan (2006), “**Differential Equations and their Applications**”, Prentice Hall of India Ltd, New Delhi.
3. K. Viswanatham & S. Selvaraj (1999), “**Vector Analysis**”, Emerald Publishers,Chennai.
4. P. Duraipandian, Laxmi Duraipandian (2003), “**Vector Analysis**”, Emerald Publishers, Chennai.

### WEB REFERENCES

1. <https://www.qb365.in/studymaterials/details-three-dimensional-geometry-casestudy-questions- 2021>
2. <https://study.com>
3. <https://www.numerade.com>
4. <https://lite.classplusapp.com>
5. <https://www.selfstudys.com>

*Note: Learners are advised to use latest edition of books.*

### COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recognize the concepts of plane, coplanar lines, ordinary differential equations, vector differentiation and vector integration.	K1
CO – 2	Illustrate the standard form of the equations of the plane, shortest distance between two given lines and interpret the differential equation, vector differentiation and integration.	K2
CO – 3	Formulate the linear differential equations of second order and apply the concepts of analytical geometry and vector calculus to solve the problem in a real-life situation.	K3
CO – 4	Categorize the solutions of differential equations and the relationship among the line integral, surface integral and volume integral.	K4
CO – 5	Examine the solutions of differential equations in real life problems and determine the relationship between vector differentiation and vector integration.	K5

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	M	L	M	M	H	H	H
<b>CO-2</b>	H	H	H	L	M	M	H	H	H
<b>CO-3</b>	H	H	H	H	M	M	H	H	H
<b>CO-4</b>	H	H	H	M	M	H	H	H	H
<b>CO -5</b>	H	H	H	H	H	H	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO -1</b>	M	H	H
<b>CO -2</b>	H	H	H
<b>CO -3</b>	H	H	H
<b>CO -4</b>	M	H	H
<b>CO -5</b>	H	H	H

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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>ALLIED 5: OPERATIONS RESEARCH (For BBA Students)</b>
<b>Code</b>	<b>U22MA4ALT19</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To impart the overall view of the subject of Operations Research and to enable the learners to apply the techniques in solving problems relating to marketing, finance and production.

### COURSE OBJECTIVES

1. To understand the L.P.P and finding solution by Graphical and Simplex Method.
2. To understand the sequencing problem and obtaining the sequence of processing n jobs through two machines and k machines.
3. To understand the various methods of transportation problem for obtaining initial basic feasible solution and understand the Hungarian method for solving Assignment problem.
4. To evaluate the inventory control theory, finding EOQ and evaluate the solution of the inventory problem.
5. To evaluate the PERT and CPM.

### UNIT I: LINEAR PROGRAMMING PROBLEM AND SIMPLEX ALGORITHM

**12 HRS**

Introduction to OR - Mathematical formulation of the problem - Graphical solution methods - General Linear Programming Problem - Canonical and standard forms of L.P.P. -The Simplex Method - Simplex Algorithm – Applications of LPP in Production Management.

**Extra Reading/ Keywords:** *Revised simplex method, Dual simplex method.*

### UNIT II : SEQUENCING PROBLEM

**12 HRS**

Sequencing problem - Processing n jobs through two machines - Processing n jobs through k machines – Applications of sequencing problem in industry.

**Extra Reading/ Keywords:** *Fractional cut method ,Processing 2 jobs through k machines*

### **UNIT III : TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM**

**12 HRS**

Transportation Problem - Initial basic feasible solution - North West corner rule - Row minima method - Column minima method - Matrix minima Method - Vogel's approximation method - Unbalanced Transportation Problem-Assignment problem-Hungarian method-unbalanced assignment problem - Applications of transportation problem.

**Extra Reading/ Keywords:** *Stepping stone solution method, Dual of the Assignment problem*

### **UNIT IV: INVENTORY CONTROL**

**12 HRS**

Types of inventory - Economic order quantity - Deterministic inventory problems with shortages - Deterministic inventory problems without shortages - Applications of inventory in environmental science.

**Extra Reading/ Keywords:** Multi-item Deterministic problems

### **UNIT V: NETWORK SCHEDULING**

**12 HRS**

Introduction to network problems - Network scheduling by CPM and PERT -Applications of network analysis in telecommunications.

**Extra Reading/ Keywords:** *Time cost Optimization Algorithm, Resource allocation and scheduling.*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.**

### **TEXT BOOK**

Kantiswarup, P.K.Gupta & Man Mohan, (2020), “**OPERATIONS RESEARCH**”, Sultan Chand & Sons, New Delhi.(19<sup>th</sup> Edition )

UNIT - I - Chapter 2 ,Chapter 3 : 3.1 -3.5 ,Chapter 4: 4.1- 4.3

UNIT II- Chapter 12:12:1-12:5

UNIT III - Chapter 10: 10.1 – 10.3 , 10.5, 10.8 ,10.9 Chapter 11-11.1 to 11.4

UNIT IV - Chapter 19: 19.1 - 19:11

UNIT V - Chapter 25

### **SUGGESTED READINGS**

1. H. Taha - IV Edition(2006), “**OPERATIONS RESEARCH**” ,Prentice Hall of India.
2. P. K. Gupta, D. S. Hira, (2001), “**PROBLEMS IN OPERATIONS RESEARCH**”, S.Chand , New Delhi.
3. Dr. H.K. Pathak, Dr. Pradeep K. Joshi & Dr. C. Sharma(1 January 2021) , “**OPERATIONS RESEARCH**”, Shree Shiksha Sahitya Prakashan Publisher Second Revised Edition , India.

### **WEB REFERENCES**

1. [http://www.nitjsr.ac.in/course\\_assignment/CA02CA3103%20RMTLPP%20%20Formulation.pdf](http://www.nitjsr.ac.in/course_assignment/CA02CA3103%20RMTLPP%20%20Formulation.pdf)
2. <http://cs.uok.edu.in/Files/79755f07-9550-4aeb-bd6f-5d802d56b46d/CustomSequencing%20Problem>.
3. [http://www.producao.ufrgs.br/arquivos/disciplinas/382\\_winston\\_cap\\_7\\_transportation.pdf](http://www.producao.ufrgs.br/arquivos/disciplinas/382_winston_cap_7_transportation.pdf)
4. <https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf>
5. [https://www2.kimep.kz/bcb/omis/our\\_courses/is4201/Chap14.pdf](https://www2.kimep.kz/bcb/omis/our_courses/is4201/Chap14.pdf)

**Note: Learners are advised to use latest edition of books.**

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recall the concepts of LPP, Sequencing problem, Transportation problem, Assignment problem, Inventory Control, PERT and CPM.	K1
CO – 2	Derive the mathematical formulation with the understanding of LPP, Sequencing Problem, Transportation Problem, Inventory Control and Network Scheduling.	K2
CO – 3	Solve the LPP using graphical, simplex method, transportation problem and assignment problem. Solving the inventory problems with shortages, without shortages and obtain optimum solution for networking using PERT & CPM	K3
CO – 4	Constructing the LPP model, Sequencing Problem and network diagrams for handling real life situation. Framing Inventory control model to enhance sustainable Environment.	K4
CO-5	Estimate the Solution of the LPP problems, transportation problem, assignment problem, the inventory problems with shortages, without shortages and obtain the optimum solution for networking using PERT & CPM in real life situations.	K5

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	M	M	H	H	H
CO-2	H	H	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	M	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H



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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>ALLIED 5: MATHEMATICS FOR BIOLOGIST (For Bioinformatics students)</b>
<b>Code</b>	<b>U22MA4ALT20</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To get the basic knowledge about matrices and to solve simple problems in differentiation, integration, equations involving planes and straight lines and vector differentiation.

### COURSE OBJECTIVES

1. To evaluate Eigen values and Eigen vectors using Cayley Hamilton theorem.
2. To understand about standard forms and methods of differentiation
3. To understand about integration, properties of definite integrals and applying reduction formula for specific standard integrals.
4. To understand equation of planes and straight lines.
5. To apply differentiation of vectors to find gradient, divergence and curl.

### UNIT I: MATRIX, EIGEN VALUES AND EIGEN VECTORS

**12 HRS**

Rank of a matrix - Eigen values and Eigen vectors – Cayley Hamilton theorem(statement only) and its verification - Application of matrix in connective tissues.

**Extra Reading/Keywords:** *Cayley matrix algebra, Hessenberg method, Algebraic Multiplicity*

### UNIT II - DIFFERENTIAL CALCULUS

**12 HRS**

Standard forms of differentiation – Product and quotient rule – Function of a function rule - Differentiation of Inverse functions - Logarithmic differentiation – Implicit differentiation - Application of differentiation in Cell Biology

**Extra Reading/ Keywords:** *Chain rule, Polar co-ordinates, Wronskian, Reynolds transport theorem*

### UNIT III: INTEGRAL CALCULUS

12 HRS

Integration – Definite integrals - Properties of definite integrals - Integration by parts - Reduction formulae for standard integrals - Application of integration in molecular biology.

**Extra Reading/Key words:** *Integration of irrational trigonometric functions and irrational fractions.*

### UNIT IV: ANALYTICAL GEOMETRY

12 HRS

The Plane – The general equation of the plane – Standard forms of equations of planes - Symmetrical form of the Equation of a line – Equation of a straight line passing through two given points -Application of fractal geometry in biological systems.

**Extra Reading/ Keywords:** *Hyperbolic plane, Euclidean plane, Stereographic projection, Geometry*

### UNIT V: VECTOR DIFFRENTIATION

12 HRS

Derivative of a vector function – Velocity and acceleration - Vector differential operator – Gradient, Divergence and curl–Application of derivative to find the tumor and velocity gradient of blood flow.

**Extra Reading/ Keywords:** *Curl in three dimensions, Co vector, Tensor field Path independence, Gauss's law for gravity.*

### TEXT BOOKS:

#### Treatment and content as in

1. Narayanan.S, Manicavachagom Pillay. T.K, (2016), **Ancillary Mathematics – Volume I**, S.Viswanathan (Printers and publishers),Chennai for Unit I

**UNIT I** : Chapter 3 :Sec 3.2 and 3.4 (simple problems only)

2. Narayanan.S, Manicavachagom Pillay. T.K, (2016), **Calculus Volume I** S.Viswanathan (Printers and publishers),Chennai for Unit II

**UNIT II** : Chapter II :Sec 1 – 5(3.11-3.14 omitted) (formulae and simple problems only)

3. Narayanan.S, Manicavachagom Pillay. T.K, (2016), **Calculus Volume II** S.Viswanathan (Printers and publishers),Chennai for Unit III

**UNIT III** : Chapter 1 :Sec 1 – 4,11,12 and 13(13.6 omitted) (formulae and simple problems only)

4.Manicavachagom Pillay. T.K, Natarajan T (2016) , **A text book of Analytical Geometry (Part II – Three Dimensions)**, S.Viswanathan (Printers and publishers),Chennai for Unit IV

**UNIT IV:** Chapter II: Sec 1 – 7 and Chapter III: Sec 1 – 4(simple problems only)

5. P.R. Vittal , V.Malini (2016), **Vector Analysis**, Margham Publications, Chennai, forUnit V.

**UNIT V:** Chapter 1(simple problems on velocity, acceleration, gradient, divergence and curl only)



**PSO – CO MAPPING**

	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	H	H	M
<b>CO2</b>	H	H	H
<b>CO3</b>	H	H	H
<b>CO4</b>	H	H	H
<b>CO5</b>	H	H	H

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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Second Year-Semester-IV**

<b>Course Title</b>	<b>NON MAJOR ELECTIVE 2:STATISTICS WITH R</b>
<b>Code</b>	<b>U22MA4NMT02</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>IV</b>
<b>Hours/ Week</b>	<b>2</b>
<b>Credits</b>	<b>2</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To understand R programming to explore and investigate the data structures and other data representations and implement various statistical and graphical techniques.

### COURSE OBJECTIVES

1. To understand the basic concepts of R Programming.
2. To describe the concept of data structure and R programming structure.
3. To illustrate the use of control statements and operators in R programming.
4. To apply the input, output operations and analyze the relationships between variables using R for plotting graphs.
5. To discuss the different types of distribution and basic statistics in R.

#### UNIT I: INTRODUCTION AND SOME BASICS

**6 HRS**

Introduction - Install R and R studio - How to run R - View R documentation - Help documentation - Packages in R - R sessions and functions - Basic Math - Variables and constants - Data types.

**Extra Reading/ Keywords:** *Supplied documentation, R Script file*

#### UNIT II: DATA STRUCTURES IN R

**6 HRS**

Vectors - Data frames - Lists - Matrices - Arrays - Class – Table.

**Extra Reading/Keywords:** *Vector indexing, Matrix like operations*

#### UNIT III: R PROGRAMMING STRUCTURE

**6 HRS**

Read line function - Control statements - Arithmetic operator and values - Basic R programs.

**Extra Reading/ Keywords:** *Scoping rules, Generic functions*

## UNIT IV & V: PRACTICALS

1. Pie Charts in R
2. Bar Charts in R
3. Histogram in R
4. Binomial distribution
5. Poisson distribution
6. Normal distribution
7. Chi square, exponential and negative binomial distribution
8. Correlation
9. Covariance
10. Regression
11. T-tests
12. Analysis of Variance (ANOVA)

**Note: Texts given in the Extra Reading/Key Word must be tested only through assignment and seminars.**

### TEXT BOOK

S. R. Manisekar, Dr. T.V. Suresh Kumar, Dr. Madhavi Kasa and Dr. Sunil Kumar S Manvi(2017), “**Programming with R**”, Cengage learning India Pvt Ltd, New Delhi.

Unit: I - Chapters 1 & 2

Unit: II - Chapter 3

Unit III – Chapter 4

Unit IV & V - Practicals

### SUGGESTED READINGS

1. Norman Matloff(2011), “**The Art of R Programming - A Tour of Statistical Software Design**”, No Strach Press, San Francisco
2. Rodger D.Peng(2015), “**R programming for data science**”, Lean publishing house.
3. Prashanth Singh, Vivek Mourya, “**The Art of R Programming**”, Cengage Learning India.
4. Tilman M. Davies(2016), “**The Book of R**”, No Strach Press, San Francisco
5. Dr. Mark Gardener(2012), “**Beginning R - The statistical programming language**”, John Wileyand Sons, Inc.

### WEB REFERENCES

1. <https://data-flair.training/blogs/r-applications/>
2. <https://www.analyticsvidhya.com/blog/2021/10/master-the-basics-of-r-programming/>
3. <https://www.programiz.com/r/examples>
4. <https://www.datamentor.io/r-programming/examples>
5. <https://www.freshersnow.com/r-programming-mcqs-and-answers-with-explanation/>

**Note: Learners are advised to use latest edition of books.**

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Recognize the fundamental syntax of R through readings, practice exercises, demonstrations and writing R code.	K1
CO-2	Explain and interpret the solution using scalars, vectors, matrices and statistical problems in R programming.	K2
CO-3	Use the online resources for R and import new function packages into the R workspace and demonstrate a variety of data formats into R using R Studio.	K3
CO-4	Infer the data and generate reports based on the data using R programming.	K4
CO-5	Explore the data sets to create testable hypotheses and identify appropriate statistical tests.	K5

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

### PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	H	L	L	L	H	H	H
CO-2	H	H	H	L	L	M	H	H	H
CO-3	H	H	H	M	M	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H

### PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H

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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester–V**

<b>Course Title</b>	<b>MAJOR CORE 11- LINEAR ALGEBRA</b>
<b>Code</b>	<b>U21MA5MCT11</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To study algebraic structures namely vector spaces, inner product spaces and matrix theory and establish some of their properties in the relevant algebraic systems.

**COURSE OBJECTIVES**

1. To understand the algebraic structure vector space and its properties
2. To understand the characteristics of Vector Space namely basis, dimension and matrix of any linear transformation
3. To understand the algebraic structure Inner product space and its properties
4. To apply the various properties for the theory of Matrices
5. To calculate eigen values and eigen vectors for various Matrices and check the consistency and diagonalization of the matrix.

**UNIT I: VECTOR SPACES**

**12 HRS**

Definition and examples - Subspaces - Linear transformation - Span of a set – Linear Independence- Linear Independence of vectors in the space of continuous functions.

**Extra Reading/ Keywords:** *Linear independent Polynomials, Row or Column Vectors*

**UNIT II: VECTOR SPACES (CONTD)**

**12 HRS**

Basis and Dimension – Rank and Nullity- Matrix of a Linear Transformation - Application of Basis and dimension in Geometrical Properties of linear transformation.

**Extra Reading/ Keywords:** *Row space , Column Space*



### UNIT III: INNER PRODUCT SPACES

12 HRS

Definition and examples of inner product spaces- Orthogonality - Orthogonal complement- Application of Gram Schmidt Process in finding Orthonormal bases of various Inner Product Spaces.

**Extra Reading/ Keywords:** *Norm of any vector, Normed Vector Space*

### UNIT IV: THEORY OF MATRICES

12 HRS

Types of Matrices- The inverse of a matrix- Elementary Transformations- Rank of a Matrix - Simultaneous Linear Equations- Application of Rank of a matrix in finding basis of Range and Kernel of a linear transformations.

**Extra Reading/ Keywords:** *Inconsistent augmented matrix*

### UNIT V: THEORY OF MATRICES (CONTD)

12 HRS

Characteristic Equation and Cayley Hamilton Theorem - Eigen Values and Eigen Vectors- Application of Eigen Vectors and values in consistency and Diagonalisation of a matrix.

**Extra Reading/ Keywords:** *Algebraic and Geometric multiplicity of a matrix*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.**

### TEXT BOOK

1. S. Arumugam, A. Thangapandi Isaac “**Modern Algebra**”(January 2018), Scitech Publications (India) Pvt Ltd, Chennai.

UNIT I - Chapter 5 (Sections 5.1 to 5.5)

UNIT II - Chapter 5(Sections5.6 to 5.8)

UNIT III - Chapter 6

UNIT IV - Chapter 7(Sections 7.2 to 7.6)

UNIT V - Chapter 7 (Sections 7.7 & 7.8)

### SUGGESTED READINGS

1. Richard W. Kaye, Robert Wilson(1998), Linear Algebra, Oxford University Press.
2. R. Balakrishnan & N. Ramabadrn(2002), A Text Book Of Modern Algebra, Vikas Publishing House, New Delhi.
3. Shanti Narayan and P K Mittal(2013), Text Book Of Matrices, 5th edition, New Delhi, S Chand and Co. Pvt. Ltd.
4. Hencry A. Pinkham(2015), Linear Algebra, Springer Publishers.
5. A.R.Vashistha, A.K. Vashistha(2019), Modern Algebra, Krishna Prakashan Publishers.
6. Shah, S.K. & Garg, S.C(2022), A Text Book Of Algebra, ISBN: 9789352710829.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H
<b>CO-6</b>	H	H	H

(For Candidates admitted in the academic year 2021-22)  
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**B.Sc. MATHEMATICS**  
**Third Year-Semester–V**

<b>Course Title</b>	<b>MAJOR CORE 12: REAL ANALYSIS – I</b>
<b>Code</b>	<b>U21MA5MCT12</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

## CONSPECTUS

To facilitate the basic concepts of real valued functions, countability and least upper bound. Also enable to learn sequences and series of real numbers and the tests for their convergence in detail. To acquaint the concept of metric space and continuous functions.

## COURSE OBJECTIVES

1. To understand the concept of real valued function, sequence and limit of a sequence.
2. To understand convergent sequence, divergence sequence, bounded sequence, monotone sequence and cauchy sequence.
3. To analyze the series of Real numbers
4. To examine convergence property using Comparison test, Cauchy's condensation test, D'Alembert's ratio test and Raabe's test.
5. To understand metric space and continuous function on a real line.

### UNIT I: REAL VALUED FUNCTIONS AND REAL SEQUENCES

**12 HRS**

Real valued functions – equivalence – countability – real numbers – least upper bound – definition of sequence and sub sequence – limit of a sequence - Applications of sequences in finance.

**Extra Reading/Key words:** *Aleph number, hyper real numbers, shift rule, Limit of nets.*

### UNIT II: CONVERGENT AND DIVERGENT SEQUENCES

**12 HRS**

Convergent sequences – Divergent sequences – Bounded sequences - Monotone sequences – operations on convergent and divergent sequences – limit superior and limit inferior – Cauchy Sequences - Applications of Cauchy sequence.

**Extra Reading/Key words:** *Cauchy's sequence in topological vector spaces and groups.*

### **UNIT III: SERIES OF REAL NUMBERS**

**12 HRS**

Series – Convergence and divergence of series – Series with non – negative terms – Alternating series – Conditional Convergence and absolute convergence-tests for absolute convergence - Applications of series in business.

**Extra Reading/Key words:** *Hyper geometric series, Series acceleration, Point wise Cauchy-convergence.*

### **UNIT IV: TESTS OF CONVERGENCE**

**12 HRS**

Comparison test - Cauchy's condensation test - D' Alembert's ratio test - Cauchy's root test – Raabe's test(simple problems only).- Applications of series in various fields.

**Extra Reading/Key words:** *Integral test, Abel's test, Dirichlet's test, Bertrand's test*

### **UNIT V: LIMITS, METRIC SPACES AND CONTINUOUS FUNCTION**

**12 HRS**

Limit of a function on the real line metric spaces – limits in a metric spaces –function continuous at a point on the real line – functions continuous on the metric space–Applications of metric spaces.

**Extra Reading/Key words:** *Equicontinuity, Lipchitz continuity, Quotient metric space*

**Note: Tests given in the Extra Reading /Key Word must be tested only through assignment and seminars**

### **TEXT BOOKS**

1. For Units I, II, III & V:

Treatment and Content as in Richard R.Goldberg(2019), “**Methods of Real Analysis**”,Oxford&IBH Publishing Co. Pvt. Ltd, New Delhi.

Unit I : Chapter 1 (Sec.1.4 – 1.7) ,Chapter 2 (Sec 2.1,2.2)Unit II : Chapter 2(Sec.2.3 - 2.10)

Unit III : Chapter 3(Sec 3.1- 3.4 , 3.6)

Unit V : Chapter 4 (Sec 4.1, 4.2(Examples 4&5 are not included) & 4.3) ,Chapter 5(Sec 5.1 & 5.3)

2. For Unit IV:

Treatment and content as in Manicavachagom Pillay, Natrarajan & Ganapathy(2013 Reprint) ,

“**Algebra**” ( Vol I), S.Viswanathan (Printers and publishers),Chennai.Unit IV : Chapter 2(Sec 12-20)

### **SUGGESTED READINGS**

1. Robert G.Bartle, Donald R.Sherbet(2010), “**A First Course in Real Analysis**”, John Wiley& Sons, Inc. 4<sup>th</sup> Edition.

2. Dr. S. Arumugam(1999), “**Sequences and Series**”, New gamma publishing house, Palayamkottai.

3. K. Chandrasekhara Rao, K.S.Narayanan(2013), “**Real Analysis**”, Volume I,S. Viswanathan (Printers & Publishers) Pvt. Ltd.

4. M.K.Singal and Asha Rani Singal ( 2010 ), “**A First Course in Real Analysis**” S.Chand &Co. New Delhi.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H
<b>CO-6</b>	H	H	H

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**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester-V**

<b>Course Title</b>	<b>MAJOR CORE 13: GRAPH THEORY</b>
<b>Code</b>	<b>U21MA5MCT13</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to be familiar with the fundamental concepts of graph theory as an application of mathematics in information technology related fields.

### COURSE OBJECTIVES

1. To understand the concept of graphs and sub graphs.
2. To inculcate the concept of degree sequence and connectedness on graphs.
3. To intricate about Eulerian, Hamiltonian graphs and trees.
4. To analyze directed graphs and its properties.
5. To apply graph theory concept on Transformation and Kinematic Graph.
6. To sketch a graph for Connector Problems, Shortest Path Problem.

### UNIT I: GRAPHS AND SUBGRAPHS

**12 HRS**

Introduction – Definition and Examples - Degrees – Subgraphs – Isomorphism – Independent Sets and Coverings –Matrices – Operations on Graphs – Applications of graph in social networks.

**Extra Reading/Keywords:** *Subdivision of Graphs.*

### UNIT II: DEGREE SEQUENCE AND CONNECTEDNESS

**12 HRS**

Introduction – Degree Sequences – Graphic Sequences; Introduction – Walks, Trails and Paths – Connectedness and Components – Blocks – Connectivity – Application of connectivity in graphs.

**Extra Reading/Keywords:** *Menger's theorem, Moon's theorem*



### **UNIT III: EULERIAN, HAMILTONIAN GRAPHS AND TREES**

**12 HRS**

Introduction – Eulerian Graphs – Hamiltonian Graphs; Introduction – Characteristics of Trees – Centre of a Tree – Application of Hamilton graph in design test.

**Extra Reading/Keywords:** *Uni cyclic and Bi cyclic trees.*

### **UNIT IV: DIRECTED GRAPHS**

**12 HRS**

Introduction – Definitions and Basic Properties – Paths and Connections – Digraphs and Matrices – Tournaments – Application of Graph theory in Computational Biology.

**Extra Reading/Keywords:** *Mapping Problem*

### **UNIT V: SOME APPLICATIONS OF GRAPH THEORY**

**12 HRS**

Introduction – Connector Problem – Shortest Path Problem – Transformation and Kinematic Graph – Applications in Information Technology.

**Extra Reading/Keywords:** *Colouring of digraphs*

**Note: Texts given in the Extra Reading /Key Word: must be tested only through assignment and seminars.**

### **TEXT BOOK**

Treatment as in Dr.S.Arumugam and Dr.S. Ramachandran(7<sup>th</sup> reprint 2006), “**Invitation to Graph Theory**”, Scitech Publications pvt ltd, India.

UNIT I: Chapter 2(omit 2.5 &2.7)

UNIT II: Chapters 3 and 4

UNIT III: Chapters 5 and 6

UNIT IV: Chapter 10

UNIT V: Chapter 11

### **SUGGESTED READINGS**

1. Harary(10<sup>th</sup> reprint 2021), “**Graph Theory**”, Narosa Publishing House, New Delhi,
2. Narsingh Deo (2008), “**Graph Theory with Applications to Engineering and Computer Science**”, Prentice Hall of India, New Delhi.
3. S.P.Rajagopalan, R.Sattanatham (Reprint 2015), “**Graph Theory**”, Margham Publications, Chennai.
4. S.K.Yadav (2010), “**Elements of Graph Theory**”, Ane Books Private Limited, New Delhi.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H
<b>CO-6</b>	H	H	H

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**B.Sc. MATHEMATICS**  
**Third Year-Semester-V**

<b>Course Title</b>	<b>MAJOR CORE 14: DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND FOURIER SERIES</b>
<b>Code</b>	<b>U21MA5MCT14</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the techniques of solving ordinary differential equations, standard forms of partial differential equations, Laplace transforms, Inverse Laplace transforms, Fourier Series.

### COURSE OBJECTIVES

1. Recall the basic concepts on ordinary differential equation with variable coefficient and by the method of variation of parameters.
2. Identify the standard forms of partial differential equations.
3. Solve Laplace transform for standard functions.
4. Analyze inverse Laplace transforms and to apply it for finding the solution of ordinary differential equations.
5. Evaluate Fourier series, half range cosine and sine series.

### UNIT I: ORDINARY DIFFERENTIAL EQUATIONS

**12 HRS**

Linear homogeneous equations with variable coefficients. Equations reducible to the linear homogeneous equation. Method of variation of parameters - Applications of differential equations-trajectories

**Extra Reading/ Keywords:** *Non-linear differential equation , Separable equations, IVP*

### UNIT II: PARTIAL DIFFERENTIAL EQUATIONS

**12 HRS**

Formation of partial differential equations by eliminating arbitrary constant and functions - solutions - General, particular and complete integrals - solutions to first order equations in four standard forms –  $F(p, q) = 0$ ,  $F(z,p,q) = 0$ ,  $F(x,p,q) = 0$ ,  $F(y,p,q) = 0$ ,  $F_1(x,p) = F_2(y,q)$ ,  $z = px + qy + f(p,q)$ , Lagrange's method of solving linear equation  $Pp + Qq = R$ . - Applications of Partial Differential Equations.

**Extra Reading/ Keywords:** *Heat equation, Wave equation*

### **UNIT III: LAPLACE TRANSFORMS**

**12 HRS**

Definition - Laplace transforms of functions  $e^{at}$ ,  $\cos at$ ,  $\sin at$ ,  $t^n$  ( $n$  is a +ve integer),  $e^{at} \cos bt$ ,  $e^{at} \sin bt$ ,  $f(t)$ ,  $f'(t)$ ,  $f''(t)$ ,  $t^n f(t)$ ,  $f(t)/t$  - Applications of Laplace Transforms in Engineering.

**Extra Reading/ Keywords:** *Solving IVP using Laplace transforms, Non constant coefficient of IVP*

### **UNIT IV: INVERSE LAPLACE TRANSFORMS**

**12 HRS**

Inverse transforms relating to the above standard functions - solution of ordinary differential equations with constant coefficients - Application of inverse Laplace Transforms.

**Extra Reading/ Keywords:** *Partial Fractions*

### **UNIT V: FOURIER SERIES**

**12 HRS**

Full Range series – Half range cosine and sine series (Change of interval excluded) - Applications of Fourier Analysis to audio signal processing.

**Extra Reading/ Keywords:** *Fourier Integrals, Relation between Fourier series and Fourier integrals*

**Note: Texts given in the Extra Reading /Keywords must be tested only through assignment and seminar.**

### **TEXT BOOKS**

1. Narayanan.S, Manicavachagom Pillay.T.K(2015), “**Differential Equations**”, S.Viswanathan (Printers and publishers),Chennai.

Unit: I - Chapter V - Sections 5 & 6 and Chapter VIII - Section 4

Unit: II - Chapter XII - Sections 1 To 5.4

Unit: III - Chapter IX – Sections 1,2,4 and 5

Unit: IV - Chapter IX– Sections 6 to 8

2. S.Narayanan and T.K.Manicavachagam Pillay(2015), “**Calculus (volume III)**” S.Viswanathan(Printers and publishers),Chennai.

Unit: V - Chapter 6 – Sections 1 to 5(Change of interval excluded)

### **SUGGESTED READINGS**

1. Arumugam.S,Thangapandi Issac.A,Somasundaram.A,(2002), “**Engineering Mathematics**” (Vol III) , SCITECH Publishers, Chennai

2. Raisinghania.M.D,(2002), “**Ordinary and Partial Differential Equations**”, S.Chand & Company New Delhi.

3.Zafar Ahsan (2006), “**Differential Equations and their Applications**”,Prentice Hall of India Ltd, New Delhi.

4. William F.French (2013), “**Elementary Differential Equations**”, Thomson Learning publishers, USA.

5. Shepley L.Ross (2010), “**Differential Equations**”, Wiley India Edition, third edition.

## WEB REFERENCES

1. <https://www.youtube.com/watch?v=Ziu0y2kWTCM>
2. <https://sam.nitk.ac.in/courses/MA713/Applications%20of%20Partial%20Differential%20Equations.pdf>
3. <https://www.cambridgescholars.com/resources/pdfs/978-1-5275-7373-4-sample.pdf>
4. [http://howellkb.uah.edu/public\\_html/DEtext/Part4/Inverse\\_Laplace.pdf](http://howellkb.uah.edu/public_html/DEtext/Part4/Inverse_Laplace.pdf)
5. <https://core.ac.uk/download/pdf/70983668.pdf>

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level K1-K6
CO – 1	Recall the basic concepts on differential equations, Laplace transforms and Fourier series.	K1
CO – 2	Derive variation of parameters in ordinary differential equations, standard form of Partial Differential Equations, Laplace transforms and Fourier series.	K2
CO – 3	Illustrate the Linear homogeneous equations with variable coefficients, solutions to first order equations in four standard forms, results on Laplace, inverse Laplace transforms and Fourier Series.	K3
CO – 4	Apply variation of parameters to solve ordinary differential equations, Inverse Laplace transforms in solving ordinary differential equations.	K4
CO – 5	Evaluate Equations reducible to the linear homogeneous equation, Lagrange’s method of solving linear equation, Full range and half range cosine and sine series.	K5
CO - 6	Develop the standard forms of partial differential equations, Laplace transforms, inverse Laplace transforms ,Fourier series and enable the students to apply in real life problems.	K6

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)**

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	M	L	H	H	H
CO-2	H	H	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	M	M	M	H	H	H
CO-6	H	H	H	M	M	M	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	M
<b>CO-5</b>	H	H	H
<b>CO-6</b>	M	H	H

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**B.Sc. MATHEMATICS**  
**Third Year-Semester-V**

<b>Course Title</b>	<b>MAJOR CORE 15: STATISTICAL PACKAGES</b>
<b>Code</b>	<b>U21MA5MCT15</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### **CONSPECTUS**

To acquire knowledge in basic theoretical, application of statistics and gain proficiency in using statistical software for data analysis which is needed to enter the job.

### **COURSE OBJECTIVES**

1. To understand the procedure of creating and saving data file, descriptive statistics and representation of charts and graphs with SPSS.
2. To understand the statistical association between variables, graphical and mathematical method of correlation.
3. To evaluate parametric tests for comparing averages between dependent and independent samples using SPSS.
4. To understand the various nonparametric tests, assumptions, procedures to solve problems.
5. To understand the concept of assumption in analysis of variance (ANOVA) and the setting up of ANOVA using techniques such as short cut method for One-way ANOVA, coding method and also understand the concept of Two-way ANOVA in comparing means.
6. To widen their knowledge in data analysis in SPSS and expose them to the visual environment for analyzing scientific data related to the social sciences.

### **UNIT I: COLLECTION OF DATA AND CREATION OF DATA BASE**

**12 HRS**

Introduction to SPSS – Opening a data file in SPSS – Variables and Scales – Descriptive Statistics with SPSS – Charts and graphs- Application of SPSS in Industries.

**Extra Reading/ Keywords:** *Segmented bar chart, Edge peak distribution, Bubble chart*



## **UNIT II: STATISTICAL ASSOCIATION BETWEEN VARIABLES**

**12 HRS**

Crosstabs – Types of correlation – Methods of studying correlation – Scatter diagram – Pearson's Correlation Coefficient – Bivariate Analysis with SPSS- Exploring and analyzing the relationship between variables in Statistics.

**Extra Reading/ Keywords:** *Partial Correlation, Regression Analysis*

## **UNIT III: PARAMETRIC TESTS**

**12 HRS**

Testing of Hypothesis – Parametric – Student t-test – One sample – Two sample independent-test – Paired t –test- Application of statistical analysis in SPSS.

**Extra Reading/ Keywords:** *Z-test and Chi-square test of independence*

## **UNIT IV: NON -PARAMETRIC TESTS**

**12 HRS**

Introduction – The sign test – Rank sum tests – The Mann- Whitney U test – Kruskal Wallis test – One sample run test – Kolmogorov Smirnov test – Friedman's test – Cochran's Q-test- Application of statistical test n SPSS.

**Extra Reading/ Keywords:** *Exploratory and Confirmatory factor Analysis*

## **UNIT V: ANALYSIS OF VARAINCE**

**12 HRS**

Assumptions and ANOVA Procedure – One way and Two-way ANOVA – Post- HOC Comparisons- Application of ANOVA in research.

**Extra Reading/ Keywords:** *Multivariate Analysis of Variance*

### **PRACTICAL WORK:**

1. Creation of data base.
2. Univariate data analysis
  - Graphs & diagrams, Pie chart, Pareto chart.
  - Numerical measures – Box plot.
3. Bivariate data analysis.
  - Cluster & Stacked bar diagram.
  - Correlation (Scatter Plot diagram).
4. Regression.
5. t-test.
6. One-way ANOVA, Chi square-test – Goodness of fit & test of independence of attributes.

**Note: Texts given in the Extra Reading/Key Word must be tested only through assignment and seminars.**

## TEXT BOOKS

1. Treatment and content as in Mrs. S. Maheswari and Mrs. S. Josephine Vinnarasi, “Course Material For Statistical Packages”, compiled by, Department of Mathematics, Holy Cross College, Trichy.
2. Dr. S. L. Gupta and Hitesh Gupta (2011), “SPSS 17.0 for Researchers”, Second edition, International book house Pvt. Ltd.

## WEB REFERENCES

1. <https://surveysparrow.com/blog/what-is-spss/>
2. <https://dacg.in/2017/11/20/basic-of-spss/>
3. <https://westernsydney.pressbooks.pub/customerinsights/chapter/chapter-19-association-between-variables/>
4. <https://libguides.library.kent.edu/spss/pearsoncorr>
5. <https://stats.oarc.ucla.edu/spss/whatstat/what-statistical-analysis-should-i-usestatistical-analyses-using-spss/>
6. <https://stats.oarc.ucla.edu/spss/modules/an-overview-of-statistical-tests-in-spss/>
7. [https://kiran.nic.in/pdf/Social\\_Science/e-learning/Non\\_Parametric\\_Test.pdf](https://kiran.nic.in/pdf/Social_Science/e-learning/Non_Parametric_Test.pdf)
8. [https://med.und.edu/research/daccota/files/pdfs/berdc\\_resource\\_pdfs/data\\_analysis\\_using\\_spss.pdf](https://med.und.edu/research/daccota/files/pdfs/berdc_resource_pdfs/data_analysis_using_spss.pdf)

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO – 1	Explain the concept of preparing data in SPSS, univariate and bivariate statistical tables, graphs and diagrams concisely.	K1
CO – 2	Compute the linear relationship between continuous and categorical variables with correlations using SPSS.	K2
CO – 3	Apply the idea of parametric tests to evaluate dependent and independent samples.	K3
CO – 4	Recall and summarize various non-parametric tests and its applicability.	K4
CO – 5	Explain the concept of assumptions in analysis of variance (ANOVA) and the setting up of ANOVA using techniques such as Short-cut method for One-way ANOVA, Coding Method and understand the concept of Two-way ANOVA	K5
CO-6	Computation of fast-visual modeling environment to analyze scientific data related to the social sciences.	K6

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)**

**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	H	L	L	L	H	H	H
<b>CO-2</b>	H	H	H	L	L	M	H	H	H
<b>CO-3</b>	H	H	H	M	M	H	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H
<b>CO-6</b>	H	H	H	H	H	H	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H
<b>CO-6</b>	H	H	H

(For Candidates admitted in the academic year 2021-22)

**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester-V**

<b>Course Title</b>	<b>MAJOR ELECTIVE 3 – R PROGRAMMING</b>
<b>Code</b>	<b>U21MA5MET07</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### **CONSPECTUS**

To understand R programming to explore and investigate the data structures and other data representations and implement various statistical and graphical techniques.

### **COURSE OBJECTIVES**

1. To understand the basic concepts of R Programming.
2. To understand the concept of data structure, R programming structure, control statements and arithmetic operators.
3. To illustrate the use of math functions in R programming.
4. To apply the input, output operations and analyze the relationships between variables using R for plotting graphs.
5. To understand the different types of distribution and basic statistics in R.

### **UNIT I: INTRODUCTION AND SOME BASICS**

**12 HRS**

Introduction – Install R and R studio – How to run R – View R documentation – Help documentation – Packages in R – R sessions and functions – Basic Math – Variables and constants – Data types – Applications of R Programming in Banking.

**Extra Reading/ Keywords:** *Supplied documentation, R Script file*

### **UNIT II: DATA STRUCTURE AND R PROGRAMMING STRUCTURE**

**12 HRS**

Vectors – Data frames - Lists – Matrices – Arrays – Class – Table – Read line function –Control statements – Arithmetic operator and values – Basic R programs - Applications of R Programming in Finance.

**Extra Reading/Keywords:** *Vector indexing, Matrix like operations*

### UNIT III: FUNCTIONS AND HANDLING MATH IN R

12 HRS

Create function – Function call – Return values – Returning complex objects – No pointers in R – Recursion – Exception handling methods – Binary search tree – Quick and selection sort – Math functions – Calculating probability – Cumulative sums and products – Maxima and minima function – Stationary distribution of Markov chains - Applications of R Programming in E-Commerce.

**Extra Reading/ Keywords:** *Scoping rules, Generic functions*

### UNIT IV: INPUT OUTPUT MANAGEMENT AND GRAPHICS IN R

12 HRS

Input and output operation – Accessing the keyboard and monitor – Reading files – Writing into files – Creating graphs and charts – Saving graphs to files - Applications of R Programming in Social Media.

**Extra Reading/ Keywords:** *Visualization, simulation, Code Profiling*

### UNIT V: PROBABILITY AND STATISTICS IN R

12 HRS

Binomial, Normal, Poisson distributions – Chi square, exponential and negative binomial distribution – Correlation and covariance – T-tests – ANOVA – Linear models – Survival analysis – Nonlinear models – Spine – Decision random forests - Applications of R Programming in Healthcare.

**Extra Reading/ Keywords:** *Hypothesis testing, Time series analysis*

**Note: Texts given in the Extra Reading/Key Word must be tested only through assignment and seminars.**

#### TEXT BOOK

S. R. Manisekar, Dr. T.V. Suresh Kumar, Dr. Madhavi Kasa and Dr. Sunil Kumar S Manvi(2017), “**Programming with R**”, Cengage learning India Pvt Ltd, New Delhi.

Unit: I - Chapters 1 & 2

Unit: II - Chapters 3 & 4

Unit III - Chapters 5 & 6

Unit IV - Chapters 7 & 8

Unit: V - Chapters 9 & 10

#### SUGGESTED READINGS

1. Norman Matloff(2011), “**The Art of R Programming - A Tour of Statistical Software Design**”, No Strach Press, San Francisco
2. Rodger D.Peng(2015), “**R programming for data science**”, Lean publishing house.
3. Prashanth Singh, Vivek Mourya, “**The Art of R Programming**”, Cengage Learning India.
4. Tilman M. Davies(2016), “**The Book of R**”, No Strach Press, San Francisco
5. Dr. Mark Gardener(2012), “**Beginning R - The statistical programming language**”, John Wiley and Sons, Inc.

## WEB REFERENCES

1. <https://data-flair.training/blogs/r-applications/>
2. <https://www.analyticsvidhya.com/blog/2021/10/master-the-basics-of-r-programming/>
3. <https://www.programiz.com/r/examples>
4. <https://www.datamentor.io/r-programming/examples>
5. <https://www.freshersnow.com/r-programming-mcqs-and-answers-with-explanation/>

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO-1	Recognize the fundamental syntax of R through readings, practice exercises, demonstrations and writing R code.	K1
CO-2	Explain and interpret the solution using scalars, vectors, matrices and statistical problems in R programming.	K2
CO-3	Use the online resources for R and import new function packages into the R workspace and demonstrate a variety of data formats into R using R Studio.	K3
CO-4	Infer the data and generate reports based on the data using R programming.	K4
CO-5	Explore the data sets to create testable hypotheses and identify appropriate statistical tests.	K5
CO -6	Design and visualize data attributes using ggplot2 and other R packages.	K6

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	H	L	L	L	H	H	H
CO-2	H	H	H	L	L	M	H	H	H
CO-3	H	H	H	M	M	H	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H
CO-6	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H
CO-6	H	H	H

(For Candidates admitted in the academic year 2021-22)  
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**B.Sc. MATHEMATICS**  
**Third Year-Semester–V**

<b>Course Title</b>	<b>MAJOR ELECTIVE 3 – VERBAL REASONING</b>
<b>Code</b>	<b>U21MA5MET08</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students competent enough to succeed in competitive examinations, enhance the employability skills and also improve aptitude, problem solving, logical and verbal reasoning questions.

### COURSE OBJECTIVES

1. To understand the idea of series completion and analogical reasoning accurately.
2. To understand the method of finding the given message using coding and decoding and illustrate blood relations problems.
3. To understand the concept of puzzle and jumbled problems.
4. To apply the idea of Venn diagrams to study the relations and concept of word formation.
5. To evaluate alpha numeric sequence puzzle and number ranking and time sequence test

### UNIT I: SERIES COMPLETION AND ANALOGY

**12 HRS**

Number series - alphabet series - Alpha-Numeric series - Continuous pattern series - Direct/Simple Analogy – Choosing the analogous pair – Double Analogy – Choosing a similar word - Detecting analogies–Multiple-word Analogy–Number Analogy–Alphabet Analogy.

**Extra Reading/ Keywords:** *Logical reasoning, Image based Analogy, Calendar and Clock test*

### UNIT II : CODING – DECODING AND BLOOD RELATIONS

**12 HRS**

Letter Coding – Direct letter coding–Number / Symbol Coding–Matrix Coding– Substitution – Deciphering message, number and symbol codes–Jumbled Coding–Blood relations –Deciphering Jumble dupdescriptions – Relation Puzzle – Coded Relations.

**Extra Reading/Keywords:** *Human relations, Odd man out*

### UNIT III : PUZZLETEST

**12 HRS**

Classification type questions – Seating and placing arrangements – Comparison type questions – Sequential order of things –Selection based on given conditions - Family based puzzles–Jumbled

problems.

**Extra Reading/Keywords:** *Logical Sequence of words*

#### **UNIT IV: LOGICAL VENN DIAGRAM AND ALPHABET TEST**

**12 HRS**

Logical Venn diagram- Alphabetical order of words –Letter word problems – Rule Detection – Alphabetical Quibble – Word formation by Unscrambling letters – Word Formation using letters of a given word.

**Extra Reading/Keywords:** *Sequential out put tracing, Direction sense test*

#### **UNIT V: ALPHA NUMERIC SEQUENCE PUZZLE AND TESTS**

**12 HRS**

Alpha Numeric Sequence puzzle-Number test –Ranking test–Time Sequence tests

**Extra Reading/Keywords:** *Number puzzle, puzzle coding*

**Note: Texts given in the Extra Reading/Key Word must be tested only through assignment and seminars.**

#### **TEXT BOOK**

1. Treatment and content as in Dr.R.S.Aggarwal (Revised edition 2018), “**A Modern Approach to Verbal and Non-Verbal Reasoning**”, S.Chand and Company Ltd, New Delhi, Reprint 2020.

Unit I : Chapter 1 &2

Unit II: Chapter 4 & 5

Unit III: Chapter 6

Unit IV: Chapter 9 & 10

Unit V: Chapter 11 & 12

#### **SUGGESTED READINGS**

1. Praveen R.V(2012), “**Quantitative Aptitude and Reasoning**”, PHI Pvt Ltd.
2. Edgar Thorpe (2012), “**Course in Mental Ability and Quantitative Aptitude**”, Third Edition, Mc Graw Hill Education.
3. Aggarwal R.S(2012), “**Objective Arithmetic for Competitive Examinations**”, S.Chand and Company Ltd., Ram Nagar, New Delhi.
4. Disha Experts(2018),” Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams 2<sup>nd</sup> Edition, Disha Publications.
5. BS Sijwalii(2018), Analytical & Logical Reasoning For CAT & Other Management Entrance Tests, Arihant Publications India limited.

#### **WEB REFERENCES**

1. <https://ggnindia.dronacharya.info/Study-Materials/Download/verbal-reasoning-Book.pdf>
2. <https://www.mathcentre.ac.uk/resources/uploaded/non-verbal-reasoning-test-1-questions.pdf>
3. <https://www.education.vic.gov.au/Documents/school/parents/secondary/verbalreasoningpractice.pdf>
4. <https://questionpaper.org/reasoning-questions-pdf-download-with-answer/>
5. <https://tekoclasses.com/CLASS%2010%20STUDY%20PACKAGE/CLASS%2010%20MENTAL%20ABILITY%20COMPETITIVE%20EXAMS.pdf>



*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Describe the idea of series completion and analyze analogical reasoning concisely and accurately.	K1
CO – 2	Explain the method of finding the given message using coding and decoding and solve blood relations problems.	K2
CO – 3	Recall and summarize concept of puzzle, classification and comparison type questions.	K3
CO – 4	Apply the idea of Venn diagram to study the relations and concept of word formation.	K4
CO – 5	Compute Alpha Numeric Sequence puzzle and Number, Ranking and Time Sequence test.	K5
CO – 6	Enhance the knowledge of analogical reasoning, concept of puzzle, Alpha numeric puzzle number ranking and time sequence test.	K6

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)**

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	M	H	H	H	H
CO-2	H	M	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	M	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H
CO-6	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H
CO-6	H	H	H

(For Candidates admitted in the academic year 2021-22)

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**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**Third Year-Semester–V**

<b>Course Title</b>	<b>NON MAJOR ELECTIVE 3: STATISTICS – I</b>
<b>Code</b>	<b>U21MA5NMT03</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>3</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students understand various characteristics of discrete and continuous statistical distributions with mathematical techniques.

### COURSE OBJECTIVES

1. To understand the various measures of dispersion.
2. To understand probability, conditional probability and its axioms.
3. To understand discrete and continuous random variable and its properties.
4. To apply properties of two dimensional random variable and various probability distribution.
5. To evaluate expectation of a random variables.
6. To find solution of real life problems under the concept of probability and probability distributions.

### UNIT I: MEASURES OF DISPERSION

**9 HRS**

Introduction- Definition of Statistics -Dispersion – calculation of Range, Quartile deviation, Mean Deviation and standard deviation.

**Extra Reading/Key words:** *Estimates of scale, Measurement uncertainty, Interquartile range.*

### UNIT II: PROBABILITY

**9 HRS**

Introduction-Classical Definition, addition theorem, multiplication theorem, Odds in favour and odds against an event, Axiomatic Approach, Axioms of Probability, Conditional Probability, Multiplicative law of probability, Probability of an event in terms of conditional probability (Problems Only) (Baye's Theorem, independent events are omitted).

**Extra reading words:** *Stock market, Tree diagram, Mutually exclusive.*

### UNIT III: RANDOM VARIABLES

9 HRS

Discrete and continuous random variable, cumulative distributive function, properties of distribution function, function of a random variable. (Problems Only)

**Extra Reading/ Keywords:** *Multinomial Distribution, Compound marginal distribution, Probability distribution fitting.*

### UNIT IV: RANDOM VARIABLES(CONTN)

9 HRS

Two dimensional random variable, joint probability function, marginal probability distribution, conditional probability distribution, independent random variables

**Extra Reading/ Keywords:** *Multinomial Distribution, Compound marginal distribution, Probability distribution fitting.*

### UNIT V : EXPECTATION

9 HRS

Expectation of a random variable - expectation of a function of a random variable, properties of expected value.(Statements and Problems Only)

**Extra Reading/ Keywords:** *Berry-Esseen Theorem, Equi-oscillation theorem, Moment of inertia, Population variance*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.**

### TEXT BOOKS

1. Treatment and content as in Navnitham P.A (2019), “**Business Mathematics and Statistics**”, Jai Publishers, Trichy.  
Unit I - Chapter 2(section 8)
2. Treatment and content as in Vittal .P.R (2002), “**Mathematical Statistics**” , Margham Publishers, Chennai.  
Unit II - Chapter 1  
Unit II - Chapter 2  
Unit IV - Chapter 2  
Unit V - Chapter 3

### SUGGESTED READINGS

1. R.S.N.Pillai, V.Bagavathi (2007), “Statistics”, S.Chand and Company Ltd. New Delhi.
2. Arora .S, Sumeet Arora (2002), “Comprehensive Statistical Methods”, S.Chand and Company Ltd, New Delhi
3. Douglas A.Lind ,William G. Marchall, Samuel A. Wathen (2003), “Basic Statistics for Business and Economics”, Mc Graw Hill, Delhi.
4. Gupta .S.C, Kapoor.V.K (2002), “Fundamentals Of Mathematical Statistics”, Sultan Chand & Sons, New Delhi.
5. Gupta .S.P (2006), “Statistical Methods”, Sultan Chand & Sons, New Delhi.

### WEB REFERENCES

1. <https://www.embibe.com/exams/theorems-on-probability/>
2. <https://www.toppr.com/guides/business-mathematics-and-statistics/measures-of-central-tendency-and-dispersion/measure-of-dispersion/>
3. <https://www.statlect.com/glossary/distribution-function>
4. [https://webspace.maths.qmul.ac.uk/b.bogacka/MS\\_NotesWeek4.pdf](https://webspace.maths.qmul.ac.uk/b.bogacka/MS_NotesWeek4.pdf)
5. <https://www.stat.auckland.ac.nz/~fewster/325/notes/ch3.pdf>

*Note: Learners are advised to use latest edition of books.*

### COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO – 1	Describe and analyze Range, Quartile deviation, Mean Deviation and standard deviation.	K1
CO – 2	Explain addition theorem, multiplication theorem, Axioms of Probability, Conditional Probability and Multiplicative law of probability.	K2
CO – 3	Recall and summarize Discrete and continuous random variable, cumulative distributive function, properties of distribution function, function of a random variable.	K3
CO – 4	Apply Probability in coins, cards and dice.	K4
CO – 5	Compute Expectation of a random variable and expectation of a function of a random variable.	K5
CO – 6	Enhance the knowledge of random variables and expose them to the Two dimensional random variable, joint probability function, Expectation of a random variable and expectation of a function of a random variable.	K6

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)**

### PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	M	H	H	H	H
CO-2	H	M	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	M	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H
CO-6	H	H	H	H	H	H	H	H	H

### PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H
CO-6	H	H	H

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**B.Sc. MATHEMATICS**  
**Third Year-Semester-V**

<b>Course Title</b>	<b>MAJOR SKILL BASED ELECTIVE 2: APTITUDE MATHEMATICS – II</b>
<b>Code</b>	<b>U21MA5SBT02</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>V</b>
<b>Hours/ Week</b>	<b>2</b>
<b>Credits</b>	<b>1</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To equip the students with basic arithmetic facts related to pipes and cisterns, train problems, area, distance, boats, interest, finance and develop problem solving skills.

### COURSE OBJECTIVES

1. To understand the facts about time and distance and pipes and cisterns and solve the problems.
2. To solve problems on Trains, Boats and Streams.
3. To remember and apply the concepts of area, surface area and volume in the relevant problems
4. To understand simple and compound interest and evaluate problems on the same.
5. To understand the concept of discount and apply to true and bankers discount.
6. To create faster computation for facing competitive examination in turn to avail employability.

### UNIT I: PIPES AND DISTANCE

**6 HRS**

Pipes and cisterns – Time and distance.

**Extra Reading/Key words:** *Work and wages, Measures.*

### UNIT II: TRAINS AND BOATS

**6 HRS**

Problems on trains – Boats and streams.

**Extra Reading/Key words:** *Races, Games.*

### UNIT III: AREA

**6 HRS**

Area – Volume and Surfaces Areas

**Extra Reading/Key words:** *Shapes, Patterns.*

**UNIT IV: INTEREST** **6 HRS**  
Simple Interest – Compound Interest

**Extra Reading/Key words:** *Stocks and Shares*

**UNIT V: DISCOUNT** **6 HRS**

True Discount – Banker's Discount

**Extra Reading/Key words:** *Revenue, Principal amount.*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.**

### **TEXT BOOK**

Aggarwal R.S. (2017), **OBJECTIVE ARITHMETIC** For Competitive Examinations, S.Chand and Company Ltd., Ram Nagar, New Delhi.

Unit I: Chapter 16 and 17

Unit II: Chapter 18 and 19

Unit III: Chapters 23 and 24

Unit IV: Chapters 21 and 22

Unit V: Chapters 25 and 26

### **SUGGESTED READINGS**

1. Aggarwal R.S., Objective Arithmetic (SSC and Railway exam special) (Revised edition 2018 and reprint 2020), S.Chand and Company Ltd., Ram Nagar, New Delhi.
2. The Official Guide to the GRE Revised General Test, Educational Testing Service, 2nd Edition, McGraw Hill; 2nd edition, 2017).
3. Arun Sharma, How to prepare Quantitative Aptitude for CAT, Mc Graw Hill Publishers, 6<sup>th</sup> Revised Edition.
4. Deepak Agarwal, D.P.Gupta, Quantitative Aptitude for CAT and other MBA Entrance Examinations, Disha publications, 4<sup>th</sup> updated Edition.
5. General Quantitative Aptitude for Competitive Exams - SSC/ Banking/ NRA CET/ CUET/ Defence/Railway/ Insurance , Disha Experts, 3rd Edition, Disha Publications.

### **WEB REFERENCES**

1. <https://testbook.com/objective-questions/mcq-on-pipe-and-cistern--5eea6a1039140f30f369e858>
2. <https://testbook.com/objective-questions/mcq-on-boat-and-river--5eea6a1039140f30f369e868>
3. <https://collegedunia.com/exams/mcq-on-surface-area-and-volume-mathematics-articleid-4135>
4. <https://www.freeonlinetest.in/competitive-exams/question-and-answer/aptitude-online-test/true-and-bankers-discount>
5. <https://youtu.be/iQsdWlj8cDs>
6. <https://youtu.be/wnYJseuKfi8>

**Note: Learners are advised to use latest edition of books.**

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO – 1	Recall the formulae and basic facts on time and distance, pipes and cisterns, area and volume, Interest and Discounts.	K1
CO – 2	Understand the problems on time and distance, pipes and cisterns, boats and streams, area and volume.	K2
CO – 3	Apply the concepts of Train Problems, time and distance, Interest and Discount in the real-life problems.	K3
CO – 4	Analyze any real life / banking sector/ industrial problems using the concepts of area and volume, Train Problems, time and distance, Interest and Discount.	K4
CO – 5	Evaluate any real life / banking sector/ industrial problems using the concepts of area and volume, Train Problems, time and distance, Interest and Discount and estimate the findings.	K5
CO – 6	Creating faster computation of problems facing competitive examination for employability	K6

(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create)

## PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	M	M	H	M	H	H	H	H
CO-2	H	M	H	M	H	M	H	H	H
CO-3	H	H	H	H	H	M	H	H	H
CO-4	H	H	H	H	H	H	H	H	H
CO-5	H	H	H	H	H	H	H	H	H
CO-6	H	H	H	H	H	H	H	H	H

## PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO-1	H	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H
CO-5	H	H	H
CO-6	H	H	H







(For Candidates admitted in the academic year 2021-22)  
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**B.Sc. MATHEMATICS**  
**Third Year-Semester–VI**

<b>Course Title</b>	<b>MAJOR CORE 16 :REAL ANALYSIS – II</b>
<b>Code</b>	<b>U21MA6MCT16</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>5</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the concepts of open sets, closed sets, connected sets, bounded sets, totally bounded sets, completeness, compactness in metric space and Riemann integration.

### COURSE OBJECTIVES

1. To understand the concept of open and closed sets.
2. To discuss connected sets, bounded sets and totally bounded sets.
3. To analyze the concepts of complete metric space, compact metric space and uniform continuity.
4. To describe the concept of upper and lower R-integral and examine the properties of Riemann integrals and improper integral.
5. To understand the derivatives of a real valued functions.

### UNIT I: OPEN AND CLOSED SETS

**15 HRS**

Open sets - Closed sets - More about open sets

**Extra Reading/ Keywords:** *Interior and exterior points of a set, closure of a set, Dense set.*

### UNIT II: CONNECTEDNESS AND BOUNDED SETS

**15 HRS**

Connected sets - Bounded sets and totally bounded sets

**Extra Reading/ Keywords:** *Equi continuous, Convergence sequence, Discontinuity of a function.*

### UNIT III: COMPLETENESS, COMPACTNESS AND UNIFORM CONTINUITY 15 HRS

Complete metric space, Compact metric spaces – Uniform Continuity

**Extra Reading/ Keywords:** *Continuity of the inverse function, Compactness and continuity, Sequentially compact metric space.*

### UNIT IV: RIEMANN INTEGRAL

15 HRS

Definition of the Riemann Integral – Existence and Properties of the Riemann Integral – Improper integrals

**Extra Reading/ Keywords:** *Riemann Stieljes integral, Functions of bounded variation, Integration of vector valued functions.*

### UNIT V: DERIVATIVES

15 HRS

Derivatives - Rolle's theorem - The law of the mean – Fundamental theorems of calculus- Taylor's Theorem

**Extra Reading/ Keywords:** *L'Hospital rule, Derivatives of higher Order, Differentiation of vector-valued functions.*

**Note: Texts given in the Extra Reading /Key Words must be tested only through assignment and seminars**

#### TEXT BOOK

Richard R.Goldberg (2020), “**Methods of Real Analysis**”, Oxford & IBH Publishing Co.pvt. ltd, New Delhi.

UNIT I: CHAPTER 5 (Sec 5.4, 5.5), CHAPTER 6 (Sec 6.1)

UNIT II: CHAPTER 6 (Sec 6.2 & 6.3)

UNIT III: CHAPTER 6 (Sec 6.4, 6.5 & 6.8)

UNIT IV: CHAPTER 7 (Sec 7.2 – 7.4 & 7.9)

UNIT V: CHAPTER 7 (Sec 7.5 -7.8), CHAPTER 8(Sec 8.5)

#### SUGGESTED READINGS

1. Dr.K. Chandrasekhara Rao, Dr. K.S.Narayanan(2008), “**Real Analysis**” Volume II, S.Viswanathan (Printers & Publishers) Pvt. Ltd., 2008 Edition
2. S.C. Malik(2018), “**Principles of Real Analysis**”, New age international publishing Pvt.Ltd., New Delhi (4<sup>th</sup> edition).
3. M.K.Singal and Asha Rani Singal(2008), “**A First Course in Real Analysis**”, S.Chand &Co. New Delhi.
4. Shanthi Narayan and Dr .M.D . Raisinghania(2008), “**Elements of Real Analysis**”, S.Chand & Company Pvt. Ltd.
5. N.L. Carothers(2006), “**Real Analysis**”, Published bythe press syndicate of the university of Cambridge House.



**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	M	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2021-22)

**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester-VI**

<b>Course Title</b>	<b>MAJOR CORE 17:COMPLEX ANALYSIS</b>
<b>Code</b>	<b>U21MA6MCT17</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to understand the basic concepts of complex valued function, analytic functions, Bilinear transformations, Cauchy's integral formula and Cauchy's integral theorem, singularities, series expansions and calculation of residues.

### COURSE OBJECTIVES

1. To understand the fundamental concepts of functions of a complex variable along with the concepts of analyticity, Cauchy-Riemann relations and harmonic functions.
2. To understand about bilinear transformation and its properties.
3. To evaluate definite integrals using Cauchy's theorem and Cauchy's integral formula.
4. To expand some simple functions as Taylor and Laurent series, understand zeros, pole and classify the nature of singularities.
5. To evaluate residues using Cauchy's residue theorem.

### UNIT I: ANALYTIC FUNCTIONS

**15 HRS**

Introduction - Functions of a complex variable - Continuous functions - Differentiability - Cauchy Riemann equations - Analytic Functions - Harmonic functions - Algebraic and Geometric view of Complex valued functions and their properties.

**Extra Reading/ Keywords:** *Conformal mapping*

### UNIT II: BILINEAR TRANSFORMATIONS

**15 HRS**

Introduction - Elementary transformations - Bilinear transformations - Cross ratio - Fixed points of Bilinear transformations - Some special bilinear transformations - Geometric view of various bilinear maps on  $\mathbb{C}$  and  $\mathbb{C}^\infty$ .

**Extra Reading/ Keywords:** *Sequences and series of functions, Power series*

### UNIT III: COMPLEX INTEGRATION

15 HRS

Introduction - Definite integral - Cauchy's theorem - Cauchy's integral formula - Higher derivatives - Geometric view of Complex path integration and Contour integration.

**Extra Reading/ Keywords:** *Winding number, Argument function*

### UNIT IV: SERIES EXPANSION

15 HRS

Introduction -Taylor's theorem - Laurent's theorem - Zeros of an analytic function - Pole - singularities -Rational Functions.

**Extra Reading/ Keywords:** *Calculation of definite integrals*

### UNIT V: CALCULUS OF RESIDUES

15 HRS

Introduction -Residues – Cauchy's Residue theorem - Evaluation of definite integrals-Sums of infinite series.

**Extra Reading/ Keywords:** *The principle of argument*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.

### TEXT BOOKS

S.Arumugam, A.Thankapandi Isaac and A.Somasundaram (2021), “**Complex Analysis**”, Scitech Publishers, Chennai

UNIT I: Chapter 2(Sec 2.0 to 2.1 and 2.4-2.8)

UNIT II : Chapter 3 (Sec.3.0 to 3.5)

UNIT III : Chapter 6 ( Sec 6.0 to 6.4)

UNIT IV : Chapter 7 ( Sec 7.0 to 7.5 )

UNIT V : Chapter 8 (Sec 8.0 to 8.4)

### SUGGESTED READINGS

1. Spiegel, Murray R (2009), “**Schaum's Outlines - Complex Variables**”, Second Edition, Mc Graw Hill Publishers.
2. V. Karunakaran (2006), “**Complex Analysis**”, Narosa publishing House, New Delhi.
3. Howie, M. John (2008), “**Complex Analysis**”, Wiley Dremtech Pvt Ltd.
4. H. A. Priestley(2006), “**Introduction to Complex Analysis**”, 2<sup>nd</sup> edition (Indian), Oxford.
5. L.V. Ahlfors(2000), “**Complex Analysis**”, 3<sup>rd</sup> edition, McGraw Hill.
6. S.Ponnusamy (2011), “**Foundations of Complex Analysis**”, Narosa publishing House, New Delhi.





**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2021-22)

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester–VI**

<b>Course Title</b>	<b>MAJOR CORE 18: FUZZY SET THEORY</b>
<b>Code</b>	<b>U21MA6MCT18</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### **CONSPECTUS**

To enable the students to have better applications of uncertainty through fuzzy mathematics for problems in physical and social sciences.

### **COURSE OBJECTIVES**

1. To understand fuzzy set theory
2. To evaluate the operations on fuzzy sets
3. To understand and evaluate fuzzy relations and its operators
4. To understand fuzzy logic and approximate reasoning
5. To apply fuzzy methods in Control Theory

### **UNIT I: FUZZY SET THEORY**

**15 HRS**

Introduction - Concept of a fuzzy set - Relation between fuzzy sets - Numbers and Crisp set associated with a fuzzy set - Fuzzy sets associated with a given fuzzy set- Extension Principle - Diverse applications of fuzzy logic.

**Extra Reading/Keywords:** *Fuzzy representation on Venn diagrams*

### **UNIT II: OPERATIONS ON FUZZY SET**

**15 HRS**

Introduction - Fuzzy Complements - Fuzzy Intersections - Fuzzy Unions - Application of fuzzy in production management.

**Extra Reading/ Keywords:** *Combination of operations, Aggregation operations, Fuzzy numbers*

### UNIT III: FUZZY RELATIONS

15 HRS

Introduction - Operations on Fuzzy Relations-  $\alpha$ -cuts of Fuzzy Relations - Compositions of Fuzzy Relations - Projections of Relations - Cylindrical Extensions - Application of fuzzy equivalence relations.

**Extra Reading/Keywords:** *Cylindrical Closure, Fuzzy order integration, Fuzzy graph*

### UNIT IV: FUZZY LOGIC

15 HRS

Introduction - Three valued logics - N valued logics for  $N > 4$  - Infinite valued logics - Fuzzy logic - Fuzzy Propositions and Rules – Reasoning - Application of fuzzy decision-making.

**Extra Reading/Keywords:** *Fuzzy Syllogism, Lattice*

### UNIT V: APPLICATIONS

15 HRS

Fuzzy methods in Control Theory - Introduction - Fuzzy Expert Systems - Classical Control Theory Vs Fuzzy Control Theory - Examples - Components of FLC - Formulation of FLC - Fuzzy logic and its application in medicine.

**Extra Reading/ Keywords:** *Real Life examples, Model free nature of FLC*

**Note:** Texts given in the Extra reading/Keyword must be tested only through assignment and seminars

### TEXT BOOKS

**M. Ganesh, Reprint (2012), “Introduction to Fuzzy Sets and Fuzzy Logic”, Prentice Hall of India Pvt. Limited, New Delhi.**

UNIT I: CHAPTER 6 – Sec 6.1 to 6.9

UNIT III: CHAPTER 7 – Sec 7.1 to 7.7

UNIT IV: CHAPTER 8 – Sec 8.1 to 8.8

UNIT V: CHAPTER 9 – Sec 9.1 to 9.8

**George J. Klir /Bo Yuan, Reprint (2013), “Fuzzy Sets and Fuzzy Logic –Theory and Applications”, Prentice Hall of India, New Delhi.**

UNIT II: Chapter 3 - Sec 3.1 to 3.4

### SUGGESTED READINGS

1. A. Kaufmann, (2005), “**Introduction to Fuzzy Theory**”, Academic press, New York.
2. George J. Kler/ Boyuan, (2005), “**Fuzzy Sets and Fuzzy Logic–Theory and Applications**”, Prentice Hall of India, New Delhi.
3. T. M. Ross (2006), “**Fuzzy Engineering Application**”, Wiley Western Company.



**PSO-CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

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**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester–VI**

<b>Course Title</b>	<b>MAJOR CORE 19: DISCRETE MATHEMATICS</b>
<b>Code</b>	<b>U21MA6MCT19</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>5</b>
<b>Credits</b>	<b>4</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To enable the students to be familiar with the fundamental concepts of Mathematical logic, permutations and combinations, functions and Boolean algebra and enable them to inculcate the habit of problem solving.

### COURSE OBJECTIVES

1. To understand the concepts of Propositions and Logical Connectives.
2. To illustrate the basic concepts of permutations, combinations, rules of sum and product of permutations and combinations.
3. To describe the concept of functions and their Properties, Composition of Functions, Recursive functions, Hashing and Pigeonhole Principle.
4. To apply the concepts of Languages, Types of Grammars, Languages and Finite state Machines.
5. To examine the concepts and significance of Boolean Algebra.

### UNIT I: MATHEMATICAL LOGIC

**15 HRS**

Propositions - Logical Connectives - Conditionals and Biconditionals - Well Formed Formulas - Tautologies - Logical Equivalences - Theory of Inference for statement Calculus - Applications of Propositional logic in Computer science and Engineering.

**Extra Reading/ Keywords:** *Predicates, Predicate Formulas*

### UNIT II: PERMUTATIONS AND COMBINATIONS

**15 HRS**

Introduction - Rules of Sum and Product - Permutations - Combinations - Generalization of Permutations and Combinations - Binomial Theorem - Functional and Geometrical applications of Permutations and Combinations.

**Extra Reading/ Keywords:** *Discrete Probability, Partial Ordering Relations*

### UNIT III: FUNCTIONS

15 HRS

Functions - Composition of Functions - Invertible functions - Recursive functions - Hashing - Pigeonhole Principle - Application of Pigeonhole Principle in real-life problems.

**Extra Reading/ Keywords:** *Recursion in Programming Languages*

### UNIT IV: MODELING COMPUTATION

15 HRS

Languages - Types of Grammars and Languages - Finite state machines - Equivalent machines - Finite state languages and type - 3 Languages - Application of finite state machines in coin-operated turnstile.

**Extra Reading/ Keywords:** *Turing Machine*

### UNIT V: BOOLEAN ALGEBRA

15 HRS

Lattices and Algebraic Systems – Principle of Duality – Basic Properties of Algebraic Systems - Boolean Algebra – Identity of Boolean Algebra - Uniqueness of Finite state Boolean Algebras - Application of boolean algebra in Logic Circuits.

**Extra Reading/ Keywords:** *Design examples using Boolean Algebra, Sequential Circuits*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.

### TEXT BOOK

CL Liu and DP Mohapatra, “**Elements of Discrete Mathematics**”, 4<sup>th</sup> Edition, McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2013.

Unit I: Chapter 1 – Sec 1.8 -1.14

Unit II: Chapter 2 – Sec 2.1 – 2.6

Unit III: Chapter 3 – Sec 3.11 – 3.16

Unit IV: Chapter 6 – Sec 6.4 – 6.12

Unit V: Chapter 11 – Sec 11.1 -11.7

### SUGGESTED READINGS

1. Grimaldi, R.P(2007). “**Discrete and Combinatorial Mathematics: An Applied Introduction**”, 4<sup>th</sup> Edition, Pearson Education Asia, Delhi.
2. Lipschutz, S. and Mark Lipson(2010)., “**Discrete Mathematics**”, 3<sup>rd</sup> Edition, Schaum,,s Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi.
3. Kolman, Busy & Ross(2005), “**Discrete Mathematical Structures**”, 5<sup>th</sup> Edition, PHI , New Delhi.
- 4.Rosen, K. H(2010)., “**Discrete Mathematics and its Application**”, 5<sup>th</sup> Edition, TataMcGraw Hill Pub. Co. Ltd., New Delhi.
5. Tremblay, J.P. and Manohar, R(2008). “**Discrete Mathematical Structures with Applications to Computer Science**”, 35<sup>th</sup> Reprint, TataMcGraw Hill Pub. Co. Ltd., New Delhi.





**PSO-CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

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**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS**  
**CHOICE BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester–VI**

<b>Course Title</b>	<b>MAJOR ELECTIVE 4: PYTHON PROGRAMMING</b>
<b>Code</b>	<b>U21MA6MET09</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students understand the basic concepts, elegant features, Python languages flavor and style, develop simple python programs, define functions, data structures, input/output with files in Python.

### COURSE OBJECTIVES

1. To understand the basic concepts and noteworthy features of Python language.
2. To illustrates the operations of built-in functions and user defined functions of Python.
3. To examine the string types, formatting operators and functions, assessing list operators and Methods.
4. To illuminate the creation of tuples and properties with the operations of Dictionary.
5. To apply the concepts of files, exceptions, user defined functions to write simple programs in Python.

### UNIT I: PYTHON DATA TYPES, EXPRESSIONS, STATEMENTS

**12 HRS**

Introduction to Python - Python identifiers, Reserved keywords, Variables, Standard data types, Operators, Statement and Expression, String Operations, Control statements, Iteration - while statement – Applications of Python in web development.

**Extra Reading /Key Words:** *Programming languages, Algorithms and Flow charts*

### UNIT II: FUNCTIONS

**12 HRS**

Introduction - Built-in functions, Composition of functions, User Defined functions, Parameterand Arguments, Function Calls, The return statement, Python Recursive Function, The Anonymous Functions - Applications of Python in game development.

**Extra Reading /Key Words:** *Writing Python Scripts, Fruitful functions*

### UNIT III: STRINGS AND LISTS

12 HRS

Strings - Compound data type, Len Function, String Slices, Immutability, String Traversal, Escape Characters, String Formatting Operators and Functions.

Lists - Values and Accessing elements, Copying the list, Mutability, Traversing, Deleting elements from list, Built - in List Operators and Methods - Applications of Python in machine learning and artificial intelligence.

**Extra Reading/Key words:** *String modules, lists as arrays and illustrative programs*

### UNIT IV: TUPLES AND DICTIONARIES

12 HRS

Tuples - Creating Tuples, Accessing Values in Tuples, Tuple Assignment, Tuples as Return Values, Built - in tuple functions.

Dictionaries - Creating a Dictionary, accessing values and updating dictionary, Deleting elements from dictionary, Properties and operations of Dictionary, Built - in Dictionary Methods - Applications of Python in data science and data visualization.

**Extra Reading/Key words:** *Advanced list processing and illustrative programs*

### UNIT V: FILES AND EXCEPTIONS

12 HRS

Text Files, Directories, Exceptions, Exceptions with Arguments, User Defined functions – Applications of Python in Education and healthcare.

**Extra Reading/Key words:** *Handling exceptions, modules and packages*

**Note:** Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.

### LIST OF PROGRAMS

1. Find the factorial of a given number using functions.
2. Calculate Euclidean distance between two points by taking input from the user.
3. Print whether the number is positive/negative using if-else.
4. Create a simple calculator using if-else statement.
5. Find the sum of all primes between 1 to 100 using for loop.
6. Compute the number of characters, words and lines in a file.
7. Print all the unique words in the file in alphabetical order.
8. Define a module to find a Fibonacci numbers and import the module to another program.
9. Create a list and perform the following methods  
(i) insert() (ii) remove() (iii) append() (iv) len() (v) pop()
10. Create a tuple and perform the following operations  
a) Concatenation b) Repetition c) Membership d) Access items e) Slicing
11. Sort (ascending and descending) a dictionary by value.
12. Prepare a students mark list using class.
13. Find the area of a circle using class and object.
14. Perform various database operations(create, insert, delete, update) using MySQL.

## TEXTBOOK

Treatment and content as in E. Balagurusamy (2018), “**Problem Solving and Python Programming**”, McGraw Hill Education (India) Private Limited, Chennai.

UNIT: I - Chapter 3: Section 3.5 - 3.14

UNIT: II - Chapters 4: Section 4.1 - 4.9

UNIT: III - Chapters 5: Section 5.1, 5.2

UNIT: IV - Chapters 6: Section 6.1, 6.2

UNIT: V - Chapters 7: Section 7.1 - 7.5

## SUGGESTED READINGS

1. Guido van Rossum and Fred L. Drake Jr(2011), “**An Introduction to Python**” – Revised and updated for Python 3.2, Network Theory Ltd.
2. Allen B. Downey(2016), “**Think Python: How to think like a Computer Scientist**”, 2<sup>nd</sup> edition, Updated for Python 3, Shroff/O’Reilly Publishers. (<http://greenteapress.com/wp/think-python/>)
3. Ashok Namdev Kamthane, Amit Ashok Kamthane(2018), “**Programming and Problem Solving with Python**” McGraw Hill Education (India) Private Limited, Chennai.
4. Timothy A. Budd(2015), “**Exploring Python**”, Mc-Graw Hill Education (India) Private Limited.
5. R Nageswara Rao(2017), “**Core Python Programming**”, Dream Tech Press.

## WEB REFERENCES

1. <https://www.geeksforgeeks.org/python-programming-language/>
2. <https://www.codecademy.com/learn/python-for-programmers>
3. <https://www.geeksforgeeks.org/top-10-python-applications-in-real-world/>
4. <https://www.henryharvin.com/blog/python-applications-in-the-real-world/>
5. <https://www.guvi.in/blog/top-20-python-applications-in-the-real-world/>
6. <https://www.analyticsinsight.net/top-10-python-applications-in-the-real-world-you-need-to-know/>

**Note: Learners are advised to use latest edition of books.**

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level(K1-K5)
CO – 1	Recognize the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.	K1
CO – 2	Explain the built-in functions and user defined functions provided by Python to build their own functions.	K2
CO – 3	Illustrate the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and strings.	K3
CO – 4	Infer the commonly used operations involving file systems and exceptions.	K4

<b>CO – 5</b>	Assess the advanced features such as file operations, exception handling methods and using the extensive functionality of Python programming with GUI Interface.	<b>K5</b>
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(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)

**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	H	L	L	L	H	H	H
<b>CO-2</b>	H	H	H	L	L	M	H	H	H
<b>CO-3</b>	H	H	H	M	M	H	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2021-22)

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**PG AND RESEARCH DEPARTMENT OF MATHEMATICS CHOICE**  
**BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester–VI**

<b>Course Title</b>	<b>MAJOR ELECTIVE 4: NON VERBAL REASONING</b>
<b>Code</b>	<b>U21MA6MET10</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>4</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

### CONSPECTUS

To make the students know about the ability based on their skills of comprehend, analysis, problem solving skills, comprising of data and information which are depicted in visual form.

### COURSE OBJECTIVES

1. To understand the logical rules and analyze visual information and solve problems using visual reasoning.
2. To describe the concept of analogy and identifying logical patterns that establishes a relationship between two given figures.
3. To identify the odd one among the various options based on their creative thinking and utilize their logical skills.
4. To evaluate the logical behind the given pattern and applying that logical reason to solve the incomplete pattern.
5. To analyse the concept of cubes and dice to solve the reasoning.

### UNIT I: SERIES

**12 HRS**

Five figure series - Three and four Figure Series - Choosing the missing Figure in a series.

**Extra Reading/ Keywords:** *Detecting the incorrect order in a series, Detecting the wrong figure in a series*

**UNIT II: ANALOGY****12 HRS**

Choosing one element of a similarly related pair - Choosing the set of similarly related figures - Choosing the set of unrelated Figures from a group of sets of similarly related figures - Choosing the odd Relationship.

**Extra Reading/ Keywords:** *Detecting one element of each of the two related pairs*

**UNIT III: CLASSIFICATION & ANALYTICAL REASONING****12 HRS**

Choosing the odd figure - Choosing a similar Figure - Finding figures with the same Characteristics -Analytical Reasoning

**Extra Reading/ Keywords:** *Mirror Images & Water Images*

**UNIT IV: COMPLETION OF INCOMPLETE PATTERN****12 HRS**

Completion Of Incomplete Pattern - Figure Matrix - Paper folding

**Extra Reading/ Keywords:** *Paper Cutting, Grouping of identical Figures*

**UNIT V: CUBES AND DICE****12 HRS**

Cubes and Dice - Counting the number of cubes / blocks in the given figure - Painting a stack of cubes - Coloring the six faces of a cube

**Extra Reading/ Keywords:** *Construction of boxes, Problems on Dice*

**Note: Texts given in the Extra Reading /Key Words must be tested only through assignment and seminars.**

**TEXT BOOK**

Treatment and content as in Dr. R.S. Aggarwal (2012), **Verbal and Non-Verbal Reasoning**, Revised edition S. Chand and Company Ltd.

Unit I: Chapters 1 (Type 1, 2, 3)

Unit II: Chapters 2

Unit III: Chapters 3 and 4

Unit IV: Chapters 8, 9 and 10

Unit V: Chapter 14

### SUGGESTED READINGS

1. Praveen R.V(2012), “Quantitative Aptitude and Reasoning”, PHI Pvt Ltd.
2. Edgar Thorpe(2012), “Course in Mental Ability and Quantitative Aptitude”, Third Edition, McGraw Hill Education.
3. Aggarwal R.S(2012), “Objective Arithmetic for Competitive Examinations”, S. Chand and Company Ltd., Ram Nagar, New Delhi.
4. Disha Experts(2018), “Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams”, 2<sup>nd</sup> Edition, Disha Publications.
5. BS Sijwalii(2018), “Analytical & Logical Reasoning For CAT & Other Management Entrance Tests”, Arihant Publications India limited.

### WEB REFERENCES

1. [https://www.stmarys-kl.cumbria.sch.uk/wp-content/uploads/2018/08/NVR\\_familiarisation\\_booklet.pdf](https://www.stmarys-kl.cumbria.sch.uk/wp-content/uploads/2018/08/NVR_familiarisation_booklet.pdf)
2. <https://www.mathcentre.ac.uk/resources/uploaded/non-verbal-reasoning-test-1-questions.pdf>
3. <https://www.stmarys-kl.cumbria.sch.uk/wp-content/uploads/2018/08/non-verbal-reasoning.pdf>
4. [https://repo.optcl.co.in/docs/e7dd002f5f21f4c066f598ffb4731ea0\\_RS%20Agarwal%20Verbal%20&%20Nonverbal.pdf](https://repo.optcl.co.in/docs/e7dd002f5f21f4c066f598ffb4731ea0_RS%20Agarwal%20Verbal%20&%20Nonverbal.pdf)
5. <https://testbook.com/objective-questions/mcq-on-non-verbal-reasoning--5eea6a0e39140f30f369e463>

*Note: Learners are advised to use latest edition of books.*

### COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1 – K5)
CO – 1	Describe and analyze the visual information to solve complex problems without relying upon or being limited by language skills.	K1
CO – 2	Understanding logical rules and process diagrams to find out the causes to evaluate the processes represented via diagrams.	K2
CO – 3	Apply the concept of classification and analytical reasoning to tests the ability.	K3
CO – 4	Analyze visual information and solve problems based on visual reasoning like Figure Matrix, Paper folding & cutting through which learn the various patterns and incomplete pattern methods.	K4
CO – 5	Explore solutions for the verbal reasoning by Cube and Dice blocks and concept.	K5

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)**



**PO – CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	M	M	H	M	H	H	H	H
<b>CO-2</b>	H	M	H	M	H	M	H	H	H
<b>CO-3</b>	H	H	H	H	H	M	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

**PSO – CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	H	H	M
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H

(For Candidates admitted in the academic year 2021-22)  
**HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002**  
**SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES**  
**PG AND RESEARCH DEPARTMENT OF MATHEMATICS CHOICE**  
**BASED CREDIT SYSTEM**  
**LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)**  
**B.Sc. MATHEMATICS**  
**Third Year-Semester–VI**

<b>Course Title</b>	<b>NON MAJOR ELECTIVE 4: STATISTICS - II</b>
<b>Code</b>	<b>U21MA6NMT04</b>
<b>Course type</b>	<b>Theory</b>
<b>Semester</b>	<b>VI</b>
<b>Hours/ Week</b>	<b>3</b>
<b>Credits</b>	<b>3</b>
<b>Marks</b>	<b>100</b>

**CONSPECTUS**

To make the students to enrich the concept of discrete, continuous distributions and sampling theory and use the concepts to solve the related real-life problems.

**COURSE OBJECTIVES**

1. To understand the concept of discrete and continuous distributions and their properties.
2. To illustrate the concept of discrete and continuous distributions with related problems
3. To analyze the large samples and evaluate testing the hypothesis
4. To examine the concept of small samples and evaluate test of hypothesis using chi-square test, student t test and their properties.
5. To demonstrate F test for Equality of two population variances and differentiate the one way and two-way classifications

**UNIT I: BINOMIAL AND POISSON DISTRIBUTIONS**

**9 HRS**

Discrete distribution - Binomial distribution - Mean, Variance and Moments of the Binomial distribution only - Poisson distribution - Mean, Variance and Moments of Poisson distribution only. (No derivation, simple problems only) - Application of Poisson distribution in real life problems.

**Extra Reading /Key Words:** *Negative binomial distribution, Geometric distribution, Hyper geometric distribution.*

**UNIT II: NORMAL DISTRIBUTION**

**9 HRS**

Continuous distribution - Normal distribution - Mean & variance; Moments, Properties of Normal distribution. (No derivation, simple problems only) - Application of Normal Distribution in population distribution.

**Extra Reading /Key Words:** *Triangular Distribution, General Uniform distribution*

### **UNIT III: TEST OF HYPOTHESIS FOR LARGE SAMPLES**

**9 HRS**

Large samples - Definitions - Test of hypothesis - Test for a specified mean, Test for the equality of two means- Test for a specified proportion - Test for the equality of two proportions - Application of large samples in business. (No derivation, simple problems only).

**Extra Reading/Key words:** *Test of hypothesis for population proportion, systematic samples, purposive samples, cluster random samples*

### **UNIT IV: TEST OF HYPOTHESIS USING t AND CHI SQUARE DISTRIBUTIONS**

**9 HRS**

Small Samples: t Test for a specified population mean - t Test for difference between two population means - t Test for paired observation.

Chi square Test – Definition Additive property – Pearson’s Statistic - Uses of Chi-square test-Test of independence of attributes - Test for a specified population variance- Application of Chi Square in data analysis.(No derivation, simple problems only).

**Extra Reading/Key words:** *Pearson’s correlation coefficient, Goodness of fit in regression analysis.*

### **UNIT V: TEST OF HYPOTHESIS USING F DISTRIBUTION**

**9 HRS**

F test for Equality of two population variances - Analysis of variance - One way and two-way classifications – ANOVA table- Application of ANOVA in manufacturing process. (No derivation, simple problems only).

**Extra Reading/Key words:** *F-test regression, Lack-of-fit sum of squares*

**Note: Texts given in the Extra Reading /Key Word must be tested only through assignment and seminars.**

### **TEXT BOOK**

Treatment and content as in Dr.Vittal .P. R (Reprint 2018), “**Mathematical Statistics**”, MarghamPublications, Chennai.

UNIT: I - Chapters 12 (omit page nos 12.19 -12.26) and Chapter 13 (Omit page nos 13.18 – 13.21)

UNIT: II - Chapters 16 (Points of inflection and normal probability integral are excluded).

UNIT: III - Chapter 24 (omit page nos: 24.42 -24.62)

UNIT: IV - Chapter 25 (omit page nos: 25.42 -25.45), Chapter 27 (omit page nos: 27.36 -27.37)

UNIT: V - Chapter 26

### **SUGGESTED READINGS**

1. Dr.S.Arumugam and A.Thangapandi Issac (2004), “**Statistics**”, New Gamma Publishing house.
2. Gupta. S.P (2021), “**Statistical Methods**”, Sultan Chand & Sons, New Delhi.
3. Navaneetham P.A. (2013), “**Business Mathematics and Statistics**”, Jai Publishers.

4. Sharma J.K, (2006), “**Business Statistics**”, Dorling Kindersley, (India) Pvt Ltd, Licensees of Pearson Education in South Asia.
5. Vital P.R. (2004), “**Business Statistics**”, 2<sup>nd</sup> edition, Margham Publications, Chennai.

## WEB REFERENCES

1. [https://bookdown.org/jarneric/spring\\_school/2-6-applications-of-poisson-distribution.html](https://bookdown.org/jarneric/spring_school/2-6-applications-of-poisson-distribution.html)
2. [https://stats.libretexts.org/Courses/Las\\_Positas\\_College/Math\\_40%3A\\_Statistics\\_and\\_Probability/06%3A\\_Continuous\\_Random\\_Variables\\_and\\_the\\_Normal\\_Distribution/6.02%3A\\_Applications\\_of\\_the\\_Normal\\_Distribution](https://stats.libretexts.org/Courses/Las_Positas_College/Math_40%3A_Statistics_and_Probability/06%3A_Continuous_Random_Variables_and_the_Normal_Distribution/6.02%3A_Applications_of_the_Normal_Distribution)
3. <https://www.researchoptimus.com/article/mean-hypothesis-testing.php#:~:text=Businesses%20often%20deal%20with%20large,product%20is%20effective%20or%20ineffective.>
4. <https://www.analyticsvidhya.com/blog/2019/11/what-is-chi-square-test-how-it-works/>
5. <https://qsutra.com/anova-in-manufacturing-process/#:~:text=We%20can%20use%20the%20ANOVA,or%20more%20independent%20sample%20groups.>

*Note: Learners are advised to use latest edition of books.*

## COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recalls the concept of discrete and continuous distributions, chi-square test, Student’s t test and F test along with their properties.	<b>K1</b>
CO – 2	Explain the concept of discrete and continuous distributions, chi-square test, Student’s t test and F test to solve problems.	<b>K2</b>
CO – 3	Apply the concepts of discrete and continuous distributions, chi-square test, Student’s t test and F test in real-life situations.	<b>K3</b>
CO – 4	Analyze the various distributions, chi-square test, Student’s t test and F test which is applicable to find the solutions.	<b>K4</b>
CO – 5	To evaluate the concept of large samples and use appropriate test such as chi square test, Student t test, F test, discrete and continuous distributions to infer the solution in real life situations.	<b>K5</b>

**(K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate)**

**PO –CO MAPPING**

<b>CO/PO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>
<b>CO-1</b>	H	H	M	L	M	H	H	H	H
<b>CO-2</b>	H	H	H	H	M	H	H	H	H
<b>CO-3</b>	H	H	H	H	H	H	H	H	H
<b>CO-4</b>	H	H	H	H	H	H	H	H	H
<b>CO-5</b>	H	H	H	H	H	H	H	H	H

**PSO–CO MAPPING**

<b>CO/PSO</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO-1</b>	M	H	H
<b>CO-2</b>	H	H	H
<b>CO-3</b>	H	H	H
<b>CO-4</b>	H	H	H
<b>CO-5</b>	H	H	H