PG AND RESEARCH DEPARTMENT OF MATHEMATICS

SYLLABUS (2022 – 2023)

B.Sc. MATHEMATICS

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

Programme Educational Objectives(PEO)

PEO 1 - To inculcate multidisciplinary knowledge and computational skills to excel in research and consultancy.

PEO 2 - To impart analytic, logical and computational skills to exhibit high levels of professional and ethical values in global competency.

PEO 3 - To enhance the computing potential for the streamlined needs in continuing professional development and adapt to current trends by engaging in lifelong learning.

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.

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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)
UG COURSE PATTERN
B.Sc. MATHEMATICS

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
I	I	Language	Tamil Paper I/ Hindi Paper I/ French Paper I		3	3	100
	II	English	English Paper I		3	3	100
	III	Major Core – 1	Calculus	U22MA1MCT01	4	4	100
		Major Core – 2	Analytical Geometry of Three Dimensions and Vector Calculus	U22MA1MCT02	5	4	100
		Major Core – 3	Algebra and Trigonometry	U22MA1MCT03	4	4	100
		Allied – 1	Mathematical Statistics-I/ Basics of Accounting / Human Resource Management	U22MA1ALT01/ U22CO1ALT03/ U22CO1ALT04	4	2	100
		Allied – 2	Mathematical Statistics-II / Cost and Management Accounting/ Indian Financial System	U22MA1ALT08/ U22CO1ALT05/ U22CO1ALT06	4	2	100
	IV	Environmental Studies	Environmental Studies	U22ES1EVS01	2	1	100
		Value Education	Ethics I/ Bible Studies I/ Catechism I	U22VE2LVE01/ U22VE2LVB01/ U22VE2LVC01	1	-	-
	VI		Service Oriented Course	-	-	-	-
			Internship / Field Work / Field Project 30 Hours – Extra Credit	U22EX1INT01	-	2(Extra Credit)	100
			Total		30	23+2	800+ 100

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
II	I	Language	Tamil Paper II/ Hindi Paper II/ French Paper II		3	3	100
	II	English	English Paper II		3	3	100
	III	Major Core – 4	Numerical Methods and its Applications	U22MA2MCT04	5	4	100
		Major Core – 5	Statics	U22MA2MCT05	4	4	100
		Major Core – 6	Programming in C	U22MA2MCT06	5	4	100
		Allied – 3	Mathematical Statistics-III / Financial Management/ Organizational Behaviour	U22MA2ALT10/ U22CO2ALT07/ U22CO2ALT08	4	2	100
	IV	Skill Based Course(SBC) –1	Soft Skills Development	U22SS2SBC01	2	1	100
		Skill Based Course(SBC) –2	Sustainable Rural Development and Student Social Responsibility	U22RE2SBC02	2	1	100
		Industrial Relation	Dynamics of Industrial Relations	U22MA2IRT01	1	1	100
		Value Education	Ethics I / Bible Studies I/ Catechism I	U22VE2LVE01/ U22VE2LVB01/ U22VE2LVC01	1	1	100
	V	Extension Activity	RESCAPES	U22EX2RES01	-	1(Extra credit)	-
	VI		Service Oriented Course	-	-	-	-
			Online Course	U22EX2ONC01	-	1(Extra credit)	100
			Internship / Field Work / Field Project 30 Hours - Extra Credit	U22EX2INT02	-	2(Extra Credit)	100
		Total			30	24+1+2 +1	1000+ 200

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	U21MA3MCT07	4	4	100
		Major Core – 8	Optimization Techniques – I	U21MA3MCT08	5	4	100
		Major Elective -1	Major Elective -1	-	4	3	100
		Allied – 4	Statistics-I/ Basics of Accounting/ Human Resource Management	U21MA3ALT14/ U21CO3ALT04/ U21CO3ALT05	4	2	100
	IV	Major Skill Based Elective(MSBE) - 1	Aptitude Mathematics-I	U21MA3SBT01	2	1	100
		Non Major Elective – I	Non Major Elective – I	-	3	3	100
		Gender Studies	Gender Studies	U21WS3GST01	1	1	100
		Value Education	Ethics II/ Bible Studies II/ Catechism II	U21VE4LVE02/ U21VE4LVB02/ U21VE4LVC02/	1	-	-
	VI		Service Oriented Course			-	-
			Internship / Field Work/ Field Project 30 Hours -Extra Credit	U21SP3ECC03		2 (Extra Credit)	100
		Total			30	24+2	900+ 100

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	U21MA4MCT09	4	4	100
		Major Core – 10	Optimization Techniques –II	U21MA4MCT10	4	3	100
		Major Elective –2	Major Elective –2		4	3	100
		Allied – 5	Statistics-II/ Cost and Management Accounting/ Indian Financial System	U21MA4ALT15/ U21CO4ALT08/ U21CO4ALT09	4	2	100
		Allied – 6	Statistics-III / Financial Management/ Organizational Behaviour	U21MA4ALT16/ U21CO4ALT11/ U21CO4ALT12	4	2	100
	IV	Non Major Elective – 2	Non Major Elective – 2	-	3	3	100
		Value Education	Ethics II/ Bible Studies II/ Catechism II	U21VE4LVE02/ U21VE4LVB02/ U21VE4LVC02/	1	1	100
	VI		Service Oriented Course		-	2(Extra Credit)	-
			Internship / Field Work / Field Project 30 Hours -Extra Credit	U21SP4ECC04		2 (Extra Credit)	100
		Total			30	24+2+2	900+ 100

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
V	III	Major Core – 11	Linear Algebra	U20MA5MCT11	4	3	100
		Major Core – 12	Real Analysis- I	U20MA5MCT12	4	4	100
		Major Core – 13	Graph Theory	U20MA5MCT13	4	3	100
		Major Core – 14	Differential Equations , Laplace Transforms and Fourier Series	U20MA5MCT14	4	3	100
		Major Core – 15	Statistical Packages	U20MA5MCT15	4	3	100
		Major Elective – 3	Major Elective – 3		4	3	100
	IV	Major Skill Based Elective (MSBE)– 2	Aptitude Mathematics- II	U20MA5SBT02	2	1	100
		Non Major Elective – 3	Non MajorElective – 3		3	3	100
		Value Education	Ethics III / Bible Studies III / Catechism III	U20VE6LVE03/ U20VE6LVB03/ U20VE6LVC03	1	-	-
			Online Course	U20OC5ECT01	-	2(Extra Credit)	100
			Internship / Field Work / Field Project 30 Hours -Extra Credit	U20SP5ECC05		2 (Extra Credit)	100
		Total			30	23+2+2	800+ 200

Sem	Part	Component	Title of the course	Code	Hours /Week	Credits	Marks
VI	III	Major Core – 16	Real Analysis – II	U20MA6MCT16	5	5	100
		Major Core – 17	Complex Analysis	U20MA6MCT17	5	4	100
		Major Core – 18	Fuzzy Set Theory	U20MA6MCT18	5	4	100
		Major Core – 19	Discrete Mathematics	U20MA6MCT19	5	4	100
		Major Elective – 4	Major Elective – 4		4	3	100
	IV	Skill Based Course (SBC) – 3	Research Methodology	U20DS6SBC03	2	1	100
		Non Major Elective – 4	Non MajorElective – 4		3	3	100
		Value Education	Ethics III / Bible Studies III /Catechism III	U20VE6LVE03/ U20VE6LVB03/ U20VE6LVC03	1	-	100
	V	Extension Activity	RESCAPES – Impact Studyof Project			2(Extra Credit)	100
			Internship / Field Work /Field Project 30 Hours - Extra Credit	U20SP6ECC06		2(Extra Credit)	100
		Total			30	24+2+2	800+200
		GRAND TOTAL			180	140+18	5200+800

LIST OF ALLIED COURSES OFFERED BY THE DEPARTMENT

S.No	Sem	Part	Component	Title	Code	Hours	Credits	Marks
1	I	III	Allied 1	Mathematical Statistics – I (for Maths students)	U22MA1ALT01	4	2	100
2	I	III	Allied 1	Algebra , Calculus and Trigonometry (for Physics students)	U22MA1ALT02	4	2	100
3	I	III	Allied 1	Statistical Methods (for B.C.A and Computer Science students)	U22MA1ALT03	4	2	100
4	I	III	Allied 1	Basic Mathematics (for B.Voc. Software Development students)	U22MA1ALT04	4	2	100
5	I	III	Allied 1	Business Mathematics (for Commerce students)	U22MA1ALT05	4	2	100
6	I	III	Allied 1	Business Mathematics and Statistics (for Commerce Vocational &CA students)	U22MA1ALT06	4	2	100
7	I	III	Allied 1	Business Mathematics and Statistics for Managers (for BBA students)	U22MA1ALT07	4	2	100
8	I	III	Allied 2	Mathematical Statistics – II (for Maths students)	U22MA1ALT08	4	2	100
9	I	III	Allied 2	Analytical Geometry of Three Dimensions andVector Calculus (for Physics students)	U22MA1ALT09	4	2	100
10	II	III	Allied 3	Mathematical Statistics – III (for Maths students)	U22MA2ALT10	4	2	100

11	II	III	Allied 3	Laplace Transforms, Partial Differential Equations and Fourier Series (for Physics students)	U22MA2ALT11	4	2	100
12	II	III	Allied 3	Numerical Methods (for B.C.A and Computer Science students)	U22MA2ALT12	4	2	100
13	II	III	Allied 3	Statistics for Data Analytics (for B.Voc. Software Development students)	U22MA2ALT13	4	2	100
14	II	III	Allied 3	Business Statistics (for Commerce students)	U22MA2ALT14	4	2	100
15	III	III	Allied 4	Discrete Mathematics (for B.C.A and Computer Science students)	U21MA3ALT13	4	2	100
16	III	III	Allied 4	Statistics-I	U21MA3ALT14	4	2	100
17	IV	III	Allied 5	Statistics-II	U21MA4ALT15	4	2	100
16	IV	III	Allied 6	Statistics-III	U21MA4ALT16	4	2	100

LIST OF MAJOR ELECTIVE COURSES OFFERED BY THE DEPARTMENT

Sem	Part	Component	Title	Code	Hours	Credits	Marks
III	III	Major Elective - 1	Sci Programming/ Latex/ Design and Analysis of Algorithms	U21MA3MET01/ U21MA3MET02/ U21MA3MET03	4	3	100
IV	III	Major Elective -2	Sci Programming Practical/ Mathematical Modelling/ Basics of Data Analytics	U21MA4MEP04/ U21MA4MET05/ U21MA4MET06	4	3	100
V	III	Major Elective –3	R Programming/ Verbal Reasoning	U20MA5MET07/ U20MA5MET08	4	3	100

VI	**III**	**Major Elective –4**	**Python Programming/ Non-Verbal Reasoning**	**U20MA6MET09/ U20MA6MET10**	**4**	**3**	**100**

LIST OF NME COURSES OFFERED BY THE DEPARTMENT

Sem	Part	Component	Title	Code	Hours	Credits	Marks
III	**IV**	**Non Major Elective – 1**	**Aptitude Mathematics – I**	**U21MA3NMT01**	**3**	**3**	**100**
IV	**IV**	**Non Major Elective – 2**	**Aptitude Mathematics –II**	**U21MA4NMT02**	**3**	**3**	**100**
V	**IV**	**Non Major Elective – 3**	**Statistics – I**	**U20MA5NMT03**	**3**	**3**	**100**
VI	**IV**	**Non Major Elective – 4**	**Statistics – II**	**U20MA6NMT04**	**3**	**3**	**100**

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LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
B.Sc. MATHEMATICS
First Year - Semester – I

Course Title	**MAJOR CORE 1 – CALCULUS**
Code	**U22MA1MCT01**
Course type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**4**
Marks	**100**

CONSPECTUS

To make the students become familiar with the techniques of differentiation and integration and apply them to solve problems.

COURSE OBJECTIVES

1. To understand the methods of successive differentiation of various functions and formation of equations using derivatives.
2. To understand partial differentiation and application of Euler's theorem, Jacobian method.
3. To apply differentiation for finding radius, center of curvature, evolute and involute.
4. To understand the properties of definite integrals and applying reduction formula for a specific standard integrals and Bernoulli's formula.
5. To evaluate double and triple integral in cartesian coordinates

DIFFERENTIAL CALCULUS

UNIT I: DIFFERENTIATION 12 HRS

Successive Differentiation: The n^{th} derivatives of Standard result - Trigonometrical transformation of functions - Formation of equations involving derivatives – Leibnitz formula for the n^{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 II: PARTIAL DIFFERENTIATION 12 HRS

Partial differentiation – Total differential coefficient –Implicit functions - Homogeneous functions – Euler's Theorem (with proof) - Partial derivatives of a function of two functions – Jacobians (Problems of finding Jacobians only) – Applications of partial derivatives in electric circuits.

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

UNIT III: APPLICATION OF DIFFERENTIATION 12 HRS

Curvature: Circle, Radius and Center of Curvature - Cartesian Formula for the Radius of Curvature - Coordinates of the Center of Curvature- Evolute and Involute – Application of radius of curvature in designing roads.

Extra Reading/Key words*:* *Radius and center of curvature in polar coordinates*

INTEGRAL CALCULUS

UNIT IV: INTEGRATION **12 HRS**

Properties of definite integrals - Integration by parts - Reduction formulae for standard integrals - 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 V: MULTIPLE INTEGRALS **12 HRS**

Double Integrals in Cartesian coordinates - Change the order of Integration – Triple Integrals -Simple problems only– Application of multiple integrals in washer cross section

Extra Reading/ Keywords: *Cylindrical coordinates, Spherical coordinates, Tetrahedron, Order of integration*

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

TEXT BOOKS

Treatment and content as in

Narayanan.S and Manicavachagom Pillay .T.K (2013), **Calculus (Vol I &II),** S.Viswanathan(Printers and publishers), Chennai.

1. Calculus (Vol I) by S. Narayanan and T.K. Manicavachagom Pillay for Units I, II and III.

Unit I: Chapter III fully
Unit II: Vol I: Chapter VIII section 1.1-- 1.7
Vol II: Chapter VI :Sections 1.1 , 1.2 (Problems of finding Jacobians only)
Unit III: Chapter X: Sections 2.1 – 2.5

2. Calculus (Vol II) by S. Narayanan and T.K. Manicavachagom Pillay for Units IV and V
Unit IV: Chapter I - Sections 11, 12, 13 & 15.1

Unit V: Chapter V - Sections 1, 2.1, 2.2 & 4

SUGGESTED READINGS

1. P. Kandasamyand Thilagavathy(2004), **Mathematics (Vol. I),** S. Chand, New Delhi.
2. Thomas and Finney(2006), **Calculus,** 9th Edition, Pearson Education.
3. David V. Widder (2003), **Advanced Calculus ,** Prentice Hall of India, Delhi.
4. Piskunov.N (1996), **Differential and Integral Calculus (Vol I & II)**, Mir Publishers,Delhi.
5. Schaums Outline Series (2005) – **Theory and problems of Advanced Calculus.**

WEB REFERENCES

1. https://www.dummies.com/article/business-careers-money/business/economics/how-to-maximize- profit-with-derivatives-167048/
2. https://www.slideshare.net/AnugyaaShrivastava/real-world-applications-of-matrices-and-partial- differentiation
3. https://slideplayer.com/slide/9328868/
4. https://www.intmath.com/applications-differentiation/8-radius-curvature.php
5. https://bookdown.org/huckley/Physical_Processes_In_Ecosystems/1-6-calcint-applications.html
6. https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(OpenStax)/06%3A_Applicatio ns_of_Integration/6.0%3A_Prelude_to_Applications_of_Integration
7. https://fl01000126.schoolwires.net/cms/lib/FL01000126/Centricity/Domain/261/FDWK_3ed_Ch07_pp378-433.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 concept of differentiation, partial differentiation and integration.	**K1**
CO-2	Interrupt the various methods for solving problems in differentiation, partial differentiation and explain the properties of definite integrals and reduction formulas for standard integrals.	**K2**
CO-3	Illustrate radius and centre of curvature, evolute, double and triple integrals and realize their significance in global context.	**K3**
CO-4	Discriminate the techniques in differentiation and integration to infer the solution to real life problems	**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	H	H	M
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H

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B.Sc. MATHEMATICS
First Year - Semester – I

Course Title	**MAJOR CORE 2 – ANALYTICAL GEOMETRY OF THREE DIMENSIONS AND VECTOR CALCULUS**
Code	**U22MA1MCT02**
Course type	**Theory**
Semester	**I**
Hours / Week	**5**
Credits	**4**
Marks	**100**

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, vector integration and the idea of line, surface and volume integrals.

COURSE OBJECTIVES

1. To understand the concept of plane, angle between the planes, length of the perpendicular, line intersection of two given planes.
2. To understand different forms of straight line, coplanar lines, shortest distance between two lines and the equation of the shortest distance.
3. To understand the concept of sphere, intersection of two spheres, plane section of a sphere and the equation of the tangent plane to the sphere.
4. To applyvector differentiation to physics concepts.
5. To evaluate line integral surface integral and volume integral using vector integration and apply Gauss divergence theorem and Stokes theorem.

UNIT I: THE PLANE 15 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 the perpendicular- Planes bisecting the angle between the planes – Applications of intersection of two planes in thermal oxidation.

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

UNIT II:THE STRAIGHT LINE **15 HRS**

Different forms of equations of a straight line – The plane and the straight line – Coplanarline – The shortest distance between two lines – Equations of shortest distance – Application of coplanar lines in rectangular prism.

Extra Reading/ Keywords: *Geodesic, Equation of a line in polar coordinates, Secant lines,Euler line, Regular Tetrahedron*

UNIT III: SPHERE **15 HRS**

Equation of a sphere – Length of the tangent from a point – The plane section of a sphere -Intersection of two spheres - Equation of the tangent planes to the sphere – Application of intersection of sphere in Molecular Modelling.

Extra Reading/ Keywords: *Pencil of spheres, Hypersphere, Spherical cap, Circle of a sphere*

UNIT IV: VECTOR DIFFERENTIATION **15 HRS**

Derivatives of vector functions – Velocity and acceleration – Differential operators – Directional derivatives, gradient, divergence and curl – Solenoidal and Irrotational vectors- Application of divergence and curl in tubing down a river.

Extra Reading/ Keywords: *Vector calculus, Directional derivatives, Closed surface, Infinitesimal balls*

UNIT V: VECTOR INTEGRATION **15 HRS**

Line integrals – Work done by a force – Conservative field – Surface integral and its applications – Volume integral and its applications - Integral theorems (without proof) - Gauss divergence theorem, Stoke's theorem (simple problems only) – Application of stokes theorem.

Extra Reading/ Keywords: *Surface, Line integral, Curve, Scalar field, Vector field, Curl theorem, Riemann integral, Contour integration, Lebesgue integral theorem*

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

TEXT BOOKS

1. Treatment and content as in T.K. Manicavachagom Pillay, T. Natarajan (2016) A PRESCRIBED TEXT of **Analytical Geometry (Part II – Three Dimensions)** Viswanathan S (Printers and publishers),Chennai, for Units III , IV & V
UNIT I: Chapter II
UNIT II: Chapter III: Sec 1-8
(omit from 8.1)
UNIT III: Chapter IV

2. Treatment and content as in Dr. P. R. Vittal, Dr. V. Malini, (Reprint 2014) **VectorAnalysis,** For Units IV and V
Unit IV: Chapter 1
Unit V: Chapter 2 (excluding Green's Theorem)

SUGGESTED READINGS

1. Duraipandian .P, Laxmi Duraipandian & D. Mahilan(2004), **Analytical Geometry-Three Dimensional,** Emerald Publishers, Chennai.
2. T. K. Manickavasagam Pillayand 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.

WEB REFERENCES

1. https://www.chegg.com/homework-help/questions-and-answers/question-1-prove-angles-formed-following-miller-indices-planes-angle-100-110-45-b-angle-10-q35108296
2. https://www.toppr.com/guides/maths/shapes-and-angles/angles-in-real-life/
3. https://www.whitman.edu/mathematics/calculus_online/section01.01.html
4. http://paulbourke.net/geometry/circlesphere/
5. https://hal.archives-ouvertes.fr/hal-01955983/document
6. https://www.mtsu.edu/faculty/wding/files/divergence_and_curl.pdf
7. https://www.khanacademy.org/math/multivariable-calculus/greens-theorem-and-stokes-theorem/stokes-theorem-articles/a/stokes-theorem-examples#:~:text=Summary,orientation%20of%20the%20surface%20itself.
8. https://collegedunia.com/exams/coplanarity-of-two-lines-definition-conditions-and-solved-examples-mathematics-articleid-4771

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 plane, straight line, sphere ,vector differentiation and integration	**K1**
CO – 2	Derive the equations of three dimensional objects and identities of vector calculus.	**K2**
CO – 3	Solve the problems in three dimensional structures, divergence, gradient, curl, solenoidal , irrotational vectors ,line integral , surface integral and volume integral	**K3**
CO – 4	Structuring three dimensional models and vector valued functions to infer solutions for dayto day life problems.	**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	M	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

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B.Sc. MATHEMATICS
First Year - Semester – I

Course Title	**MAJOR CORE – 3: ALGEBRA AND TRIGONOMETRY**
Code	**U22MA1MCT03**
Course type	**Theory**
Semester	**I**
Hours / Week	**4**
Credits	**4**
Marks	**100**

CONSPECTUS

To enable the students to understand the techniques of solving algebraic equations and to expose the basic ideas of summation of series and number theory. To make the students familiar with expansion of trigonometric functions and Hyperbolic functions that facilitate ways of separating complex functions**.**

COURSE OBJECTIVES

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

ALGEBRA

UNIT I: THEORY OF NUMBERS 12HRS

Introduction – Divisors of a given number N – Euler's function Ø (N) – Highest power ofa prime p contained in n! – Congruences – Numbers in arithmetical progression – Fermat's theorem-Wilson's theorem – Lagrange's theorem (without proof) – Application of arithmetic progression in pyramid-like patterns.

Extra Reading/ Keywords: *Aliquot part of positive divisor, Euler's quotient function, Modular arithmetic*

UNIT II: SUMMATION OF SERIES 12HRS

Summation of Binomial, Exponential and Logarithmic series and approximation (Problems only) – Applications of binomial series in Statistical and Probability Analyses.

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

UNIT III: THEORY OF EQUATIONS **12HRS**

Relation between roots and coefficients – Symmetric functions of roots in terms of the coefficients –Sum of the powers of the roots of an equation- Newton's Theorem on the sumof the powers of the roots – Application of trajectories on projectiles and spacecrafts.

Extra Reading/ Keywords: *Fundamental theorem of algebra, Vieta's formulas, Newton's inequality, Roots of a Polynomial*

TRIGONOMETRY

UNIT IV: EXPANSIONS OF TRIGONOMETRIC FUNCTIONS **12HRS**

Expansions of Cosnθ, Sinnθ, Tannθ where n is a positive integer (excluding formation of equations); Expansions of $Cos^n\theta$, $Sin^n\theta$ in a series of sines and cosines of multiples of θ, (θ in radians) and expansion of Cos θ, Sinθ, tanθ in a series of powers of θ – Approximations and limits - Application of trigonometric functions in flight engineering.

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

UNIT V: HYPERBOLIC FUNCTIONS **12HRS**

Hyperbolic functions – Inverse hyperbolic functions, separation into real and imaginaryparts - Logarithm of complex numbers – General value of logarithm - Application of hyperbolic functions in catenoid.

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

TEXT BOOKS

1. Treatment and content as in **Algebra Volume II** byT.K. Manicavachagom Pillay, T.Natarajan, K.S. Ganapathy,(2008), S.Viswanathan (Printers and publishers),Chennai, For Unit I.

UNIT I: Chapter 5 fully

2. Treatment and content as in **Algebra Volume I** by T.K. Manicavachagom Pillay, T. Natarajan, K.S.Ganapathy, (2013),S.Viswanathan (Printers and publishers),Chennai, For Units II & III

UNIT II: Chapter 3 – Section 10 & 14 (Problems only)Chapter 4 – Sections 3 and 7 (Problems only)

UNIT III: Chapter 6– Sections 11 – 14

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&5.2

SUGGESTED READINGS

1. Arumugam, Thangapandi Issac, (2005) **Theory of Equations and Trigonometry,** NewGamma Publishing House, Delhi.
2. Kandasamy.P.Thilagavathy.K (2006), **Mathematics Vol- I,** S.Chand & Company,New Delhi.
3. Balasubrahmanyam P., Venkatachary P.R. ,Venkataraman G.R.(1992), **Text Book on Trigonometry** Published byRoc House & Sons, Chennai.
4. Narayanan. S, Manicavachagom Pillay.T.K,(2011), **Ancillary Mathematics –Volume I ,** S.Viswanathan (Printers and publishers),Chennai
5. Dr.P.R.Vittal & V.Malini(2016), **Algebra,** Margham Publications, Chennai

WEB REFERENCES

1. https://learn.careers360.com/maths/binomial-theorem-and-its-simple-applications-chapter/#:~:text=The%20binomial%20theorem%20is%20used,of%20equations%20in%20higher%20powers.
2. https://timefliesedu.com/2019/12/17/examples-of-real-life-arithmetic-sequences/
3. https://math.stackexchange.com/questions/123/real-world-uses-of-hyperbolic-trigonometric-functions
4. 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-K4)
CO – 1	Enumerate the notion of theory of numbers and trigonometric functions.	**K1**
CO – 2	Demonstrate the properties of numbers, nature of the series and expansions of trigonometric and hyperbolic functions.	**K2**
CO – 3	Utilize the concepts of theoryof equations and expansions of trigonometric functions to solve problems.	**K3**
CO – 4	Infer the solutions for real life problem using theoryof equations and trigonometric functions.	**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	M	H
CO-2	H	H	H	M	H	L	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

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 from the academic year 2022-23 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)
B.Sc. MATHEMATICS
First Year - Semester – I

Course Title	**ALLIED 1: MATHEMATICAL STATISTICS – I**
Code	**U22MA1ALT01**
Course type	**Theory**
Semester	**I**
Hours / Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To understand the various methods of collection of data and representing them through diagrams and graphs. 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.
2. To analyze various measures of dispersion.
3. To understand to correlate data and fit into a linear regression curve.
4. To evaluate index number using Laspeyre's, Fisher's methods, Aggregate expenditure methodand family Budget method.
5. To analyze time series with respect to different variation.

UNIT I: COLLECTION, CLASSIFICATION, TABULATION AND PRESENTATIONOF DATA 12 HRS

Definition of Statistics – collection of data- primary and secondary data – classification and tabulation of data- Diagrammatic and graphic representation- Applications to business management.

Extra Reading/ Keywords: *Business statistics, Measures of central tendency, Descriptivestatistics, Economics.*

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

Dispersion - Range- calculation of Quartile deviation, Mean Deviation, standard deviation, coefficient of variation, concept of skewness, kurtosis and their measures, moments for frequency distributions- Applications in industry and education.

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

UNIT III : CORRELATION AND REGRESSION 12 HRS

Simple Correlation – rank correlation – regression equation and regression coefficient-- Applications in medical diagnosis (Error analysis, Concurrent deviation method, correlation of time series in chapter 12 omitted and standard error of estimate in chapter 13).

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-Applications in measuring the changes in price level and forecasting future economic activity.

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- Applications to weather forecasting.

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 seminars.

TEXT BOOK

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

UNIT I: Chapter 1,4,6,7 & 8
UNIT II: Chapters 10 and 11
UNIT III: Chapter 12 and 13 (Omit "Error analysis, Concurrent deviation method,correlation of time series in chapter 12 and standard error of estimate in chapter 13 ")
UNIT IV: Chapter 14 (other methods in weighted aggregate type omitted - Unit and Circulartests omitted - Splicing and deflating indexes omitted)
UNIT V: Chapter 15 (Ratio to trend and ratio to moving averages methods omitted)

SUGGESTED READINGS

1. Arora .S, Sumeet Arora (2002), **Comprehensive Statistical Methods,** S.Chand andCompany Ltd ,New Delhi.
2. Douglas A.Lind ,William G.Marchall ,Samuel A. Wathen (2003), **Basic Statistics forBusiness and Economics,** Mc Graw Hill, Delhi.
3. Gupta .S.C, Indra Gupta (2004), **Business Statistics,** Himalaya Publishing House,New Delhi.
4. Gupta .S.P (2006), **Statistical Methods,** Sultan Chand & Sons, New Delhi.
5. Sharma J.K, (2006), **Business Statistics,** Dorling Kindersley, (India) Pvt Ltd, Licensees of Pearson Education in South Asia.

WEB REFERENCES

1. **https://resource.cdn.icai.org/46683bosfnd-p3-cp14.pdf**
2. **https://resource.cdn.icai.org/46684bosfnd-p3-cp15-u1.pdf**
3. **https://www.statology.org/linear-regression-real-life-examples/**
4. **https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc41.htm**
5. **https://www.aptech.com/blog/introduction-to-the-fundamentals-of-time-series-data-and-analysis/**
6. **https://resource.cdn.icai.org/46689bosfnd-p3-cp19-u1.pdf**

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO – 1	Define basic statistical concepts, measures of dispersion, correlation and regression, time series components and index numbers.	**K1**
CO – 2	Identify the method of collecting primary and secondary data. Calculate coefficient of correlation, regression, price, quantity index numbers, trend and seasonal variations in time series.	**K2**
CO – 3	Solve the problems related to measures of averages, dispersion, correlation, regression, index numbers and time series.	**K3**
CO – 4	Analyze the different types of index numbers and the methods of fitting linear and non-linear models for time series data to forecast business related problems.	**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	L	M	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	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	H	H	H

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LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
First Year - Semester – I

Course Title	**ALLIED 1:ALGEBRA,CALCULUS AND TRIGONOMETRY (For Physics Students)**
Code	**U22MA1ALT02**
Course type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

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 evaluate double and triple integrals in Cartesian coordinates
4. To evaluate the expansions of trigonometric functions as multiple of θ and a series ofpowers of θ
5. To understand hyperbolic function, inverse hyperbolic function and separation into real and imaginaryparts.

UNIT I : ALGEBRA **12 HRS**

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

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

UNIT II: DIFFERENTIAL CALCULUS **12 HRS**

Leibnitz formula for the n^{th} derivative of product - Curvature – circle, radius and center of curvature – Cartesian formula for the radius of curvature - Theco-ordinates of the center of curvature-Evolute and involute – Application of involute in tooth thickness.

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

UNIT III : MULTIPLE INTEGRALS **12 HRS**

Reduction formulae: $\int_0^{2} \sin^n x\, dx, \int_0^{\pi} 2 \cos$, $\int 2 \int_0^{\pi} \sin^n x \cos^n x\, dx$ (Problems only) - Introduction to evaluation of double and triple (in Cartesian only) integrals (Change of order of integration excluded) - Application of multiple integrals in washer cross section.

Extra Reading/ Keywords: *Hyper volumes, cylindrical coordinates, Divergence theorem, transcendental function*

UNIT IV: EXPANSIONS OF TRIGONOMETRIC FUNCTIONS **12 HRS**

Expansions of cosnθ, sinnθ and tannθ (n being a positive integer)–Expansions of and $cos^n\theta$ in a series of sines and cosines of multiples of θ (n being a positive integer and θin radians) – Expansions of sinθ, cosθ and tanθ in a series of powers of θ (Formation of equations excluded) – Application of trigonometric functions in flight engineering.

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

Treatment and content as in

1. Narayanan.S, Manicavachagom Pillay. T.K, (2011), **Ancillary Mathematics – Volume I** , S.Viswanathan (Printers and publishers),Chennai for Units I, IV and V.
   UNIT I : Chapter3 : Sec3.4
   UNIT IV : Chapter 5: Sec5.1–5.3(Excluding Approximations)
   UNIT V : Chapter 5:Sec5.4
2. S.Narayanan and T. K.Manickavasagam Pillay (2013), **Calculus Volume I**, S.Viswanathan (Printers& Publishers) Pvt. Ltd. Reprint 2011.

   UNIT II : Chapter 3 : Sec 2.1, 2.2

   Chapter 10 : Sec2.1– 2.5
3. Treatment and content as in Narayanan.S,Manicavachagom Pillay.T.K, (2013), **Calculus-Volume II**, S.Viswanathan (Printers and publishers), Chennai for Unit III.
   UNIT III : Chapter 1: Sec 13.1–13.5
   Chapter 5: Sec 1,2.1,2.2 (change of order of integration omitted) (Problems only)
   Sec4 (change of order of integration omitted) (Problems only)

SUGGESTED READINGS

1. Aggarwal.S,(2000), **Algebra-I,** S.Chand & Company(Pvt) Ltd., NewDelhi.
2. BalasubrahmanyamP.,VenkatacharyP.R.,VenkataramanG.R.(1992), **Text Book on Trigonometry**, Published byRocHouse & 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.tec-science.com/mechanical-power-transmission/involute-gear/calculation-of-involute-gears/
3. https://www.mathnasium.com/real-life-applications-of-trigonometry
4. https://fl01000126.schoolwires.net/cms/lib/FL01000126/Centricity/Domain/261/FDWK_3ed_Ch07_pp378-433.pdf
5. https://math.stackexchange.com/questions/123/real-world-uses-of-hyperbolic-trigonometric-functions

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
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, multiple integrals and expansions of trigonometric functions.	**K3**
CO-4	Examine the Eigen value and Eigen vectors using Cayley Hamilton theorem and inspect multiple integrals in Cartesian coordinates and trigonometric functions.	**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	L	H	H	H	H	H
CO-2	H	H	H	L	H	H	H	H	H
CO-3	H	H	H	M	H	M	H	H	H
CO-4	H	H	H	M	H	M	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

(For Candidates admitted from the academic year 2022-23 onwards)

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CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
First Year - Semester – I

Course Title	**ALLIED 1: STATISTICAL METHODS (For B.C.A and Computer Science students)**
Code	**U22MA1ALT03**
Course type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

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 byusing 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, Chand and 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, 12th 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 inMathematical 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-K4)
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**

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

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

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

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002
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CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
First Year - Semester – I

Course Title	**ALLIED 1-BASIC MATHEMATICS (for B.Voc. Software Development students)**
Code	**U22MA1ALT04**
Course Type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To get the basic knowledge about matrices and to solve simple problems in matrix, Differentiation and to acquire the knowledge of problem solving ability, understand the linear programming technique.

COURSE OBJECTIVES

1. To find the rank of a matrix and solving simultaneous linear equation.
2. To understand eigen values and corresponding eigenvectors of a given matrix
3. To enumerate the successive differentiation of variables
4. To discuss Trigonometrically transformation of functions;
5. To apply Simplex Method, Two Phase Simplex Method to solve problems in Linear Programming.

UNIT I: MATRIX **12Hrs**

Matrices – Rank of a matrix – Solving simultaneous linear equation in three unknownsusing Elementary Operations method - Application of Matrices in Computer graphics.

Extra Reading /Keywords*:* *Fourier Transform*

UNIT II: EIGEN VALUES AND EIGEN VECTORS **12Hrs**

Eigen values and Eigen vectors – Verification of Cayley Hamilton theorem - Application ofeigen values and vectors to systems of first order differential equations.

Extra Reading /Keywords*:* *Eigen values for similar matrices*

UNIT III: SUCCESSIVE DIFFERENTIATION **12Hrs**

The nth derivatives of Standard result - Trigonometrically transformation of functions - Application of differentiation in business management.

Extra Reading /Keywords*:* *Tangents and Normal*

UNIT IV :LEIBNITZ FORMULATION **12Hrs**

Formation of equations involving derivatives - Leibnitz formula for the nth derivative of a product - Related problems -Application of Leibnitz formula in the field of Optimization.

Extra Reading /Keywords : *Higher derivatives*

UNIT V: LINEAR PROGRAMMING **12Hrs**

General LPP – Canonical and Standard Forms of LPP – The Computational Procedure – Simplex Method - Two Phase Simplex Method - Application of Linear programming in Transportation Optimization.

Extra Reading /Keywords*:* *Resource Optimization*

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

TEXT BOOKS

1. Engineering Mathematics, Vol.-I, 2000 Edition, S. Arumugam, A.Thangapandi Isaac,A.Somasundaram.
   UNIT I and II : Chapter 4- sec 4.0 – 4.4
2. T.K. Manicavachagom Pillay and Others, Calculus Volume-I, S. Viswanathan Publishers Pvt Ltd. (2004).
   UNIT III and IV: Chapter 3
3. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand and Sons Publishers, New Delhi, 1992.
   UNIT V: Chapter 3 (3.4, 3.5), Chapter 4 (4.1, 4.3 except Big-M Method)

SUGGESTED READINGS

1. P. Prem Kumar Gupta and D.S. Hira, **Operations research**, S. Chand (2000).
2. J.K. Sharma, **Operations Research Theory and Applications**, Macmillan India Ltd. (2000).
3. M.D. Raisinghania, **Ordinary and Partial Differential Equations**, S. Chand & Co. (2010).
4. M.L. Khanna, **Differential Equations**, Jai Prakash Nath and Co. (2004)
5. Devi Prasad **Advanced Calculus**, Prentice Hall of India Learning Pvt. Ltd. (2009).

WEB REFERENCES :

1. https://byjus.com/maths/application-of-matrices/
2. https://www.cpp.edu/~manasab/eigenvalue.pdf
3. https://www.dummies.com/article/business-careers-money/business/economics/how-to-maximize-profit-with-derivatives-167048/
4. https://byjus.com/maths/applications-of-trigonometry/
5. https://commerceiets.com/linear-programming-applications/#gsc.tab=0

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO- 1	Recognize the basics of Matrix Operations and calculus ideas.	K1
CO- 2	Demonstrating the concept of successive differentiation, Leibnitz formula.	K2
CO- 3	Apply the various techniques to solve real life problems.	K3
CO- 4	Analyze the methods to infer optimized solution through differentiation and Linear programming problem	K4

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

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 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 – I

Course Title	**ALLIED 1: BUSINESS MATHEMATICS (For Commerce Students)**
Code	**U22MA1ALT05**
Course type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To make the students become familiar with the basic concepts of mathematics relevant to business and managerial skills.

COURSE OBJECTIVES

1. To understand mathematical finance, simple and compound interests, depreciation and discounting.
2. To understand matrices and test for consistency of equation using matrices.
3. To apply differentiation for finding marginal functions, elasticity, maxima and minima.
4. To evaluate initial basic feasible solution to transportation problem.
5. To evaluate assignment problem using Hungarian algorithm.

UNIT I: MATHEMATICS OF FINANCE **12 HRS**

Mathematics of finance – Simple interest – Compound interest – Depreciation – discounting (Excluding Effective and nominal rate of interest in section 5, Annuities , Sinking Fund and Amortisation Table)- Application of Depreciation in Capital Asset pricing model.

Extra Reading/ Keywords: *Financial modeling, Black-Scholes model, Fundamental theorem of asset pricing*

UNIT II: MATRICES **12 HRS**

Matrices - inverse of a matrix - rank of a matrix –Test for Consistency of equations.(Excluding Algebra of Matrices, Determinants and also Input – Output Analysis)- Application of matrices in designing 3D Games

Extra Reading/ Keywords: *Eigen values, Eigen vectors, Matrix inversion method*

UNIT III: APPLICATIONS OF DIFFERENTIATION **12 HRS**

Application of derivatives –marginal functions –elasticity–increasing and decreasing functions –maxima and minima.

Extra Reading/ Keywords: *Rolle's Theorem, Arc elasticity, Critical number, Newton's method*

UNIT IV: TRANSPORTATION PROBLEM 12 HRS

Transportation problem – Initial basic feasible solution – North West Corner rule – Vogel's Approximation method – Matrix minima method (optimal solution excluded)- Application of transportation problem in route planning.

Extra Reading/ Keywords: *Modified Distribution, Sequencing problem, Job sequencing problem, Game theory*

UNIT V: ASSIGNMENT PROBLEM 12 HRS

Assignment problem (Travelling salesman problem excluded)- Application of Assignment problem in Education domain.

Extra Reading/ Keywords: *Travelling Salesman problem, Quadratic assignment problem, Secretary problem, Hungarian method*

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

TEXT BOOKS

Treatment and content as in

1. Navaneetham P.A.(2012) , **Business Mathematics and Statistics** ,Jai Publishers, Trichy, forUnits I , II and III.

UNIT I : Chapter 2 - Section -1 to 6 and 10

UNIT II: Chapter 4 - Section 9,10,11

UNIT III: Chapter 7 - Section 1 to 4

2. KantiSwarup, Gupta P.K, Man Mohan (2020), **Operations Research,** Sultan Chand & Sons,New Delhi, for Units IV and V.

UNIT IV: Chapter 10 (Omit Sec 10.4,10.6,10.7,10.10 to 10.17)
UNIT V : Chapter 11 (Omit Sec 11.5 to 11.7)

SUGGESTED READINGS

1. Vittal. P.R (2004), **Business Mathematics** , Margham Publishers, Chennai.
2. Aggarwal. D.R (2005), **Business Mathematics,** Miranda Publications, New Delhi.
3. Sancheti D.C, Kapoor V.K(2014), **Business Mathematics,** S.Chand & Co, New Delhi.
4. Gupta P.K, Hira D.S(2003), **Problems in Operations Research,** S.Chand & Co, NewDelhi.
5. HamdyTaha (2005), Operations Research, Prentice Hall of India, New Delhi.

WEB REFERENCES

1. https://ijpam.eu ; https://www.scirporg
2. https://www.embibe.com
3. https://www.quora.com
4. https://www.sidmartinbio.org
5. https://www.sciencedirect.com ; https://www.researchgate.com

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 Mathematics of finance, Differentiation, Transportation and Assignment Problem.	**K1**
CO-2	Interpret the methods to test the consistency of a equation and optimal schedule of a given problem by suitable algorithms.	**K2**
CO-3	Illustrate the concepts of differentiation to estimate marginal functions, elasticity, maxima and minima, optimization techniques of linear programming to solve problems.	**K3**
CO-4	Infer the solutions of simple and compound interest, matrices, optimization techniques for the problems relevant to business.	**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	H	L	L	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	H	H	H
CO-2	H	H	M
CO-3	H	H	H
CO-4	H	H	H

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002
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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
First Year - Semester – I

Course Title	**ALLIED 1: BUSINESS MATHEMATICS AND STATISTICS (For Commerce Vocational and CA Students)**
Code	**U22MA1ALT06**
Course type	**Theory**
Semester	**I**
Hours / Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To acquire the knowledge on application of derivatives, Transportation and Assignment problem and various statistical tools which enables them to compute various problems in business sectors.

COURSE OBJECTIVES

1. To applydifferentiation for finding marginal function, elasticity, maxima and minima
2. To evaluate initial basic feasible solution to transportation and assignment problems
3. To understand various method of collection of data and its representation through graphs.
4. To illustrate various measures of dispersion and correlation
5. To evaluate Index numbers using Laspeyre's, Fisher's methods, Aggregate Expenditure method and family Budget method

UNIT I: APPLICATIONS OF DIFFERENTIATION 12 HRS

Application of derivatives –marginal functions –elasticity –increasing and decreasing functions –maxima and minima

Extra Reading/ Keywords: *Rolle's Theorem, Arc elasticity, Critical number, Newton's method*

UNIT II: TRANSPORTATION AND ASSIGNMENT PROBLEM 12 HRS

Transportation Problem –North-West Corner Rule –Matrix minima method-Vogels approximation method (only initial basic feasible solution) –Assignment Problem – Hungarian method-Application of transportation and assignment problem in Business and Industries,

Extra Reading/ Keywords: *Modified Distribution, Sequencing problem, Job sequencing problem, Game theory*

UNIT III: COLLECTION AND PRESENTATION OF DATA 12 HRS

Statistics –meaning and scope –collection of data –classification and tabulation – diagrams andgraphs –histogram-polygon –cumulative frequency curves- Application of Statistics in Finance and Marketing.

Extra Reading/ Keywords: *Ogive curve, Glaciology, Pareto chart, Ethnography*

UNIT IV : MEASURES OF DISPERSION AND CORRELATION 12 HRS

Measures of dispersion –range, quartile deviation, mean deviation, standard deviation, coefficient of variation-merits demerits –Karl Pearson's coefficient of correlation, Rank correlation- Application of Dispersion and correlation in the field of Economics.

Extra Reading/ Keywords: *Lorenz curve, Skewness, Kurtosis, Method of moments, Bowley'sco-efficient*

UNIT V: INDEX NUMBERS 12 HRS

Index Numbers – Laspeyer's, Fisher's and Paasche's Index Numbers- Tests for IndexNumbers- Cost of living Index Number - Uses of Index Numbers- Application of Index numbers in the field of Marketing.

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

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

TEXT BOOKS

1. Navanitham PA. **Business Mathematics and Statistics** (2009), for **Unit I**.
2. Kanti Swarup, Gupta P.K , Manmohan(2017), 19th Edition, **Operations Research ,**SultanChand, New Delhi for **Unit II.**
3. Pillai R.S.N , Bagavathi .V (2007) **Statistics**, S.Chand and Company, New Delhi for**Units III , IV and V**

SUGGESTED READINGS

1. Kanti Swarup, Gupta PK., Man Mohan (2019), **Operations Research- Introduction to Management Science,** Sultan Chand Publishers, New Delhi.
2. Hamdy Taha A (2019), **Operations Research- An Introduction to Research,** Prentice Hallof India, New Delhi. 10th Edition, Pearson Paperback.
3. Gupta, Hira (1989), **Operations Research,** S.Chand Publishers, New Delhi.
4. SC Gupta, Kapoor VK,(2020), **Fundamentals of Mathematical Statistics,** Sultan Chand & Sons, 12th Edition, New Delhi.
5. Chaudhary Ray, Sharma (2017), **Mathematical Statistics,** Ram Prasad Publications, Agra.
6. Gupta Vikas, Gupta SC., Gupta Sanjeev Kumar (2019), **Problems and Solutions in Mathematical Statistics,** Sultan Chand & Sons Publishers, New Delhi.

WEB REFERENCES

1. https://www.researchgate.net
2. https://www.researchgate.net ; https://journals.plos.org
3. https://studiousguy.com
4. https://www.sciencedirect.com ; https://study.com
5. https://www.youarticlelibrary.com

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Recall various methods of collection of data, classify, tabulate andinterpret thedata through diagramsand graphs	**K1**
CO-2	Illustrate various Transportation Methods, Hungarian Method of Assignment, Measures of Central Tendency, Dispersion, Co efficient of variation	**K2**
CO-3	Apply the concept of differentiation in Marginal functions, Elasticity and Maxima and Minima of functions and Choose an appropriate type 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**

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

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 onwards)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002
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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
First Year - Semester – I

Course Title	**ALLIED 1:BUSINESS MATHEMATICS AND STATISTICS FOR MANAGERS (For BBA Students)**
Code	**U22MA1ALT07**
Course type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To impart the knowledge of the basic concepts of mathematics relevant to businessand managerial skills.

COURSE OBJECTIVES

1. To understand mathematical finance, simple and compound interests, Depreciation and Discounting.
2. To apply differentiation for finding marginal functions, elasticity, maxima and minima.
3. To understand various method of collection of data and its representation through diagramsand graphs.
4. To understand the various measures of dispersion.
5. To illustrate the correlation variables and test the variable using chi square test.

UNIT I : MATHEMATICS OF FINANCE 12 HRS

Mathematics of finance–Simple interest–Compound interest–Depreciation– Discounting (Excluding Effective and nominal rate of interest in section 5, Annuities, Sinking Fund and Amortisation Table) Application of Depreciation in Business.

Extra Reading/ Keywords: *Financial modeling, Black-Scholes model, Fundamental theoremof asset pricing*

UNIT II: APPLICATIONS OF DIFFERENTIATION 12 HRS

Application of derivatives–marginal functions–elasticity–increasing and decreasing functions–maxima and minima.

Extra Reading/Keywords: *Rolle's Theorem, Arc elasticity, Critical number, Newton'smethod*

UNIT III: COLLECTION AND PRESENTATION OF DATA 12 HRS

Statistics–meaning and scope–collection of data–classification and tabulation–Diagrams and Graphs – Measures of Central Tendency (Mean, Median, Mode)- Application of classification andtabulation in Census Analysis

Extra Reading/Keywords: *Ogive curve, Glaciology, Pareto chart, Ethnography*

UNIT IV:MEASURES OF DISPERSION **12 HRS**

Measures of dispersion–Range–Quartile deviation-Mean deviation-Standard deviation, Coefficient of variation- Application of variation in the field of Share marketing

Extra Reading/Keywords: *Lorenz curve, Skewness, Kurtosis, Method of moments*

UNIT V: CORRELATION AND CHI-SQUARE **12 HRS**

Correlation - Karl Pearson's coefficient of correlation - Rank correlation – Chi square test – Test of Goodness of fit–Test of Independence - Application of correlation in Analyzing survey responses.

Extra Reading/Keywords: *Bowley's co-efficient, Goodness of fit in regression analysis*

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

TEXT BOOKS

Treatment as in

1. Navaneetham P.A.(2012) , **Business Mathematics and Statistics** ,Jai Publishers, Trichy,for Units I and II.

   UNIT I : Chapter 2 - Section -1 to 6 and 10

   UNIT II: Chapter 7 - Section 1 to 4

2. Vittal .P.R (2020) **, Business Statistics** Margham Publishers, Chennai

   UNIT III: Chapter 1 to 5 (Exclude Geometric mean, Harmonic mean , Quartiles and Deciles)

3. Pillai R.S.N , Bagavathi .V (2018) **Statistics**, S.Chand and Company,New Delhi

   UNIT IV: Chapter 10

   UNIT V : Chapter 12 (Exclude Error, Concurrent deviation and Correlation of Time series)
   Chapter 21 (Exclude Yate's correction ,Test of Homogeneity)

SUGGESTED READINGS

1. Arora.S,Sumeet Arora(2002), **Comprehensive Statistical Methods,** S.Chand and Company Ltd, New Delhi.
2. Douglas A. Lind, Williamg Marchall, Samuel A.Wathen(2003), **Basic Statistics for Business and Economics,** Mcgraw Hill, Delhi.
3. Gupta.S.C, Indra Gupta(2004), **Business Statistics,** Himalaya Publishing House, New Delhi.
4. Gupta.S.P(2006), **Statistical Methods,** Sultan Chand &Sons, New Delhi.
5. Sharma J.K,(2006), **Business Statistics,** Dorling Kindersley, (India) Pvt Ltd, Licenses of Pearson Education.

WEB REFERENCES

1. https://www.researchgate.net ; https://www.econstor.eu
2. https://www.toppr.com
3. https://www.toppr.com
4. https://www.asianindex.co.in
5. https://towardsdatascience.com

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 mathematical finance, applications of differentiation, collection and presentation of statistical data, measures of dispersion, correlation and chi-square tests.	**K1**
CO-2	Outline the concepts of collection and presentation of statistical data through diagrams and graphs.	**K2**
CO-3	Extend the concept of differentiation to estimate marginal functions, elasticity, maxima and minima and make use of the concepts of measures of central tendencyin dispersion, correlation and chi-square test.	**K3**
CO-4	Categorize the measures of dispersion and correlation and examine the chi-square test in the test of goodness of fit and test of independence.	**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	L	H	H	H	H	H
CO-2	H	H	H	L	H	H	H	H	H
CO-3	H	H	H	M	H	M	H	H	H
CO-4	H	H	H	M	H	M	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

(For Candidates admitted from the academic year 2022-23 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)
B.Sc.MATHEMATICS
First Year - Semester – I

Course Title	**ALLIED 2 : MATHEMATICAL STATISTICS – II**
Code	**U22MA1ALT08**
Course type	**Theory**
Semester	**I**
Hours/Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To make the students understand various characteristics of discrete and continuous statistical distributions with mathematical techniques.

COURSE OBJECTIVES

1. To understand probability, conditional probability and its axioms.
2. To understand discrete and continuous random variable and its properties and properties of two dimensional random variable.
3. To evaluate expectation and variance and its relevant theorems.
4. To evaluate binomial distribution Poisson distribution and their properties.

UNIT I: PROBABILITY **12 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 - Baye's theorem, Independent Events. (Problems Only)- Application of Conditional probability in Insurance and Politics.

Extra Reading/ Keywords: *Stock market, Tree diagram, Mutually exclusive*

UNIT II: RANDOM VARIABLES **12 HRS**

Discrete and continuous random variable - Cumulative distributive function - properties of distribution function - Function of a random variable - Two dimensional random variable- Joint probability function - Marginal probability distribution - Conditional probability distribution - Independent random variables- Application of Random variables in Civil and Electrical Engineering.

Extra Reading/ Keywords: *Multinomial Distribution, Compound marginal distribution, Probability distribution fitting*

UNIT III: EXPECTATION AND VARIANCE 12 HRS

Expectation of a random variable - Expectation of a function of a random variable- Properties of expectation

Variance – Definition - Theorems on variance - Tchebychev's inequality - Application of expectation and Variance in Machine Learning.

Extra Reading/ Keywords: *Berry-Esseen Theorem, Equioscillation theorem, Moment of inertia, Population variance*

UNIT IV: DISCRETE DISTRIBUTIONS 12 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 - Poisson distribution as limiting form of binomial distribution – Moments - Recurrence formula for moments - Moment generating function – Mode- Application of Discrete distribution in Testing a Drug, Estimate the number of fraudulent transactions.

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

UNIT V – CONTINUOUS DISTRIBUTION 12 HRS

Normal Distribution – Definition – Moments - Moment generating function - Linearity property -Mean deviation - Mode - Properties of normal distribution.(Points of inflection and normal probability integral are excluded)- Application of Continuous distribution in Technical Stock Market in Economy.

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

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

TEXT BOOKS

Treatment and content as in Vittal .P.R (2002), **Mathematical Statistics,** Margham Publishers, Chennai.

Unit I	-	Chapter 1 (Theorems without proof)
Unit II	-	Chapter 2
Unit III	-	Chapters 3 and 4
Unit IV	-	Chapters 12 and 13
Unit V	-	Chapters 16 (Points of inflection and normal probability integral are excluded).

SUGGESTED READINGS

1. Arora .S,Sumeet Arora (2002), **Comprehensive Statistical Methods,** S. Chandand Company Ltd ,New Delhi.
2. Gupta .S.C, Kapoor.V.K (2002), **Fundamentals Of Mathematical Statistics,** Sultan Chand& Sons , New Delhi.
3. Gupta .S.P (2006), **Statistical Methods,** Sultan Chand & Sons ,New Delhi.
4. J. N. Kapur, H. C. Saxena(2003), **Mathematical Statistics,** S.Chand & CompanyLtd, New Delhi.
5. S. G. Venkatachalapathy, Dr. H.Premraj(2015), **Statistical Methods,** Margham Publications, Chennai.

WEB REFERENCES

1. https://www.upgrad.com/blog/conditional-probability-explained/
2. https://www.slideshare.net/EngrHabiburRehmanCha/applications-of-random-variable
3. https://en.wikipedia.org/wiki/Expected_value#Uses_and_applications
4. https://studiousguy.com/binomial-distribution-examples/
5. https://studiousguy.com/real-life-examples-normal-distribution/

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 probability, random variables, expectation and variance, discrete and continuous distributions.	**K1**
CO-2	Illustrate the axioms of probability, random variables, expectation and variance, discrete and continuous distributions.	**K2**
CO-3	Determine the solution for real life problem by applying the concepts of probability, random variables, expectation and variance, discrete and continuous distributions.	**K3**
CO-4	Categorize the real life problem and infer the solution using probability, random variables, expectation and variance, discrete and continuous distributions.	**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	H	H	H	H	H
CO-2	H	H	H	M	H	H	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	H	H	H
CO-2	H	H	H
CO-3	H	H	H
CO-4	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)
First Year - Semester – I

Course Title	**ALLIED 2: ANALYTICAL GEOMETRY OF THREE DIMENSIONS AND VECTOR CALCULUS(For Physics Students)**
Code	**U22MA1ALT09**
Course type	**Theory**
Semester	**I**
Hours / Week	**4**
Credits	**2**
Marks	**100**

CONSPECTUS

To make the students familiar with the basic concepts of three dimensional geometry,Vector differentiation, vector integration and excel in solving related problems in physics.

COURSE OBJECTIVES

1. To understand direction cosines and direction ratios, the plane and its standard forms
2. To understand equation of line, co planarityof lines, skew lines and shortest distance between them.
3. To understand sphere and section of sphere bya plane.
4. To applydifferentiation of vectors to find curl and divergence
5. To demonstrate line integral, surface integral and volume integrals and apply Gauss and Stoke'stheorem to solve the problems related to Physics.

UNIT I: PLANE **12 HRS**

Direction Cosines – Direction ratios – Angle between two lines - The Plane – The general equation of the plane – Standard forms of equations of planes- Application of plane in theory of flight.

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

UNIT II: STRAIGHT LINES **12 HRS**

Equation of a line - Equation of the line of shortest distance (Cartesian only) – Coplanarityof Straight lines - Skewlines – Shortest distance between two skewlines- Application of coplanar lines in Rectangular prism.

Extra Reading/ Keywords: *Geodesic, Equation of a line in polar coordinates, Secantlines ,Euler line, Regular Tetrahedron*

UNIT III: SPHERE **12 HRS**

Sphere - General equation – Tangent planes – Section of a sphere bya plane – Sphere through a given circle- Application of Intersection of sphere in MolecularModelling.

Extra Reading/ Keywords: *Pencil of spheres, Hypersphere, Spherical cap, Circle of a sphere*

UNIT IV: DIFFERENTIATION OF VECTORS **12 HRS**

Velocity – Acceleration – Scalar and vector fields – Gradient, Divergence and curl –Application of Differentiation of vectors in the field of Engineering.

Extra Reading/ Keywords: *Relative velocity, Group velocity, Escape velocity, Curl inthree dimensions, Co vector, Tensor field*

UNIT V: VECTOR INTEGRATION **12 HRS**

Line integral – Surface integral – Volume integral – Application of Gauss and Stoke's theorems (Statement only) simple problems- Application of surface integral in Fluid Dynamics.

Extra Reading/ Keywords: *Path independence, Manifold, Inverse square law, Gauss's law for gravity*

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. Manicavachagom Pillay. T.K, Natarajan T (2016) , **A Prescribed Text of Analytical Geometry (Part II – Three Dimensions),** S.Viswanathan (Printers and publishers),Chennaifor Unit I , II & III

UNIT I : Chapter 1 & 2
UNIT II : Chapter 3 (Sections 1 to 8)
UNIT III: Chapter 4

2. P.R. Vittal , V.Malini (2014), **Vector Calculus, Fourier Series and Fourier Transforms,** MarghamPublications, Chennai for Unit IV & V.

UNIT IV: Chapter 1
UNIT V: Chapter 2

SUGGESTED READINGS

1. Duraipandian .P, Laxmi Duraipandian & D.Mahilan(1990) , **Analytical Geometry,** Emerald Publishers, Chennai.
2. Duraipandian.P, Laxmi Duraipandian, (1998) , **Vector Analysis** , Emerald Publishers Chennai.
3. Dr . M.K. Venkatraman. **Engineering Mathematics (Third year – Part B)**
4. A.R. Vasishtha, Dr. R. K. Gupta J. P. Chauhan,, **Analytical Geometry of ThreeDimensions,** Krishna Prakashan Media
5. Jerrold Franklin(2020), **Understanding Vector Calculus: Practical development and solved problems,** Kindle edition

WEB REFERENCES

1. https://www.sciencedirect.com
2. https://www.vendantu.com
3. https://studiousguy.com ; https://www.cuemath.com
4. https://www.quora.com
5. https://link.springer.com

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 plane, straight line, sphere, vector differentiation and integration.	**K1**
CO-2	Describe the three dimensional geometric structures and vector calculus	**K2**
CO-3	Construct the equations of three dimensional structures and interpret vector differentiation and vector integration to the problems related to Physics	**K3**
CO-4	Examine the three dimensional models and vector valued function and provide the solution to real world problems	**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	L	H	L	H	H	H
CO-2	H	H	H	L	H	L	H	H	H
CO-3	H	H	H	M	H	H	H	H	H
CO-4	H	H	H	M	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 from the academic year 2022-23 onwards)

Course Title	MAJOR CORE 4: NUMERICAL METHODS AND ITS APPLICATIONS
Code	U22MA2MCT04
Course type	Theory
Semester	II
Hours / Week	5
Credits	4
Marks	100

CONSPECTUS

To make the students know about different methods of solving numerical equations and differential 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 using numerical methods.
3. To understand numerical differentiation and integration and evaluate finite integrals using Trapezoidal and Simpson's rule.
4. To apply finite difference to evaluate polynomial using interpolation for equal and unequal intervals.
5. To analyse numerical solution to ordinary differential equations using direct method.

UNIT I : SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: 15 HRS

Introduction - Bisection Method - The Method of False Position -Iteration Method - Newton -Raphson Method - Applications to solving nonlinear equations in Chemical Engineering.

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

UNIT II: SOLUTION OF LINEAR SYSTEMS OF EQUATIONS: 15 HRS

Solution of simultaneous linear algebraic equations – Direct methods – Gauss elimination method –Gauss- Jordan method – Iterative methods – Jacobi method – Gauss-Seidal method - Solving linear system of equations by Gauss elimination and Gauss Seidal method in Chemical and industrial Engineering**.**

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

UNIT III: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:

15 HRS

Introduction – Boundary Value Problems, Finite – Difference Method, Solution by Taylor's series, Euler's method, Modified Euler's method, Runge-Kutta method- Applications of solving ordinary differential equations using Eulers and Runge kutta method.

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

UNIT IV: INTERPOLATION **15 HRS**

Introduction -Finite Differences, Forward and Backward differences only, Newton's formula for interpolation, Interpolation formulae, Interpolation with unevenly spaced points, Lagrange's interpolation formula- Application of Lagrange interpolation in engineering fields.

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

UNIT V: NUMERICAL DIFFERENTIATION AND INTEGRATION: **15 HRS**

Introduction - Numerical differentiation, Maximum and minimum values of a tabulated function, Numerical integration – Trapezoidal rule, Simpson's 1/3-rule- Application of Numerical integration in computer engineering.

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

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO – 1	Recognize the various concepts in numerical methods.	**K1**
CO – 2	Derive numerical methods for several mathematical operations such as interpolation, differentiation, integration, solutions of linear, nonlinear and differential equations.	**K2**
CO – 3	Illustrate the various numerical techniques in computing solution algebraic and transcendental equations, differentiation, integration, differential equations and implement it for solving diverse engineering problems.	**K3**
CO – 4	Categorize the problem arising in real life situations, to establish mathematical model and use appropriate numerical methods to infer the solution.	**K4**

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

TEXT BOOK

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

UNIT I: Chapter 2 - Sec. 2.1 to 2.5

UNIT II: Chapter 7 - Sec.7.1, 7.5, 7.5.1, 7.5.2, 7.5.3, 7.5.4, 7.6

UNIT III: Chapter 8 - Sec 8.1, 8.2, 8.4, 8.4.1, 8.5 8.10, 8.10.1

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, 6.3, 6.4, 6.4.1 and 6.4.2

SUGGESTED READINGS

1. Dr. M.K. Venkataraman(2017), **"Numerical Methods in Science and Engineering**", National Publishing House, Chennai
2. A.Singaravelu (2008), **"Engineering Mathematics -Numerical Methods",** Meenakshi Publishers,Chennai
3. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram (2010), **"Numerical Methods"**, Scitech Publishers ,Chennai
4. M.K.Jain, S.R.K.Iyengar, R.K.Jain (2012), **"Numerical Methods For Scientific And Engineering Computation",** New Age International Publishers, New Delhi.
5. Steven Chapra , Raymond Canale (2016),**"Numerical Methods for Engineers"**, McGraw Hill Education India Private Limited, Uttar Pradesh.

WEB REFERENCES

1. http://numericalmethods.eng.usf.edu/
2. https://nm.mathforcollege.com/
3. https://www.showme.com/sh/?h=bkzczGC
4. https://people.clas.ufl.edu/kees/files/MAD4401PracticeProblems.pdf
5. https://www.sjsu.edu/me/docs/hsu-Chapter%2010%20Numerical%20solution%20methods.pdf

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

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 from the academic year 2022-23 onwards)

Course Title	MAJOR CORE 5: STATICS
Code	U22MA2MCT05
Course type	Theory
Semester	II
Hours / Week	4
Credits	4
Marks	100

CONSPECTUS

To enable the students to enhance the concepts of types of forces, moments, couples, friction Equilibrium of strings and excel in solving the related real life problems.

COURSE OBJECTIVES

1. To understand the concept of equilibrium of forces and related theorems.
2. To describe parallel forces and moments.
3. To demonstrate the equilibrium of three forces acting on a rigid body.
4. To categorize the various types of friction and deduce the conditions for equilibrium of a particle under the frictional force.
5. To analyze the equilibrium of strings and its application to catenary.

UNIT I: EQUILIBRIUM OF FORCES 12 HRS

Force – Types of Forces – Equilibrium – Forces acting at a point Parallelogram of forces – Triangle of forces - Polygon of forces - Lami's theorem – Resolution of a force – Composition of forces – Resultant – Conditions of equilibrium - Application of Lami's theorem.

Extra Reading/ Keywords*: Translational and Rotational equilibrium.*

UNIT II: PARALLEL FORCES 12 HRS

Parallel Forces – Like and Unlike parallel forces – Resultants – Moment of a force about a point - Varigon's Theorem on Moments – Principle of Moments – Moment of a force aboutan axis-Applications of Principle of Moments.

Extra Reading/ Keywords*: Center of gravity of simple uniform bodies*

UNIT III: THREE FORCES ACTING ON A RIGID BODY 12 HRS

Three forces acting on a rigid body: Rigid body subjected to any three forces – Three coplanar forces – Two trigonometrical theorems useful in the solution of statical problems– Problem solving- Applications of coplanar forces.

Extra Reading/ Keywords*: Coplanar forces*

UNIT IV: FRICTION **12 HRS**

Introduction – Statical, Dynamical and limiting friction – Friction – Coefficient of friction –Angle of friction – Cone of friction – Equilibrium of a particle on a rough inclined plane.- Problems involving the force of friction- Applications of frictions.

Extra Reading/ Keywords*: Centre of gravity*

UNIT V: EQUILIBRIUM OF STRINGS **12 HRS**

Equilibrium of strings – Common catenary – equations – tension at any point – geometrical properties – Parabolic catenary – Suspension Bridge- Applications of tension and spring.

Extra Reading/ Keywords*: Equilibrium of uniform homogeneous strings*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO – 1	Recall the concepts of forces with their types, equilibrium of forces, Moments, Parallel forces, Coplanar forces, Friction, angle of friction and equilibrium of strings.	**K1**
CO – 2	Discuss the geometrical properties of forces, Principle of Moments, the resultant of parallel forces acting on a rigid body, equilibrium of a particle on a rough inclined plane and common catenary.	**K2**
CO – 3	Illustrate the conditions of Parallelogram of forces, triangle of forces, polygon of forces, resolution of force, equilibrium of three forces acting on a rigid body, frictional forces and Parabolic catenary.	**K3**
CO – 4	Analyzing the real life applications of Lami's theorem, Principle of Moments, coplanar forces, frictions, Suspension Bridge, tension and spring.	**K4**

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

TEXT BOOKS

Treatment and content as in Dr. M.K. Venkataraman(2013), **"Statics",** Agasthiar Publications, Trichy.

Unit: I - Chapters 1 & 2
Unit: II – Chapters 3
Unit III- Chapter 5
Unit IV -Chapter 7
Unit: V – Chapter 11

SUGGESTED READINGS

1. A.V.Dharmapadam(1993), **"Statics"** , S.Viswanathan Printers and Publishing Pvt.,Ltd,.
2. P.Duraipandian and Laxmi Duraipandian(1985), **"Mechanics"** , S.Chand and Company
3. Ltd, RamNagar, New Delhi -55.
4. Dr.P.P.Gupta(1983-84), **"Statics"**, Kedal Nath Ram Nath, Meerut,.
5. K.Viswanatha Naik& M.S.Kasi(1992), **"Statics**", Emerald Publishers.
6. N.P. Bali(1992), **"Statics**", Golden Mathematics Series, Laxmi publications.

WEB REFERENCES

1. https://www.brainkart.comt
2. https://www.toppr.com
3. https://www.study.com
4. https://study.com
5. https://www.basicmathematics.com

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

PO – CO MAPPING

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

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

(For Candidates admitted from the academic year 2022-23 onwards)

Course Title	**MAJOR CORE 6: PROGRAMMING IN C**
Code	**U22MA2MCT06**
Course type	**Theory**
Semester	**II**
Hours / Week	**5**
Credits	**4**
Marks	**100**

CONSPECTUS

To introduce the concepts of C language which will enable them to write programmes for numerical methods.

COURSE OBJECTIVES

1. To understand basic concepts of C language.
2. To apply the basic concepts of C in real-time applications using decision making and control Statements.
3. To understand user defined function and Recursion.
4. To analyze Arrays and its types, Structures and Unions.
5. To understand file management and I/O operations on file.

UNIT-I: INTRODUCTION 15 HRS

Constants, variables, data types, symbolic constants - operators and expressions – types of operators - evaluation of expressions - reading and writing a character - formatted input and output –handling of character strings-operations on strings-string handling functions.

Extra Reading/Keywords*: Basic structures of C*

UNIT-II: DECISION MAKING AND CONTROL STATEMENTS 15 HRS

Decision making and branching - Using IF, IF-ELSE, Nesting of IF-ELSE statements -ELSE-IF ladder - Switch statement - the conditional operator - GOTO statement – Decision making and looping-the WHILE, DO, FOR statements.

Extra Reading/Keywords*: Concise test expressions*

UNIT -III: USER DEFINED FUNCTIONS 15 HRS

User defined functions - the form of C functions - Return values and their types - calling a function - category of functions - no arguments and no return values - Arguments but no return values - Arguments with return values - Nesting of functions - Recursion -the scope and lifetime of variables in functions.

Extra Reading/Keywords*: Functions in arrays*

UNIT-IV: ARRAYS , STRUCTURES AND UNIONS: 15 HRS

Arrays - one dimensional, two dimensional, multi-dimensional arrays.
STRUCTURES AND UNIONS:
Introduction – Defining a Structure-Declaring StructureVariables– Accessing Structure Members-Structure Initialization-Arrays of Structures-Arrays within Structures – Structures within Structures-Structures and Functions–Unions.

Extra Reading/Keywords*:* *Create Programs using Arrays.*

UNIT-V: POINTERS AND FILE MANAGEMENT 15 HRS

Introduction - Understanding Pointers- Accessing the Address of a Variable -Declaring and Initializing Pointers.
FILE MANAGEMENT**:** File management- Defining and opening a file-Closing a file - I/O operations on files

Extra Reading/Keywords*:* *Implement the system and file concepts using Pointers*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Identify the basic concepts of C language and Identify and Examine the effective ways to solve the problems	K1
CO-2	Summarize and associate the correct identifiers, keywords, operators and control structures to solve the problem with reduced complexity and to promote reusability	K2
CO-3	Describe the problem, compare the appropriate pre-build functions, procedures and create customized coding sequence to solve the problem effectively	K3
CO-4	Analyze the real world problem to solve them using the programming skills and apply the skills for further knowledge updating and Employability	K4

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

TEXT BOOKS

E. Balagurusamy (2017), **"Programming in ANSI C",** Fifth Edition McGraw Hill Publishing Company, New Delhi
UNIT - I: Chapters 2,3,4 and 8
UNIT - II: Chapters 5 and 6
UNIT-III: Chapters 9
UNIT-IV: Chapter 7,10
UNIT-V: Chapter 11,12

SUGGESTED READINGS

1. C-V.Rajaraman (2020) , **"Programming in C-Schaum's Series".**

2. Yashavant Kanetkar (2020), **"Let Us C: Authentic Guide To C Programming Language"** 17 Th Edition: BPB Publications, New Delhi

3. Herbert Schildt (2017), **"C: The Complete Reference"**, McGraw Hill Education , New Delhi.

WEB REFERENCES

https://www.guru99.com/c-programming-language.html
https://www.tutorialspoint.com/cprogramming/index.htm
https://www.freecodecamp.org/news/the-c-beginners-handbook/
https://www.programiz.com/c-programming https://www.learn-c.org/

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

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 onwards)

Course Title	ALLIED 3 : MATHEMATICAL STATISTICS – III
Code	U22MA2ALT10
Course type	Theory
Semester	II
Hours / Week	4
Credits	2
Marks	100

CONSPECTUS

To facilitate students to apply the acquired theoretical knowledge from statistical methods and tests of significance that is used at different stages of a research and in real-life problems.

COURSE OBJECTIVES

1. To impart the fundamental concepts in sampling theory, Chi-square test, Student t test and F test and their properties.
2. To understand estimators and method of maximum likelihood.
3. To understand Large samples and Small samples and evaluate test of hypothesis using t , chi-square distribution and F distribution.
4. To prepare students in handling sample surveys.
5. To investigate various sampling techniques and understand their goodness and flaws.

UNIT I: SAMPLING DISTRIBUTION (Chi Square, t, F Distribution) 12 HRS

Sampling Distribution - Chi Square Distribution – Student t Distribution – Limiting form of t-Distribution - Properties - F Distributions- Application of sampling Distribution for hypothesis testing.

Extra Reading/Key words*: Sampling variability, non-central chi-squared distribution,Robust parametric modeling.*

UNIT II: ESTIMATION 12 HRS

Point Estimation - Cramer-Rao Inequality - Rao-Blackwell theorem – Most efficient estimator - Consistent estimator - Sufficient estimator - Method of moments - Method of Maximum likelihood. (Minimum Chi Square estimators and Interval estimation are excluded)- Applications of Cramer – Rao inequality to investigate some problems of the minimax theory of estimation.

Extra Reading/Key words*: Multi variate case of cramer rao, method of moments lognormal distribution, mean squared error version.*

UNIT III: TEST OF HYPOTHESIS FOR LARGE SAMPLES 12 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- Test for a specified standard deviation of the population – Test of significance for correlation coefficient. (Test for equality of two standard deviations, Confidence interval, Confidence limits for population mean and proportions – Determination of sample space are excluded) – Enormous research applications for large sample size in a wide variety of scientific and social science fields.

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

UNIT IV: SMALL SAMPLES – t TEST AND CHI SQUARE TEST 12 HRS

t Test: Test for a specified mean – Test of significance for the difference between two population means when population standard deviations are not known –
t Test for paired observations-(Confidence interval for small samples excluded).

Chi square Test – Definition, Test for a specified population variance - Test of independence of attributes (Chi square distribution theorem excluded)- Applications of Chi Square Distribution in Sports Analytics..

Extra Reading/Key words*: Pearson's correlation coefficient, Goodness of fit in regression analysis.*

UNIT V: SMALL SAMPLES – F TEST 12 HRS

Test of Equality of two population variances - Analysis of variance – One-Way Classification and Two-Way classification. Applications of F test in data analytics.

Extra Reading/Key words*: F-test regression, Lack-of-fit sum of squares*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Retrieve the essential of sampling theory, Chi-square test, Student t test and F test, estimators and the method of maximum likelihood.	**K1**
CO-2	Categorize the given samples using different sampling techniques for solving the problems in large and small samples.	**K2**
CO-3	Illustrate the t test, Chi square and F distribution in large and small samples and determine unbiased estimates and confidence limits of population parameters.	**K3**
CO-4	Discriminate the techniques in samples to infer the solution to real life problems.	**K4**

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

TEXT BOOKS

Treatment and content as in

Vittal .P.R(2002,Reprint 2009), Mathematical Statistics, Margham Publications,Chennai.

UNIT : I - Chapter 22
UNIT : II - Chapter 23 (omit page nos : 23.61 – 23.66)
UNIT : III - Chapter 24 (omit page nos : 24.43 – 24.55)
UNIT : IV - Chapter 25 (omit page nos : 25.42 – 25.45),
Chapter 27 (omit page nos : 27.36 – 27.38, 27.44 - 27.46)
UNIT : V - Chapter 26.

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), Fundamentals of Mathematical Statistics, Sultan Chand& Sons, New Delhi.
3. Gupta .S.P (2006), Statistical Methods, Sultan Chand & Sons ,New Delhi.
4. J. N. Kapur, H. C. Saxena(2003), Mathematical Statistics, S.Chand & Company Ltd, New Delhi.
5. S. G. Venkatachalapathy, Dr. H.Premraj(2015), Statistical Methods, Margham Publications, Chennai.

WEB REFERENCE :

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
3. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004032240235420anoop_singh_Test_of_Significance_for_Large_and_Small_Samples.pdf
4. https://mgkvp.ac.in/Uploads/Lectures/13/4572.pdf
5. https://egyankosh.ac.in/bitstream/123456789/20554/1/Unit-11.pdf
6. https://opentextbc.ca/introductorybusinessstatistics/chapter/f-test-and-one-way-anova-2/
7. https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_hypothesistesting-chisquare/bs704_hypothesistesting-chisquare_print.html
8. https://www.vedantu.com/formula/f-test-formula

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

PO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 onwards)

Course Title	ALLIED 3 : LAPLACE TRANSFORMS, PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES (For Physics Students)
Code	U22MA2ALT11
Course type	Theory
Semester	II
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

To expose the students to Laplace and inverse Laplace transforms, standard forms of partial differential equations, second order linear partial differential equations with constant coefficients and Fourier series and enable them to inculcate the habit of problem solving.

COURSE OBJECTIVES

1. To understand the concept of Laplace transform.
2. To apply Inverse Laplace transform for solving ordinary differential equation with constant coefficient.
3. To understand the concept of partial differential equation and finding the General, Particular, Complete and Singular integral of partial differential equation.
4. To understand second order partial differential equation and its application.
5. To evaluate full range Fourier series and half range Fourier series.

UNIT I: LAPLACE TRANSFORMS 12HRS

Laplace transforms of the functions e^{at}, e^{-at}, cosat, sinat, t^n, e^{-at}cosbt, e^{-at}sinbt, $e^{-at}t^n$, $f'(t)$, $f''(t)$,$f^n(t)$ (where n is a positive integer)- Applications of Laplace transforms .

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

UNIT II: INVERSE LAPLACE TRANSFORMS 12 HRS

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

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

UNIT III: PARTIAL DIFFERENTIAL EQUATIONS 12 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+F(p,q),Lagrange's equations Pp+Qq=R -Applications of Partial Differential Equations.

Extra Reading/Keywords *: Quasi linear equations, Linear heat equation and wave equation.*

UNIT IV: SECOND ORDER PARTIAL DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS **12 HRS**

Second order linear partial differential equations with constant coefficients(simple problems only)- Application of second order linear partial differential equations with constant coefficients .

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

UNIT V: FOURIER SERIES **12 HRS**

Full Range Fourier series[In the range$(0,2\pi)$and$(-\pi,\pi)$]– Half range cosine and sine series (Excluding change of intervals)-Applications of Fourier series in signals and systems.

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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO–1	Recognize the concepts of Laplace transforms, Inverse Laplace transforms, Partial Differential Equations ,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 partial differential equations.	**K2**
CO–3	Demonstrate the idea of Laplace Transforms, Inverse Laplace transforms, Partial differential equations, full and half range 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)

TEXT BOOKS

1. For Units I, II and III

Treatment and content as in Narayanan.S,Manicavachagom Pillay.T.K,(2006), "**Calculus–Volume III",** S.Viswanathan(Printers and publishers),Chennai.

Unit I : Chapter 5 : Sec 1-5
Unit II : Chapter 5 : Sec 6 - 8
Unit III : Chapter 4 : Sec 1 -5.4,6

2. For Unit IV:

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

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

3. For Unit V:

Treatment and content as in Narayanan.S,Manicavachagom Pillay.T.K,(2006), "**Calculus–Volume III",** S.Viswanathan(Printers and publishers),Chennai.

Unit V : Chapter 6 : Sec 1- 5.2

SUGGESTED READINGS

1. Arumugam.S,ThangapandiIssac.A,Somasundaram.A,(2002),**Engineering Mathematics,Vol III,** Scitech Publishers, Chennai
2. Zafar Ahsan(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.

WEB REFERENCES:

1. https://www.irjet.net
2. https://www.studybug.com
3. https://www.qb365.in
4. https://vedantu.com
5. https://math.stackexchange.com

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

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	L	L	H	H	H
CO-2	H	H	H	M	M	M	H	H	H
CO-3	H	H	H	M	M	M	H	H	H
CO-4	H	H	H	H	M	M	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 from the academic year 2022-23 onwards)

Course Title	ALLIED 3: NUMERICAL METHODS (for BCA and B.Sc. Computer Science students)
Code	U22MA2ALT12
Course type	Theory
Semester	II
Hours / Week	4
Credits	2
Marks	100

CONSPECTUS

To make the students know about different methods of solving numerical equations and differential 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 solutionof a system of linear equations using numerical methods.
3. To analyze numerical solution to ordinary differential equations using direct method.
4. To apply finite difference 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 - The Method of False Position -Iteration Method - Newton -Raphson Method-Applications of Newton Raphson method.

Extra Reading/ Keywords*: Rolle's theorem, Taylor's series for a function of one variable*

UNIT II: SOLUTION OF LINEAR SYSTEMS OF EQUATIONS 12 HRS

Introduction – Gaussian elimination, Gauss – Jordan, Gauss -Seidel and Gauss Jacobi methods-Applications of Linear equations.

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-Applications of Differential equations.

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, Interpolation formulae, Interpolation with unevenly spaced points, Lagrange's interpolation formula-Applications of Interpolation.

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-Applications of Numerical differentiation.

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.

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)

TEXT BOOK

S.S. Sastry (Fourth Edition, April 1995), **Introductory Methods of Numerical Analysis,** New Age Publishing Company.

UNIT I: Chapter 2 - Sec. 2.1 to 2.5

UNIT II: Chapter 6 - Sec.6.1, 6.3 ,6.3.1,6.3.2,6.3.3,6.4

UNIT III: Chapter 7 - Sec 7.1, 7.2. 7.4, 7.4.2, 7.5.

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 5 - Sec. 5.1 ,5.2, 5.4, 5.4.1 and 5.4.2

SUGGESTED READINGS

1. A. Singaravelu (2008), **Engineering Mathematics - Numerical Methods**, MeenakshiPublishers,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 REFERENCE

1. **https://en.wikipedia.org/wiki/Numerical_analysis**
2. **https://www.sciencedirect.com/topics/engineering/numerical-method**
3. **https://nptel.ac.in/courses/111/107/111107105/**
4. **https://www.math.hkust.edu.hk/~machas/numerical-methods.pdf**

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

PO – CO MAPPING

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

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 from the academic year 2022-23 onwards)

Course Title	ALLIED – 3:STATISTICS FOR DATA ANALYTICS B.Voc. (SOFTWARE DEVELOPMENT)
Code	U22MA2ALT13
Course Type	Theory
Semester	II
Hours/Week	4
Credits	2
Marks	100

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 analyze the properties of distribution, marginal probability distribution and conditional probability distribution.
3. To apply test of hypothesis for large samples.
4. To evaluate the test statistic using t tests and F tests.
5. To analyze test of independence of attributes and test for specified population variance.

UNIT-I: STATISTICS AND DATA ANALYTICS 12HRS

INTRODUCTION TO DATA ANALYTICS: Role of statistics and the data analysis Process - **DESCRIPTIVE STATISTICS**: Collection of Data - Primary and Secondary data – Classification and tabulation of data- Diagrammatic and graphical representation of data (Excluded: Ogive curve & Graphof time series). Application of Collection of Data in Business Management.

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

UNIT-II: RANDOM VARIABLES 12HRS

Discrete and continuous random variable - cumulative distributive function - properties of distribution function - function of a random variable -two dimensional random variable - joint probability function - marginal probability distribution - conditional probability distribution - Independent random variables. Application of Random variables in Statistics.

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

UNIT-III: 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 - Application of hypothesistesting in Textile Engineering.

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

UNIT-IV:TEST OF HYPOTHESIS USING t AND F TEST 12HRS

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

Small Samples- F Test:

Test of Equality of two population variances - Analysis of variance - one way& two way classifications.Application of one way Anova in real life.

Extra Reading /Keywords*: Null and Alternative hypothesis*

UNIT-V:TEST OF HYPOTHESIS FOR CHI-SQUARETEST 12HRS

Chi square Test – definition, additive property, Pearson's Statistics, Uses of Chi-square test-test of independence of attributes-test for a specified population variance. Application of Chi square test in Business Analytics.

Extra Reading /Keywords*: Application of regressions in data science*

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

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 andgraphs, characterization of random variables, test of significance with mean and populations.	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 for a specified population variance in Chi-square.	K4

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

TEXT BOOKS

1. Roxy Peck, Chris Olsen, Jay Devore, (2008) „„„INTRODUCTION TO STATISTICS AND DATA 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 And Company, New Delhi

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

3. Treatment and content as in Vittal .P.R (2002), MATHEMATICAL STATISTICS, Margham Publishers, Chennai.

UNIT II : Chapter 2
UNIT III : Chapter 24 (Omit page : 24.44– 24.62)
UNIT IV: Chapter 25 (Omit pages : 25.33 -25.45), Chapter 26
UNIT V : Chapter 27

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 Company Ltd, 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://resource.cdn.icai.org/46683bosfnd-p3-cp14.pdf
2. https://personal.utdallas.edu/~scniu/OPRE- 6301/documents/Random_Variables_Applications.pdf
3. https://www.intechopen.com/chapters/82651
4. https://www.statology.org/anova-real-life-examples/
5. https://www.academia.edu/33800575/Application_of_Chi_Square_Test_in_Business_Analytics

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

PO – CO MAPPING

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

PSO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 onwards)

Course Title	ALLIED 3: BUSINESS STATISTICS (For Commerce Students)
Code	U22MA2ALT14
Course type	Theory
Semester	II
Hours / Week	4
Credits	2
Marks	100

CONSPECTUS

To enable the students to be familiar with the basic statistical concepts related to business applications and to provide statistical techniques for business data analysis.

COURSE OBJECTIVES

1. To understand various methods of collection of data and represent them through diagrams.
2. To apply various measures of central tendency and dispersion.
3. To statistically analyze the strength of relationship between variables using correlation and regression methods.
4. To understand time series data, components of time series and its applications to various fields.
5. To understand the basic problems in the construction of index numbers and to know various types of index numbers.

UNIT I: COLLECTION AND PRESENTATION OF DATA 12 HRS

Meaning – Scope – Importance and Limitations of Statistics - Collection of Data - Classification and Tabulation - Diagrammatic representation - Applications to Business Management.

Extra Reading/Key words: *Functions and distrust of statistics, Graphic representation.*

UNIT II: MEASURES OF AVERAGES AND DISPERSION 12 HRS

Arithmetic Mean, Weighted – Geometric Mean – Harmonic Mean – Merits and demerits –Median – Quartiles and Deciles – Mode - Measures of Dispersion - Range - Quartile Deviation - Mean Deviation - Standard Deviation - Relative measures - Applications in Industry and education.

Extra Reading/Key words: *Chariler's Accuracy check, Combined mean and standard deviation.*

UNIT III : CORRELATION AND REGRESSION 12 HRS

Correlation - Scatter Diagram - Karl Pearson's Coefficient of Correlation - Rank Correlation - (Correlation of a bivariate frequency distribution and Coefficient of concurrent Deviation to be excluded)Regression - Properties, Regression lines and problems- Applications in Medical diagnosis.

Extra reading words: *Least square method, Concurrent deviation method.*

UNIT IV : ANALYSIS OF TIME SERIES **12 HRS**

Time Series - components of Time Series - measurement of trend - measures of seasonal variation(Methods of simple averages and Link relatives only) – problems (Deseasonalization is excluded)- Applications to weather forecasting.

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

UNIT V : INDEX NUMBERS **12 HRS**

Index Numbers – Laspeyer's, Fisher's and Paasche's index numbers- tests for Index Numbers - cost of living Index Number - uses of Index Numbers- Applications in measuring the changes in price level and forecasting future economic activity.

Extra Reading/ Keywords: *Base Shifting, Order reversal test, Zero-based budget, Cash-Only budget.*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO – 1	Define basic statistical concepts, measures of dispersion, correlation and regression, time series components and index numbers.	**K1**
CO – 2	Identify the method of collecting primary and secondary data. Calculate coefficient of correlation, regression, price, quantity index numbers, trend and seasonal variations in time series.	**K2**
CO – 3	Solve the problems related to measures of averages, dispersion, correlation, regression, index numbers and time series.	**K3**
CO – 4	Infer the different types of index numbers and the methods of fitting linear and non-linear models for time series data to forecast business related problems.	**K4**

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

TEXT BOOK

Treatment and content as in Vittal .P.R (2004) , **BUSINESS STATISTICS,** Margham Publishers, Chennai.

UNIT I - Chapters 1 to 4
UNIT II - Chapters 5,6
UNIT III - Chapters 8, 9
UNIT IV - Chapter 12
UNIT V - Chapter 13

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, Indra Gupta (2004) , **Business Statistics**, Himalaya Publishing House,New Delhi.
5. Gupta .S.P (2006), **Statistical Methods**, Sultan Chand & Sons, New Delhi.
6. Sharma J.K, (2006), **Business Statistics**, Dorling Kindersley, (India) Pvt Ltd, Licenses of Pearson Education in South Asia.

WEB REFERENCES

1. https://resource.cdn.icai.org/46683bosfnd-p3-cp14.pdf
2. https://resource.cdn.icai.org/46684bosfnd-p3-cp15-u1.pdf
3. https://www.statology.org/linear-regression-real-life-examples/
4. https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc41.htm
5. https://www.aptech.com/blog/introduction-to-the-fundamentals-of-time-series-data-and-analysis/
6. https://resource.cdn.icai.org/46689bosfnd-p3-cp19-u1.pdf

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

PO – CO MAPPING

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

(For Candidates admitted from the academic year 2022-23 onwards)

Course Title	Part – IV: INDUSTRIAL RELATION-DYNAMICS OF INDUSTRIAL RELATIONS
Code	U22MA2IRT01
Course type	Theory
Semester	II
Hours / Week	1
Credits	1
Marks	100

CONSPECTUS

To enable the students to understand the concepts and the basic issues involved in industrial relation.

COURSE OBJECTIVES

1. Remember and understand the concept of industrial relation
2. Understand the methods of settling industrial disputes.
3. Understand the characteristics of Indian labour and conditions of labour.
4. Understand the factors influencing collective bargaining units and levels.
5. Remember the Problems of trade unions and trade union movement in India.

UNIT – I INTRODUCTION TO INDUSTRIAL RELATIONS

Industrial relations – concepts- importance of industrial relations – Scope and aspects of industrial relations – Factors affecting Industrial Relations – Dunlop's industrial Relation system – Characteristics of the Indian IR system – Industrial Relations in India.

Extra Reading/Key words: *Industrial Relation in other countries*

UNIT – II INDUSTRIAL DISPUTES

Industrial disputes – meaning – methods of settling industrial disputes – settlement under the influence of the state – Different methods of disputes settlements in India – procedurefor the settlement of industrial disputes.

Extra Reading/Key words: *Dispute settlement: case study*

UNIT – III EMPLOYMENT AND INDIAN LABOUR

Introduction – industrialization – post independence industrialization – post – liberalization trends – characteristics of Indian labour conditions of labour – recent employment trends.

Extra Reading/Key words: *Success stories of countries with industrialization*

UNIT – IV COLLECTIVE BARGAINING

Meaning - importance - factors influencing bargaining units and levels – subject matters of collective of bargaining – Collective Agreements – Hurdles to collective bargaining in India.

Extra Reading/Key words: *Case study of success stories*

UNIT –V TRADE UNION

Trade Union – definition – concept – features – types and structure of trade unions – Problems of trade unions – Trade union movement in India.

Extra Reading/Key words: *Case study of successful Trade Unions*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K4)
CO-1	Explain the concepts industrial relation.	**K1**
CO-2	List out the methods of settling industrial disputes.	**K2**
CO-3	Describe the characteristic of Indian labour and conditions of labour.	**K3**
CO-4	Explain the factors influencing collective bargaining units and levels.	**K4**

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

SUGGESTED READINGS

1. Ratna sen(2011), "**Industrial Relation**" Macmillan publishers India Ltd.,

2. P.R.N. Sinha, India Balasinha, seema priyadarshini shekhar(2004), "**Industrial Relations ,Tradeunions, and labour legislation"**, Pearson Education (Singapore) pvt. Ltd.,

3. D.K. Lal Das(1983), "**Industrial Relations in India"**, S. Chand and company Ltd,

4. Mamoria, Gankar(2003), **"Dynamics of industrial Relations"**, Himalaya publishing house.

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

(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
Second Year - Semester – III

Course Title	**MAJOR CORE 7: DYNAMICS**
Code	**U21MA3MCT07**
Course type	**Theory**
Semester	**III**
Hours/ Week	**4**
Credits	**4**
Marks	**100**

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 12 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 12 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 – Velocityof the projectile– Simple problems-Application of Projectile.

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

UNIT III: PROJECTILE ON INCLINED PLANE 12 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 **12 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 **12 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– 6.1to 6.11
Unit: III– Chapter VI–6.12to6.17
Unit: IV – Chapter VII – 7.1 to 7.5, Chapter VIII - 8.1to 8.8
Unit: V– Chapter X– 10.1to 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 Company Ltd,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.

WEB REFERENCES

1. https://opentextbc.ca/openstaxcollegephysics/chapter/further-applications-of-newtons-laws-of- motion
2. https://opentextbc.ca/universityphysicsv1openstax/chapter/4-3-projectile-motion
3. https://openstax.org/books/physics/pages/5-4-inclined-planes
4. https://studiousguy.com/impulse-force-examples
5. https://www.sparknotes.com/physics/oscillations/applicationsofharmonicmotion/section1/

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO–1	Recall the basic concepts of laws of motion, projectile on horizontal plane and inclined plane, impulsive forces and simple harmonic motion.	**K1**
CO–2	Derive the general form of projectile on horizontal plane and inclined plane, impulsive forces and simple harmonic motion.	**K2**
CO–3	Apply the motion of a projectile on an inclined plane, impulsive forces and simple harmonic motion to solve the problems to obtain the general solution on simple harmonic motion and composition of simple harmonic motion.	**K3**
CO–4	Constructing the dynamics problems in real life situation.	**K4**
CO-5	Assess real life situations and implement the concept of dynamics to the same.	**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	L	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

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 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
Second Year - Semester – III

Course Title	**MAJOR CORE 8: OPTIMIZATION TECHNIQUES -I**
Code	**U21MA3MCT08**
Course type	**Theory**
Semester	**III**
Hours/Week	**5**
Credits	**4**
Marks	**100**

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 Radiotherapy 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

CO No.	Course Outcomes	Cognitive Level (K1 – K5)
CO –1	Recognize the formulation of LPP and solve LPP by Graphical, Simplex, Big M Method and Two Phase Method.	**K1**
CO –2	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.	**K2**
CO –3	Solve the Assignment and Travelling Salesman Problem using Hungarian Algorithm and Sequencing problems.	**K3**
CO –4	Analyzing the real life applications of transportation problems, travelling sales man problem, Two-Phase Simplex method, Job sequencing problems and Linear programming problems	**K4**
CO –5	Evaluate LPP adopting Graphical, Simplex, Big M, Two Phase method, Design optimization models for some real life problems in current scenario.	**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	L	L	M	L	M	H	H
CO-2	H	H	H	M	H	M	M	M	L
CO-3	H	M	M	L	M	M	H	M	M
CO-4	H	H	M	M	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	M	M
CO-2	H	H	H
CO-3	H	H	M
CO-4	H	H	H
CO-5	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)
Second Year - Semester – III

Course Title	**MAJOR ELECTIVE 1- SCI PROGRAMMING**
Code	**U21MA3MET01**
Course type	**Theory**
Semester	**III**
Hours / Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To understand the important features of SCILAB programming and apply them to solve the mathematical problems.

COURSE OBJECTIVES

The learner will be able to

1. To understand the basics concepts of Scilab.
2. To analyze SCILAB matrices.
3. To understand loops and functions in Scilab.
4. To create 2D plot.
5. To evaluate ordinary differential equations using SCILAB tools.

UNIT I: INTRODUCTION TO SCILAB 12 HRS

Overview of Sci lab- How to get started with Scilab- Getting help from Scilab demonstrations and macros- The Console - The editor- Batch Processing.

Creating Real Variables- Elementary mathematical functions- Booleans - Complex numbers- Integers- Floating Points- Strings- Dynamic variables.

Extra Reading/Key words*:* *Working with Polynomials*

UNIT II: MATRICES 12 HRS

Matrices- Create Matrices of Real Variables- Accessing Elements of Matrices- Matrices are dynamic- Element wise Operations- Conjugate transpose and Non-conjugate transpose- Multiplication of two vectors Comparing to real matrices- Issues with floating point integers- More on elementaryfunctions- Higher level linear algebra features.

Extra Reading/Key words*:* *Sparse Matrices in SCILAB*

UNIT III: LOOPING AND BRANCHING 12 HRS

Looping and Branching- The if, select, for, and while statements –The break and continue statements

Functions- Function libraries- Managing output arguments -Levels in the call stack- The return statement- Debugging functions with pause.

Extra Reading/Key words: *Robust control statements*

UNIT IV: PLOTTING **12 HRS**

Plotting- 2D plot- Contour plots- Titles, axes and legends- Export.

Extra Reading/Key words*:* *3D-Plot*

UNIT V: APPLICATIONS OF SCI LAB **12 HRS**

Solving ordinary differential equations using Scilab- Numerical solutions of initial value problems in ordinary differential equations.

Extra Reading/Key words*:* *solving boundary value problems in ODE*

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

1. Introduction to Scilab - Michael Baudin from Scilab consortium,2010
   Chapters 1 to 8 (Book Freelydownloadable in internet)
   UNIT : I - Chapters 1, 2 & 3
   UNIT : II - Chapter 4
   UNIT : III - Chapters 5 & 6
   UNIT : IV - Chapter 7

FOR UNIT V

2. Scilab Textbook Companion for numerical methods: Principles, Analysis and Algorithms by S. Pal, Oxford University Press, 2009.
   UNIT V - Chapter 5

SUGGESTED READINGS

1. Modelling and Simulation in Scilab, Stephen. L Campbell, Jean-Phillippe Chancellor and Ramine Nikoukhah.
2. An Introduction to Scilab from a Matlab User's point of view by Eike Rietsch.
3. Plotting using Scilab-An open source document-www.openeering.com

WEB REFERENCES:

1. https://www.google.com/url?sa=t&source=web&rct=j&url=https://math.unice.fr/~jabin/Scilabnotes.pdf&ved=2ahUKEwjd6cfpwKT3AhUC63MBHQctA3gQFnoECB4QAQ&usg=AOvVaw2mu3CqYnAeJ8rsCJ9JUi1t
2. https://www.google.com/url?sa=t&source=web&rct=j&url=http://www.m-hikari.com/ams/ams-2014/ams-25-28-2014/catarinoAMS25-28-2014.pdf&ved=2ahUKEwjPhrmywaT3AhXJBN4KHWEZB7EQFnoECAQQAQ&usg=AOvVaw3kJmYfs42BfxEXpNsQen-i
3. https://stanford.edu/class/archive/cs/cs106b/cs106b.1154/qtcreator/DebuggingWithQtCreator.pdf
4. https://www.scilab.org/tutorials/getting-started/plotting
5. https://www.math.utah.edu/~gustafso/s2013/3150/pdeNotes/urroz-ode-scilab.pdf

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

COURSE OUTCOMES:

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Identifies the scilab features to enable their usage inhigher learning.	**K1**
CO – 2	Demonstrates the procedure for creating scilab program in ordinary differential equation problem with the manipulation of variables, mathematical functions, matrices, plotting of graphs, looping and branching.	**K2**
CO – 3	Analyze the conditions for creating real variables, accessing the elements of matrices in variousdynamical way, functions, plotting 2d graphs and theirimplementation in ordinary differential equation problem.	**K3**
CO – 4	Interpret and visualize the numerical computing environment using scilab codes with its application in solving the problem of ordinary differential equations.	**K4**
CO – 5	To evaluate and interpret results on real life problems using appropriate numerical techniques and to customize and visualize mathematical structures by using appropriate graphical features of SCI.	**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	M	H	H
CO-2	H	H	H	M	H	M	H	H	H
CO-3	H	H	H	H	M	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 – III

Course Title	**MAJOR ELECTIVE 1: LATEX**
Code	**U21MA3MET02**
Course type	**Theory**
Semester	**III**
Hours / Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to acquire knowledge about LATEX in the preparation of documents and promote them to create research article in portable document file format.

COURSE OBJECTIVES

1. To illustrate simple type setting of Latex with font size and font type.
2. To understand page setting and numbering of documents, also acquire knowledge about parts of a document and understand how to divide the document.
3. To illustrate table of contents, index and glossary.
4. To acquire knowledge about displayed text, rows and columns.
5. To exemplify Mathematics miscellany with new operators and understands many faces of mathematics symbols.

UNIT I: THE BASICS **12 HRS**

What is Latex? – Simple Typesetting – Fonts – Type Size-Application of Latex in type setting documents.

Extra reading/Keywords: *Scripted Fonts, Slanted shapes*

UNIT II: THE DOCUMENT **12 HRS**

Document Class - Page Style and Numbering – Formatting Lengths – Parts of a document – Dividing the Document- Application of Latex in preparation of Research articles.

Extra reading/Keywords: *TEXpertrise, SECTSTY Package, setting the margin*

UNIT III: TABLE OF CONTENTS, INDEX AND GLOSSARY **12 HRS**

Table of Contents – Index – Glossary - Application of Latex in book writing.

Extra reading/Keywords: *Tabular environment, Improving hyphenation*

UNIT IV: DISPLAYED TEXT & ROWS AND COLUMNS **12 HRS**

Borrowed words – Poetry in typesetting – Making list – When order matters –Descriptions and definitions – Keeping tabs – Tables - Application of Latex in formatting prose and poetry writing.

Extra reading/Keywords: *Handling narrow columns and rows, Coloring tables, generating*

multi-page tables.

UNIT V: TYPESETTING MATHEMATICS 12 HRS

The Basics – Custom Commands – More on Mathematics – Mathematics Miscellany –New operators – many faces of Mathematics - Application of Latex in typing mathematical equations and symbols.

Extra reading/Keywords: *Building math structures, setting accents, typesetting matrices.*

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

TEXT BOOKS

Treatment and content as in **Latex Tutorials - A Primer to Latex by Indian TEX UsersGroup,** Trivandrum, India.

Unit I: Chapter 1- Sec (1.1 – 1.4)
Unit II: Chapter 2 – Sec (2.1 – 2.6)
Unit III: Chapter 5 – Sec (5.1 – 5.3)
Unit IV: Chapter 6 – Sec (6.1 – 6.5) and Chapter 7 – Sec (7.1 and 7.2)
Unit V: Chapter 8 – sec (8.1 – 8.6)

SUGGESTED READINGS

1. Stefan Kottwitz(2011), **Latex – Beginner's Guide,** Packt publishing, Birmingham, Mumbai.
2. Dilip Datta, **A short note on Latex in 24 hours- A Practical guide for scientific writing,** Springer Publication.
3. David R Wilkins(2021), **Getting Started with Latex,** second edition, e book.
4. David Francis Griffiths and Desmond Higham(1997), **Learning Latex,** David Marshall Publisher,.

WEB REFERENCES

1. **https://typeset.io/resources/learn-latex-beginners-step-by-step-guide/**
2. **https://www.resurchify.com/latex_tutorial/latex_page_numbering.php**
3. **https://www.tutorialandexample.com/index-and-glossary-in-latex**
4. **http://labmaster.mi.infn.it/wwwasdoc.web.cern.ch/wwwasdoc/TL8/texmf/doc/latex/poems col/poemscol.pdf**
5. **http://www.gang.umass.edu/~franz/latexmanual.pdf**

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Defines the typesetting features, page-setting format, format of creating table, typesetting of Mathematical Formulas.	**K1**
CO – 2	Understand the simple typesetting with font size and font type, page style, numbering, procedure for creating the table of content, new operators and many faces of mathematics.	**K2**

CO – 3	Apply the document with the simple typesetting, page setting, Table of Content, index and Glossary.	**K3**
CO – 4	Illustrates the documentation with displayed text, rows and columns, new operators and typesetting mathematics in LATEX	**K4**
CO-5	Justifies the features of Latex over MS word as it features with a reliable program for footnotes, images, bibliographic, tables and cross references.	**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	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	M	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 2021-22)

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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)
Second Year - Semester – III

Course Title	**MAJOR ELECTIVE 1:DESIGN AND ANALYSIS OF ALGORITHMS**
Code	**U21MA3MET03**
Course type	**Theory**
Semester	**III**
Hours/ Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To acquire the ability of applying various algorithmic concepts for all domains and efficient interpretation of real life problems**.**

COURSE OBJECTIVES

1. To understand the role of algorithms in computing.
2. To learn divide and conquer paradigm in solving recurrence problems.
3. To understand the Greedy method as a design technique in solving optimization problems.
4. To learn an algorithm design method dynamic programming in solving sequencing problems.
5. To learn back tracking formulation in obtaining optimal solution for problems.

UNIT I: FUNDAMENTALS **12 HRS**

The Role of Algorithms in Computing–Algorithms – Insertion Sort-Designing Algorithms –Analyzing Algorithms- Application of Insertion sort .

Extra reading/Keywords: *Algorithms, Complexity, Time Space Trade off, Other Asymptotic Notations for Complexity of Algorithms.*

UNIT II: DIVIDE AND CONQUER **12 HRS**

Introduction-The maximum-sub array problem - Strassen's algorithm for matrix multiplication - The substitution method for solving recurrences - The recursion-tree method for solving recurrences – The master method for solving recurrences- Application of maximum-sub array problem in graphical user interface.

Extra reading/Keywords: *Convex Hull, The Quick Hull Algorithm, Graham's Scan*

UNIT III: GREEDY METHOD **12HRS**

The general method-Container loading-Knapsack problem-Tree vertex splitting-Job sequencing with deadlines – Minimum cost spanning trees – Huffman Codes- Application of Minimum cost spanning trees in Network designing.

Extra reading/ Keywords: *Optimal Storage of Tapes, Job sequencing with deadlines, Coin Change Problem, Optimal Merge patterns*

UNIT IV: DYNAMIC PROGRAMMING 12HRS

The general method – Multi stage Graphs – All pairs shortest paths –Single source shortest paths - 0/1Knapsack, Reliability Design – The Travelling salesperson problem- Application of Travelling salesperson problem.

Extra reading/ Keywords: *String editing, optimal binary search trees, Flow Shop Scheduling*

UNIT V: BACKTRACKING 12HRS

BackTracking- The General Method- The 8-Queens problem - Sum of subsets - Graph Coloring – Hamiltonian Cycles - Application of BackTracking algorithm in the knight's tour problem.

Extra reading/Keywords: *Two backtracking control, Generalized Hamiltonian Cycle, Knapsack Problems*

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

TEXT BOOKS

Treatment and content as in

1. Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein(2014), **"Introduction toAlgorithms" 3rd Edition,** The MIT Press Cambridge, Massachusetts, London, England.
   Unit I: Chapter 1:Sections1.1; Chapter 2:Sections2.1-2.3
   Unit II: Chapter 4:Sections4.1-4.53

2. EllisHorowitz, Sartajsahni, Sanguthevar, Rajesekaran(2007), **"Fundamentals of ComputerAlgorithms",** Universities Press India Pvt Ltd(Second Edition)

   Unit III: Chapter 4 Sections 4.1-4.6 (Omit4.6.3)
   Unit IV: Chapter 5: Sections 5.1 - 5.4, 5.7 - 5.9
   Unit V: Chapter 7: Sections 7.1– 7.5

SUGGESTED READINGS

1. S.Sridhar(2015),**"Design and Analysis of Algorithms"**,OxfordUniversityPress.
2. Richard Johnson Baugh, Marcus Schaefer(2004),**"Algorithms",**Pearsoneducation.
3. Mark Allen Weiss(2006), **"Data Structures and Algorithm Analysis in C",** 2nd Edition, PearsonEducation, Inc.
4. Rajesh K Shukla(2015), **"Analysis and Design of Algorithms-A Beginner's Approach",** Wiley publisher.
5. Gilles Brassard and Paul Bratley(2006), ***"Fundamentals of Algorithmics",*** Prentice Hall of India Pvt Ltd, New Delhi.

WEB REFERENCES

1. https://www.mygreatlearning.com/blog/insertion-sort-with-a-real-world-example/
2. https://mzhang2021.github.io/cp-blog/divide-and-conquer/
3. https://techvidvan.com/tutorials/greedy-algorithm
4. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorit hms_dynamic_programming.htm

5. https://www.simplilearn.com/tutorials/data-structure-tutorial/backtracking-algorithm

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO–1	Identifies the algorithmic approach in computing and design techniques.	**K1**
CO–2	Illustrates the Bubble sort algorithm, Divide & Conquer technique, Greedy Method, Dynamic Programming technique and Back Tracking approach.	**K2**
CO–3	Identifies the Bubble sort algorithm and various design techniques to obtain optimum solutions.	**K3**
CO–4	Examines the algorithmic approach and design techniques applicable to the real life situations.	**K4**
CO- 5	Predicting the solution to the real life problem by various designing techniques.	**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	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

(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)
Second Year - Semester – III

Course Title	**MAJOR SKILL BASED ELECTIVE 1: APTITUDE MATHEMATICS–I**
Code	**U21MA3SBT01**
Course type	**Theory**
Semester	**III**
Hours/ Week	**2**
Credits	**1**
Marks	**100**

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*.

UNITII: 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.*

UNITV: 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., Ram Nagar, 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://careerdost.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-K4)
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

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

Course Title	**NON MAJOR ELECTIVE 1: APTITUDE MATHEMATICS–I**
Code	**U21MA3NMT01**
Course type	**Theory**
Semester	**III**
Hours/ Week	**3**
Credits	**3**
Marks	**100**

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 **9 HRS**

Number System –Simplification using formulae and rules

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

UNITII: AVERAGE **9 HRS**

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

Extra Reading/Keywords*: Histogram,Ogives*

UNIT III: AGES AND PERCENTAGE **9 HRS**

Problems on ages – Percentage.

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

UNIT IV: PROFIT AND RATIO **9 HRS**

Profit and Loss – Ratio and Proportion

Extra Reading / Keywords*: Business, Metric measures.*

UNITV: PARTNERSHIP AND TIME **9 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: Chapters1 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://careerdost.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 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)
Second Year - Semester – III

Course Title	**ALLIED 4:DISCRETE MATHEMATICS (for B.C.A and Computer Science students)**
Code	**U21MA3ALT13**
Course type	**Theory**
Semester	**III**
Hours / Week	**4**
Credits	**2**
Marks	**100**

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.Busy 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: Chapter2:Sections 2-1-2.2,2.4
UNIT II : Chapter4:Sections 4.1-4.5 (omitted Digraphs)UNIT III : Chapter6: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.

UNITIV:Chapter1 Sections1.1-1.5,Chapter 2Sections2.1, 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"**,3rd 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, SuchiVatsa,**"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
5. https://owlcation.com/stem/What-are-the-Basics-and-Real-World-Applications-of-Graph-Theory

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO–1	Define the logical, conditional operator, Partially ordered sets, Relations, directed graph and weighted graph	**K1**
CO–2	Derive the Product Sets and Relations, identify how it can be applied in real life situations	**K2**
CO–3	Illustrate the Partially Ordered sets, Relations and graphs to implement it for hasse diagram and constructing a minimum spanning tree	**K3**
CO–4	Categorize the problem arising in real life situations and to establish the idea of graph theory, Partially ordered relation and use it to appropriate to infer the solution.	**K4**
CO-5	Appraise the problems in real life situations related to mathematical logic, applications of graph theory and Interpret the results.	**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	M	M	M	M	M	L	H	H	H
CO-2	M	M	M	M	M	L	H	H	H
CO-3	H	H	M	M	M	L	H	H	H
CO-4	H	H	M	M	M	L	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	M	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 2021-22)

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

Course Title	ALLIED 4: STATISTICS-I
Code	U21MA3ALT14
Course type	Theory
Semester	III
Hours / Week	4
Credits	2
Marks	100

CONSPECTUS

To understand the various methods of collection of data and representing them through diagrams and graphs. 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.
2. To analyze various measures of dispersion.
3. To understand to correlate data and fit into a linear regression curve.
4. To evaluate index number 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, CLASSIFICATION, TABULATION AND PRESENTATIONOF DATA **12 HRS**

Definition of Statistics – collection of data- primary and secondary data – classification and tabulation of data- Diagrammatic and graphic representation- Applications to Business Management.

Extra Reading/ Keywords: *Business statistics, Measures of central tendency, Descriptive statistics, Economics.*

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

Dispersion - Range- calculation of Quartile deviation, Mean Deviation, standard deviation, coefficient of variation, concept of skewness, kurtosis and their measures, moments for frequency distributions- Applications in Industryand education.

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

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

Simple Correlation – rank correlation – regression equation and regression coefficient-- Applications in Medical diagnosis (Error analysis, Concurrent deviation method, correlation of

time series in chapter 12 omitted and standard error of estimate in chapter 13).

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-Applications inmeasuring the changes in price level and forecasting future economic activity.

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- Applications to weather forecasting.

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 seminars.

TEXT BOOK

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

UNIT I: Chapter 1,4,6,7 & 8
UNIT II: Chapters 10 and 11
UNIT III: Chapter 12 and 13 (Omit "Error analysis, Concurrent deviation method,correlation of time series in chapter 12 and standard error of estimate in chapter 13")
UNIT IV: Chapter 14 (other methods in weighted aggregate type omitted - Unit and Circular tests omitted - Splicing and deflating indexes omitted)
UNIT V: Chapter 15 (Ratio to trend and ratio to moving averages methods omitted)

SUGGESTED READINGS

1. Arora .S, Sumeet Arora (2002), **Comprehensive Statistical Methods,** S.Chand and Company Ltd ,New Delhi.
2. Douglas A.Lind ,William G.Marchall ,Samuel A. Wathen (2003), **Basic Statistics for Business and Economics,** Mc Graw Hill, Delhi.
3. Gupta .S.C, Indra Gupta (2004), **Business Statistics,** Himalaya Publishing House, New Delhi.
4. Gupta .S.P (2006), **Statistical Methods,** Sultan Chand & Sons, New Delhi.
5. Sharma J.K, (2006), **Business Statistics,** Dorling Kindersley, (India) Pvt Ltd, Licensees of Pearson Education in South Asia.

WEB REFERENCES

1. **https://resource.cdn.icai.org/46683bosfnd-p3-cp14.pdf**
2. **https://resource.cdn.icai.org/46684bosfnd-p3-cp15-u1.pdf**
3. **https://www.statology.org/linear-regression-real-life-examples/**

4. **https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc41.htm**
5. **https://www.aptech.com/blog/introduction-to-the-fundamentals-of-time-series-data-and-analysis/**
6. **https://resource.cdn.icai.org/46689bosfnd-p3-cp19-u1.pdf**

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Define basic statistical concepts, measures of dispersion, correlation and regression, time series components and index numbers.	**K1**
CO – 2	Identify the method of collecting primary and secondary data. Calculate coefficient of correlation, regression, price, quantity index numbers, trend and seasonal variations in time series.	**K2**
CO – 3	Solve the problems related to measures of averages, dispersion, correlation, regression, index numbers and time series.	**K3**
CO – 4	Analyze the different types of index numbers and the methods of fitting linear and non-linear models for time series data to forecast business related problems.	**K4**
CO-5	Recommend the best statistical methods to solve real life problems and draw inference.	**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	L	M	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	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 2021-2022)

Course Title	MAJOR CORE 9: ABSTRACT ALGEBRA
Code	U21MA4MCT09
Course type	Theory
Semester	IV
Hours / Week	4
Credits	4
Marks	100

CONSPECTUS

To enable the students to understand the concepts of relations and mappings, characteristics of Algebraicstructures 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 12 HRS

Relations - Equivalence Relations - Partial order - Functions - Binary Operations-Applications ofequivalence relation

Extra Reading/ Keywords:*Lattices , Hasse diagram*

UNIT II: GROUPS 12 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) 12 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 **12 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 **12 HRS**

Ideals – Quotient rings – Maximal and prime ideals – Homomorphism of rings-Applications of principleideal 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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO–1	Recall relation and its types ,functions and binary operations, groups, rings and ideals	**K1**
CO–2	Summarize cyclic groups, normal groups, quotient groups, Isomorphism and homomorphism, types of rings, elementary properties of rings, ideals, Maximal, prime ideals and homomorphism of rings.	**K2**
CO–3	Illustrate the fundamental ideas of Groups and Rings to diverse situation in Physics, Chemistry, Computer Science, Engineering and other mathematical Contexts	**K3**
CO–4	Examine the concepts of Group and Ring theory.	**K4**
CO-5	Assess theorems relating to Groups and Rings to solve real life problems	**K5**

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

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, June 1986.
3. M.L. Santiago, **Modern Algebra**, Tata McGraw-Hill Publishing Co. Ltd, 2001.
4. N.Herstein, **Topics in Algebra**, JohnWiley & Sons, Student 2 nd edition,1975.

WEB REFERENCES

1. **https://courses.engr.illinois.edu/cs173/fa2009/Lectures/lect_38.pdf**
2. **https://laurensommers.files.wordpress.com/2014/12/capstonefinal2.pdf**
3. **http://www.nou.ac.in/econtent/Msc%20chemistry%20paper%202/MSc%20Chemistry%20Paper-II%20Unit-4.pdf.**
4. **https://en.wikipedia.org/wiki/Group_theory#:~:text=Physicists%20are%20very%20interested%20in, group%2C%20and%20the%20Poincar%C3%A9%20group.**
5. **https://wireilla.com/ns/maths/Papers/3414ijscmc05.pdf**
6. **https://math.stackexchange.com/questions/2507993/what-are-some-applications-of-principal-ideal-rings**

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

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	L	M	H	M	L	H	H	H
CO-2	H	M	H	M	H	L	H	H	H
CO-3	H	H	H	H	H	M	H	H	H
CO-4	H	H	H	H	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	H	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 2021-22)

Course Title	**MAJOR CORE 10: OPTIMIZATION TECHNIQUES - II**
Code	**U21MA4MCT10**
Course type	**Theory**
Semester	**IV**
Hours / Week	**4**
Credits	**3**
Marks	**100**

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 X n and m X 2 games – Applications of Game theory in logic and computer science.

Extra Reading/ Keywords: *arithmetic Method of n X 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 ofInventory 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 allocationand scheduling*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recall the basic concepts of game theory, queuing theory, inventory control, multi-item deterministic problem, network scheduling.	**K1**
CO – 2	Derive the problem formulation of game theory, queuing theory, inventory control, multi-item deterministic problem, network scheduling.	**K2**
CO – 3	Apply the knowledge of game theory concepts, Q system, inventory control theory and compute EOQ, PERT.	**K3**
CO – 4	Construct the Multi-item Deterministic problems.	**K4**
CO – 5	Assess real life situations and implement the concepts of optimization.	**K5**

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

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 (20:1-20:3)

UNIT V: Chapter 25(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.

WEB REFERENCES

1. https://www.geeksforgeeks.org/game-theory-normal-form-game-set-6-graphical-method-2-x-n-game/amp.
2. https://www.wisdomjobs.com/e-university/quantitative-techniques-for-management-tutorial-297/poisson-and-exponential-distributions-9931.html.
3. https://learn.financestrategists.com/explanation/cost-accounting/material-costing/economic-order- quantity-eoq-practical-problems-and-solutions.
4. https://engineeringnotes.com/
5. https://engineeringnotes.com/networking/network-analysis/top-4-problems-on-pert-network-analysis-networking/15725.

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

PO – CO MAPPING

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

(For Candidates admitted in the academic year 2021-22)

Course Title	**MAJOR ELECTIVE 2: SCI PROGRAMMING PRACTICAL**
Code	**U21MA4MEP04**
Course type	**Practical**
Semester	**IV**
Hours / Week	**4**
Credits	**3**
Marks	**100**

CONSPECTUS

To make the students understand the familiarization of the syntax, semantics, data- types and library functions of numerical computing languages in SCILAB, and application of languages for implementation/simulation and visualization of basic mathematical functions .

COURSE OBJECTIVES

1. To understand the fundamentals of scilab commands and utilization.
2. To understand about matrices and its operations.
3. To analyze the comparison of built-in, library and user-defined functions.
4. To evaluate the graph for plotting 2D and contour plot.
5. To evaluate the program for solving ordinary differential equations.

List of Practicals:

1. Create an image processing with scilab
2. Create a functions in scilab
3. Find the surface area of sphere and volume of sphere using scilab .
4. Create different web pages using scilab and about console.
5. Finding the largest and smallest of three numbers using if, if-else.
6. Find the solution of a Quadratic Equation (all cases) using scilab.
7. Matrix operations using

i) Addition ii) Subtraction iii) Multiplication

8. Finding Eigen values and Eigen vectors using scilab.
9. Finding min, max, length, sum, product, mean, median, standard deviation, sorting the elements in ascending and descending order, array multiplication and powering the elements of the vector using scilab.

10. Creating a row vector, column vector, accessing elements, modifying the elements, concatenating the vectors using scilab.

11. Changing the color of the graph.

12. Describe plotting of data in scilab using plot2d() and subplot() commands in scilab13. Plot the graph using 3D dimensions.

14. Solve $\frac{dy}{dx} = -2x - y$ with initial conditions y(0) = −1 and y(0.4) = ? by using scilab

15. Solving second order differential equations using scilab.

(For Candidates admitted in the academic year 2021-22)

Course Title	MAJOR ELECTIVE 2: MATHEMATICAL MODELLING
Total Hours	60
Hours / Week	4
Code	U21MA4MET05
Course type	Theory
Credits	3
Marks	100

CONSPECTUS

To enable the students to learn mathematical models through ODE, difference equations and teach students how to create mathematical models for real life situations.

COURSE OBJECTIVES

1. To understand the basic concepts involved in Mathematical Modelling using ordinary differential equations.
2. To understand the concepts of Mathematical Modelling through the system of first order ordinary differential equations by constructing compartment model.
3. To understand the concepts of Mathematical Modelling through the system of first order ordinary differential equations by constructing Susceptible-infected-susceptible (SIS) model and removal and immigrations model.
4. To understand the concepts of Mathematical Modelling through the system of difference equations.
5. To understand the concepts of Mathematical Modelling through Harrod Model and the Cobweb Model.

UNIT I: MATHEMATICAL MODELLING: 12 HRS

Simple Situations Requiring Mathematical Modelling - The Technique of Mathematical Models – Classification of Mathematical Models – Some Characteristics of Mathematical Models – Mathematical Modelling Through Geometry. Applications of mathematical modelling through Simple Situations.

Extra Reading/ Keywords: *Finding the Radius of the earth, Motion of Planets*

UNIT II: MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER 12 HRS

Mathematical Modelling Through Differential Equations - Linear Growth and Decay Models - Non-Linear Growth and Decay Models - Compartment Models. Applications of Mathematical Modelling through Ordinary Differential Equations of First Order.

Extra Reading/Keywords: *Simple Harmonic Motion, Motion of a Rocket.*

UNIT III: MATHEMATICAL MODELLING THROUGH SYSTEM OF ORDINARY DIFFERENTIAL EQUATIONS OF THE FIRST ORDER 12 HRS

Prey-Predator Models - Competition Models – A Simple Epidemic Model – A Susceptible-infected-susceptible (SIS) model – SIS Model with Constant Number of Carriers – Simple Epidence Model with Carriers - Model with Removal - Model with Removal and immigrations. Applications of Mathematical Modelling through System of Ordinary Differential Equations of first order.

Extra Reading/Keywords: *Richardson's Model, Lanchester's Model*

UNIT IV: INTRODUCTION TO DIFFERENCE EQUATIONS 12HRS

The Need for Mathematical Modelling Through Difference Equations: Some Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients - Applications of Mathematical Modelling through Difference Equations.

Extra Reading/ Keywords: *Model for Population growth, Age- Structured Population model*

UNIT V: MATHEMATICAL MODELLING THROUGH DIFFERENCE EQUATIONS 12HRS

The Harrod Model - The Cobweb Model - Application to Actuarial Science.

Extra Reading/ Keywords: *Genetics models*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level(K1-K5)
CO–1	Recall the basic concepts involved in Mathematical Modelling through ordinary differential equations, system of ordinary Differential equations of first order and difference equations.	**K1**
CO–2	Derive the equations for Mathematical Models through ordinary differential equations, system of ordinary differential equations of first order and difference equations.	**K2**
CO–3	Apply the mathematical models through ordinary differential equations, system of ordinary differential equations of first order, difference equations to practical problems.	**K3**
CO–4	Constructing mathematical models for real life situation.	**K4**
CO -5	Assess real life situations and implement the concept of Mathematical Modelling to the same.	**K5**

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

TEXTBOOK

Content and treatment as in J. N. Kapur, **"Mathematical Modelling"**, New Age International publishers. New Delhi, 2009.

Unit I: Chapter 1: Sections 1.1-1.5
Unit II: Chapter 2: Sections 2.1- 2.4
Unit III: Chapter 3: Sections 3.1.1, 3.1.2 and 3.2
Unit IV: Chapter 5: Sections 5.1 and 5.2
Unit V: Chapter 5: Sections 5.3 (5.3.3 not included)

SUGGESTED READINGS

1. J. N. Kapur, Mathematical Models in biology and Medicine, EWP, New Delhi, 1985.
2. Keshet,L.E.,"Mathematical Models in Biology", SIAM
3. Fred Brauer and Carlos Castillo-Chavez, Mathematical Models in Population Biology and Epidemiology, Springer.
4. Frank R. Giordano, William Price Fox, Maurice D. Weir, A First Course in Mathematical Modelling, 4th Ed., Charlie Van Wagner.
5. Walter J. Meyer, Concept of Mathematical Modeling, McGraw-Hill.

WEB REFERENCES

1. https://ncert.nic.in/ncerts/l/iemh1a2.pdf
2. https://math.dartmouth.edu/opencalc2/dcsbook/c6pdf/sec63.pdf
3. https://mysite.science.uottawa.ca/rsmith43/MAT4996/Epidemic.pdf
4. https://www.up.ac.za/media/shared/259/Documents/Teaching%20material/book-jb.zp158054.pdf
5. https://math.libretexts.org/Bookshelves/Calculus/Map%3A_CalculusEarly_Tra_nscendentals_(Stewart)/09%3A_Differential_Equations/9.01%3A_Modeling_with_Differential_Equations

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

PO–CO MAPPING

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

(For Candidates admitted in the academic year 2021-22)

Course Title	**MAJOR ELECTIVE 2: INTRODUCTION TO DATA ANALYTICS**
Code	**60**
Course type	**4**
Semester	**U21MA4MET06**
Hours/ Week	**Theory**
Credits	**3**
Marks	**100**

CONSPECTUS

To impart knowledge in Fundamental of Big Data Analytics and Map Reduce Fundamentalsand to recognize the key concepts of Hadoop framework, Map Reduce.

COURSE OBJECTIVES

1. Understand the fundamental concepts of Big data.
2. Analyze the usage and extraction techniques of Big data Analytical framework and Specify the importance of distributed computing and Cloud environment for Big Data.
3. Understand the Hadoop Foundation.
4. Understand the Map Reduce techniques.
5. Determines the Operational Data bases & Data Warehouses.

UNIT I: INTRODUCTION TO BIG DATA 12 HRS

Introduction to Big Data: Types of Digital Data-Characteristics of Data – Evolution of Big Data– Definition of Big Data – Challenges with Big Data – 3Vs of Big Data – Applications of Big data intechnical fields

Extra Reading/ Keywords*: Big data & Importance, use cases for Big data and Big data analytics*

UNIT II: **TECHNOLOGIES FOR HANDLING BIG DATA 12 HRS**

Distributed and parallel Computing for Big Data – Difference between Distributed and parallel Computing.- Cloud Computing and Big Data -In-Memory -application of Cloud Computing Technologyfor Big Data.

Extra Reading/Keywords*: Usage of cloud for Big Data Cloud Market*

UNIT III: HADOOP ECOSYSTEM 12 HRS

Hadoop and its ecosystem -Hadoop components HDFS , MapReduce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper

Extra Reading/ Keywords*: Interacting with the Hadoop ecosystem*

UNIT IV: FUNDAMENTALS OF MAPREDUCE **12 HRS**

Map reduce and its components- Advantages of Map Reduce – Applications of Map reducing in solving the storage of Big data.

Extra Reading/ Keywords*: Importance of* Map Reduce *in Big Data*

UNIT V: DATABASES AND DATA WAREHOUSES **12 HRS**

Databases and Data Warehouses and its Characteristics of Database Difference between Database and Data Warehouse- Applications of Database and Data Warehousing

Extra Reading/ Keywords*: Analyzing the examples of Big Data Operational Databases with Apps.*

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO–1	Introducing the concept of Big data, its types and characteristics, cloud computing and recalling the basics of data.	**K1**
CO–2	Understand the challenges of handling big data, distributed and parallel computing.	**K2**
CO–3	Apply data warehouses and data bases in storing big data.	**K3**
CO–4	Analyzing the usage of map reduce and Hadoop in big data	**K4**
CO-5	Assess real life situations and implement the concept of solving tools of big data.	**K5**

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

TEXT BOOK

Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman(2013), "**Big Data for Dummies**", AWiley Brand - Wiley Publications.

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. Nitin Upadhyay, "**Big Data Management and Analytics"**, Cengage LearningIndia Pvt. Ltd, 2018.2.Pam Baker, " **Big Data Strategies**" , Cengage Learning India Pvt. Ltd, 2015.
3. Bill Franks, "**Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics"**, 1st Edition, Wiley and SAS Business Series, 2012.
4. Seema Acharya, Subhashini Chellappan, **"Big Data and Analytics"**, Wiley Publication,First Edition,Reprint in 2016.
5.O"ReillyMedia, **"Big Data Now: Current Perspective"** O"ReillyMedia, 2013 Edition.
6..Mike Barlow, **"Real-Time Big Data Analytics: Emerging Architecture"**, O'ReillyMediaInc., 2013.

WEB REFERENCES

1. https://www.simplilearn.com/tutorials/big-data-tutorial/big-data-applications
2. http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=4768
3. https://slideplayer.com/slide/10546471/
4. https://www.youtube.com/watch?v=3ZG1p0aFADY
5. https://www.edureka.co/blog/big-data-testing/
6. https://www.xenonstack.com/insights/big-data-testing-strategy

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

PO – CO MAPPING

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

(For Candidates admitted in the academic year 2021-22)

Course Title	ALLIED 5: STATISTICS II
Code	U21MA4ALT15
Course type	Theory
Semester	IV
Hours/ Week	4
Credits	2
Marks	100

CONSPECTUS

To enable the students to know about the various characteristics of discrete and continuous Statistical distributions with mathematical techniques.

COURSE OBJECTIVES

1. To understand the probability, conditional probability and their axioms.
2. To understand discrete, continuous and two dimensional random variable and their properties.
3. To evaluate expectation and variance and their relevant theorems.
4. To evaluate Binomial, Poisson distribution and their properties.
5. To evaluate normal distribution and its properties.

UNIT I: PROBABILITY 12 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- Baye's theorem, Independent Events- Applications of Baye's theorem. (Problems Only)

Extra Reading/Keywords: *Stock market, Tree diagram, mutually exclusive*

UNIT II: RANDOM VARIABLES 12 HRS

Discrete and continuous random variable -Cumulative distribution -properties of distribution function - Two dimensional random variable-Joint probability function-Marginal probability distribution-Conditional probability distribution- Independent random variables - Applications of Two dimensional random variable.

Extra Reading /Keywords: *Multinomial Distribution, Compound marginal distribution, Probability distribution fitting*

UNIT III: EXPECTATION AND VARIANCE 12 HRS

Expectation of a random variable- Expectation of a function of a random variable - Properties ofexpectation.

Variance – Definition- Theorems on variance - Applications of variance.

Extra Reading/ Keywords: *Berry- Esseen Theorem, Equioscillation theorem, Moment of inertia, Population variance*

UNIT IV: DISCRETE DISTRIBUTIONS **12 HRS**

Binomial distribution–Definition-Binomial frequency distribution - Poisson distribution –Definition - Properties - Poisson frequency distribution - Applications of Poisson distribution.

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

UNIT V–CONTINUOUS DISTRIBUTION **12 HRS**

Normal Distribution–Definition–Properties of normal distribution- Applications of Normal Distribution.

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

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO–1	Recall the basic concepts of probability, random variables, expectation and variance, discrete and continuous distributions.	**K1**
CO–2	Derive the statistical hypothesis on probability, random variables, expectation and variance, discrete and continuous distributions.	**K2**
CO–3	Apply the axioms of a probability for solving the problems on random variables, expectation and variance, discrete and continuous distributions.	**K3**
CO–4	Constructing the problems on probability in real life situation.	**K4**
CO-5	Assess real life situations and implement the concept of probability to the same.	**K5**

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

TEXT BOOK

Treatment and content as in Vittal.P.R (2002), **Mathematical Statistics**, Margham Publishers, Chennai.

Unit I - Chapter 1 (1.1-1.20, 1.32-1.35; Theorems without proof)
Unit II - Chapter 2 (2.1-2.10, 2.17- 2.33)
Unit III - Chapters 3 and 4 (3.1-3.18, 4.1 - 4.16; Theorems without proof)
Unit IV - Chapters12 and 13 (12.1-12.16, 13.1-13.12)
Unit V - Chapters 16 (16.1, 16.12-16.27)

SUGGESTED READINGS

1. Arora. S, Sumeet Arora (2002), **Comprehensive Statistical Methods**, S.Chand andCompany Ltd, New Delhi.
2. Gupta.S.C,Kapoor.V.K(2002), **Fundamentals of Mathematical Statistics**, SultanChand & Sons , New Delhi.
3. Gupta.S.P (2006), **Statistical Methods**, Sultan Chand & Sons, New Delhi.
4. J. N. Kapur, H. C. Saxena (2003), **Mathematical Statistics**, S.Chand & CompanyLtd, New Delhi.

5.S.G.Venkatachalapathy, Dr.H.Prem raj (2015), **Statistical Methods**, Margham Publications, Chennai

WEB REFERENCES

1. **https://www.upgrad.com/blog/bayes-theorem-explained-with-example-complete- guide/**
2. **https://webspace.maths.qmul.ac.uk/b.bogacka/MS_NotesWeek4.pdf**
3. **https://www.cuemath.com/data/variance/**
4. **https://www.statology.org/poisson-distribution-real-life-examples/**
5. **https://www.superprof.co.uk/resources/academic/maths/probability/normal-distribution/normal-distribution-word-problems.html**

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

PO –CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO-1	H	H	M	M	L	M	H	H	H
CO-2	H	H	H	H	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	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 2021-22)

Course Title	ALLIED 6: STATISTICS –III
Code	U21MA4ALT16
Course type	Theory
Semester	IV
Hours / Week	4
Credits	2
Marks	100

CONSPECTUS

To facilitate the students to apply acquired theoretical knowledge of tests of significance in real life problems.

COURSE OBJECTIVES

1. To Understand and apply sampling theory, Chi-square test, Student t test and F test and theirproperties.
2. To Understand estimators and method of maximum likelihood.
3. To Understand Large sample and evaluate testing the hypothesis.
4. To prepare Small sample and evaluate test of hypothesis using t and chi-square distribution.
5. To investigate test of hypothesis using F distribution.

UNIT I: SAMPLING DISTRIBUTION 12 HRS

Sampling Distribution – Chi square - Student-t - F distributions – Properties – Application of sampling Distribution for hypothesis testing.

Extra Reading/Key words*:* *Sampling variability, non-central chi-squared distribution, Robust parametric modeling*

UNIT II: ESTIMATION 12 HRS

Point Estimation –Cramer- Rao inequality - Rao – Blackwell theorem – Most efficient estimator - Consistent estimator - Sufficient estimator - Method of moments - Method of maximum likelihood- Applications of Cramer – Rao inequality to investigate some problems of the minimax theory of estimation. (Minimum chisquare estimators and interval estimation are excluded)

Extra Reading/Key words*:* *Multi variate case of cramer rao, method of moments lognormal distribution, mean squared error version*

UNIT III: TEST OF HYPOTHESIS FOR LARGE SAMPLES 12 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- Test for a specified standard deviation of the population – Test of significance for correlation coefficient– Enormous research applications for large sample size in a wide variety of scientific and social science fields.(Test for the equality of two standard deviations, Confidence interval, Confidence limits for population mean and proportions – Determination of sample space are excluded)

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 12 HRS

SMALL SAMPLES: t Test for a specified population mean - t Test for difference between two population means - t Test paired observation.

Chi square Test – Definition Additive property - Pearson's Statistics - Uses of Chi-square test Test for a specified population variance - Test of independence of attributes- Applications of Chi Square Distribution in Sports Analytics..

Extra Reading/Key words*: Pearson's correlation coefficient, Goodness of fit in regression analysis.*

UNIT V:TEST OF HYPOTHESIS USING F DISTRIBUTION 12 HRS

F test for Equality of two population variances - Analysis of variance - One way and two way classifications - Applications of F test in data analytics.

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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO – 1	Recall the basic concepts of sampling theory, estimation, Large Samples, t distribution, Chi Square distribution and F distribution.	**K1**
CO – 2	Derive the general form of sampling theory, estimation, Large Samples, t distribution, Chi Square distribution and F distribution	**K2**
CO – 3	Apply the concept of sampling theory, estimation, Large Samples, t distribution, Chi Square distribution and F distribution.	**K3**
CO – 4	Analyzing the real life applications of sampling theory, estimation, Large Samples, t distribution, Chi Square distribution and F distribution	**K4**
CO – 5	Appraise the problems in real life situations related to sampling theory, estimation, Large Samples, t distribution, Chi Square distribution and F distribution.	**K5**

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

TEXT BOOK

Treatment and content as in Vittal .P.R(2002), Mathematical Statistics, Margham Publishers, Chennai.
UNIT : I - Chapter 22
UNIT : II - Chapter 23 (omit page nos : 23.61 – 23.66)
UNIT : III - Chapter 24 (omit page nos : 24.43 – 24.55)
UNIT : IV - Chapter 25 (omit page nos : 25.42 – 25.45),
Chapter 27 (omit page nos : 27.36 – 27.38, 27.44 - 27.46)
UNIT : V - Chapter 26.

SUGGESTED READINGS

1. Arora .S,Sumeet Arora (2002),**Comprehensive Statistical Methods**, S.Chand and CompanyLtd ,New Delhi.
2. Gupta .S.C, Kapoor.V.K (2002), **Funtamentals of Mathematical Statistics**, SultanChand& Sons, New Delhi.
3. Gupta .S.P (2006), **Statistical Methods**, Sultan Chand & Sons ,New Delhi.
4. J. N. Kapur, H. C. Saxena(2003), **Mathematical Statistics**, S.Chand & Company Ltd, NewDelhi.
5. S. G. Venkatachalapathy, Dr. H.Premraj(2015), **Statistical Methods**, MarghamPublications, 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
3. https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200403224023542 0anoop_singh_Test_of_Significance_for_Large_and_Small_Samples.pdf
4. https://mgkvp.ac.in/Uploads/Lectures/13/4572.pdf
5. https://egyankosh.ac.in/bitstream/123456789/20554/1/Unit-11.pdf
6. https://opentextbc.ca/introductorybusinessstatistics/chapter/f-test-and-one-way-anova-2/
7. https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_hypothesistesting-chisquare/bs704_hypothesistesting-chisquare_print.html
8. https://www.vedantu.com/formula/f-test-formula

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

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 Candidates admitted in the academic year 2021-22)

Course Title	NON MAJOR ELECTIVE - 2: APTITUDE MATHEMATICS – II
Total Hours	45
Hours / Week	3
Code	U21MA4NMT02
Course type	Theory
Credits	3
Marks	100

CONSPECTUS

To equip the students 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.

UNIT I: PIPES AND DISTANCE **9 HRS**

Pipes and cisterns – Time and distance**.**

Extra Reading/Key words*:* *Work and wages**,** Measures.*

UNIT II: TRAINS AND BOATS **9 HRS**

Problems on trains – Boats and streams.

Extra Reading/Key words*:* *Races, Games.*

UNIT III: AREA **9 HRS**

Area – Volume and Surfaces Areas

Extra Reading/Key words*:* *Shapes, Patterns.*

UNIT IV: INTEREST **9 HRS**

Simple Interest – Compound Interest

Extra Reading/Key words*:* *Stocks and Shares*

UNIT V: DISCOUNT **9 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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K5)
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	Analyse 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**

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

TEXT BOOK

Aggarwal R.S. (2012), **OBJECTIVE ARITHMETIC** For Competitve 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 edition2018 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, 6th RevisedEdition.
4. Deepak Agarwal, D.P.Gupta, Quantitative Aptitude for CAT and other MBA Entrance Examinations,Disha publications,4th 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.

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

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 Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002
SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Third Year - Semester – V

Course Title	**MAJOR CORE 11- LINEAR ALGEBRA**
Total Hours	**60**
Hours / Week	**4**
Code	**U20MA5MCT11**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand vector space and its properties
CO – 2	Apply the concepts of linear independence, basis, dimension for various vector spaces and matrix of any linear transformation
CO – 3	Understand algebraic concept of inner product spaces and its properties
CO – 4	Apply the various properties for the theory of Matrices
CO – 5	Calculate eigen values and eigen vectors for various Matrices

UNIT I: VECTOR SPACES **12 HRS**

Definition and examples - Subspaces - Linear transformation - Span of a set – Linear Independence.

Extra Reading/ Keywords: *Linear independent Polynomials, Row or Column Vectors*

UNIT II: VECTOR SPACES (CONTN) **12 HRS**

Basis and Dimension – Rank and Nullity- Matrix of a 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.

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.

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 .

Extra Reading/ Keywords: *Diagonalisation of a Matrix*

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

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recall vector space and its properties	**PSO – 1**	**R,U**
CO – 2	Recognize basis, dimension, rank, matrix linear transformation	**PSO -2**	**R,U**
CO – 3	Describe Inner Product Space and its properties	**PSO -5**	**R,U**
CO – 4	Recall Matrix Theory and their properties	**PSO -3**	**R,U**
CO – 5	Compute eigen values and eigen vector of any Matrix	**PSO -4**	**U,E**
CO – 6	Study Vector spaces as an abstract algebraic system and establish some of the properties of such systems- Skill Development	**PSO -2**	**R,U**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember;

U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED TEXT BOOKS

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)

BOOKS FOR REFERENCE

1. Richard W. Kaye, Robert Wilson(1998), Linear Algebra, Oxford University Press.
2. R. Balakrishnan & N. Ramabadran(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.

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002

SCHOOL OF MATHEMATICAL COMPUTATION SCIENCE

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM

B.Sc., MATHEMATICS

Third year - Semester – V

Course Title	**MAJOR CORE 12 – REAL ANALYSIS-I**
Total Hours	**60**
Hours / Week	**4**
Code	**U20MA5MCT12**
Course type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of real valued function, sequence and limit of a sequence.
CO – 2	Understand convergent sequence, divergence sequence, bounded sequence, monotone sequence and cauchy sequence.
CO – 3	Analyze the series of Real numbers.
CO – 4	Test convergence property using Comparison test, Cauchy's condensation test, D'Alembert's ratio test and Raabe's test.
CO – 5	Understand limits, 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

Extra Reading/Key words: *Aleph number, hyperreal 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

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.

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).

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.

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

COURSE OUTCOMES (CO) :
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recognize real valued function, sequence and limit of a sequence.	**PSO – 3**	**R,U**
CO – 2	Recall convergent sequence , divergence sequence, Bounded sequence, Monotone sequence and Cauchy sequence.	**PSO -2**	**R,U**
CO – 3	Analyze the series of Real numbers.	**PSO -1**	**An**
CO – 4	Examine convergence property using Comparison test, Cauchy's condensation test, Alembert's ratio test and Raabe's test.	**PSO -5**	**U,An**
CO – 5	Explain limits, metric space and continuous function on a real line.	**PSO -4**	**R,U**
CO – 6	Test convergence property using Comparison test, Cauchy's condensation test, Alembert's ratio test and Raabe's test - Skill Development	**PSO-2**	**U,An**

PRESCRIBED 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)

BOOKS FOR REFERENCE

1. Robert G.Bartle,Donald R.Sherbet(2010), **"A First Course in Real Analysis"**, JohnWiley & Sons,Inc. 4th 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.
5. Shanthi Narayan(2009), **"A Course of Mathematical Analysis",** Margaum Publishers.
6. Shanthi Narayan, Dr.M.D.Raisighania(2014), **"Elements Of Real Analysis",**S.Chand & Co. New Delhi, Fifteenth Revised Edition.

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002

SCHOOL OF MATHEMATICAL COMPUTATION SCIENCE

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM

B.Sc., MATHEMATICS

Third year - Semester – V

Course Title	**MAJOR CORE – 13: GRAPH THEORY**
Total Hours	**60**
Hours/Week	**4**
Code	**U20MA5MCT13**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of graphs and sub graphs.
CO – 2	Understand the degree sequence and connectedness on graphs.
CO – 3	Understand about Eulerian, Hamiltonian graphs and trees.
CO – 4	Understand directed graphs and its properties.
CO – 5	Apply graph theory concept onConnector Problems, Shortest Path Problem and Transformation and Kinematic Graph.

UNIT I: GRAPHS AND SUBGRAPHS 12 HRS

Introduction – Definition and Examples - Degrees – Subgraphs – Isomorphism – Independent Sets and Coverings –Matrices – Operations on Graphs.

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.

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.

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.

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 without Solutions.

Extra Reading/Keywords: *Colouring of digraphs*

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

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recall and relate graphs and sub graphs with their Operations	**PSO - 4**	**R,U**
CO – 2	Recognize the degree sequence and connectedness	**PSO - 5**	**U**
CO – 3	Relate Eulerian, Hamiltonian graphs and Trees	**PSO - 2**	**U**
CO – 4	Describe directed graphs and its properties.	**PSO - 3**	**U**
CO – 5	Apply graph theory to Connector Problem, Shortest Path Problem, Transformation and Kinematic Graph	**PSO - 1**	**U, Ap**
CO – 6	Understand the concepts of graph theory as an application of mathematics in information technology related fields- Skill Development	**PSO - 2**	**U,Ap**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E-Evaluate; C – Create

PRESCRIBED TEXT BOOK

Treatment as in Dr.S.Arumugam and Dr.S.Ramachandran(7^{th} 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

BOOKS FOR REFERENCE

1. Harary (10^{th} 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.

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002

SCHOOL OF MATHEMATICAL COMPUTATION SCIENCE
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third year - Semester – V

Course Title	**MAJOR CORE- 14: DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND FOURIER SERIES**
Total Hours	**60**
Hours / Week	**4**
Code	**U20MA5MCT14**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To expose the standard forms of partial differential equations, Laplace transform, inverse of Laplace transform ,Fourier series and applications of partial differential equations .

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Evaluate ordinary differential equation with variable coefficient and by the method ofvariation of parameter
CO – 2	Form and solve Partial differential equations
CO – 3	Understand Laplace transform and to find Laplace transforms for standard Functions
CO – 4	Understand inverse Laplace transforms and to apply it for finding the Solution of ordinary differential equations
CO – 5	Understand Fourier series and compute full range and 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.

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.

Extra Reading/ Keywords: *Heat equation, Wave equation*

UNIT III: LAPLACE TRANSFORMS 12 HRS

Definition - Laplace transforms of functions e^{at}, Cosat, Sinat, t^n (n is a +ve integer), e^{at}cosbt,e^{at} sinbt, f'(t), f"(t), f^n(t), t^n f(t), f(t)/ t

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 - application to solution of ordinary differential equations with constant coefficients.

Extra Reading/ Keywords*: Partial Fractions*

UNIT V: FOURIER SERIES 12 HRS

Full Range series – Half range cosine and sine series (Change of interval excluded)

Extra Reading/ Keywords*: Fourier Integrals, Relation between Fourier series and Fourier integrals*

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

Course Outcomes (CO):
The learner will be able to

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Apply variation of parameters to solve ordinary differential equation	**PSO – 4**	**Ap, E**
CO – 2	Form and solve Partial Differential Equations	**PSO -3**	**U,Ap**
CO – 3	Recall Laplace transform and Compute Laplace transforms for standard Functions	**PSO -2**	**U,E**
CO – 4	Recognize inverse Laplace transforms and apply it in solving ordinary differential equations	**PSO -1**	**U,E**
CO – 5	Recall Fourier series and evaluate Full range and half range cosine and sine Series	**PSO -5**	**U,E**

CO – 6	Expose the standard forms of partial differential equations, Laplace transform, inverse of Laplace transform ,Fourier series and enable the students to apply in problems- Skill Development	**PSO-2,3**	**U,Ap**

PSO – Programme Specific Outcome; CO – Course Outcome; R-Remember; U-Understand;Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED TEXT BOOK

1.Narayanan.S , ManicavachagomPillay.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)

BOOKS FOR REFERENCE

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. Thomas /Finanera(1984), **"Calculus and Analytic Geometry"**, NarosaPublishing House, Delhi.

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002

SCHOOL OF MATHEMATICAL COMPUTATION SCIENCE
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third year - Semester – V

Course Title	**MAJOR CORE 15 – STATISTICAL PACKAGES**
Total Hours	**60**
Hours / Week	**4**
Code	**U20MA5MCT15**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To make the students understand basic theoretical and applied principles of statistics and gain proficiency in using statistical software for data analysis which is needed to enter the job force.

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the procedure of creating and saving data file, descriptive statistics and representation of charts and graphs with SPSS.
CO – 2	Understand the statistical association between variables, graphical and mathematical method of correlation.
CO – 3	Evaluate parametric tests for comparing averages between dependent and independent samples using SPSS.
CO – 4	Understand the various nonparametric tests, assumptions, procedures to solve problems.
CO – 5	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.

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.

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.

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 t-test – Paired t –test.

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.

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.

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.
7. Sign test , Signed Rank sum test, Mann-Whitney test, Runtest.
8. Kruskal-Wallis, Kolmorghov Smirnov test, Kendall's and Fried-man tests.

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

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Explain the concept of preparing data in SPSS, univariate and bivariate statistical tables, graphs and diagrams concisely.	**PSO – 2**	**U, E**
CO – 2	Compute the linear relationship between continuous and categorical variables with correlations using SPSS.	**PSO – 3**	**U, E**
CO – 3	Apply the idea of parametric tests to evaluate dependent and independent samples.	**PSO – 3**	**U, E**
CO – 4	Recall and summarize various non-parametric tests and its applicability.	**PSO – 3,4**	**Ap, E**
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 theconcept of Two-way ANOVA	**PSO – 4,5.**	**Ap, E**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED 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.

BOOKS FOR REFERENCE

1. A. Rajathi and P. Chandran(2010), **"SPSS for you",** MJP Publishers, Chennai.
2. Ajai S. Gaur and Sanjana S. Gaur(2009), **"Statistical Methods for Practice and Research"**, Second Edition, Sage Publications Ltd.
3. S.P. Gupta(2006), "**Statistical Methods"**, Sultan Chand and sons, Educational Publishers,New Delhi, Revised Edition.
4. S.C. Gupta(2010**), "Fundamentals of Statistics",** Sixth revised and enlarged edition, Himalaya Publishing House,New Delhi.

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002

SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM

B.Sc. MATHEMATICS

Third Year-Semester–V

Course Title	**MAJOR ELECTIVE 3 – R PROGRAMMING**
Total Hours	**60**
Hours/ Week	**4**
Code	**U20MA5MET07**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

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

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO–1	To understand the basic concepts of R Programming.
CO–2	To understand the concept of data structure, R programming structure, control statements and arithmetic operators.
CO–3	To understand the use of math functions in R programming
CO–4	To understand the input, output operations and analyze the relationships between variables using R for plotting graphs.
CO–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

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 – Readline function – Control statements – Arithmetic operator and values – Basic R programs

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

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

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

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.

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO–1	Explain critical R programming concepts.	PSO-2	**R,E**
CO–2	Design and implement the solution using vectors, matrices and data frames	PSO-5	**U,E**
CO–3	Apply various functions to write programs in R.	PSO–3	**Ap, E**
CO–4	Analyze data and generate reports based on the data.	PSO-2	**An, E**
CO -5	Implement probability distribution and statistical techniques to sole a wide variety of problems.	PSO-5	**An, E**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember;

U-Understand; Ap–Apply; An–Analyse; E-Evaluate; C– Create

PRESCRIBED 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

BOOKS FOR REFERENCE

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.

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Third Year-Semester–V

Course Title	**MAJOR ELECTIVE 3 – VERBAL REASONING**
Total Hours	**60**
Hours / Week	**4**
Code	**U20MA5MET08**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the idea of series completion and analogical reasoning accurately.
CO – 2	Understand the method of finding the given message using coding and decoding and illustrate blood relations problems.
CO – 3	Understand the concept of puzzle andjumbled problems.
CO – 4	Apply theidea of venndiagram to study therelationsandconcept of wordformation.
CO – 5	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 Jumpled up descriptions – 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: LOGICALVENNDIAGRAM ANDALPHABET 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 output tracing, Direction sense test*

UNIT V: ALPHANUMERICSEQUENCEPUZZLEANDTESTS 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.

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Explain the idea of series completion and analyze analogical reasoning concisely and accurately.	**PSO - 2**	**R, E**
CO – 2	Explain the method of finding the given message using coding and decoding and solve blood relations problems.	**PSO - 5**	**U, E**
CO – 3	Recall and summarize concept of puzzle, classification and comparison type questions.	**PSO – 3**	**U, E**
CO – 4	Apply the idea of venn diagram to study the relations and conceptof word formation.	**PSO - 2**	**Ap, E**
CO – 5	Compute Alpha Numeric Sequence puzzle and Number, Ranking and Time Sequence test	**PSO – 3,4**	**Ap, E**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember;

U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED TEXT BOOKS

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

BOOKS FOR REFERENCE

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(2012),

(For Candidates admitted in the academic year 2020-21)

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002

SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES

PG AND RESEARCH DEPARTMENT OF MATHEMATICS

CHOICE BASED CREDIT SYSTEM

B.Sc. MATHEMATICS

Third Year-Semester–V

Course Title	**MAJOR SKILL BASED ELECTIVE 2: APTITUDE MATHEMATICS – II**
Total Hours	**30**
Hours / Week	**2**
Code	**U20MA5SBT02**
Course type	**Theory**
Credits	**1**
Marks	**100**

GENERAL OBJECTIVE

To revise arithmetic facts related to area, distance, boats, interest, finance etc., and develop problem solving techniques**.**

COURSE OBJECTIVES

To enable the learners:

CO No.	**Course Objectives**
CO–1	Describe time and distance and evaluate problems on pipes and cisterns;
CO–2	Evaluate problems on trains, boats and streams;
CO–3	Remember and applythe concept of area to evaluate volume and surface areas;
CO–4	Understand simple and compound interest and evaluate problems on the same;
CO–5	Understand the concept of discount and applyto true and bankers discount.

UNIT I: PIPES AND DISTANCE **6 HRS**

Pipes and cisterns – Time and distance**.**

Extra Reading/Keywords*:* *Work and wages**,** Measures.*

UNIT II: TRAINS AND BOATS **6 HRS**

Problems on trains – Boats and streams.

Extra Reading/Keywords*:* *Races, Games.*

UNIT III: AREA **6 HRS**

Area – Volume and Surfaces Areas

Extra Reading/Keywords*:* *Shapes, Patterns.*

UNIT IV: INTEREST **6 HRS**

Simple Interest – Compound Interest

Extra Reading/Keywords*:* *Stocks and Shares*

UNIT V: DISCOUNT **6 HRS**

True Discount – Banker's Discount

Extra Reading/Keywords*:* *Revenue, Principal amount.*

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

COURSE OUTCOMES(CO)
The learners will be able to:

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Understand time and distance and evaluate problems on pipes and cisterns;	**PSO-2**	**U,E**
CO-2	Evaluate problems on trains, boats and streams;	**PSO-3**	**E**
CO-3	Remember the concept of area to evaluate volume and surface areas;	**PSO-1**	**R, E**
CO-4	Understand simple and compound interest and evaluate problems on the same;	**PSO-4**	**U,E**
CO-5	Understand the concept of discount and applyto true and bankers discount;	**PSO-5**	**U, Ap**
CO-6	Faster Computation of problems for Competitive Exams-Employability.	**PSO-1**	**R, Ap**

PSO–Programme Specific Outcome; CO–Course Outcome; R-Remember; U-Understand;Ap–Apply; An–Analyse; E-Evaluate; C–Create

PRESCRIBED TEXT BOOK

Aggarwal R.S. (2012), **"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 26 and 27

BOOK FOR REFERENCE

1. Aggarwal R.S(Revised edition2018 and reprint 2020), "**Objective Arithmetic" (SSC and Railway exam special)**, 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.

(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
Third Year - Semester – V

Course Title	**NON MAJOR ELECTIVE 3: STATISTICS –I**
Total Hours	**45**
Hours / Week	**3**
Code	**U20MA5NMT03**
Course type	**Theory**
Credits	**3**
Marks	**100**

GENERAL OBJECTIVE

To make the students understand various characteristics of discrete and continuous statistical distributions with mathematical techniques.

COURSE OBJECTIVES

The learner will be able

CO No.	Course Objectives
CO – 1	Understand the various measures of dispersion
CO – 2	Understand probability, conditional probability and its axioms
CO – 3	Understand discrete and continuous random variable and its properties
CO – 4	Apply properties of two dimensional random variable and various probability distribution.
CO – 5	Evaluate expectation of a random variables.

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 onlythrough assignment and seminars.

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Describe and analyze Range, Quartile deviation, Mean Deviation and standard deviation .	**PSO - 2**	**K, E**
CO – 2	Explain addition theorem, multiplication theorem, Axioms of Probability, Conditional Probability and Multiplicative law of probability.	**PSO - 5**	**U,E**
CO – 3	Recall and summarize Discrete and continuous random variable, cumulative distributive function, properties of distribution function, function of a random variable	**PSO – 3**	**U, E**
CO – 4	Apply Probability in coins, cards and dice	**PSO - 2**	**Ap, E**
CO – 5	Compute Expectation of a random variable and expectation of a function of a random variable	**PSO – 3,4**	**Ap, E**
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	**PSO-2,3**	**R, Ap**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember;U-

Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED 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 III	-	Chapter 2
Unit IV	-	Chapter 2
Unit V	-	Chapter 3

BOOKS FOR REFERENCE

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",** SultanChand & Sons ,New Delhi.
5. Gupta .S.P (2006), "**Statistical Methods",** Sultan Chand & Sons, New Delhi.

(For Candidates admitted in the academic year 2020-21)

Course Title	MAJOR CORE 16 : REAL ANALYSIS – II
Total Hours	75
Hours / Week	5
Code	U20MA6MCT16
Course type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE:

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 which will develop a deeper understanding of Real Analysis and enhance their potential to enter the field of research.

Course Objectives

The learner will be able to

CO No.	Course Objectives
CO – 1	To understand the concept of open and closed set
CO – 2	To understand connected sets, bounded sets and totally bounded sets
CO – 3	Analyze the concepts of complete metric space, compact, totally bounded and uniformcontinuity
CO – 4	To understand the concept of upper and lower R-integral as well as examine the properties of Riemann integrals and improper integral
CO – 5	To understand derivatives of a real valued function with the help of Rolle's theorem and Taylor's theorem

UNIT I: OPEN AND CLOSED SETS **15 HRS**

Open sets - Closed sets – More about open sets

Extra Reading/ Keywords: I*nterior 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 ofvector-valued functions.*

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

Course Outcomes (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recognize the difference between open set and closed set.	**PSO - 2**	**R,U**
CO – 2	Describe the sets to be connected, bounded and totally bounded.	**PSO -1**	**R,U**
CO – 3	Analyze the functions to be continuous, complete metric space and uniformly continuous.	**PSO -5**	**U, An**
CO – 4	Determine the concept of Riemann integral and their properties, Rolle's Theorem, Taylor's theorem.	**PSO -2**	**R, U**
CO – 5	Understand the idea of real valued function has a derivatives at a point and to be continuous, the mean value theorem, Rolle's theorem and Taylor's theorem.	**PSO -2**	**R, U**
CO – 6	Apply the concept of complete and compact metric space, property of Heine –Borel theorem , Riemann integration and its properties, Rolle's Theorem , Taylors Theorem.	**PSO 3**	**U, Ap**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember;

U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED 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)

BOOKS FOR REFERENCE

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^{th} 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 by the press syndicate of the university ofCambridge House.

(For Candidates admitted in the academic year 2020-21)

Course Title	MAJOR CORE – 17: COMPLEX ANALYSIS
Hours / Week	5
Code	U20MA6MCT17
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the fundamental concepts of functions of a complex variable along with the concepts of analyticity, Cauchy-Riemann relations and harmonic functions
CO - 2	Understand about bilinear transformation and its properties
CO - 3	Evaluate definite integrals using Cauchy's theorem and Cauchy's integral formula
CO – 4	Expand some simple functions as Taylor and Laurent series, understand zeros, pole and classify the nature of singularities
CO – 5	Evaluate residues using Cauchy's residue theorem
CO – 6	Evaluate definite integrals

UNIT I: ANALYTIC FUNCTIONS **15 HRS**

Introduction –Functions of a complex variable- Continuous functions – Differentiability-Cauchy - Riemann equations- Analytic Functions -Harmonic functions

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.

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.

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.

Extra Reading/ Keywords*: Rational functions, Calculation of definite integrals*

UNIT V: CALCULUS OF RESIDUES **15 HRS**

Introduction -Residues – Cauchy's Residue theorem - Evaluation of Definite Integrals.

Extra Reading/ Keywords*: Sums of infinite series, The principle of argument*

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

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO - 1	Recall the functions of complex variable, analytic functions and harmonic functions.	**PSO - 1**	**R,U**
CO - 2	Explain bilinear transformation and its special types.	**PSO -2**	**U,E**
CO - 3	Evaluate complex integration using Cauchy's Integral formula and higher derivatives.	**PSO -5**	**Ap, E**
CO - 4	Recognize zeros, poles and singularities of an analytic functions and expand the functions as a series using Taylor's theorem and Laurent's theorem	**PSO -3**	**U,E**
CO - 5	Calculate residues and apply Cauchy Residue theorem to evaluate integrals.	**PSO -4**	**E**
CO - 6	Extend the idea of integration in the complex field by using residues and evaluating contour integrals and to understand the concept of bilinear transformation and visualizing their images - Skill Development	**PSO -2,3**	**U,E**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember; U- Understand;Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED TEXT BOOK

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 7.4)
UNIT V : Chapter 8 (Sec 8.0 to 8.3)

BOOKS FOR REFERENCE

1.V.Karunakaran (2006), „**Complex Analysis**", Narosa publishing House ,New Delhi 2.Howie, M. John (2008), „**Complex Analysis**",Wiley Dremtech Pvt Ltd

3. H. A. Priestley(2006), **„Introduction to Complex Analysis"**, 2nd edition (Indian), Oxford.

4.L.V. Ahlfors(2000), **„Complex Analysis"**, 3rd edition, McGraw Hill.

5. S.Ponnusamy (2011), „**Foundations of Complex Analysis",** Narosa publishing House, New Delhi.

(For Candidates admitted in the academic year 2020-21)

Course Title	MAJOR CORE 18: FUZZY SET THEORY
Total Hours	75
Hours / Week	5
Code	U20MA6MCT18
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVES:

To enable the students to have better applications of uncertainty through fuzzy mathematics for problems in physical and social sciences.

COURSE OBJECTIVES:
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand fuzzy set theory
CO – 2	Evaluate the operation on fuzzy sets
CO – 3	Understand and evaluate fuzzy relations and its operators
CO – 4	Understand fuzzy logic and approximate reasoning
CO – 5	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.

Extra Reading/ Keywords*: Fuzzy representation On Venn diagrams*

UNIT II: OPERATIONS ON FUZZY SET **15 HRS**

Introduction - Fuzzy Complements- Fuzzy Intersections-Fuzzy Unions.

Extra Reading/ Keywords: *Combination of operations, Aggregation operations, Fuzzy numbers.*

UNIT III: FUZZY RELATIONS **15 HRS**

Introduction- Operations on Fuzzy Relations-α-cuts of Fuzzy Relations-Compositions of FuzzyRelations-Projections of Relations-Cylindric Extensions.

Extra Reading/ Keywords: *Cylindric Closure, Fuzzy ordering relation, 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.

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.

Extra Reading/ Keywords: *Real Life examples, Model free nature of FLC.*

Note: Texts given in the Extra reading/Key word must be tested only through assignment and seminars

COURSE OUTCOMES(CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Recall and relate fuzzy set theory.	**PSO-2**	**R, U**
CO-2	Recognize and relate the operation on fuzzy sets.	**PSO-4**	**U, Ap**
CO-3	Recall and evaluate fuzzy relations and its operators.	**PSO-1**	**U, E**
CO-4	Describe and discuss fuzzy logic and approximate reasoning.	**PSO-3**	**U, Ap**
CO-5	Reproduce fuzzy methods in control theory and formulation of FLC.	**PSO-5**	**U, Ap**
CO-6	Enable the students to have better applications of uncertainty through fuzzy mathematics for problems in physical and social sciences-Skill Development	**PSO-2**	**U, Ap**

PSO-Programme Specific Outcome; CO-Course Outcome: R-Remember: U-Understand;

Ap-Apply; An-Analyse; E-Evaluate; C-Create

PRESCRIBED TEXT BOOKS

1. 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

2. 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)

BOOKS FOR REFERENCE

1. A.Kaufmann, (2005), **„Introduction to Fuzzy Theory",** Academic press, Newyork.
2. George J .Kler /Bo yuan, (2005), **„Fuzzy Sets and Fuzzy Logic –Theory andApplications",** Prentice Hall ofIndia ,New Delhi .
3. T.M.Ross(2006), **„Fuzzy Engineering Application"**, Wiley Western Company.

(For Candidates admitted in the academic year 2020-21)

Course Title	MAJOR CORE 19: DISCRETE MATHEMATICS
Total Hours	75
Hours / Week	5
Code	U20MA6MCT19
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concepts of Propositions and Logical Connectives
CO – 2	Understand the basic concepts of permutations and combinations and rules of sum and product of permutations and combinations
CO – 3	Understand the concept of functions and their Properties , Composition of Functions, Recursive functions , Hashing and Pigeonhole Principle
CO – 4	Understand the concepts of Languages and Types of Grammars and Languages and Finite state Machines
CO – 5	Understand the concepts and significance of Boolean Algebra

UNIT I : MATHEMATICAL LOGIC **15 HRS**

Propositions – Logical Connectives – Conditionals and Biconditions- Well Formed Formulas - Tautologies – Logical Equivalences – Theory of Inference for statement Calculus

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

Extra Reading/ Keywords: *Discrete Probability , Partial Ordering Relations*

UNIT III: FUNCTIONS **15 HRS**

Functions - Composition of Functions – Invertible functions – Recursive functions – Hashing – Pigeonhole Principle

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

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

Extra Reading/ Keywords: *Design examples using Boolean Algebra, Sequential Circuits*

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Describe and analyze Mathematical logic , connectives, normal form of the Mathematical logic	**PSO – 2**	**K, E**
CO – 2	Explain the concepts of permutations and combinations and rules of sum and product of permutations and combinations	**PSO – 5**	**U,E**
CO – 3	Recall and summarize functions and their Properties , Composition of Functions, Recursive functions , Hashing and Pigeonhole Principle	**PSO – 3**	**U, E**
CO – 4	Describe the concepts of Languages and Types of Grammars and Languages and Finite state Machines	**PSO – 2**	**Ap, E**
CO – 5	Apply lattices and Boolean algebra in computer science	**PSO – 3,4**	**Ap, E**
CO – 6	Enhance the knowledge of Mathematical logic, permutations and combinations , functions, lattices and Boolean algebra	**PSO-2,3**	**R, Ap**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember;

U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED TEXT BOOKS

CL Liu and DP Mohapatra , **"Elements of Discrete Mathematics "**, 4th 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

BOOKS FOR REFERENCE

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", 3rd Edition, Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2010.
3. Kolman, Busy & Ross , "Discrete Mathematical Structures", 5th Edition, PHI , New Delhi , 2005
4. Rosen, K. H., "Discrete Mathematics and its Application" , 5th Edition , TataMcGraw Hill Pub. Co. Ltd., New Delhi, 2010.
5. Tremblay, J.P. and Manohar, R. "Discrete Mathematical Structures with Applications to Computer Science", 35th Reprint, TataMcGraw Hill Pub. Co. Ltd., New Delhi, 2008.

(For Candidates admitted in the academic year 2020-21)

Course Title	MAJOR ELECTIVE 4 – PYTHON PROGRAMMING
Total Hours	60
Hours / Week	4
Code	U20MA6MET09
Course type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE:

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the basic concepts and noteworthy features of Python language
CO – 2	Illustrates the operations of built-in functions and user defined functions of Python
CO – 3	Examine the string types, formatting operators and functions, assessing list operators and methods
CO – 4	Illuminate the creation of tuples and properties with the operations of Dictionary
CO – 5	Apply 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.

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, Parameter and Arguments, Function Calls, The return statement, Python Recursive Function, The Anonymous Functions.

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.

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.

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.

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.

Course Outcomes (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recognize the standard data types, variables, controlstatements with their computation.	**PSO-1**	**R**
CO – 2	Explain and apply the built-in functions and user definedfunctions provided by Python to build their ownfunctions to perform some particular tasks.	**PSO -4**	**U, Ap**
CO – 3	Implement Strings and lists with their functions and methods to write and execute simple python programs.	**PSO – 3**	**U**
CO – 4	Use Python tuples and dictionaries for accessing data.	**PSO -2**	**U**
CO – 5	Read and write data from/ to files in Python.	**PSO -5**	**An**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyze; E- Evaluate; C – Create

PRESCRIBED 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

BOOKS FOR REFERENCE

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"**, 2nd 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.

(For Candidates admitted in the academic year 2020-21)

Course Title	MAJOR ELECTIVE 4: NON VERBAL REASONING
Total Hours	60
Hours / Week	4
Code	U20MA6MET10
Course type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the logical rules and analyze visual information and solve problems using visual reasoning
CO – 2	Understand the concept of analogy and identifying logical patterns that establish a relationship between two given figures
CO – 3	Identifying the odd one among the various options based on their creative thinking and utilize their logical skills
CO – 4	Evaluate the logical behind the given pattern and applying that logical reason to solve the incomplete pattern
CO – 5	Understand the Concept of Cubes & Dice to solve the verbal 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*

UNT 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.

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Describe and analyze the visual information to solve complex problems without relying upon or being limited by language skills.	**PSO –1**	**U,E**
CO – 2	understanding logical rules and process diagrams to find out the causes to evaluate the processes represented via diagrams.	**PSO -2**	**Ap, E**
CO – 3	Understanding the concept of Classification and Analytical reasoning to tests the ability to analyse visual information and solve problems based on visual reasoning.	**PSO -5**	**E**
CO – 4	Understanding the concept of Figure Matrix, Paper folding & cutting through which learn the various patterns and incomplete pattern methods.	**PSO -3**	**E**
CO – 5	Enhancing the knowledge to figure out the solutions for the verbal reasoning by Cube and Dice blocks and concept.	**PSO -4**	**U,E**
CO – 6	**To** analyze and solve critical and real time problems based on the various concepts and being limited by aptitude skills.	**PSO -2**	**Ap, E**

PSO – Programme Specific Outcome; CO – Course Outcome; R -Remember;U-Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

PRESCRIBED 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

BOOKS FOR REFERENCE

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.

(For Candidates admitted from the academic year 2020-21)

Course Title	NON MAJOR ELECTIVE - 4 : STATISTICS - II
Total Hours	45
Hours / Week	3
Code	U20MA6NMT04
Course type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE:

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

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of discrete and continuous distributions and their properties
CO – 2	Illustrate the concept of discrete and continuous distributions with related problems
CO – 3	Analyze the large samples and evaluate testing the hypothesis
CO – 4	Examine the concept of small samples and evaluate test of hypothesis using chi-square test, student t test and their properties
CO – 5	Demonstrate F test for Equality of two population variances and differentiate theone 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).

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 Normaldistribution.(No derivation, simple problems only).

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 oftwo means- Test for a specified proportion - Test for the equality of two proportions.
(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.
(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
(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.

Course Outcomes (CO):

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recognize the concept of discrete, continuous distributions a n d sampling theory along with their properties.	**PSO-1**	**R**
CO – 2	Explain and apply the concept of discrete and continuous distributions and sampling theory to solve problems arising in the real life situations.	**PSO -4**	**U,Ap**

CO – 3	Explain the concept of Large sample and evaluate testing the hypothesis.	**PSO – 3**	**U**
CO – 4	Categorize small sample and testing the hypothesis by using chi-square test, Student t test and F test.	**PSO -2**	**U**
CO – 5	Analyze the concept of sampling theory and use appropriate test such as chi square test, Student t test and F test to infer the solution.	**PSO -5**	**An**

PSO – Programme Specific Outcome; CO – Course Outcome; R- Remember; U- Understand;Ap – Apply; An – Analyze; E- Evaluate; C – Create

PRESCRIBED TEXTBOOK

Treatment and content as in Dr.Vittal .P. R (Reprint 2018), **"Mathematical Statistics",** Margham Publications, 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

BOOKS FOR REFERENCE

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",** 2nd edition, Margham Publications, Chennai.