PG AND RESEARCH DEPARTMENT OF MATHEMATICS

SYLLABUS (2021 – 2022)

B.Sc. MATHEMATICS

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.

(For Candidates admitted from June 2021 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI – 620 002
SCHOOL OF MATHEMATICAL AND 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	U21MA1MCT01	4	4	100
		Major Core – 2	Analytical Geometry of Three Dimensions and Vector Calculus	U21MA1MCT02	5	4	100
		Major Core – 3	Algebra and Trigonometry	U21MA1MCT03	4	3	100
		Allied – 1	Properties of Matter, Optics and Sound	U21PH1ALT01	4	2	100
		Allied – 2	Basic Physics Practical-I	U21PH1ALP02	4	2	100
	IV	Environmental Studies	Environmental Studies	U21RE1EST01	2	1	100
		Value Education	Ethics I/ Bible Studies I/ Catechism I	U21VE2LVE01/ U21VE2LVB01/ U21VE2LVC01	1	-	-
			Service Oriented Course	-	-	-	-
			Internship / Field Work / Field Project 30 Hours – Extra Credit	U21SP1ECC01	-	2(Extra Credit)	100
			Total		30	22+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	U21MA2MCT04	5	4	100
		Major Core – 5	Statics	U21MA2MCT05	4	3	100
		Major Core – 6	Programming in C	U21MA2MCT06	5	4	100
		Allied – 3	Modern Physics, Electricity and Electronics	U21PH2ALT04	4	2	100
	IV	Skilled Based Course(SBC) – 1	Soft Skills Development	U21RE2SBT01	2	1	100
		Skilled Based Course(SBC) – 2	Sustainable Rural Development and Student Social Responsibility	U21RE2SBT02	2	1	100
		Industrial Relation	Industrial Relation	U21MA2IRT01	1	1	100
		Value Education	Ethics I / Bible Studies I/ Catechism I	U21VE2LVE01/ U21VE2LVB01/ U21VE2LVC01	1	1	100
			Service Oriented Course	-	-	-	
			Internship / Field Work / Field Project 30 Hours - Extra Credit	U21SP2ECC02		2(Extra Credit)	100
			Total		30	23+2	1000+ 100

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	U20MA3MCT07	4	3	100
		Major Core – 8	Optimization Techniques – I	U20MA3MCT08	5	4	100
		Major Elective - 1	Sci Programming (Theory)/ Latex/ Design and Analysis of Algorithms	U20MA3MET01/ U20MA3MET02/ U20MA3MET03	4	4	100
		Major Skill Based Elective -1	Aptitude Mathematics I	U20MA3SBT01	2	1	100
		Allied – 4	Statistics I/ Basics of Accounting / Human Resources Management	U20MA3ALT13/ U20CO3ALT05/ U20CO3ALT10	4	2	100
	IV	Non Major Elective – I	Aptitude Mathematics I	U20MA3NMT01	3	3	100
		Gender Studies	Gender Studies		1	1	100
		Value Education	Ethics II/ Bible Studies II/ Catechism II	U20VE4LVE02/ U20VE4LVB02/ U20VE4LVC02/	1	-	-
			Service Oriented Course			-	-
			Internship / Field Work / Field Project 30 Hours -Extra Credit	U20SP3ECC03		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	U20MA4MCT09	4	3	100
		Major Core – 10	Optimization Techniques –II	U20MA4MCT10	4	3	100
		Major Elective -2	Sci Programming (Practical)/ Mathematical Modelling/ Basics of Data Analytics	U20MA4MEP04/ U20MA4MET05/ U20MA4MET06	4	4	100
		Allied – 5	Statistics II/ Cost and Management Accounting/ Indian Financial System	U20MA4ALT14/ U20CO4ALT07/ U20CO4ALT11	4	2	100
		Allied – 6	Statistics III / Financial Management/ Organizational Behaviour	U20MA4ALT15/ U20CO4ALT09/ U20CO4ALT12	4	2	100
	IV	Non Major Elective – 2	Aptitude Mathematics II	U20MA4NMT02	3	3	100
		Value Education	Ethics II/ Bible Studies II/ Catechism II	U20VE4LVE02/ U20VE4LVB02/ U20VE4LVC02/	1	1	100
			Service Oriented Course		-	2	-
			Internship / Field Work / Field Project 30 Hours -Extra Credit	U20SP4ECC04		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 – 7	Modern Algebra – II	U15MA5MCT07	5	4	100
		Major Core – 8	Optimization Techniques	U15MA5MCT08	5	4	100
		Major Core – 9	Graph theory	U15MA5MCT09	5	4	100
		Major Core – 10	Real Analysis – II	U15MA5MCT10	5	4	100
		Major Elective -2	Mechanics/ Astronomy	U15MA5MET02 / U15MA5MET06	5	5	100
	IV	Non Major Elective – 1	Quick Mathematics	U15MA5NMT01	2	2	100
		Skill Based Elective -4	Online Course	U19OC5SBT04	2	2	100
		Value education	Ethics III /Bible Studies III / Catechism III	U15VE6LVE03/ U15VE6LVB03/ U15VE6LVC03	1	--	--
		Internship/Field Work/Field Project 30 hours -Extra Credit		U18SP5ECC05/ U18SP5ECC02	-	2(Extra Credit)	100
TOTAL					30	25+2	700+100

Sem	Part	Component	Title of the course	Code	Hours / Week	Credits	Marks
VI	III	Major Core – 11	Theory of Functions of a Complex Variable.	U15MA6MCT11	6	5	100
		Major Core – 12	Differential Equations , Laplace Transforms and Fourier Series	U15MA6MCT12	6	5	100
		Major Core – 13	Introduction to Fuzzy Mathematics	U15MA6MCT13	6	5	100
		Major Elective 3	Programming in C++/ Number Theory	U15MA6MET03/ U15MA6MET07	5	5	100
	IV	Non Major Elective – 2	Art of Programming	U15MA6NMT02	2	2	100
		Skill Based Elective – 5	Application of Algorithms	U15MA6SBT05	2	2	100
		Skill Based Elective –6	Research Methodology	U15DS6SBT06	2	2	100
		Value Education	Ethics III /Bible Studies III / Catechism III	U15VE6LVE03/ U15VE6LVB03/ U15VE6LVC03	1	-	-
		Internship/Field Work/Field Project 30 hours -Extra Credit		U18SP6ECC06/ U18SP6ECC0 2	-	2 (Extra Credit)	100
	IV	Extension Activity	RESCAPES - Impact study of Project		-	1	100
		TOTAL			30	27+2	800+ 100

LIST OF ALLIED COURSES OFFERED BY THE DEPARTMENT

S.No	Sem	Part	Component	Title	Code	Hours	Credits	Marks
1	I	III	Allied 1	Algebra , Calculus and Trigonometry (for Physics students)	U21MA1ALT01	4	2	100
2	I	III	Allied 1	Differential Calculus and Trigonometry (for Chemistry students)	U21MA1ALT02	4	2	100
3	I	III	Allied 1	Statistical Methods (for B.C.A and Computer Science students)	U21MA1ALT03	4	2	100
4	I	III	Allied 1	Business Mathematics (for Commerce students)	U21MA1ALT04	4	2	100
5	I	III	Allied 1	Business Mathematics and Statistics (for Commerce Vocational & CA students)	U21MA1ALT05	4	2	100
6	I	III	Allied 1	Business Mathematics and Statistics for Managers (for BBA students)	U21MA1ALT06	4	2	100
7	I	III	Allied 2	Analytical Geometry of Three Dimensions and Vector Calculus (for Physics students)	U21MA1ALT07	4	2	100
8	I	III	Allied 2	Algebra and Integral Calculus (for Chemistry students)	U21MA1ALT08	4	2	100

9	II	III	Allied 3	**Laplace Transforms, Partial Differential Equations and Fourier Series (for Physics students)**	**U21MA2ALT09**	**4**	**2**	**100**
10	II	III	Allied 3	**Analytical Geometry of Three Dimensions, Vector Calculus and Differential Equations (For Chemistry students)**	**U21MA2ALT10**	**4**	**2**	**100**
11	II	III	Allied 3	**Numerical Methods (for B.C.A and Computer Science students)**	**U21MA2ALT11**	**4**	**2**	**100**
12	II	III	Allied 3	**Business Statistics (for Commerce students)**	**U21MA2ALT12**	**4**	**2**	**100**
13	III	III	Allied 4	Discrete Mathematics (for B.C.A and Computer Science students)	U20MA3ALT12	4	2	100
14	III	III	Allied 4	Statistics I	U20MA3ALT13	4	2	100
15	IV	III	Allied 5	Statistics II	U20MA4ALT14	**4**	**2**	**100**
16	IV	III	Allied 6	Statistics III	U20MA4ALT15	**4**	**2**	**100**

LIST OF NME OFFERED BY THE DEPARTMENT

Sem	Part	Component	Title	Code	Hours	Credits	Marks
III	IV	Non Major Elective – 1	Aptitude Mathematics I	U20MA3NMT01	3	3	100
IV	IV	Non Major Elective – 2	Aptitude Mathematics II	U20MA4NMT02	3	3	100

Course Title	MAJOR CORE 1 – CALCULUS
Code	U21MA1MCT01
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 nth derivatives of Standard result - Trigonometrical transformation of functions - Formation of equations involving derivatives – Leibnitz formula for the nth derivative of a product - Related problems.
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)
Extra Reading/Key words*: Euler's equation of motion, change of variables, transformation*

UNITIII: 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.
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.

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.

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. Kandasamy and 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, Differential and Integral Calculus (Vol I & II) (1996), Mir Publishers, Delhi.
5. Schaums Outline Series (2005) – Theory and problems of Advanced Calculus.

WEB REFERENCE
1. https://theengineeringmaths.com/wp-content/uploads/2017/08/Chapter-1-Successive-Differentiation-.pdf
2. https://magadhmahilacollege.org/wp-content/uploads/2020/05/Partial-Differentiation-.pdf
3. https://www.egyankosh.ac.in/bitstream/123456789/11956/1/Unit-3.pdf
4. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/2018/MultipleIntegrals.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

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

Course Title	**MAJOR CORE 2 – ANALYTICAL GEOMETRY OF THREE DIMENSIONS AND VECTOR CALCULUS**
Code	**U21MA1MCT02**
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 apply vector 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 givenplanes - Length of the perpendicular- Planes bisecting the angle between the planes.

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 – Coplanar line – The shortest distance between two lines – Equations of shortest distance.

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.

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

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 and their applications(simple problems only)

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), AnalyticalGeometry-ThreeDimensional, Emerald Publishers, Chennai.
2. T. K. Manickavasagam Pillay and Others(2004), Vector Calculus,S.Viswanathan Publications.

3. S. Shanti Narayan(1966), A Prescribed Text of Vector Calculus, S. Chand and Co.,New Delhi.
4. K. Viswanatham & S. Selvaraj(1999), Vector Analysis, Emerald Publishers, Chennai.
5. P. Duraipandian, Laxmi Duraipandian(2003), Vector Analysis, Emerald Publishers, Chennai.

WEB REFERENCE

1. http://www.mhtlab.uwaterloo.ca/courses/me201/lecturenotes/me201_web_2017_ch11.pdf
2. https://www.pietech.edu.in/doc/mathematics-unit-2.pdf
3. https://learn.lboro.ac.uk/archive/olmp/olmp_resources/pages/workbooks_1_50_jan2008/Workbook12/12_5_diffrntiatn_vectors.pdf
4. https://www.whitman.edu/mathematics/calculus_online/chapter16.html
5. https://learn.lboro.ac.uk/archive/olmp/olmp_resources/pages/workbooks_1_50_jan2008/Workbook15/15_1_integrtn_of_vectors.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO – 1	Recall the 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 day to day life problems.	**K4**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

Course Title	MAJOR CORE – 3: ALGEBRA AND TRIGONOMETRY
Code	U21MA1MCT03
Course type	Theory
Semester	I
Hours / Week	4
Credits	3
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 of a prime p contained in n! – Congruences – Numbers in arithmetical progression – Fermats' theorem-Wilson's theorem – Lagranges' theorem (without proof).
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 (Problemsonly).
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 sum ofthe powers of the roots.
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}θ, Sin^{n}θ in a series of sines and cosines of multiples of θ, (θ in radians) and expansion of Cosθ, Sinθ, tanθ in a series of powers of θ – Approximations and limits.
Extra Reading/ Keywords: *Taylor series, Inverse trigonometric functions, Asymptotic expansion*

UNIT V: HYPERBOLIC FUNCTIONS   12HRS
Hyperbolic functions – Inverse hyperbolic functions, separation into real and imaginary parts - Logarithm of complex numbers – General value of logarithm**.**
Extra Reading/ Keywords*: Hyperbolic angle, Inverse hyperbolic Cotangent, Secant, Cosecant*

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

TEXT BOOKS

1. Treatment and content as in **Algebra Volume II** by T.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 by Roc 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 REFERENCE

1. **https://ocw.mit.edu/courses/mathematics/18-781-theory-of-numbers-spring-2012/lecture-notes/**
2. **https://www.britannica.com/science/mathematics/Theory-of-equations**
3. **https://lib.alfaisal.edu/pdf/AlgebraAndTrigonometry-LR.pdf**
4. **http://www.mcclendonmath.com/m120/m120coursenotes.pdf**
5. **https://www.math.lsu.edu/courses/ClassNotes**

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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 theory of equations and expansions of trigonometric functions to solve problems.	**K3**
CO – 4	Infer the solutions for real life problem using theory of equations and trigonometric functions.	**K4**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

Course Title	ALLIED 1:ALGEBRA,CALCULUS AND TRIGONOMETRY (For Physics Students)
Code	U21MA1ALT01
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 of powers of θ
5. To understand hyperbolic function, inverse hyperbolic function and separation into real and imaginary parts.

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

UNIT II: DIFFERENTIAL CALCULUS   12 HRS
Leibnitz formula for the nth derivative of product - Curvature – circle, radius and center of curvature – Cartesian formula for the radius of curvature - The co-ordinates of the center of curvature-Evolute and involute.
Extra Reading/ Keywords: *Chain rule, Polar co-ordinates, Wronskian, Reynolds transport theorem*

UNIT III : MULTIPLE INTEGRALS   12 HRS
Reduction formulae: $\int_0^{p/2}\sin^n x\, dx$, $\int_0^{p/2}\cos^n x\, dx$, $\int_0^{p/2}\sin^n x \cos^n x\, dx$ (Problems only) - Introduction to evaluation of double and triple (in Cartesian only) integrals (Change of order of integration excluded)
Extra Reading/ Keywords: *Hyper volumes, cylindrical coordinates, Divergence theorem, transcendental functions*

UNIT IV: EXPANSIONS OF TRIGONOMETRIC FUNCTIONS   12 HRS

Expansions of $\cos n\theta$, $\sin n\theta$ and $\tan n\theta$ (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 θ in radians) – Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in a series of powers of θ (Formation of equations excluded)

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.

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 by RocHouse & 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.sathyabama.ac.in/sites/default/files/course-material/2020-10/Iunit.pdf
2. https://theengineeringmaths.com/wp-content/uploads/2017/08/Chapter-1-Successive-Differentiation-.pdf
3. http://nitkkr.ac.in/docs/5-Multiple%20Integrals%20and%20their%20Applications.pdf
4. https://www.slcc.edu/math/docs/oer-trigonometry.pdf
5. https://www.cimt.org.uk/projects/mepres/alevel/fpure_ch2.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO-1	Recall the 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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 1: DIFFERENTIAL CALCULUS AND TRIGONOMETRY (For Chemistry Students)
Code	U21MA1ALT02
Course type	Theory
Semester	I
Hours/Week	4
Credits	2
Marks	100

CONSPECTUS

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

COURSE OBJECTIVES

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

UNIT I : DIFFERENTIAL CALCULUS   **12 HRS**

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

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

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

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

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

UNIT III: PARTIAL DIFFERENTIATION   **12 HRS**

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

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

UNIT IV: EXPANSIONS   12 HRS

Expansions of $\cos n\theta$, $\sin n\theta$ and $\tan n\theta$ (n being a positive integer) (formation of equations is excluded) – Expansions of $\sin^n\theta$ and $\cos^n\theta$ in a series of sines and cosines of multiples of (n being a positive integer and θ in radians) (only problems involving the above expansions).

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

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

TEXT BOOKS

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

UNIT I: Chapter II: Sections 4.1, 4.2, 5
          Chapter III Sections 1.1-1.3, 2.1 & 2.2
UNIT II: Chapter V: Sections 1.1, 1.2, 1.3 (statement only with simple problems)
           Chapter IV: Section 2.1, 2.2
UNIT III: Chapter VIII

Units IV& V
2.Treatment and Content as in S. Narayanan and T. K.Manicavachagom Pillay (2004)
Trigonometry, S. Viswanathan Printers & Publishers Pvt.Ltd.,.

UNIT IV: Chapter III: Sections 1-4.

UNIT V: Chapter IV: Sections1 & 2

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

WEB REFERENCES

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

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO-1	Underline the concept of differentiation, partial differentiation and identities of trigonometric functions.	**K1**
CO-2	Summarize the various methods for solving problems in differentiation, partial differentiation and expansions of trigonometric functions.	**K2**
CO-3	Make use of differentiation for finding maxima and minima, Euler's theorem for partial differentiation, Trigonometric identities for hyperbolic and inverse hyperbolic functions.	**K3**
CO-4	Classify the techniques for solving problems in differentiation, trigonometric, hyperbolic and inverse hyperbolic functions.	**K4**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

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

Course Title	**ALLIED 1: STATISTICAL METHODS** **(For B.C.A and Computer Science students)**
Code	**U21MA1ALT03**
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 by using relevant statistical tools**.**

COURSE OBJECTIVES
1. To understand various methods of collection of data and representing them through Graphs and diagrams
2. To apply various measures of central tendency.
3. To relate two kinds of data through correlation and fit it into a linear regression curve.
4. To evaluate Index numbers using Laspeyre's, Fisher's Methods, Aggregate ExpenditureMethod 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.
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, coefficientof variation and moments for frequency distributions- concept of skewness and kurtosis and their measures.
Extra Reading/ Keywords: *Grouped data, Gaussian Distribution, Laplace distribution*

UNIT III : CORRELATION AND REGRESSION   12 HRS
Simple Correlation – rank correlation - Concurrent Deviation – Linear regression. (Erroranalysis in chapter 12 omitted)
Extra Reading/ Keywords: *Least squares method, Multiple regression, Karl Pearson'smethod, 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 .

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**.**

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) <u>STATISTICS</u> S.Chandand Company,New Delhi.

UNIT I: Chapter 1,2,4,6,7,8 & 9
UNIT II: Chapters 10 and 11
UNIT III: Chapter 12 and 13(Omit "Error Analysis" in Chapter 12)
UNIT IV: Chapter 14
UNIT V: Chapter 15

SUGGESTED READINGS

1. SC Gupta, Kapoor VK,(2020), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 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 in Mathematical Statistics, Sultan Chand & Sons,
4. Gupta.S.P (2006), Statistical Methods, Sultan Chand & Sons ,New Delhi.5.
5. Sharma J.K, (2006), Business Statistics, Dorling Kindersley, (India) Pvt Ltd,Licensees of Pearson Education in South Asia.

WED REFERENCES

1. **https://www.nios.ac.in/media/documents/SecEcoCour/English/Chapter-17.pdf**
2. **https://www.scribd.com/document/526226147/Measures-of-Central-Tendency-and- dispersion**
3. **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC374386/pdf/cc2401.pdf**
4. **https://www.itl.nist.gov/div898/handbook/pmc/section4/pmc4.htm**
5. **https://www.vedantu.com/commerce/index-numbers**

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 1: BUSINESS MATHEMATICS (For Commerce Students)
Code	U21MA1ALT04
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).

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)

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 decreasingfunctions –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)

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

UNIT V: ASSIGNMENT PROBLEM   **12 HRS**
Assignment problem (Travelling salesman problem excluded)

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.(2007) , **Business Mathematics and Statistics** ,Jai Publishers, Trichy, forUnits I , II and III.

UNIT I : Chapter 2 - Section -1 to 8 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 (2018), **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, New Delhi.
5. Hamdy Taha (2005), Operations Research, Prentice Hall of India, New Delhi.

WEB REFERENCES

1. https://www.pnw.edu/wp-content/uploads/2020/03/attendance7-1.pdf
2. https://uom.lk/sites/default/files/math/files/MATRICES-COMPLETE_LECTURE_NOTE.pdf
3. https://ncert.nic.in/textbook/pdf/lemh106.pdf
4. https://www.alamo.edu/contentassets/20691fef0c254307b473b980bb6648fb/differentiation/math1325-marginal-functions.pdf
5. https://ocw.ehu.eus/pluginfile.php/40935/mod_resource/content/1/5_Transportation.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO-1	Recall the 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, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

Course Title	ALLIED 1: BUSINESS MATHEMATICS AND STATISTICS (For Commerce Vocational and CA Students)
Code	U21MA1ALT05
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 apply differentiation 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'smethod*

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 – Hungarianmethod.
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.
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

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 Index Numbers- Cost of living Index Number - Uses of Index Numbers.
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 Hall of India, New Delhi. 10th Edition, Pearson Paperback.
3. Guppta, 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.dummies.com/education/math/calculus/how-to-determine-marginal-cost-marginal-revenue-and-marginal-profit-in-economics/
2. https://www.scribd.com/document/526226147/Measures-of-Central-Tendency-and- dispersion
3. https://link.springer.com/chapter/10.1007/978-1-4612-1009-2_7
5. https://www.vedantu.com/commerce/index-numbers
6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC374386/pdf/cc2401.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO-1	Recall various methods of collection of data, classify, tabulate and interpret the data through diagrams and 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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 1:BUSINESS MATHEMATICS AND STATISTICS FOR MANAGERS (For BBA Students)
Code	U21MA1ALT06
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 business and 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 diagrams and 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).
Extra Reading/ Keywords: *Financial modeling, Black-Scholes model, Fundamental theorem of 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's method*

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)
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

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.

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. Unit **I &II**-Business Mathematics and Statistics by P.R.Navaneethan.
2. Unit **III,IV&V**- Business Statistics by P.R.Vittal.

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.pearson.com/content/dam/one-dot-com/one-dot-com/us/en/higher-ed/en/products-services/course-products/lial-applied-mathematics-info/pdf/LGR-Finite-Ch5.pdf
2. https://www.brainkart.com/article/Elasticity_36997/
3. https://www.geeksforgeeks.org/collection-and-presentation-of-data/#:~:text=Collection%20of%20data%20refers%20to,of%20people%20with%20Covid%20Vaccines.
4. https://www.arwy.org/article.asp?issn=2665-9425;year=2019;volume=2;issue=3;spage=120;epage=125;aulast=Ali#:~:text=Mean%2C%20Median%20and%20Mode%20are,relationship%20between%20two%20numerical%20variables.
5. https://stattrek.com/chi-square-test/goodness-of-fit.aspx

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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 tendency in 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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 2: ANALYTICAL GEOMETRY OF THREE DIMENSIONS AND VECTOR CALCULUS(For Physics Students)
Code	U21MA1ALT07
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 planarity of lines, skew lines and shortest distancebetween them.
3. To understand sphere and section of sphere by a plane.
4. To apply differentiation of vectors to find curl and divergence
5. To demonstrate line integral, surface integral and volume integrals and apply Gaussand Stoke's theorem 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.
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) – Coplanarity of Straight lines - Skewlines – Shortest distance between two skewlines
Extra Reading/ Keywords: *Geodesic, Equation of a line in polar coordinates, Secant lines, Euler line, Regular Tetrahedron*

UNIT III: SPHERE   **12 HRS**

Sphere -   General equation – Tangent planes – Section of a sphere by a plane - Sphere through a given circle.
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 – applications.
Extra Reading/ Keywords: *Relative velocity, Group velocity, Escape velocity, Curl in three 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.
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,Margham Publications, 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 PublishersChennai.
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 Three Dimensions, Krishna Prakashan Media
5. Jerrold Franklin(2020), Understanding Vector Calculus: Practical development and solved problems, Kindle edition

WEB REFERENCES

1.   https://brilliant.org/wiki/3d-coordinate-geometry-equation-of-a-plane/
2. https://www.cleariitmedical.com/2019/06/mathematics-notes-three-dimensional-geometry.html
3. https://www.askiitians.com/iit-jee-3d-geometry/theory-of-3d-straight-line-and-equation-of-straight-line-in-different-forms/
4. http://nitkkr.ac.in/docs/17-%20Vector%20Calculus%20with%20applications.pdf
5. https://www2.physics.ox.ac.uk/sites/default/files/profiles/fender/vectorcalculus2018-42414.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 2:ALGEBRA AND INTEGRAL CALCULUS (For Chemistry Students)
Code	U21MA1ALT08
Course type	Theory
Semester	I
Hours/Week	4
Credits	2
Marks	100

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

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

UNIT I: MATRICES 12 HRS
Types of matrices-Operations between matrices- Matrix inversion method of solving equations.

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

UNIT II: RANK OF A MATRIX 12 HRS

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

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

UNIT III: EIGEN VALUES AND EIGEN VECTORS 12 HRS
Eigen values and Eigen vectors–properties – problems – Cayley – Hamilton theorem (statement only) and its applications – Diagnolisation of Matrices– Orthogonal Transformation – problems.

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

UNIT IV: INTEGRATION 12 HRS
Introduction – Integration of irrational functions – Methods of integration of the following types only:

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

Integration by parts, Bernoulli's formula.

Extra Reading / Keywords: *symbolic integration, integration by substitution*

UNIT V: REDUCTION FORMULAE   **12 HRS**

Formulae to evaluate $\int_0^{\frac{\pi}{2}} \sin^n x \, dx$, $\int_0^{\frac{\pi}{2}} \cos^n x \, dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx$ - Properties of definite integrals

Extra Reading / Keywords: *differentiation integration formulas, reduction formula for tangent*

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

TEXT BOOKS

For UNITS I, II & III

1. T.K.Manicavachagom Pillay, T.Natarajan & KSGanapathy (2008), **Algebra, VolumeII**, Viswanathan Publishers, Chennai.
   UNIT I: Chapter2: Sections 1-8 & 10
   UNIT II: Chapter2: Sections 11 -15
   UNIT III: Chapter 2: Section 16

For UNITS IV AND V

2. S. Narayanan and T. K. Manicavachagom Pillay, (2009) **Calculus – Volume II**, S.Viswanathan Printers & Publishers Pvt. Ltd.
   UNIT IV: Chapter1: Section8 Cases (i) - (iii), Sections 12, 15.1
   UNIT V: Chapter1: Sections 13.3 -13.5, 11

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

WEB REFERENCES

1. https://www.math.stonybrook.edu/~aknapp/download/b2-alg-inside.pdf
2. https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf
3. https://people.math.wisc.edu/~angenent/Free-Lecture-Notes/free221.pdf
4. https://ocw.mit.edu/resources/res-18-001-calculus-online-textbook-spring-2005/study-guide/MITRES_18_001_guide5.pdf
5. https://web.pdx.edu/~erdman/CALCULUS/CALCULUS_pdf.pdf

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO-1	Outline the concept of matrices and integration and reduction formulae.	**K1**
CO-2	Demonstrate the various methods for solving problems in matrices and integration.	**K2**
CO-3	Make use of rank of a matrix to test for consistency in system of equations.	**K3**
CO-4	Examine Eigen values and Eigen vectors using Cayley Hamilton theorem.	**K4**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

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

Course Title	MAJOR CORE 4: NUMERICAL METHODS AND ITS APPLICATIONS
Code	U21MA2MCT04
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 throughassignment and seminar.

  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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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 for 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, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

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

Course Title	**MAJOR CORE 5: STATICS**
Code	**U21MA2MCT05**
Course type	**Theory**
Semester	**II**
Hours / Week	**4**
Credits	**3**
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*

UNITIV: 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

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 REFERENCE:
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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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, K5=Evaluate, K6=Create)

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

Course Title	MAJOR CORE 6: PROGRAMMING IN C
Code	U21MA2MCT06
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   **15HRS**

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   **15HRS**

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   **15HRS**

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: **15HRS**

Arrays - one dimensional, two dimensional, multi-dimensional arrays.
STRUCTURES AND UNIONS: Introduction – Defining a Structure-Declaring Structure Variables– 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   **15HRS**

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.

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 17Th 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.

ANNEXURE:
1. Solution of Quadratic Equation
2. Sum of Natural numbers, Squares of natural numbers, even and odd numbers.
3. Finding the sum of odd numbers and even numbers from the given list of numbers.
4. Finding the biggest and smallest element in an array.
5. Arranging the numbers in ascending and descending order
6. Arranging names in alphabetical order.
7. Addition, subtraction and multiplication of matrices.
8. Payroll Processing
9. Finding factorial of a given number and nPr and nCr.
10. Students result processing using fill

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 3 : LAPLACE TRANSFORMS,PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES (For Physics Students)
Code	U21MA2ALT09
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 12HRS

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 12HRS

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   **12HRS**

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   **12HRS**

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.**

TEXT BOOKS

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

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)

   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 REFERENCE

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.

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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 re 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, K5=Evaluate, K6=Create)

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

Course Title	**ALLIED 3: ANALYTICAL GEOMETRY OF THREE DIMENSIONS, VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS** **(For Chemistry Students)**
Code	**U21MA2ALT10**
Course type	Theory
Semester	**II**
Hours / Week	**4**
Credits	**2**
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 and vector integration.

COURSE OBJECTIVES

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

UNIT I: PLANES   **12 HRS**

The Plane – the general equation of the plane – Standard forms of equations of planes Applications of planes.
Extra Reading/ Keywords: *Planes bisecting the angles between planes.*

UNIT II: COPLANAR LINES   **12 HRS**

The condition that two different straight lines should be coplanar – The shortest distance between two given lines – The equation of two skew lines in a simplified form- Applications of coplanar lines
Extra Reading/ Keywords: *Angle between the planes , Symmetrical form of equation of line*

UNIT III: DIFFERENTIAL EQUATIONS   **12 HRS**

Equations of first order and first degree-Variable separable method - Homogeneous and non-homogeneous equations-Linear differential equation of second order with constant coefficients - Particular integrals for e^{ax}, sin ax &cos ax- Applications of differentiation .
Extra Reading/ Keywords: *Non linear differential equation , Separable equations, IVP*

UNIT IV: VECTOR DIFFERENTIATION   **12 HRS**

Velocity – acceleration – scalar and vector fields – Gradient, Divergence and curl –Applications of vector Differentiation.
Extra Reading/ Keywords *: Partial differentiation*

UNIT V: VECTOR INTEGRATION   **12 HRS**

Line integral – Surface integral – Volume integral- Applications of vector integration.
Extra Reading/ Keywords: *Stokes theorem, Greens theorem*

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

TEXT BOOKS

For UNITS I & II:

1. Treatment and content as in T.K. Manicavachagom Pillay & T Natarajan (2010), "A Prescribed Text of Analytical Geometry , Part II – Three Dimensions", Viswanathan Publishers ,Chennai.

   Unit I : Chapter II:Sections10,10.1&10.2

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

For UNIT III :

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

   Unit III: Chapter 1: Sections 2.1 – 2.3,

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

For UNITS IV & V:

3. Treatment and content as in Dr.P.R.Vittal, Dr.V.Malini, (2009)Vector Calculus, Fourier Series and Fourier Transforms

   Unit IV: Chapter 1

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

SUGGESTED READINGS

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

WEB REFERENCES

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

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

COURSE OUTCOMES

CO No.	Course Outcomes	Cognitive Level (K1-K6)
CO – 1	Recognize the concepts of plane, coplanar lines, ordinary differential equations, vector differentiation and vector integration	**K1**
CO – 2	Illustrate the standard form of the equations of the plane, shortest distance between two given lines and interpret the differential equation, vector differentiation and integration.	**K2**
CO – 3	Formulate the linear differential equations of second order and apply the concepts of analytical geometry and vector calculus to solve the problem in a real-life situation	**K3**
CO – 4	Categorize the solutions of differential equations and the relationship among the line integral, surface integral and volume integral	**K4**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create)

PO – CO MAPPING

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

Course Title	ALLIED 3: NUMERICAL METHODS (for BCA and B.Sc. Computer Science students)
Code	U21MA2ALT11
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 solution sof a systemof 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.

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, Meenakshi Publishers,Chennai
   2. S. Arumugam, A. Thangapandi Isaac & A. Somasundaram (2010), NumericalMethods, 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.

     COURSE OUTCOMES :

CO No.	Course Outcomes	Cognitive Level (K1-K6)
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, K5=Evaluate, K6=Create)

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

Course Title	ALLIED 3: BUSINESS STATISTICS (For Commerce Students)
Code	U21MA2ALT12
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 concurrentDeviation 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.

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 REFERENCE

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-K6)
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, K5=Evaluate, K6=Create)

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

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
Second Year - Semester – III

Course Title	MAJOR CORE 7: DYNAMICS
Total Hours	60
Hours / Week	4
Code	U20MA3MCT07
Course type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the laws of motions and motion of a particles.
CO – 2	Understand projectile and evaluation of its characteristics.
CO – 3	Understand the motion of the projectile and its applications in real life problems.
CO – 4	Understand impulsive forces, different types of impact and behavior of elastic bodies in practical problems.
CO – 5	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.

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.

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

UNIT III: PROJECTILE ON INCLINED PLANE   12HRS
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.

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.

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.

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

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recall laws of motions and related theorem.	**PSO –5**	**R,U**
CO – 2	Describe projectile and evaluation of its characteristics.	**PSO -3**	**U,E**
CO – 3	Analyze the motion of a projectile on an inclined plane and solving the problems.	**PSO -1**	**U**
CO – 4	Illustrate impulsive forces & different types of impact.	**PSO -2**	**U,E**

CO – 5	Discuss simple harmonic motion in a straight line and solving the problems.	**PSO -4**	**U,E**
CO – 6	Become familiar about the concepts of laws of motion, projectile on horizontal and inclined plane, impulsive force and simple harmonic motion- Skill Development.	**PSO-2,3**	**R,U**

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
Venkatraman. M.K.(2009), DYNAMICS, Agasthiar Publications,
Tiruchy-2.Unit: I – Chapter IV – 4.1 to 4.18, 4.20 to 4.23
Unit:II- Chapter VI – 6.1 to
6.11 Unit:III – Chapter VI
– 6.12 to 6.17
Unit:IV – Chapter VII – 7.1 to 7.5, Chapter VIII - 8.1
to 8.8Unit:V – Chapter X – 10.1 to 10.3, 10.6, 10.7

BOOKS FOR REFERENCE
1. Raisinghania M.D (2006), Dynamics S.Chand & Company Ltd, New Delhi.
2. Venkatachalapathy.S.G (2002), Mechanics, Margham Publication, Chennai.
3. ViswanathaNaik .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. ViswanathanPrinters & Publishers Pvt Ltd.,
6. M.L. Khanna(2004), Dynamics, Jai Prakash Nath and Company.

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SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year - Semester – III

Course Title	MAJOR CORE 8: OPTIMIZATION TECHNIQUES I
Total Hours	75
Hours / Week	5
Code	U20MA3MCT08
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

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
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand LPP and finding solution by graphical method.
CO – 2	Evaluate of solution of LPP by Big M method and two phase Method.
CO – 3	Understand various methods of transportation problem and obtaining the initial basic feasible solution.
CO – 4	Understand the Hungarian method to solve the assignment problem.
CO – 5	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.

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.

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

UNIT III : TRANSPORTATION PROBLEM   **15 HRS**

Transportation Problem - Initial basic feasible solution - Northwest corner rule - Row minima method - Column minima method - Matrix minima Method - Vogel's approximation method - Optimal solution - u - v method - Degeneracy - Unbalanced Transportation Problem.

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

UNIT IV : ASSIGNMENT PROBLEM   **15 HRS**

Assignment Problem - Hungarian method - Unbalanced assignment problem - Travelling Salesman Problem.

Extra Reading/ Keywords: *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 throughk machines**.**

Extra Reading/ Keywords: *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.

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recall LPP and Solving LPP by Graphical method	PSO – 3	U,E
CO – 2	Solve LPP by Simplex, Big M Method and Two Phase Method.	PSO -2	E
CO – 3	Compute initial basic feasible solutions using various methods of transportation problem	PSO -4	E
CO – 4	Solve LPP by assignment problem.	PSO - 5,4	Ap, E
CO – 5	Recognize and solve sequencing problem.	PSO -1	U,E
CO – 6	Enable the students to convert any real life situation into a mathematical model and solve them using an appropriate algorithm- Skill Development.	PSO – 1,2	U,E

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

PRESCRIBED TEXT BOOKS
Kanti Swarup, P.K.Gupta & Man Mohan, (2009) OPERATIONS
RESEARCH , SultanChand 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

BOOKS FOR REFERENCE
1. Taha H.A., Operations Research: An introduction(Seventh edition), Pearson Prentice Hall, 2002
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. Pannerselvam, (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, Resource Management Techniques, A.R. Publications, 2002.

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CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year - Semester – III

Course Title	MAJOR ELECTIVE 1- SCI PROGRAMMING(Theory)
Total Hours	60
Hours / Week	4
Code	U20MA3MET01
Course type	Theory
Credits	4
Marks	100

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the basics concepts of Scilab.
CO – 2	Analyze SCILAB matrices.
CO – 3	Understand loops and functions in Scilab.
CO – 4	Create 2D plot.
CO – 5	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- Elementwise Operations- Conjugate transpose and Non-conjugate transpose- Multiplication of two vectors Comparing to real matrices- Issues with floating point integers- More on elementary functions- 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 arguements
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.

COURSE OUTCOMES (CO):
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Describe the main feature of SCILAB program development to enable their usage in higher learning.	**PSO - 2**	U
CO – 2	Demonstrate looping and branching in SCILAB Develop programs in SCILAB.	**PSO - 3**	U
CO – 3	Analyze how to access to elements of a matrix.	**PSO - 4**	**An**
CO – 4	Interpret and visualize simple mathematical functions and operations there on using plots/display.	**PSO - 4**	E

CO – 5	Implement simple mathematical functions/equations in numerical computing environment such as SCILAB.	PSO - 4	E
CO – 6	Analyze the program for correctness and determine the output using SCILAB tools – Entrepreneurship	PSO-4	An

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

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

PRESCRIBED TEXT BOOKS

 FOR UNITS I,II,III & IV
1. Introduction to Scilab-Michael Baudin from Scilab consortium,2010
    Chapters 1 to 8 (Book Freely downloadable 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

BOOKS FOR REFERENCE

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

(For Candidates admitted from the academic year 2020-21 onwards)

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B.Sc. MATHEMATICS
Second Year - Semester – III

Course Title	MAJOR ELECTIVE 1: LATEX
Total Hours	60
Hours / Week	4
Code	U20MA3MET02
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE:
    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 :
The learner will be able to

CO No.	Course Objectives
CO – 1	Illustrate simple type setting of Latex with font size and font type.
CO – 2	Understand page setting and numbering of documents, also acquire knowledge about parts of a document and understand how to divide the document
CO – 3	Illustrate table of contents, index and glossary.
CO – 4	Acquire knowledge about displayed text and rows and columns.
CO – 5	Exemplify Mathematics miscellany with new operators and understands many faces of mathematics like symbols.

UNIT I: THE BASICS   **12 HRS**

What is Latex? – Simple Typesetting – Fonts – Type Size

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

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

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

Table of Contents – Index - Glossary

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

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

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

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	Understand simple type setting of Latex with font size and font type.	**PSO -1**	U
CO – 2	Acquire knowledge about page setting, numbering of documents and parts of a document and understand how to divide the document.	**PSO -2**	R
CO – 3	Acquire knowledge about table of contents, index and glossary.	**PSO -2**	R
CO – 4	Exemplify Illustrates about displayed text and rows and columns	**PSO -3**	An
CO – 5	Analyze Mathematics miscellany with new operators and understands many faces of mathematics symbols.	**PSO -3**	An

CO – 6	Acquire knowledge about type setting of LATEX in the preparation of documents and promote them to create research article in portable document file format - Skill Development.	**PSO – 4**	An

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

PRESCRIBED TEXT BOOKS

**Treatment and content as in
Latex Tutorials - A Primer to Latex by Indian TEX Users Group, 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)

BOOKS FOR REFERENCE

1. Stefan Kottwitz, Latex – Beginner's Guide , Packt publishing, Birmingham, Mumbai, 2011.

2. Dilip Datta, A short note on Latex in 24 hours- A Pratical guide for scientific writing, Springer Publication.

3. David R Wilkins, getting Started with Latex, second edition, e book, 2021.

4. David Francis Griffiths and Desmond Higham, Learning Latex, David Marshall Publisher, December 1997.

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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year - Semester – III

Course Title	MAJOR ELECTIVE 1: DESIGN AND ANALYSIS OF ALGORITHMS
Total Hours	60
Hours / Week	4
Code	U20MA3MET03
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	To understand the role of algorithms in computing.
CO-2	To learn divide and conquer paradigm in solving recurrence problems.
CO-3	To understand the Greedy method as a design technique in solving in solving optimization problems.
CO-4	To learn an algorithm design method dynamic programming in solving sequencing problems.
CO-5	To learn backtracking formulation in obtaining optimal solution for problems.

UNIT I: FUNDAMENTALS   **12 HRS**

The Role of Algorithms in Computing – Algorithms – Insertion Sort-Designing Algorithms – Analysing Algorithms

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

UNIT II:DIVIDE AND CONQUER   **12 HRS**
        Introduction-The maximum-subarray 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

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

UNIT III: GREEDY METHOD   **12 HRS**
        The general method-Container loading-Knapsack problem-Tree vertex splitting-Job sequencing with deadlines-Minimum cost spanning trees-Huffman Codes.

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

UNIT IV: DYNAMIC PROGRAMMING   **12 HRS**
        The general method-Multistage Graphs-All pairs Shortest paths- Single source shortest paths -0/1 Knapsack, Reliability Design-The Travelling salesperson problem.

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

UNIT V: BACK TRACKING   **12 HRS**
        Back Tracking- The General Method- The 8-Queens problem-Sum of subsets-Graph Coloring- Hamiltonian Cycles**.**

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

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 role and analysis of algorithms in Computing.	**PSO – 1**	**R,U**
CO-2	Apply divide and conquer method to solve a problem.	**PSO – 2**	**Ap**
CO-3	Ability to solve a real life problems with the Greedy algorithmic Techniques.	**PSO – 2**	U
CO-4	Demonstrate the concept of dynamic programming in solving sequencing problems.	**PSO – 3**	**An**
CO-5	Apply backtracking method in obtaining optimal solution.	**PSO – 4**	**Ap**
CO – 6	Apply various algorithms in various real life software problems - Employability.	**PSO -4**	**Ap**

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

PRESCRIBED TEXT BOOKS

Treatment and content as in

Thomas H Cormen, Charles E Leiserson, Ronald L Revest, Clifford Stein, *"Introduction to Algorithms" 3rd Edition,* The MIT Press Cambridge, Massachusetts
London, England, 2014

Unit I: Chapter 1: Sections 1.1; Chapter 2: Sections 2.1-2.3

Unit II: Chapter 4: Sections 4.1 - 4.5

Ellis Horowitz, Sartajsahni, Sanguthevar, Rajesekaran, *"Fundamentals of Computer Algorithms"*, Universities Press India Pvt Ltd(2007)(Second Edition)

Unit III: Chapter 4 Sections 4.1-4.6 (Omit 4.6.3)

Unit IV: Chapter 5: Sections 5.1-5.4, 5.7-5.9

Unit V: Chapter 7: Sections 7.1 – 7.5

BOOKS FOR REFERENCE
1.S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 2015

2. Richard Johnson Baugh, Marcus Schaefer,*"Algorithms",* Pearson education,2004

3. Mark Allen Weiss, *"Data Structures and Algorithm Analysis in C"*, 2nd Edition,
Pearson Education, Inc., 2006

4. Rajesh K Shukla, *"Analysis and Design of Algorithms-A Beginner's Approach",* Wiley publisher ,2015

5.Gilles Brassard and Paul Bratley ,"*Fundamentals of Algorithmics",*Prentice Hall of India Pvt Ltd ,New Delhi,2006(Indian Reprint)

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B.Sc. MATHEMATICS
Second Year – Semester - III

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

GENERAL OBJECTIVE

To revise arithmetic facts related to numbers, ratios, percentages etc., and develop problem solving techniques**.**

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand number system and simplification of numbers using formulae and rules.
CO – 2	Understand averages and evaluationof LCM and HCF.
CO – 3	Evaluate problems on ages and percentage through data representation through diagram.
CO – 4	Evaluate profit and loss and ratio and proposition.
CO – 5	Apply time and work to real life problems and evaluate partnershipproblems.

UNIT I: NUMBER SYSTEM   6 HRS

Number System – Simplification using formulae and rules

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

UNIT II: AVERAGE   **6 HRS**

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

Extra Reading/Key words*: Histogram, Ogives*

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

        Problems on ages – Percentage.

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

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

        Profit and Loss -Ratio and Proportion

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

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

        Partnership - Time and Work.

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

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

COURSE OUTCOMES (CO):
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Describe number system, simplification using formulae and rule.	PSO – 2	R,E
CO – 2	Recall averages and Evaluation of LCM and HCF of more than two numbers.	PSO 3	U,E
CO – 3	Evaluate problems on ages and percentage.	PSO -1	E
CO – 4	Evaluate problems on profit and loss, Ratio and proposition.	PSO -4	E
CO – 5	Applications on time and work problems and evaluation of partnership problems.	PSO -5	Ap, E
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 Competitve Examinations, S.Chand and Company Ltd., Ram Nagar, New Delhi.
Unit I: Chapters 1, 2
Unit II: Chapters 4 and 6
Unit III: Chapters 8 and 10
Unit IV: Chapters 11 and 12
Unit V: Chapters 13 and 15

BOOKS FOR REFERENCE

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

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B.Sc. MATHEMATICS
Second Year – Semester - III

Course Title	ALLIED 4: STATISTICS I
Total Hours	60
Hours / Week	4
Code	U20MA3ALT13
Course type	Theory
Credits	2
Marks	100

GENERAL OBJECTIVE

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
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand various methods of collection of data and representing them through graphs.
CO – 2	Analyze various measures of dispersion.
CO – 3	Understand to correlate data and fit into a linear regression curve.
CO – 4	Evaluate index number using Laspeyre's, Fisher's methods, Aggregate expenditure method and family Budget method.
CO – 5	Analyze time series with respect to different variation.

UNIT I: COLLECTION, CLASSIFICATION, TABULATION AND PRESENTATION OF DATA   12 HRS

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

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.

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. (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 .

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**.**

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.

COURSE OUTCOMES (CO):
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO - 1	Recall various methods of collection of data and describe graphic representation.	PSO – 2	R,U
CO – 2	Categorize and evaluate various measures of dispersion.	PSO – 3	E
CO – 3	Calculate correlation and regression.	PSO – 1	E, An
CO – 4	Compute index number by Laspeyre's, Fisher's methods, expenditure method and family Budget method.	PSO – 5	Ap
CO – 5	Examine time series with respect to different variation.	PSO – 4	E, An
CO – 6	Analyze various measures of dispersion. Understand to correlate data and fit into a linear regression curve- Skill Development	PSO-1,2	An, Ap

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 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)

BOOKS FOR REFERENCE
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.

(For Candidates admitted from the academic year 2020-21onwards)
HOLY CROSS COLLEGE(AUTONOMOUS), TIRUCHIRAPPALLI – 620002
SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester – III

Course Title	ALLIED 4: DISCRETE MATHEMATICS (for B.C.A and Computer Science students)
Total Hours	60
Hours / Week	4
Code	U20MA3ALT12
Course type	Theory
Credits	2
Marks	100

GENERAL OBJECTIVE

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
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the basic ideas to solve multitude of problems using logical reasoning.
CO – 2	Understand the basic concepts of Product Sets and Relations.
CO – 3	Understand the basic concepts of Partially Ordered Sets and Lattices.
CO – 4	Illustrate the paths and circuits with examples and explain connected and disconnected graphs.
CO – 5	Understand the concept of directed graphs.

UNIT I: LOGIC 12 HRS

Propositional and Logical Operations, Conditional statements, Mathematical Induction.

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.

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

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

UNIT IV: GRAPHS 12 HRS

Introduction – Paths and Circuits – Isomorphism, Sub graphs, Walks, Paths and Circuits, Connected & Disconnected Graphs.

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

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

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

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO- 1	Understand Propositional and Logical Operations.	**PSO - 2**	U
CO- 2	Recognize Product Sets andRelations.	**PSO - 1**	U
CO -3	Understand Partially Ordered Setsand Relations.	**PSO- 5**	U
CO- 4	Identify the sub graphs, paths and circuits.	**PSO-1**	R

CO -5	Understand the concept reachability indirected graph.	PSO -2	U
CO -6	Enables the students with the Basic Knowledge both theoretical and empirical necessary to understand - Skill Development.	PSO-1,5	U

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

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

PRESCRIBED TEXT BOOKS

Treatment and content as in

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

UNIT I: Chapter 2: Sections 2-1-2.2, 2.4
UNIT II: Chapter 4:Sections4.1- 4.5 (omitted Digraphs)
UNIT III: Chapter 6: Sections 6.1-6.3

For Units IV, V Treatment and content as in

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

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

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

BOOKS FOR REFERENCE
1. J.P. Tremblay & R. Manohar,   "Discrete Mathematical Structures with Applications to Computer Science", McGraw-Hill International Edition, 2008.
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, Chennai, Revised Edition 2012.
5. B. S. Vatsa, Suchi Vatsa, "Discrete Mathematics", New Age International Limited, Publishers, Reprint 2012.

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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester - III

Course Title	NON MAJOR ELECTIVE 1: APTITUDE MATHEMATICS – I
Total Hours	45
Hours / Week	3
Code	U20MA3NMT01
Course type	Theory
Credits	3
Marks	100

General Objective:

To revise arithmetic facts related to numbers , ratios, percentages etc., and develop problem solving techniques**.**

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand number system and simplification of numbers using formulae and rules.
CO – 2	Understand averages and evaluationof LCM and HCF.
CO – 3	Evaluate problems on ages and percentage through data representation through diagram.
CO – 4	Evaluate profit and loss and ratio and proposition.
CO – 5	Apply time and work to real life problems and evaluate partnershipproblems.

UNIT I: NUMBER SYSTEM   **9 HRS**

Number System – Simplification using formulae and rules

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

UNIT II: AVERAGE   **9 HRS**

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

Extra Reading/Key words*: Histogram, Ogives*

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

     Problems on ages – Percentage.

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

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

     Profit and Loss -Ratio and Proportion

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

UNIT V: PARTNERSHIP AND TIME   **9 HRS**

    Partnership - Time and Work.

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

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

COURSE OUTCOMES (CO):
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO - 1	Describe number system, simplification using formulae and rule.	PSO – 2	R,E
CO - 2	Recall averages and Evaluation of LCM and HCF of more than two numbers.	PSO 3	U,E
CO - 3	Evaluate problems on ages and percentage.	PSO -1	E
CO - 4	Evaluate problems on profit and loss, Ratio and proposition.	PSO -4	E
CO - 5	Applications on time and work problems and evaluation of partnership problems.	PSO -5	Ap,E
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 Competitve
Examinations, S.Chand andCompany Ltd., Ram Nagar, New Delhi. Unit
I: Chapters 1, 2
Unit II: Chapters 4 and 6
Unit III: Chapters 8 and 10
Unit IV: Chapters 11 and 12
Unit V: Chapters 13 and 15

BOOKS FOR REFERENCE

1. Aggarwal R.S.,OBJECTIVE ARITHMETIC (SSC and Railway exam special) (Revisededition
2018 and reprint 2020), S.Chand andCompany 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 from the academic year 2020-21onwards)
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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester - IV

Course Title	MAJOR CORE 9: ABSTRACT ALGEBRA
Total Hours	60
Hours / Week	4
Code	U20MA4MCT09
Course type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE

　　　　To enable the students to understand algebraic structures like Groups, Rings, Fields and Ideals.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of groups and its equivalence properties.
CO – 2	Understand normal groups, quotient groups, isomorphism and homomorphism.
CO – 3	Understand rings, its types, and elementary properties.
CO – 4	Understand the concept of ideals, Maximal prime ideals and homomorphism of rings.
CO – 5	Understand U.F.D and P.I.D.

UNIT I: GROUPS　　　　　　　　　　　　　　　　　　　　　　　　　　**12 HRS**

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

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

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

Order of an element – Cosets and Lagrange's theorem - Normal Subgroups and Quotient Groups – Isomorphism – Homomorphisms.

Extra Reading/ Keywords: *Counting Principle, Normalizer*

UNIT III: RINGS   **12 HRS**

Definition and examples - Elementary properties of rings - Isomorphism of rings – Types of rings – Characteristic of a ring - Subrings.

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

UNIT IV: IDEALS   **12 HRS**

Ideals – Quotient rings – Maximal and prime ideals – Homomorphism of rings

Extra Reading/ Keywords: *polynomial rings over UFD*

UNIT V: FIELDS   **12 HRS**

Field of quotients of an integral domain – Ordered integral domain – Unique Factorization domain – Euclidean domain – Every P.I D is a U.F.D.

Extra Reading/ Keywords: *polynomial rings over Q.*

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 groups and its classifications.	PSO – 3	R,U
CO – 2	Explains cyclic groups, normal groups, quotient groups, Isomorphism and homomorphism.	PSO -2	R,U
CO – 3	Relate rings, its types and elementary properties.	PSO -1	R,U
CO – 4	Describes the concept of ideals, Maximal, prime ideals and homomorphism of rings.	PSO -5	R,U
CO – 5	Recognizes Euclidean domain, U.F.D and P.I.D.	PSO -4	R,U
CO – 6	Make the students understand the characteristics of algebraic structures like Groups, Rings, Fields and Ideals- Skill Development.	PSO-2,3	R,U

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 S. Arumugam and A.Thangapandi Isaac,
MODERN ALGEBRA (August 2003), Scitech Publications (India) pvt ltd Chennai.

UNIT I: (Chapter 3 - Sec.3.1 to 3.6)
UNIT II: (Chapter 3 - Sec.3.7 to 3.11)
UNIT III: (Chapter 4 - Sec 4.1 to 4.6)
UNIT IV: (Chapter 4 - Sec 4.7 to 4.10)
UNIT V: (Chapter 4 - Sec 4.11 to 4.15)

BOOKS FOR REFERENCE

1. Shanti Narayanan, A Text Book of Modern Abstract Algebra, Margham Publishers.
2. R. Balakrishnan & N. Ramabadran, A Text Book of Modern Algebra, Stosius Inc/Advent Books Division, June 1986.

3. M.L. Santiago, Modern Algebra, Tata McGraw-Hill Publishing Co. Ltd, 2001.

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B.Sc. MATHEMATICS
Second Year – Semester - IV

Course Title	MAJOR CORE 10: OPTIMIZATION TECHNIQUES II
Total Hours	60
Hours / Week	4
Code	U20MA4MCT10
Course type	Theory
Credits	3
Marks	100

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of game theory.
CO – 2	Understand the concept of poisson process and exponential distribution.
CO – 3	Understand inventory control theory and finding EOQ.
CO – 4	Evaluate of solution of Inventory problem with uncertain demand and probabilistic inventory problems.
CO – 5	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.

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.

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

UNIT III: INVENTORY CONTROL   **12 HRS**

Types of inventory - Economic order quantity - Deterministic inventory problem

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)

Extra Reading/ Keywords: *Dynamic Order Quantity*

UNIT V: NETWORK SCHEDULING   **12 HRS**

PERT - CPM time calculations in Networks -Critical Path method (CPM) - PERT calculation

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

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

COURSE OUTCOMES(CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Solve payoff matrix by Maximin and Minimax principle.	**PSO - 3**	**U,E**
CO – 2	Evaluate Queueing Theory problems.	**PSO -5**	**E**
CO – 3	Discuss inventory control theory and compute EOQ.	**PSO -1**	**U,E**
CO – 4	Recognize and solve Multi-item Deterministic problem.	**PSO -4**	**E**
CO – 5	Evaluate PERT and CPM.	**PSO -5**	**E**
CO – 6	Enable the students to convert any real life situation into a mathematical model and solve them using an appropriate algorithm- Skill Development.	**PSO – 1, 2**	**U,E**

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

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

PRESCRIBED TEXT BOOK

Kantiswarup, P.K.Gupta and Manmohan (2017) <u>OPERATIONS RESEARCH</u> , Sultan Chand Publishers , Ninteenth 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 (20:1-20:3)

UNIT - V : Chapter 25 (25:1 – 25:8)

BOOKS FOR REFERENCE

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.

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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester - IV

Course Title	MAJOR ELECTIVE 2: SCI PROGRAMMING(PRACTICAL)
Total Hours	60
Hours / Week	4
Code	U20MA4MEP04
Course type	Practical
Credits	4
Marks	100

GENERAL OBJECTIVE

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
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the fundamentals of scilab commands and utilization.
CO – 2	Understand about matrices and its operations.
CO – 3	Analyze the comparison of built-in, library and user-defined functions.
CO – 4	Evaluate the graph for plotting 2D and contour plot.
CO – 5	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 scilab

13. 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.

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CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester – IV

Course Title	MAJOR ELECTIVE 2: MATHEMATICAL MODELLING
Total Hours	60
Hours / Week	4
Code	U20MA4MET05
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

To study the mathematical models through ode and difference equations and train the students to develop mathematical models in real life problems.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the basic concepts involved in Mathematical Modelling using ordinary differential equations.
CO – 2	Understand the concepts of Mathematical Modelling through the system of first order ordinary differential equations by constructing population dynamic model and compartment model.
CO – 3	Understand the concepts of Mathematical Modelling through the system of second order ordinary differential equations by constructing satellite and compartment model.
CO – 4	Understand the concepts of mathematical modeling through the system of differential equations.
CO – 5	Understand the concepts of mathematical modelling through graphs.

UNIT I : MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS   12 HRS

Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

Extra Reading/ Keywords: *Concavity, inflection points, increasing and decreasing functions; local and absolute extrema.*

UNIT II: MATHEMATICAL MODELLING THROUGH SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS OFFIRSTORDER   12 HRS

Population Dynamics – Epidemics – Compartment Models – Economics – Medicine,Arms Race, Battles and International Trade – Dynamics.

Extra Reading/ Keywords: *Doubling time, Half-life period.*

UNIT III: MATHEMATICAL MODELLING THROUGH ORDINARY DIFFERENTIAL EQUATIONS OFSECOND ORDER   12 HRS

Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

Extra Reading/ Keywords: *Newton's law of cooling and heating, Continuous compounding.*

UNIT IV: MATHEMATICAL MODELLING THROUGH DIFFERENCE EQUATIONS   12 HRS

Simple Models – Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – ProbabilityTheory

Extra Reading/ Keywords: *Polynomial interpolation,Projectile motion.*

UNIT V: MATHEMATICAL MODELLINGTHROUGHGRAPHS   12 HRS

Solutions that can be Modelled Through Graphs – Mathematical Modelling in Terms of Directed Graphs, Signed Graphs, Weighted Digraphs and Unoriented Graphs.

Extra Reading/ Keywords: *Direct and Indirect Proportion,Parabolic relation, linear relation.*

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 basic concepts involved in Mathematical Modelling.	**PSO – 2**	**R,U**
CO - 2	Recognize the concepts of Mathematical Modelling through the system of first order ordinary differential equations.	**PSO -3**	**Ap, E**
CO – 3	Recognize the concepts of Mathematical Modelling through the system of second order ordinary differential Equations	**PSO -1**	**E**
CO – 4	Recognize the concepts of Mathematical Modelling through difference equations.	**PSO -4**	**An**
CO – 5	Recall the concepts of graphs and solves the mathematical models using graphs.	**PSO -5**	**R,U**
CO – 6	To acquaint the students become familiar with mathematical models and apply them using ordinary differential equations to solve problems - Skill Development	**PSO-2**	**Ap**

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

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

PRESCRIBED TEXT BOOKS

J.N. Kapur, Mathematical Modelling, Wiley Eastern Limited, NewDelhi,1988.

Unit 1: Chap 2, Sec 2.1–2.6
Unit 2: Chap 3, Sec 3.1–3.6
Unit 3: Chap 4, Sec 4.1–4.4
Unit 4: Chap 5, Sec 5.1–5.5
Unit 5: Chap 7, Sec 7.1–7.5

BOOKS FOR REFERENCE

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 Modelling,McGraw-Hill.

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CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester – IV

Course Title	MAJOR ELECTIVE 2: BASICS OF DATA ANALYTICS
Total Hours	60
Hours / Week	4
Code	U20MA4MET06
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO-1	Understand the fundamental concepts of Big data.
CO-2	Analyze the usage and extraction techniques of Big data Analytical framework.
CO-3	Specify the importance of distributed computing and Cloud environment for Big Data.
CO-4	Determines the Operational Data bases & Map Reduce techniques.
CO-5	Understand the Hadoop Foundation.

UNIT I:GETTING STARTED WITH BIG DATA   **12 HRS**

The Evolution of Data Management - Understanding the Waves of Managing Data – Defining Big Data – Building a successful Big Data Management Architecture –The Big Data Journey - Defining Structured Data – Defining Unstructured Data -Looking at Real time and Non-Real time Requirements – Putting Big Data together.

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

UNIT II: DISTRIBUTED COMPUTING AND DIGGING INTO BIG DATA TECHNOLOGY COMPONENTS   **12 HRS**

Distributed Computing – Understanding the Basics of Distributed Computing – Getting Performance Right. Exploring the Big Data Stack – Redundant Physical Infrastructure – Security Infrastructure – Interfaces and Feeds to and from Applications and the Internet – Operational Databases – Organizing Data Services and Tools – Analytical Data Warehouses – Big Data Analytics – Big Data Applications.

Extra Reading/Keywords: Importance of Distributed system in Big Data and its components

UNIT III: VIRTUALIZATIONAND EXAMINING THE CLOUD WITH BIG DATA
                                                              12 HRS

Understanding the Basics of Virtualization – Managing Virtualization with the Hypervisor – Abstraction and Virtualization Implementing Virtualization to work with Big Data. Defining the cloud in the context of Big Data – Understanding Cloud Deployment and Delivery Models – The Cloud as an Imperativefor Big Data – Making use of the Cloud for Big Data Providers in the Big Data Cloud Market

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

UNIT IV: OPERATIONAL DATABASES AND MAPREDUCE FUNDAMENTALS
                                                              12 HRS

RDBMSs are Important in a Big Data Environment – Non- relational databases – Key Value Pair Databases – Document Databases – Columnar Databases - Graph Databases – Spatial Databases – Polyglot Persistence - Tracing the origins of MapReduce Understanding the Map Function – Adding the Reduce Function – Putting Map and Reduce Together – Optimizing Map Reduce Tasks.

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

UNIT V: EXPLORING THE WORLD OF HADOOP   **12 HRS**

Explaining Hadoop – Understanding the Hadoop Distributed File System (HDFS) – Hadoop MapReduce – Building a Big data foundatation with the Hadoop ecosystem – Managing resources and applications – Storing and Mining Big data with HBase, Hive, Pig, Sqoop and Zookeeper.

Extra Reading/Keywords: Interacting with the Hadoop ecosystem

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	Explains the fundamentals of Big Data and categorizes Big Data and its importance.	PSO - 1	R
CO-2	Identifies the distributed Computing with Big Data andthe various layers of the Stack.	PSO - 2	U
CO-3	Describes the virtualization approaches and models withcloud environment in big data.	PSO - 3	R, U
CO-4	Explores the various operational databases and technologies like Map Reduce.	PSO - 4	R, U
CO-5	Summarizes the basic concepts of Hadoop in various environments.	PSO - 5	Ap, An
CO-6	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications –Employability.	PSO - 5	Ap, An

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

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

PRESCRIBED TEXT BOOKS
Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman, "**Big Data for Dummies**", A Wiley Brand - Wiley Publications, 2013.
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. Nitin Upadhyay, "Big Data Management and Analytics", Cengage Learning India 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"Reilly Media, "Big Data Now: Current Perspective" O"Reilly Media, 2013 Edition.
6. Mike Barlow, "Real-Time Big Data Analytics: Emerging Architecture", O'Reilly MediaInc., 2013.

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

Course Title	ALLIED 5: STATISTICS II
Total Hours	60
Hours / Week	4
Code	U20MA4ALT14
Course type	Theory
Credits	2
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 to

CO No.	Course Objectives
CO – 1	Understand probability, conditional probability and its axioms.
CO – 2	Understand discrete and continuous random variable and its properties and properties of two dimensional random variable.
CO – 3	Evaluate expectation and variance and its relevant theorems.
CO – 4	Evaluate binomial distribution Poisson distribution and their properties.
CO – 5	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. (Problems Only)

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.

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

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.

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).

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.

COURSE OUTCOMES(CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO -1	Recognize and discuss probability, conditional probability and its axiom, Theorems.	**PSO - 3**	**R,U**
CO – 2	Explain and relate discrete and continuous random variable.	**PSO - 5**	**U,Ap**
CO – 3	Compute expectation and variance and discuss relevant theorems.	**PSO - 1**	**E**

CO – 4	Recognize binomial distribution, Poisson distribution and describe their properties.	**PSO - 2**	**U, Ap**
CO – 5	Explain normal distribution and its properties.	**PSO - 4**	**U, Ap**
CO – 6	Understand discrete and continuous random variable and its properties and properties of two dimensional random variable. Evaluate expectation and variance and its relevant theorems- Skill Development.	**PSO – 2,3**	**U, An**

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 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).

BOOKS FOR REFERENCE
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.

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CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester – IV

Course Title	ALLIED 6: STATISTICS III
Total Hours	60
Hours / Week	4
Code	U20MA4ALT15
Course type	Theory
Credits	2
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand and apply sampling theory, Chi-square test, Student t test and F test and their properties.
CO – 2	Understand estimators and method of maximum likelihood.
CO – 3	Understand Large sample and evaluate testing the hypothesis.
CO – 4	Understand Small sample and evaluate test of hypothesis using t and chi-square distribution.
CO – 5	Evaluate test of hypothesis using F distribution.

UNIT I: SAMPLING DISTRIBUTION   **12 HRS**

Sampling Distribution – Chisquare - Student-t - F distributions - Properties.

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 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. (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

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

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 and explain sampling theory, Chi-square test, Student t test and F test.	**PSO - 2**	**R,E**
CO – 2	Recall and compute estimators and method of maximum likelihood.	**PSO - 3**	**Ap, E**

CO – 3	Explain Large sample and evaluate testing the hypothesis.	PSO - 1	R, E
CO – 4	Discuss Small sample and evaluate test of hypothesis using t and chi-square distribution.	PSO - 5	An,E
CO – 5	Evaluate and apply test of hypothesis using F distribution.	PSO – 4	Ap, E
CO – 6	Understand Large sample and evaluate testing the hypothesis. Understand Small sample and evaluate test of hypothesis using t and chi-square distribution- Skill Development.	PSO-4	U,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 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 25,27
UNIT : V   - Chapter 26.

BOOKS FOR REFERENCE
1. Arora .S,Sumeet Arora (2002),Comprehensive Statistical Methods, S.Chand and Company Ltd ,New Delhi.
2. Gupta .S.C, Kapoor.V.K   (2002), Funtamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
3. Gupta .S.P (2006), Statistical Methods, Sultan Chand & Sons ,New Delhi.
4. 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.

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CHOICE BASED CREDIT SYSTEM
B.Sc. MATHEMATICS
Second Year – Semester – IV

Course Title	NON MAJOR ELECTIVE 2: APTITUDE MATHEMATICS – II
Total Hours	45
Hours / Week	3
Code	U20MA4NMT02
Course type	Theory
Credits	3
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES
The learner will be able to

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 apply the 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 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)
The learners

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 apply to 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 Competitve Examinations, S.Chand andCompany 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

BOOKS FOR REFERENCE

1. Aggarwal R.S., Objective Arithmetic (SSC and Railway exam special) (Revised edition 2018 and reprint 2020), S.Chand andCompany 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 from the academic year 2015 onwards)
HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – V

Course Title	**MAJOR CORE 7- MODERN ALGEBRA II**
Total Hours	**75**
Hours / Week	**5**
Code	**U15MA5MCT07**
Course type	**Theory**
Credits	**4**
Marks	**100**

GENERAL OBJECTIVE
To study vector spaces as an abstract algebraic system and establish some of the properties of such systems.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand vector space and its properties.
CO – 2	Understand about basis, dimension, rank, matrix linear transformation
CO – 3	Understand of inner product space and its properties.
CO – 4	Understand the theory of matrices.
CO – 5	Understand eigen values and eigen vector and its application

UNIT I: VECTOR SPACES 15 Hrs
Definition and examples - Subspaces - Linear transformation - Span of a set - Linear Independence .
Extra Reading/ Keywords: Set,Vectors

UNIT II: VECTOR SPACES (CONTN) 15 Hrs
Basis and dimension – Rank and nullity- Matrix of a Linear Transformation.
Extra Reading/ Keywords: subspace, Linearly Independent

UNIT III: INNER PRODUCT SPACES   **15 Hrs**

        Definition and examples of inner product spaces- Orthogonality-
Orthogonal complement.
Extra Reading/ Keywords: Vector Space, Dot Product

UNIT IV: THEORY OF MATRICES   **15 Hrs**

     Types of Matrices- Inverse of a matrix- Elementary Transformation- Rank of a Matrix-
Consistency of system of non-homogenous linear equation- Simultaneous Linear Equations.
Extra Reading/ Keywords: Echelon form, singular matrix

UNIT V: THEORY OF MATRICES(CONTD)   **15 Hrs**

      Characteristic Equation - Cayley Hamilton Theorem and its application -Eigen Values and
Eigen Vectors .
Extra Reading/ Keywords: Diagonalisation

**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	**PSO -3**	**R,U**
CO – 5	Compute eigen values and eigen vector and its application	**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 BOOK
S. Arumugam , A. Thangapandi Isaac "TREATMENT AS IN MODERN ALGEBRA" (August
2003) , Scitech Publications (India) pvt ltd Chennai
UNIT I – Chapter 5 (section 5.1 to 5.5)
UNIT II- Chapter 5 (section 5.6 to 5.8)
UNIT III - Chapter 6
UNIT IV - Chapter 7 (section 7.2 to 7.6)
UNIT V - Chapter 7 (section 7.7 & 7.8)

BOOKS FOR REFERENCE

1. Shanti Narayanan, <u>A TEXT BOOK OF MODERN ABSTRACTALGEBRA</u>. Margam Publishers
2. Topics in Algebra,SecondEdition,I.N.Herstein,Wiley Student edition,2009.
3. K. Sivasubramanian. , <u>MODERN ALGEBRA</u> ,Allied publishers, New Delhi
4. R. Balakrishnan & N. Ramabadran<u>A TEXT BOOK OF MODERN ALGEBRA</u>.

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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – V

Course Title	MAJOR CORE- 8: OPTIMIZATION TECHNIQUES
Total Hours	75
Hours / Week	5
Code	U15MA5MCT08
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

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

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand L.P.P and finding solution by Graphical and Simplex Method.
CO – 2	Evaluate of solution of L.P.P by Big M method and Two phase Method
CO – 3	Understand sequencing problem and obtaining the sequence of processing n jobs through two machine and k machines
CO – 4	Understand inventory control theory and finding EOQ
CO – 5	Evaluate PERT and CPM.

UNIT I : LINEAR PROGRAMMING PROBLEM AND SIMPLEX ALGORITHM. 15 Hrs

Introduction to OR - Mathematical formulation of the problem - Graphical solution methods - General Linear Programming Problem - Canonical and standard forms of L.P.P. The Simplex Method - Simplex Algorithm.
Extra Reading/ Keywords:*Revised simplex method , Dual simplex method.*

UNIT II : ARTIFICIAL VARIABLES AND SEQUENCING PROBLEM   15 Hrs

Artificial variables - Charnes Method of penalties (Big - M method) - Two-Phase Simplex method – Sequencing problem - processing n jobs through two machines - processing n jobs through k machines .
Extra Reading/ Keywords:*Fractional cut method ,Processing 2 jobs through k machines*

UNIT III : TRANSPORTATION PROBLEM AND ASSIGNMENT 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-Assignment problem-Hungarian method-unbalanced assignment problem, Travelling salesman problem.

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

UNIT IV: INVENTORY CONTROL 15 Hrs

Types of inventory - Economic order quantity - Deterministic inventory problems with shortages - Deterministic inventory problems without shortages - Problems of EOQ with price breaks.

Extra Reading/ Keywords :Multi-item Deterministic problems

UNIT V :NETWORK SCHEDULING 15 Hrs

Introduction to network problems-Network scheduling by CPM and PERT

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

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

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO - 1	Recall L.P.P and Solving LPP by Graphical and Simplex Method	**PSO - 3**	**U,E**
CO - 2	Solve L.P.P by Big M method and Two phase Method	**PSO -2**	**E**
CO - 3	Recognize and solve sequencing problem	**PSO -4**	**E**
CO - 4	Discuss inventory control theory and compute EOQ.	**PSO -1**	**U,E**
CO - 5	Evaluate PERT and CPM	**PSO -5**	**E**
CO - 6	Enable the students to convert any real life situation into a mathematical model and solve them using an appropriate algorithm- Skill Development	**PSO – 1,PSO -2**	**U,E**

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

PRESCRIBED TEXT BOOK

Kantiswarup,P.K.Gupta& Man Mohan , (2009) <u>OPERATIONS RESEARCH</u> ,
UNIT - I - Chapters 2 ,Chapter 3 : 3.1 -3.5 ,Chapter 4: 4.1- 4.3
UNIT II- Chpter 4: 4.4 ;Chapter 12:12:1-12:5
UNIT III - Chapter 10 : 10.1 – 10.3 , 10.5, 10.8 -10.13,10.15, Chapter 11-11.1 to 11.4,11.7
UNIT IV - Chapter 19: 19.1 - 19:12
UNIT V - Chapter 25

BOOKS FOR REFERENCE

1. H. Taha(IV Edition) <u>OPERATIONS RESEARCH</u> ,Prentice Hall of India
2. P. K. Gupta, D. S. Hira, (2001) <u>PROBLEMS IN OPERATIONS RESEARCH</u>, S.Chand ,New Delhi

Course Title	MAJOR CORE - 9: GRAPH THEORY
Total Hours	75
Hours / Week	5
Code	U15MA5MCT09
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE
        To understand the 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 graph and its operations.
CO – 2	Understand the characteristics of graph
CO – 3	Understand about special graphs
CO – 4	Understand directed graphs and its properties
CO – 5	Apply graph theory to travelling salesman problem

UNIT I : INTRODUCTION AND OPERATIONS ON GRAPHS.   **15 Hrs**
        Introduction- graphs and subgraphs-isomorphism- Independent sets and coverings - Matrices - Operations on graphs.
Extra Reading/ Keywords: Ramsey numbers, Subdivision of graphs.

UNIT II : CHARACTERISTICS OF GRAPH   **15 Hrs**
        Degree sequence-graphic sequences-walks, trails and paths-connectedness & components-blocks-connectivity.
Extra Reading/ Keywords:Clique number, Matching.

UNIT III :SPECIAL GRAPHS   **15 Hrs**
Eulerian, Hamiltonian graphs and trees.
Extra Reading/ Keywords: Unicyclic and bicyclic trees

UNIT IV : DIRECTED GRAPHS   **15 Hrs**
        Introduction – Definitions and Basic Concepts –Paths and Connections –Digraphs and Matrices –Tournaments .
Extra Reading/ Keywords: Colouring of Digraphs

UNIT V : APPLICATIONS OF GRAPH THEORY   15 Hrs

       Introduction –Connector Problem –Shortest Path Problem –Transformation and kinematic Graph –Designing One Way Traffic System – Applications - The travelling salesman problem – Job sequencing problem.

Extra Reading/ Keywords: Mapping problem

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 graph and its operations	**PSO - 4**	**R, U**
CO – 2	Recognize the characteristics of graph	**PSO -5**	U
CO – 3	List and relate special graphs**.**	**PSO -2**	U
CO – 4	Describe directed graphs and its properties.	**PSO -3**	U
CO – 5	Apply graph theory to travelling salesman problem**.**	**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

Dr.S.Arumugam and Dr.S.Ramachandran, TREATMENT AS IN "INVITATION TO GRAPH THEORY" by 1994 edition.
UNIT I : Chapters 1 and 2(omit section 2.5 & 2.7)
UNIT II : Chapters 3 and 4
UNIT III : Chapter 5 and 6
UNIT IV : Chapter 10
UNIT V : Chapter 11

BOOKS FOR REFERENCE

1. Harary ,GRAPH THEORY, Narosa Publishing House ,New Delhi,
2. NarsinghDeo, GRAPH THEORY WITH APPLICATIONS TO ENGINEEERING AND COMPUTER SCIENCE Prentice Hall of India, New Delhi

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B.Sc., MATHEMATICS
Third Year - Semester – V

Course Title	MAJOR CORE – 10 : REAL ANALYSIS – II
Total Hours	75
Hours / Week	5
Code	U15MA5MCT10
Course type	Theory
Credits	4
Marks	100

GENERAL OBJECTIVE

To introduce the concepts of open sets, closed sets , connected and bounded sets in a metric space. To enable the students to know about completeness, compactness , derivatives and Riemann integration.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand open set and closed set.
CO – 2	Understand the concepts of connected sets and bounded sets.
CO – 3	Understand the concepts of completeness, compactness and uniform continuity
CO – 4	Understand derivatives, Rolle's theorem and Taylor's theorem.
CO – 5	Understand Riemann integral, properties of Riemann integrals and improper integral.

UNIT I : OPEN , CLOSED SETS   **15 Hrs**

Open sets - Closed sets – More about open sets
Extra Reading/ Keywords: *Properties of interior points and closure*.

UNIT II : CONNECTED AND BOUNDED SETS   **15 Hrs**

Connected sets - Bounded and totally bounded sets
Extra Reading/ Keywords: *Equi continuous, Path connectedness, disconnected, von newmann bounded.*

UNIT III :COMPLETENESS , COMPACTNESS AND UNIFORM CONTINUITY 15 Hrs
Complete metric space , Compact metric spaces – Uniform Continuity .
Extra Reading/ Keywords: Lindeloff, continuity and connectedness, continuity and compactness, Monotonic functions.
UNIT IV : DERIVATIVES   **15 Hrs**
Derivatives - Rolle's theorem - The law of the mean – Fundamental theorem of calculus-Taylor's Theorem.
Extra Reading/ Keywords: *Binomial theorem, L'Hospital rule, differentiation of vector-valued functions*

UNIT V : RIEMANN INTEGRAL   **15 Hrs**
Definition of the Riemann Integral – Existence and Properties of the Riemann Integral – Improper integrals.
Extra Reading/ Keywords:*Riemann criterion, Riemann Stieljes integral.*

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 open set and closed set.	**PSO - 4**	**R**
CO – 2	Describe connectedness and boundedness	**PSO -1**	**R,U**
CO – 3	Describe completeness, compactness and uniform continuity	**PSO -5**	**U**
CO – 4	Recognize derivatives, Rolle's theorem, Taylor's theorem.	**PSO -3**	**R,U**
CO – 5	Discuss Riemann integral and properties of Riemann integrals.	**PSO -2**	**U**
CO – 6	Introduce the concepts of open sets, closed sets , connected and bounded sets in a metric space. To enable the students to know about completeness, compactness , derivatives and Riemann integration.- Skill Development	**PSO -1,2**	**R,U**

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(1963), '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 7.5 -7.8), CHAPTER 8(8.5)
UNIT V: CHAPTER 7(Sec 7.2 – 7.4 and 7.9)

BOOKS FOR REFERENCE

1. Dr. S. Arumugam and others <u>REAL ANALYSIS</u> ,New gamma publishing House,Palayamkottai

2. K. ChandrasekharaRao, K.S.Narayanan, <u>'REAL ANALYSIS'</u> Volume I, S. Viswanathan(Printers & Publishers) Pvt. Ltd., 2008 Edition

3. M.K.Singal and Asha Rani Singal(2008) <u>'A FIRST COURSE IN REAL ANALYSIS'</u> S.Chand& Co. New Delhi.

4. Shanthi Narayan <u>'A COURSE OF MATHEMATICAL ANALYSIS'</u>''Margaum Publishers.

5. Tom Apostol, '<u>MATHEMATICAL ANALYSIS'</u>, Narosa Publishing House, New Delhi, 1985.

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

Course Title	MAJOR ELECTIVE-2: MECHANICS
Total Hours	75
Hours / Week	5
Code	U15MA5MET02
Course type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE
      To enable the students to know about the concepts of types of forces, moments ,couples, Equilibrium of strings, projectiles, impulsive forces and collision elastic bodies

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of equilibrium of forces and related theorem.
CO – 2	Understand parallel forces , Principle of moments and Moment of a force about an axis.
CO – 3	Understand equilibrium of strings and its application to centenary
CO – 4	Understand projectile and evaluation of its characteristics
CO – 5	Apply impulsive forces, & different types of impact

UNIT : I EQUILIBRIUM OF FORCES   **15 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.
Extra Reading/ Keywords: *Laws of friction , angle of friction , equilibrium of a body*

UNIT: II PARALLEL FORCES   **15 Hrs**
      Parallel Forces – Like and Unlike parallel forces – Resultants – Moment of a force about a point - Varignon's Theorem on Moments – Principle of Moments – Moment of a force about an axis.
Extra Reading/ Keywords: *Center of gravity of simple uniform bodies*

UNIT III : EQUILIBRIUM OF STRINGS   **15 Hrs**
      Equilibrium of strings – Common catenary – equations – tension at any point – geometrical properties – Parabolic catenary – Suspension Bridge.
Extra Reading/ Keywords: *Equilibrium of uniform homogeneous strings*

UNIT IV :PROJECTILE ON HORIZONTAL PLANE   **15 Hrs**

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

Extra Reading/ Keywords*: projectile on inclined plane , two trajectories with given speed and range*

UNIT V: IMPULSIVE FORCES   **15 Hrs**

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

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

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 equilibrium of forces and related theorem.	**PSO –5**	**R,U**
CO – 2	Recognize and list parallel forces ,Principle of moments and Moment of a force about an axis	**PSO -2**	**R,U**
CO – 3	Discuss equilibrium of strings and its application to catenary	**PSO -1**	**U**
CO – 4	Describe projectile and evaluation of its characteristics	**PSO -3**	**U,E**
CO – 5	Illustrate impulsive forces, & different types of impact	**PSO -4**	**U,E**
CO – 6	Enable the students to know about the concepts of types of forces, moments ,couples, Equilibrium of strings, projectiles, impulsive forces and collision elastic bodies- Skill Development	**PSO-2,3**	**R,U**

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

PRESCRIBED TEXT BOOKS

TREATMENT AS IN
   1. Dr. M.K. Venkataraman, STATICSAgasthiar Publications, Trichy (2013).
Unit: I - Chapters 1 & 2
Unit: II – Chapters 3
Unit: III – Chapter 11
 2. Dr. M.K. Venkataraman.(2008), DYNAMICS,Agasthiar Publications, Trichy-
Unit: IV –Chapter VI(6.1-6.11)
Unit:V – Chapter VII – 7.1 to 7.5, Chapter VIII - 8.1 to 8.8

BOOKS FOR REFERENCE

1. A.V.Dharmapadam, Statics , S.Viswanathan Printers and Publishing Pvt.,Ltd,1993.
2. P.Duraipandian and Laxmi Duraipandian, Mechanics , S.Chand and Company Ltd,Ram Nagar, New Delhi -55,1985.
3. Dr.P.P.Gupta, Statics, Kedal Nath Ram Nath, Meerut,1983-84.

4. K.Viswanatha Naik& M.S.Kasi, Statics, Emerald Publishers,1992
5. N.P. Bali, Statics, Golden Mathematics Series, Laxmipublications,1992

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

Course Title	MAJOR ELECTIVE-2: ASTRONOMY
Total Hours	75
Hours / Week	5
Code	U15MA5MET06
Course type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE

To enable the students to know about the exciting world of astronomy and help them to study spherical trigonometry in the field of astronomy. To understand the movements of the celestial objects.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO - 1	Recall and Understand the concept of Sphere and Celestial sphere.
CO - 2	Understand stars and its properties.
CO - 3	Understand refraction and its laws.
CO – 4	Understand Kepler's law and its verification.
CO – 5	Understand celestial moon and its phase.

UNIT: I   SPHERE   (15 HRS)

Relevant properties of sphere and formulae in spherical trigonometry (no proof, no problems) - Celestial sphere and diurnal motion -Celestial coordinates-sidereal time.
Extra Reading/ Keywords: *Motion of planets and birth of modern astronomy*

UNIT: II STARS   (15 HRS)

Morning and evening stars -circumpolar stars- diagram of the celestial sphere - zones of earth -perpetual day-dip of horizon-twilight.
Extra Reading/ Keywords:*Stellar Structure,Extragalactic Astronomy*

UNIT III: REFRACTION   (15 HRS)

Refraction - laws of refraction -tangent formula-Cassini's formula - horizontal refraction- geocentric parallax -horizontal parallax.
Extra Reading/ Keywords: *planetary ring and their formation, Roche limit*

UNIT IV : KEPLER'S LAWS   (15 HRS)

Kepler's laws of planetary motion- verification of 1st and 2nd laws in the case of earth - Anomalies -Kepler's equation - Seasons -causes -kinds of years.

Extra Reading/ Keywords: *newton's law of planetary motion*

UNIT V : MOON   (15 HRS)

Moon-sidereal and synodic months - elongation - phase of moon - eclipses-umbra and penumbra - lunar and solar eclipses - ecliptic limits - maximum and minimum number of eclipses near a node and in a year -Saros.

Extra Reading/ Keywords: *The Galilean moon of Jupiter*

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 concept of sphere and its formulae.	PSO –5	R,U
CO – 2	Recognize and list the types of stars.	PSO -2	R,U
CO – 3	Discuss refraction and laws of refractions.	PSO -1	U
CO – 4	Describe Kepler's laws and its verification	PSO -3	U,E
CO – 5	Illustrate moon and its phases.	PSO -4	U,E
CO – 6	Enable the students to know about the exciting world of astronomy and help them to study spherical trigonometry in the field of astronomy and understand the movements of the celestial objects .- Skill Development	PSO-2,3	R,U

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
Kumaravel, S. and Susheela Kumaravel,*Astronomy* ,8th Edition ,SKV Publications,2004.
Unit 1: Sec: 39-79
Unit 2: Sec: 80-90,106-116
Unit3: Sec: 117-144
Unit 4: Sec:146-162,173-178
Unit 5: Sec:229-241,256-275

BOOKS FOR REFERENCE:
1.   G V Ramachandran, Text Book of Astronomy, Mission Press, Palayamkottai, 1965.
2.   Moons and Planets, W.K. Houtmann, Wadsworth Publishing Company 4th Ed.
3.   W.M.Smart: Text book of Spherical Astronomy.
4.   McCusky: Introduction to Celestial Mechanics.
5.   G.Abell: Exploration of the Universe.

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
III UG NME - Semester – V

Course Title	**NON MAJOR ELECTIVE – 1: QUICK MATHEMATICS**
Total Hours	**30**
Hours / Week	**2**
Code	**U15MA5NMT01**
Course type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE
　　　　To revise arithmetic facts related to numbers , ratios, percentages etc. and to train them inproblem solving techniques**.**

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand number system, simplification using formula and rule and evaluation of LCM and HCF
CO – 2	Understand averages, percentage and data representation through diagram
CO – 3	Evaluate profit and loss ,ratio and proposition
CO – 4	Understand time and work concept and its application to cisterns and pipes.
CO – 5	Understand time and distance and applying to the problem of trains, boats and streams.

UNIT I:NUMBER SYSTEM 　　　　　　　　　　　　　　　　　　　**6 Hrs**
　　　　Number System – Simplification using formulae and rules – L.C.M and H.C.F of 2 or more numbers
Extra Reading/Key words*: History of numbers, Algebraic numbers*.

UNIT II: AVERAGE AND PERCENTAGE 　　　　　　　　　　　　　**6 Hrs**
Averages-Percentage
Extra Reading/Key words*: Histogram, Line chart*

UNIT III: PROFIT AND RATIO 　　　　　　　　　　　　　　　　**6 Hrs**
Profit and Loss -Ratio and Proportion
Extra Reading/Key words*: Partnership, Discount*

UNIT IV: TIME AND WORK 　　　　　　　　　　　　　　　　　　**6 Hrs**
Time and Work – Cisterns and Pipes
Extra Reading/Key words*: Clocks, Business*

UNIT V: TIME AND DISTANCE **6 Hrs**

     Time and Distance –Trains-Boats and Streams
Extra Reading/Key words*: Races and Games of skill,*

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

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Demonstrate number system, simplification using formula and rule and evaluation of LCM and HCF	**PSO - 2**	**E**
CO – 2	Compute averages, percentage and data representation through diagram	**PSO 3**	**E**
CO – 3	Evaluate profit and loss ,ratio and proposition.	**PSO -1**	**E**
CO – 4	Recognize time and work concept and apply to cisterns and pipes.	**PSO -4**	**R,E**
CO – 5	Recall time and distance and apply trains, boats and streams.	**PSO -5**	**R,E**
CO – 6	Faster Computation for Competitive Exams-Employability.	**PSO -1**	**E**

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 ForCompetitve Examinations, S.Chand andCompany Ltd., Ram Nagar, New Delhi.
Unit I: Chapters 1, 2 and 4
Unit II: Chapters 6 and 10
Unit III: Chapters 11 and 12
Unit IV: Chapters 15 and 16
Unit V: Chapters 17,18 and 19

BOOKS FOR REFERENCE

    1.Competition Success Review for Bank Probationary Officer's Exam.
    2.Competition Success Review for MBA Entrance Examinations.
    3.Any text book on Competitive Examinations

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – VI

Course Title	MAJOR CORE – 11: THEORY OF FUNCTIONS OF A COMPLEX VARIABLE
Total Hours	90
Hours / Week	6
Code	U15MA6MCT11
Course type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE
      To extend the idea of integration in the complex field by using residues and evaluating contour integrals. To understand the concept of bilinear transformation and visualizing their images

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the concept of complex variable, Analytic functions 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	Understand zeros, pole and singularities of an analytic functions and their expressions using Taylor's theorem and Laurent's theorem
CO – 5	Evaluate residues using Cauchy's residue theorem.
CO – 6	Evaluate definite integrals between limits$-\infty$ to ∞

UNIT I : ANALYTIC FUNCTIONS   **18 Hrs**
      Introduction –Functions of a complex variable- Limits – Theorems on limits-Continuous functions –Differentiability- Cauchy - Riemann equations- Analytic Functions -Harmonic functions
Extra Reading/ Keywords*: conformal mapping*

UNIT II: BILINEAR TRANSFORMATIONS   **18 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   18 Hrs

Introduction –Definite integral- Cauchy's theorem -Cauchy's integral formula (Riemann's proof only) and its extension – Higher derivatives.
Extra Reading/ Keywords: *winding number, Argument function*

UNIT IV : SERIES EXPANSION   18 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   18 Hrs

Introduction -Residues - Cauchy's Residue theorem - Evaluation of Definite Integrals between limits (-µ to µ) - Jordan's lemma (Statement only)- Evaluation of
Sin ax f(x) dx, Cos ax f(x)dx where a > 0 and (i) f(z) does not have a pole on the real axis
(ii) f(z) have poles on the real axis .
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 complex variable, analytic functions and harmonic functions.	**PSO - 1**	R,U
CO - 2	Explain and relate bilinear transformation and its properties	**PSO -2**	U,E
CO - 3	Apply Cauchy's theorem and cauchy's integral formula to compute definite integrals	**PSO -5**	Ap,E
CO - 4	Recognize zeros, pole and singularities of an analytic functions and their expressions using Taylor's theorem and Laurent's theorem	**PSO -3**	U,E
CO - 5	Calculate residues using cauchy's residue theorem.	**PSO -4**	E
CO - 6	Compute definite integrals between limits$-\infty$ to ∞	**PSO -5**	E
CO - 7	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 (2006), <u>COMPLEX ANALYSIS ,</u>
Scitech Publishers, Chennai
   UNIT I: Chapter 2(Sec 2.0 to 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) <u>COMPLEX ANALYSIS</u> , Narosa publishing House ,New Delhi.
2.Howie, M.John (2008), <u>COMPLEX ANALYSIS</u> ,WileyDremtechpvt ltd
3.H.A.Priestley, Introduction to Complex Analysis, 2nd edition (Indian), Oxford, 2006.
4.L.V.Ahlfors, Complex Analysis, 3rd edition, McGraw Hill, 2000.
5.J.E. Marsden and M. J. Hoffman,Basic Complex Analysis, 3rd edition, W.H.
Freeman,1999

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – VI

Course Title	MAJOR CORE- 12:DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORMS AND FOURIER SERIES
Total Hours	90
Hours / Week	6
Code	U15MA6MCT12
Course type	Theory
Credits	5
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 and enable the students to apply in problems

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Evaluate ordinary differential equation with variable coefficient by the method of variation of parameter
CO - 2	Form PDE and to solve PDE
CO - 3	Understand Laplace transform and to find Laplace transforms for standard Functions
CO – 4	Understand inverse Laplace transforms and to apply ILT for finding the Solution of ordinary differential equations
CO – 5	Understand Fourier series and find Full range and half range cosine and sine Series

UNIT I : ORDINARY DIFFERENTIAL EQUATIONS   **18 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   **18 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   18 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   18 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   18 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 learners

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 PDE and to solve PDE	**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 to apply ILT 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 applications of partial differential equations 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 BOOKS

1. Narayanan.S , ManicavachagomPillay.T.K, <u>DIFFERENTIAL EQUATIONS,</u>
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 9
2. Calculus (volume III) by S.Narayanan and T.K.ManicavachagamPillay, S.Viswanathan (Printers and publishers),Chennai.
UNIT:V Chapter 6 – Sections 1 to 5(Change of interval excluded)

BOOKS FOR REFERENCE

1.Arumugam.S,ThangapandiIssac.A,Somasundaram.A,(2002) <u>ENGINEERING MATHEMATICS</u>Vol III ,SCITECH Publishers, Chennai
2.Raisinghania.M.D,(2002),<u>ORDINARYAND PARTIAL DIFFERENTIAL EQUATIONS</u> ,S.Chand&Company ,New Delhi.
3. ZafarAhsan (2006) <u>DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS</u>,Prentice Hall of India Ltd,New Delhi.
4. Thomas /Finanera(1984), <u>CALCULUS AND ANALYTIC GEOMETRY</u>Narosa Publishing House,Delhi.

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT
SYSTEMB.Sc.,
MATHEMATICS
Third Year - Semester – VI

Course Title	MAJOR CORE 13: INTRODUCTION TO FUZZY MATHEMATICS
Total Hours	90
Hours / Week	6
Code	U15MA6MCT13
Course type	Theory
Credits	5
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 (CO) :
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 (18 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 (18 HRS)
Introduction - Fuzzy Complements- Fuzzy Intersections-Fuzzy Unions.
Extra Reading/ Keywords: Combination of operations, Aggregation operations, Fuzzy numbers.

UNIT III: FUZZY RELATIONS (18 HRS)
Introduction- Operations on Fuzzy Relations-α-cuts of Fuzzy Relations-Compositions of Fuzzy Relations-

Projections of Relations - Cylindric Extensions.
Extra Reading/ Keywords: Cylindric Closure, Fuzzy ordering relation, Fuzzy graph.

UNIT IV: FUZZY LOGIC (18 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 (18 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 , (2006) <u>INTRODUCTION TO FUZZY SETS AND FUZZY LOGIC</u>,   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(2005) , .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)<u>INTRODUCTION TO FUZZY THEORY</u>,Academic press ,Newyork .
2. George J .Kler /Bo yuan, (2005).<u>FUZZY SETS AND FUZZY LOGIC –THEORY AND APPLICATIONS</u>, Prentice Hall of India ,New Delhi .
3. T.M.Ross(2006),FUZZY ENGINEERING APPLICATION ,Wiley Western Company

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – VI

Course Title	MAJOR ELECTIVE – 3: PROGRAMMING IN C++
Total Hours	75
Hours / Week	5
Code	U15MA6MET03
Course type	Theory & Practical
Credits	5
Marks	100

GENERAL OBJECTIVE
　　　　　To enable the students to understand the concept of OOPS which will enable them to write programs.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the keywords, identifier, data type, symbolic constants, variable of C++.
CO – 2	Understand operations of functions of C++.
CO – 3	Understand Classes, Objects and constructors of C++.
CO – 4	Understand constructors and its types
CO – 5	Apply constructors overload binary and urinary operations

UNIT I : BEGINNING WITH C++: 　　　　　　　　　　　　　　　　　**15 Hrs**
　　　　Introduction to C++-Applications of C++ statements-structure of C++ programs -
Tokens, keywords, identifiers, data types - symbolic constants   -type compatibility- defining variables.
Extra Reading/ Keywords*: Benefits of OOP, object oriented languages*

UNIT II : OPERATORS AND FUNCTIONS: 　　　　　　　　　　　　　**15 Hrs**
　　　　Operators in C++ - Manipulators -Type cast operator- Expressions – Operator Overloading-control structures -Main function-Function prototyping-call by reference-return by reference-inline functions-default arguments-constant arguments-Recursion- Function overloading.
Extra Reading/ Keywords*:Friend and Virtual functions.*

UNIT III : CLASSES, OBJECTS AND CONSTRUCTORS   15 Hrs

Specifying a class – Defining member functions –Making an outside function inline – Nesting of member functions – Arrays within a class – Memory allocation for objects-Constructors – Parameterized constructors –Multiple constructors in a class – Constructors with default arguments

Extra Reading/ Keywords: *Static data members, static member functions*

UNIT IV: CONSTRUCTORS (CONTD) AND OPERATOR OVERLOADING   15 Hrs

Dynamic initialization of objects – Copy constructor –Dynamic constructor - Destructors-Defining operator overloading – Overloading unary , binary operators.

Extra Reading/ Keywords: *const objects*

UNIT V : OPERATOR OVERLOADING(CONTD) AND INHERITANCE   15 Hrs

Binary operators overloading using friends – Manipulation of strings using operators - Rules for overloading operators –Defining derived classes – Single Inheritance – Making a private member inheritable – Multilevel, Multiple, Hierarchical and Hybrid inheritance.

Extra Reading/ Keywords: *type conversions , Virtual base classes*

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

PRACTICAL WORK

1. Sorting numbers in ascending and descending order
2. Implementation of Default arguments
3. Implementation of Reference variables
4. Friend Function
5. Inline Functions
6. Constructor and Destructor
7. Students Mark list
8. Employee Information System
9. Multiple Inheritance
10. Function Overloading

 NOTE: PROGRAMS MUST BE TAKEN ONLY FROM THE PRACTICAL WORK.

COURSE OUTCOMES (CO)

The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO - 1	Recall the keywords, identifier, data type, symbolic constants, variable of C++.	**PSO – 2**	**R,U**
CO - 2	Recognize operations of functions of C++.	**PSO -1**	U
CO - 3	Reproduce Classes, Objects and constructors of C++.	**PSO -5**	U
CO - 4	Relate constructors and its types	**PSO -3**	U
CO - 5	Apply constructors overload binary and urinary operations	**PSO -4**	**U,Ap**
CO - 6	Languages needed for further computer courses-Employability	**PSO -4**	**U,Ap**

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

PRESCRIBED TEXT BOOK

E. Balagurusamy (sixth edition 2014), " OBJECT ORIENTED PROGRAMMING WITH C++", TATA MCGRAW HILL.

UNIT I: Chapter 2 (Sec 2.1 -2.6), Chapter 3 (Sec 3.1 -3.13)
UNIT II: Chapter 3 (Sec 3.14 -3.25), Chapter 4 (Sec 4.1 - 4.10)
UNIT III: Chapter 5 (Sec 5.1 – 5.10),Chapter 6(Sec6.1 – 6.5)
UNIT IV: Chapter 6(Sec6.6 – 6.8,6.11) , Chapter 7 (Sec 7.1 – 7.4)
UNIT V: Chapter 7 (Sec 7.5 – 7.8),Chapter 8 (Sec 8.1 – 8.8)

BOOKS FOR REFERENCE

1. M.A.Jayaram and D.S. Rajendra Prasad,(2002) "OBJECT ORIENTED PROGRAMMING WITH C++" ,Mumbai, Himalaya Publishing.
2. D.Ravichandran ,(1999), "PROGRAMMING WITH C++" ,New York, Mcgraw Hill.
3. Maria Litvin and Gary Litvin ,(2001), "PROGRAMMING IN C++" ,New Delhi,Vikas Publishing House Pvt. Ltd.,
   Nell Dale,Chip Weems and Mark Headington(1999), "PROGRAMMING IN C++",New

HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI – 620002
PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – VI

Course Title	MAJOR ELECTIVE – 3: NUMBER THEORY
Total Hours	75
Hours / Week	5
Code	U15MA6MET07
Course type	Theory
Credits	5
Marks	100

GENERAL OBJECTIVE

To highlight the niceties and nuances in the world of numbers and prepare the students for coding through congruence's

COURSE OBJECTIVES

The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the basic concepts of Divisibility involving Euclid's Division Lemma and Linear Diophantine Equation.
CO – 2	Understand the basic concepts of Permutations and Combinations using Fermat's Little Theorem and Wilson's Theorem.
CO - 3	Understand the basic Properties of Congruences Residue Systems by using the theorems of Fermat and Wilson Revisited.
CO - 4	Understand the concepts of Polynomial Congruences using Chinese Remainder theorem.
CO - 5	Understand the concepts of multiplicative arithmetic function using Mobius Inversion Formula.

NUMBER THEORY

UNIT I:DIVISIBILITY 15Hrs

Euclid's Division Lemma – Divisibility – The Linear Diophantine Equation – The Fundamental Theorem of Arithmetic.
Extra Reading/ Keywords: *Primality testing, Division algorithm, Gauss's Lemma.*

UNIT II : PERMUTATIONS AND COMBINATIONS   **15Hrs**

Permutations and Combinations – Fermat's Little Theorem – Wilson's Theorem – Generating Functions.

Extra Reading/ Keywords: *Counting principle, perfect number, transcendental number*

UNIT III: CONGRUENCES   **15Hrs**

Basic Properties of Congruences -Residue Systems. Linear Congruences – The Theorems of Fermat and Wilson Revisited.

Extra Reading/ Keywords: *Elliptic Curve, Continued fractions.*

UNIT IV : POLYNOMIAL CONGRUENCES   **15Hrs**

The Chinese Remainder Theorem – Polynomial Congruences – Combinational Study of F(n).

Extra Reading/ Keywords: *Miller-Rabin primality test, pseudo primality.*

UNIT V : ARITHMETIC FUNCTION   **15Hrs**

Formulae for d(n) and s(n) – Multiplicative Arithmetic Function – The Mobius Inversion Formula.

Extra Reading/ Keywords: *Liouville function, Euler phi function , totient function.*

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 basic concepts of Divisibility involving Euclid's Division Lemma and Linear Diophantine Equation.	**PSO – 2**	**R,U**
CO - 2	Recognize the basic principles on Permutations and Combinations using Fermat's Little Theorem and Wilson's Theorem.	**PSO -3**	**Ap, E**
CO - 3	Recognize the basic Properties of Congruences Residue Systems by using the theorems of Fermat and Wilson Revisited .	**PSO -1**	**E**
CO - 4	Recognize the concepts of Polynomial Congruences using Chinese Remainder theorem.	**PSO -4**	**An**
CO - 5	Recall the concepts the concepts of Arithmetic functions using Mobius Inversion formula.	**PSO -5**	**R,U**
CO - 6	To acquaint the students become familiar with the concepts of divisibility and arithmetic functions and apply them to solve problems - Skill Development	**PSO-2**	**Ap**

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

PRESCRIBED TEXTBOOK

Number Theory by *George E.Andrews,* Hindustan Publishing Corporation – 1984, Edition.

Unit I: Chapter - 2 Sec. 2.1 – 2.4pages12-29
Unit II: Chapter – 3 Sec. 3.1, 3.4pages30-44
Unit III: Chapter – 4Sec. 4.1 – 4.2 Pages 49 – 55, Sec. 5.1- 5.2Pages58-65
Unit IV: Chapter – 4 Sec. 5.3 – 5.4 pages 66-74, Sec. 6.1Pages75-81
Unit V: Chapter – 5 Sec. 6.2 – 6.3Pages82-92

BOOKS FOR REFERENCE

1. David M. Burton (2007), **ELEMENTARY NUMBER THEORY**, Tata Mc_Graw Hill Publishing Company Limited,New Delhi.
2. Ireland,Kenneth(2005),**CLASSICAL INTRODUCTION TO MODERN NUMBER THEORY,**Wiley-Dreamtech**,**India Private Limited,New Delhi.
3. KumaraveluS. ,SusheelaKumaravelu (2002), **ELEMENTS OF NUMBER THEORY,**S.K.V.Publishers,Nagercoil.
4. Nadkarni M.G.,Dani J.S.(1999), **NUMBER THEORY**, Tata Mc_Graw Hill Publishing Company Limited,New Delhi.

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PG AND RESEARCH DEPARTMENT OF MATHEMATICS
CHOICE BASED CREDIT SYSTEM
III UG NME - Semester – VI

Course Title	NON MAJOR ELECTIVE 2-- ART OF PROGRAMMING
Total Hours	30
Hours / Week	2
Code	U15MA6NMT02
Course type	Theory
Credits	2
Marks	100

GENERAL OBJECTIVE
To acquire knowledge about Algorithms ,Flow Chart and to write Simple programs independently.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand about flow chart and preparation of flow chart.
CO – 2	Prepare algorithm for square, rectangle, circle and triangle, calculate simple interest and compound interest.
CO – 3	Understand Hardware and Software
CO – 4	Understand statements and application of statements for simple programs.
CO – 5	Understand arrays.

UNIT I : FLOW CHART   6Hrs
Flow chart –Definition – Symbols
Flow Chart for:
(i) To find the area of a square , rectangle ,circle and triangle
(ii) To calculate simple interest and compound interest
(iii)To find the sum of first n natural numbers
(iv)To find the sum of n given numbers and their average and standard deviation
(v)To pick the largest of 3 given numbers.
Extra Reading/ Keywords: *Flow chart for perimeter for the above given shapes.*

UNIT II : ALGORITHMS   6 Hrs
Algorithm-Definition-Algorithm for those ((i) to (v)) mentioned in unit I
Extra Reading/ Keywords: *Algorithm for perimeter for the above given shapes in unit I.*

UNIT III:CONSTANTS,VARIABLES AND EXPRESSIONS   6 Hrs
Low level and High Level Languages – Hardware and Software
Alphabet- Constants- Variables- Arithmetic Expressions-Precedence rules of arithmetic operators-
Logical expressions-Library functions – SIN , COS ,TAN,SQRT,EXP and LOG.
Extra Reading/ Keywords: *Algebraic expression*

UNIT IV:STATEMENTS   6 Hrs
Comment Statement
Input –Output Statements
Assignment Statement
Conditional Statement –THE BLOCK IF CONSTRUCT
Loop Statement – THE BLOCK DO LOOP
Extra Reading/ Keywords : *DO WHILE LOOP*

UNIT V: SIMPLE PROGRAMS   6 Hrs
Arrays
PROGRAMS:
For those mentioned in Unit I ((i) to (v))
(vi) For income Tax Calculation **(Example Program 6.6)**
(vii) To find the result of students in a class and the % of pass **(Example Program 8.1 / 8.3)**
(viii) To find the first mark in a class of n students **(Example Program 7.11)**
(ix) To find the average height of boys and girls in a class **(Example Program 7.4)**
(x) For adding / multiplying two matrices
Extra Reading/ Keywords: Structures, pointers

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 flow chart and preparation of flow chart	**PSO - 1**	**R,U**
CO – 2	Design algorithm for square, rectangle, circle and triangle, calculate simple interest and compound interest.	**PSO -2**	U
CO – 3	Reproduce and relate Hardware and Software	**PSO -5**	U
CO – 4	Recognize statements and application of statements for simple programs.	**PSO -3**	U
CO – 5	List arrays and its types	**PSO -3**	U
CO – 6	Languages needed for further computer courses - Skill Development.	**PSO - 4**	U

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

PRESCRIBED TEXT BOOKS
1.P.S .Grover 1996 <u>COMPUTER PROGRAMMING IN BASIC</u> Allied Publishers Ltd,
New Del hi for Units I &II
2. V.Rajaraman , <u>COMPUTER PROGRAMMING IN FORTRAN 90 AND</u> 95   Prentice Hallof India,
New Delhi for Units III, IV &V
Unit III :
Chapter 3 (3.1 and 3.2)
Chapter 4 (4.1 and 4.5)
Chapter 6 (6.1)
Chapter 8 (8.2 and 8.3)
Unit IV: Chapter 4 (4.6 and 4.7) Chapter 5(5.1 and 5.2) Chapter 6 (6.2) Chapter 7 (7.1)
Unit V: Chapter 10 (10.2 , 10.3)

BOOKS FOR REFERENCE

1.Interactive Fortran 77: A Hands on Approach by Ian D Chivers, Jane Sleightholme
2.FORTRAN 90 for engineers and scientists by Larry R. Nyhoff
3. Fortran 95/2003 for Scientists & Engineers by Stephen J. Chapman

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Third Year - Semester – VI

Course Title	SKILL BASED ELECTIVE– 5: APPLICATION OF ALGORITHMS
Total Hours	30
Hours / Week	2
Code	U15MA6SBT05
Course type	Theory
Credits	2
Marks	100

GENERAL OBJECTIVE
Motivating the students to take interest in understanding the matrix representation of a graph and algorithmic approach for various aspects of graph theory

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand Matrix representation and its type
CO – 2	Understand the relationship between matrices and cut set matrices
CO – 3	represent graph and finding minimal spanning tree using Prism's algorithm and Kruskal algorithm
CO – 4	Understand Fundamental circuit algorithm and applications of Dijikstrasalgorithm
CO – 5	Apply travelling salesman problem algorithm and David Huffman algorithm

MATRIX REPRESENTATION
Unit I: **6 Hrs**
Incidence matrix – Reduced incidence matrix – Circuit matrix – Fundamental circuit matrix (Proof of the theorem excluded)
Extra Reading/ Keywords: *Matrices, Matrix operations*

Unit II: **6 Hrs**
Cut set matrix – Fundamental cut set matrix – Relationship between matrices – Adjacency matrix – Path matrix(Proof of the theorem excluded)

Extra Reading/ Keywords: *Different types of graphs , Cut set vertex*

ALGORITHMIC APPROACH

Unit III: **6 Hrs**

　　　Introduction – Computer representation of a graph –Kruskal algorithm and R.C Prim's algorithm for finding minimal spanning tree.

Extra Reading/ Keywords: *Breadth first **search**, Depth – first search*

Unit IV: **6 Hrs**

　　　All fundamental circuits algorithm – Dijikstras algorithm - Dijikstras algorithm for weighted graphs.

Extra Reading/ Keywords: *Labeling procedure*

Unit V: **6 Hrs**

　　　Travelling salesman problem algorithm – Algorithm for finding all spanning trees –   David Huffman algorithm .

Extra Reading/ Keywords: Travelling Salesman Insertion method

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 Matrix representation and its type	**PSO - 5**	**R,U**
CO - 2	Recall and relate the relationship between matrices and cut set matrices	**PSO -3**	U
CO - 3	Apply Prism's algorithm and Kruskal algorithm for finding minimal spanning tree	**PSO -2**	**U,Ap**
CO - 4	Reproduce Fundamental circuit algorithm and to applyDijikstras algorithm	**PSO -1**	**U,Ap**
CO - 5	Apply travelling salesman problem algorithm and David Huffman algorithm	**PSO -4**	**U,Ap**
CO - 6	To get equip in getting optimum solutions to data driven problems and to provide working solutions in time especially with dynamic problem definition - 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 TEXTBOOK

Treatment as in ,"A TEXT BOOK OF GRAPH THEORY AND ITS APPLICATIONS" by B. SOORYANARAYANAN and G. K. RANGANATH,(2001), S. Chand company ltd , New Delhi.
Unit 1 and 2 :   Chapter 8(8.-8.9)
Unit 3,4 and 5 : Chapter 11(11.1 , 11.2, 11.5 to 11.7, 11.10, 11.11, 11.13, 11.14 and 11.16)

BOOKS FOR REFERENCE

1. Kenneth H. Rosen(2005)Fifth edition "DISCRETE MATHEMATICS AND IT'S APPLICATIONS"
, Tata McGraw Hill Publishing company limited , New Delhi.
2. Harary , "GRAPH THEORY" , Narosa Publishing House New Delhi, Bombay.
3. NarsinghDeo , "GRAPH THEORY WITH APPLICATIONS TO ENGINEEERING AND
COMPUTER SCIENCE", Prentice Hall of India, New Delhi.

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CHOICE BASED CREDIT SYSTEM
B.Sc., MATHEMATICS
Third Year - Semester – VI

Course Title	**SKILL BASED ELECTIVE - 6: RESEARCH METHODOLOGY**
Total Hours	**30**
Hours / Week	**2**
Code	**U15DS6SBT06**
Course type	**Theory**
Credits	**2**
Marks	**100**

GENERAL OBJECTIVE
   Students get introduced to concept of research and to carrying out of research projects.

COURSE OBJECTIVES
The learner will be able to

CO No.	Course Objectives
CO – 1	Understand the types of research literature review and data collection from different resources.
CO – 2	Understand the objectives, Hypothesis and area of research
CO – 3	Prepare and evaluate dissertation
CO – 4	Present dissertation

UNIT I :   **6 Hrs**
   Introduction To Research: Concept of Research-Types of Research- Introduction to Research Literature Base-Collection of Research Information from different Sources;Majortenance of Information.
Extra Reading/ Keywords: *processing of information in research methodology, research design*

UNIT II :   **6 Hrs**
   Research Focusing: Identifying Research area-Drawing Objectives\Hypothesis – Designing the Work-Data Collection-Analysis.
Extra Reading/ Keywords: *secondary data collection , types of report, collecting and analyzing*

UNIT III :   **6 Hrs**
　　　Preparation of Dissertation : Structure of Dissertation-Editing –Bibliography.
Extra Reading/ Keywords*: interpretation of research work , structuring the research project*

UNIT IV& UNIT V: Project Work   **6 Hrs**

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

COURSE OUTCOMES (CO)
The learners

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO – 1	Recognize the types of research literature review and data collection	**PSO – 1, PSO - 4**	**R,U**
CO – 2	Recall the objectives, Hypothesis and area of research.	**PSO -2**	**U**
CO – 3	Discuss and evaluate dissertation	**PSO -5**	**Ap,E**
CO – 4	Demonstrate dissertation	**PSO -3**	**E**
CO – 5	Students get introduced to concept of research and to carrying out of research projects-- Skill Development	**PSO-2,5**	**Ap,E**

BOOKS FOR REFERENCE

　　　Blaxter,L.,Hughues,C.Aned Tight(1999) How To Research. Viva
　　　BookPrivateLimited.
　　　Kothari.,C.R(2004)Research Methodology-Methods And Techniques,
　　　NewAgeInternational Publishers, India.
　　　Lal,B.,(2002) Research Methodology, Abd Publishers, India