



Don Bosco College of Arts and Science, Keela Eral

VISION AND MISSION

Vision:

Don Bosco College of Arts and Science, inspired by divine and human values, envisages enlightenment and empowerment of the youth towards personal and social transformation.

Mission:

1. To make higher education qualitative, inclusive, cost effective and accessible to the rural masses.
2. To exercise a preferential option in favor of the rural youth especially the First Generation Learners and socially and economically weaker sections of the society.
3. To facilitate the actualization of individual potential, integrating knowledge, skills, values and behaviour and prepare the students to face the global opportunities and challenges of a meaningful life and career.
4. To constantly pursue higher standards of excellence, integrity and credibility in all endeavors and transform the students, in collaboration with all the stakeholders of higher education, to be agents of social transformation.

DEPARTMENT OF MATHEMATICS

VISION AND MISSION

- 1. Vision of the Department :** To centre stage Mathematical Knowledge in the curriculum, instill analytical and logical thinking among students and promote Mathematical thought as an important area of human thought.
- 2. Mission of the Department :** To provide every student of our department, the required Mathematical Knowledge for their professional career and further study.

PREAMBLE

The LOCF (Learning outcomes based curriculum framework) committee constituted University Grants Commission (UGC) is pleased to submit the report concerning the syllabi of B.Sc with Mathematics as a subject. The committee discussed the framework of syllabi in its meetings and suggests the implementation these syllabi in the Colleges based on following facts.

1. The learning outcomes of each paper are designed so that these may help learners understand the main objectives of studying the course
2. This will enable learners to select elective papers depending on the individual inclinations and contemporary requirements
3. The objectives of the LOCF are to mentally prepare the students to learn mathematics leading graduate degree with mathematics as a subject.
4. These syllabi in mathematics under CBCS are recommended keeping in view of the wide applications of mathematics in science, engineering, social science, business and a host of other areas.
5. The study of the syllabi will enable the students to equip with the state of the art of the subject and will empower them to get jobs in technological and engineering fields as well as business, education and healthcare sectors.
6. The LOCF committee in Mathematics had prepared this draft paying suitable attention objectives and learning outcomes of the papers. These syllabi may be implemented with minimum modifications with appropriate justifications keeping in view regional, national and international contents and needs.
7. The outcomes of each paper may be modified as per the local requirements.
8. The text books mentioned in references are denotative/demonstrative. The divisions of each paper in units are specified to the context mentioned in course. These units will help the learners to complete the study of concerned paper in certain periods and prepare them for examination.
9. The mathematics is a vast subject with immense diversity. Hence it is difficult for every student to learn each branch of mathematics, even though each paper has its unique importance. Under these circumstances, LOCF in Mathematics suggests a number of elective papers also with compulsory papers. A student can select elective papers as per his needs and interests.
10. The committee expects that the papers may be taught using various Computer Algebraic systems (CAS) softwares such as Mathematica, MATLAB, Maxima and R to strengthen the conceptual understanding and to wide up the horizon of student's self experience.
11. The committee of the LOCF in Mathematics expects that the concern colleges will encourage their faculty members to include necessary topics in addition to courses suggested by LOCF committee. It is hoped that the needs of all around development in the careers of learners will be fulfilled by the recommendations of LOCF in mathematics.

4. PROGRAMME STRUCTURE

B.Sc. Mathematics (ChoiceBased Credit System)

	Part	Sub. No.	Subject Status	Subject Title	Hrs/ Week	Credits	Marks				
							Maximum			Passing Minimum	
							Int.	Ext	Tot.	Ext.	Tot.
I	I	1	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	2	Language	Communicative English-I	6	4	25	75	100	30	40
	III	3	Core-I Paper-I	Calculus and Classical Algebra	6	4	25	75	100	30	40
		4	Addon major (Mandatory) Paper-II	Professional English for Physical Sciences-I	4	4	25	75	100	30	40
		5	Allied-I (For Maths students)	Statistics-I OR Physics with Practical / Chemistry with Practical / Computer Science**	6	3	25	75	100	30	40
					6	5	25	75	100	30	40
			Allied-I (For Science students)	Algebra and Differential Equations	6	4	25	75	100	30	40
	IV	6	Common	Environmental Studies	2	2	25	75	100	30	40
			Total		30	21/23					
II	I	7	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	8	Language	Communicative English-II	6	4	25	75	100	30	40
	III	9	Core-II Paper-III	Differential Equations and Analytical Geometry of Three Dimensions	6	4	25	75	100	30	40
		10	Addon major (Mandatory) Paper-IV	Professional English for Physical Sciences-II	4	4	25	75	100	30	40
		11	Allied-II (For Maths Students)	Statistics-II OR Physics with Practical / Chemistry with Practical / Computer Science**	6	3	25	75	100	30	40
					6	5	25	75	100	30	40
			Allied-II (For Science Students)	Vector Calculus & Fourier Series	6	4	25	75	100	30	40
	IV	12	Common	Value based education	2	2	25	75	100	30	40
			Total		30	21/23					
** The Allied Computer Science shall be taken by the Department of Mathematics										0	

Sem	Part	Sub. No.	Subject Status	Subject Title	Hrs/week	Credits	Mark				
							Maximum			Passing minimum	
							Int.	Ext.	Tot.	Ext.	Tot.
III	I	13	Language	Tamil/Other Languages	6	4	25	75	100	30	40
	II	14	Language	English	6	4	25	75	100	30	40
	III	15	Core III Paper-V	Sequences and Series	6	4	25	75	100	30	40
		16	Allied-II	Statistics-I OR Physics with Practical / Chemistry with Practical / Computer Science	6	3	25	75	100	30	40
					6	5	25	75	100	30	40
	17	Skill Based Core	Vector Calculus	4	4	25	75	100	30	40	
	IV	18	Non-Major Elective	Any one of the following Mathematics for Competitive Examinations-I Fundamentals of Statistics-I	2	2	25	75	100	30	40
19				Common	Yoga*	2	2	25	75	100	30
			Total		30	25					
IV	I	20	Language	Tamil/Other Languages	6	4	25		100	30	40
	II	21	Language	English	6	4	25		100	30	40
	III	22	Core-IV Paper-VI	Abstract Algebra	6	4	25		100	30	40
		23	Allied-II	Statistics-II OR Physics with Practical / Chemistry with Practical/ Computer Science	6	3	25		100	30	40
					6	5	25		100	30	40
	24	Skill Based Core	Trigonometry, Laplace Transforms and Fourier Series	4	4	25		100	30	40	
	IV	25	Non-Major Elective	Any one of the Following: Mathematics for Competitive Examinations-II Fundamentals of Statistics-II	2	2	25		100	30	40
26				Common	Computers for Digital Era*	2	2	25		100	30
V		Extension activities	NCC/NSS/YRC/YWF/PE	-	1	-		-	-	-	
			Total		3	26					

				0	/2					
					8					
V	III	27	Core-V Paper-VII	LinearAlgebra	5	4	25	100	30	40
		28	Core-VI	RealAnalysis	5	4	25	100	30	40

			Paper-VIII								
		29	Core-VII Paper-IX	Statics	5	4	25	75	100	30	40
		30	Core-VIII Paper-X	Integral Transforms and Z Transforms	5	4	25	75	100	30	40
		31	Major Elective-I Paper-XI	Anyone of the Following: Programming in C Discrete Mathematics Combinatorial Mathematics	4	4	25	75	100	30	40
		32	Major Elective -II Paper-XII	Anyone of the Following: Operations Research-I Stochastic Process Math Typing using LaTeX	4	4	25	75	100	30	40
	IV	33	Skill Based Common	Personality Development	2	2	25	75	100	30	40
			Total		30	26					
VI	III	34	Core-IX Paper-XIII	Complex Analysis	5	4	25	75	100	30	40
		35	Core-X Paper-XIV	Graph Theory	5	4	25	75	100	30	40
		36	Core-XI Paper-XV	Number Theory	4	4	25	75	100	30	40
		37	Core-XII Paper-XVI	Dynamics	4	4	25	75	100	30	40
		38	Core-XIII Paper-XVII	Numerical Methods	4	4	25	75	100	30	40
		39	Major Elective-III Paper-XVIII	Any one of the following Astronomy Fuzzy Mathematics Mathematical Modeling	4	4	25	75	100	30	40
		40	Major Elective-IV Paper-XIX	Any one of the following Operations Research-II Coding Theory Programming in C++	4	4	25	75	100	30	40
			Total		30	28					

5. EVALUATION SCHEME (INTERNAL, EXTERNAL, PASSING MINIMUM)

Evaluation Scheme

Internal Marks	25 Marks
External Marks	75 Marks
Maximum Marks	100 Marks
Passing Minimum	40 Marks

6. MODEL QUESTION PAPER

MODEL QUESTION PAPER- CBCS-PATTERN (UG MATHEMATICS)

MAXIMUM MARKS: 75

TIME: 3 HOURS

Part –A (10×1 = 10 Marks)

Answer all the questions, Choose the correct answer

Question No. 1,2	Unit –I	Question No. 7,8	Unit –IV
Question No. 3,4	Unit -II	Question No. 9,10	Unit –V
Question No. 5,6	Unit –III		

Part –B(5×5 = 25 Marks)

Answer all the questions, Choosing either (a) or (b).

Question No. 11(a) or11 (b)	Unit –I	Question No. 14(a) or14 (b)	Unit –IV
Question No. 12(a) or12 (b)	Unit -II	Question No. 15(a) or15 (b)	Unit –V
Question No. 13(a) or13 (b)	Unit –III		

Part –A (8×5 = 40 Marks)

Answer all the questions, Choosing either (a) or (b).

Question No. 16(a) or16 (b)	Unit –I	Question No. 19(a) or19 (b)	Unit –IV
Question No. 17(a) or17 (b)	Unit –II	Question No. 20(a) or20 (b)	Unit –V
Question No. 18(a) or18 (b)	Unit –III		

**MODEL QUESTION PAPER
CALCULUS AND CLASSICAL ALGEBRA**

Time: Three hours

Maximum: 75 marks.

Part-A (10× 1 = 10 marks)

Answer All questions

Sl.No	Choose the correct Answer.	Course outcome	Knowledge Level
1.	The curvature of the curve $ax+by+c=0$ is..... a) b b) a c) 0 d) none of the above	CO 1	K1, K5
2.	The radius of the curvature of $y = e^x$ at (0,1) is..... a)1 b) 2 c) $2\sqrt{2}$ d) none of the above	CO 1	K1, K5
3.	The value of $\int_1^b \int_1^a \frac{axay}{xy} = \dots\dots\dots$ a) $\log(\frac{a}{b})$ b) $\log(ab)$ c) $\log\log b$ d) none of the above	CO 2	K2, K3
4.	The Jacobian of $u = x + y$ and $v = x - y$ is..... a) 2 b) 1 c) -2 d) none of the above	CO 2	K2, K3
5.	$\int_0^1 x^2(1-x)dx = \dots\dots\dots$ a)2 b) $\frac{1}{2}$ c) $\frac{1}{3}$ d) none of the above	CO 3	K2, K4
6.	$\int_0^\pi \int_0^{\frac{\pi}{2}} \int_0^1 r^2 \sin\theta dr d\theta d\phi = \dots\dots\dots$ a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) none of the above.	CO 3	K4
7.	The least degree of the equation with rational coefficients one of whose roots $\sqrt{2} + \sqrt{3}$ is..... a) 3 b)2 c) 4 d) none of the above	CO 4	K4, K5
8.	If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ then $\sum \frac{1}{\alpha}$ a) $-\frac{q}{r}$ b) $\frac{q}{r}$ c) $\frac{p}{r}$ d) none of the above	CO 4	K6
9.	The roots of the equation $x^n + 1=0$ (n is even) are a) All imaginary b) (n-1) imaginary c)(n-2) imaginary d) none of the above	CO 5	K3
10.	One of the roots of the equation $2x^3 + 3x^2 - 3x - 2 = 0$ is -2, the other roots are..... a)-2,-1 b) $-\frac{1}{2}, 1$ c) $-\frac{1}{2}, -1$ d) none of the above	CO 5	K6

PART B – (5× 5 = 25 marks)

Sl.No	Answer ALL questions,choosing either (a) or (b)	Course outcome	Knowledge Level
11.	a) Find the p-r equation (pedal equation) of the curve $r^2 = a^2 \sin 2\theta$	CO 1	K1
	Or		
	b) Find the co-ordinates of the center of curvature of the curve $x^3 + y^3 = 3axy$ at $(\frac{a}{2}, \frac{a}{2})$.	CO 1	K1
12.	a) Find the area of the region common to $y^2 = 4ax$ and $x^2 = 4ay$.	CO 2	K2, K3
	Or		
	b) If $u = 2xy, u = x^2 - y^2, x = r \cos\theta, y = r \sin\theta$, evaluate $\frac{\partial(uv)}{\partial(r,\theta)}$ without actual substitution.	CO 2	K2, K3
13.	a) Prove that $\int_0^{\frac{\pi}{2}} x^{n+1} = \frac{(2n)! \sqrt{\pi}}{4^n n!}$ Where $n=0,1,2,\dots$	CO 3	K5
	Or		

	b) Prove that $\int^{\pi/4} \sin^p \theta \cos^q \theta d\theta = \frac{1}{2} \beta \left(\frac{p+1}{2}, \frac{q+1}{2} \right)$	CO 3	K5
14.	a) Show that the sum of the 6 th powers of the roots of $x^7 - x^4 + 1 = 0$ is 3 Or b) If α, β, γ are the roots of the equation $x^3 + ax^2 + bx + c = 0$, form the equation whose roots are $\alpha\beta, \alpha\gamma$ and $\beta\gamma$	CO 4 CO 4	K2, K4 K2, K5
15.	a) Transform the equation $x^4 - 4x^3 - 18x^2 - 3x + 2 = 0$ into an equation with the third term absent. Or b) Remove the fractional coefficient from the equation $x^3 + \frac{1}{4}x^2 - \frac{1}{16}x + \frac{1}{72} = 0$	CO 5 CO 5	K6 K6

PART C – (5× 8 = 40marks)

Sl.No	Answer ALL questions, choosing either (a) or (b)	Course outcome	Knowledge Level
16.	a) Find the coordinates of the center of curvature of $y = x \log x$ at the point where $\frac{dy}{dx} = 0$. Or b) Find the evolute of the asteroid $x^{2/3} + y^{2/3} = a^{2/3}$	CO 1 CO 1	K1, K6 K1, K6
17.	a) By changing the order of integration, evaluate the integral $\int_0^1 \int_y^{2-y} xy \, dx dy$ Or b) By changing into polar coordinates, show that $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy = \frac{\pi}{4}$. Hence evaluate $\int_0^\infty e^{-t^2} dt$.	CO 2 CO 2	K2, K4 K2, K4
18.	a) Evaluate $\int_0^1 x^n (1-x^n)^p dx$ in terms of gamma functions and hence find $\int_0^1 \frac{dx}{\sqrt{1-x^n}}$ Or b) Using gamma functions evaluate $\int xy(1-x-y)^{1/2} dx dy$ over the area enclosed by the lines $x = 0, y = 0$ and $x + y = 1$ in the positive quadrant.	CO 3 CO 3	K3, K5 K3, K5
19.	a) Solve $6x^3 - 11x^2 + 6x - 1 = 0$ where roots are in harmonic progression Or b) If $a + b + c + d = 0$, show that $a^5 + b^5 + c^5 + d^5 = \frac{a^2 + b^2 + c^2 + d^2}{2} \cdot \frac{a^3 + b^3 + c^3 + d^3}{3}$	CO 4 CO 4	K3 K3
20.	a) Show that the equation $x^4 - 3x^3 - 4x^2 - 2x + 1 = 0$ can be transformed into a reciprocal equation by diminishing the roots by unity. Hence solve the given equation. Or b) Solve the equation $6x^6 - 35x^5 + 56x^4 - 56x^2 + 35x - 6 = 0$.	CO 5 CO 5	K1 K1

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

7. PROGRAMME OUTCOMES FOR B.Sc MATHEMATICS

PROGRAMME OUTCOMES

1. Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of mathematics. This also leads to study of related areas like computer science and statistics. Thus, this programme helps the learners in building a solid foundation for higher studies in mathematics.
2. The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning. This can be utilized in modelling and solving real life problems
3. Students undergoing this programme learn to logically question assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and insights while seeking and benefitting from knowledge and insight of others. This helps them to learn to behave responsibly in a rapidly changing independent society
4. Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.
5. Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools.
6. This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

8. PROGRAMSPECIFIC OUTCOMES

PROGRAM SPECIFIC OUTCOMES

After the completion of B.Sc. program in mathematics, the students are able to have

PSO 1: A Solid Foundation in Knowledge: B.Sc. degree is the culmination of depth knowledge of my core branches of mathematics such as Calculus, Classical Algebra, Analytical Geometry, Differential Equations, Sequence and Series, Abstract Algebra, Real and Complex Analysis, Number Theory, Mechanics, Operation Research, Statistics, Graph Theory, Discrete Mathematics, Trigonometry, Transforms and their application and C++/Python. Thus, this programme helps students in creating a solid foundation for further higher studies and research in mathematics

PSO 2: A Competency in Skills: The skills and knowledge gained have intrinsic logic which leads to proficiency in analytical reasoning critical understanding, analysis and synthetic in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, it can also be applied in modelling and solving the real-life problems.

PSO 3: A Problem-Solving Techniques: Students undergoing this programme learn to logically understand the question assertions to classify the patterns and to evaluate the difference between the necessities and unnecessities of the problems which helps to analyze the problem clearly and to take correct decision for solving the problems.

PSO 4: Interdisciplinary and Research Skills: Students completing this programme will be able to create and present mathematical concepts clearly and precisely, to describe mathematical ideas from multiple perspectives and to explain fundamental concepts of mathematics to non-mathematics people in a better manner.

PSO 5: A Proficiency in Employments: The programme will help students build up with employability for government jobs, jobs in banking, insurance and investments sectors, data analysis jobs and jobs in various other public and private enterprises.

COURSE OUTCOMES

Semester-I Core-I Calculus and Classical Algebra

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Core-I		Calculus and Classical Algebra	90	----	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I	I	25	75	100

Objective: To explain the curvature and radius of curvature in polar coordinates and Cartesian coordinates. Also to find the roots of the equations by various methods.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Course Attainment
CO1	Apply the mathematical knowledge to analyze the properties of a curve such as curvature, radius of curvature, Involute and Evolute.	K3, K4
CO2	Classify double and triple integrals	K4
CO3	Identify Beta and gamma function and to apply the rules of beta and gamma function in evaluating double and triple integrals.	K3
CO4	Construct different types of equations and to find the roots of the equations by Newton's Theorem	K1,K6
CO5	Solve the different types of reciprocal equations and to find the number of real roots using Descartes rule of signs.	K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	3	3	3	2
CO2	2	3	3	3	1
CO3	3	3	3	1	1
CO4	3	1	3	2	2
CO5	3	1	2	1	2
Total contribution of COs to PSOs	14	11	14	10	8
Weighted Percentage of COs contribution to PSOs	93.33	73.33	93.33	66.66	53.33

Course Content

UNIT-1:

Curvature, Radius of Curvature and Centre of curvature in Cartesian and polar Coordinates-Pedal equation-Involute and Evolute.

UNIT-2:

Double and Triple Integrals -Changing the order of integration- Jacobians and change of variables.

UNIT-3:

Beta and Gamma functions – Applications of Beta and Gamma Functions in evaluation of Double and Triple Integrals.

UNIT-4:

Theory of Equations – Formation of equations –Relation between roots and coefficients – symmetric function of the roots. Sum of the powers of the roots of an equation–Newton's theorem.

UNIT-5: Reciprocal equation-Transformation of equations-Descarte's rule of signs.

TextBooks:

1. Narayanan.S and T.K.Manickavachagam Pillai-Differential Equations and its applications, S.Viswanathan Printers Pvt.Ltd,2006.
2. Manickavachagam Pillai.T.K,and S,Narayanan -Algebra -Viswanathan Publishers and Printers Pvt.Ltd,2004.

Books for Reference:

1. Kandasamy PandK. Thilagavathi- Mathematics for B.Sc., Volume II– 2004, S.Chand & Co., New Delhi.
2. Kandasamy PandK. Thilagavathi- Mathematics for B.Sc.,- 2004, Volume I and Volume IV, S.Chand & Co., New Delhi.
3. Apostol T.M. - Calculus, Vol. I (4th edition) John Wiley and Sons, Inc., New York 1991.
4. Apostol T.M. Calculus, Vol. II (2nd edition) John Wiley and Sons, Inc., New York 1969.

Semester-I/III
Allied Paper-I
Statistics- I (For Mathematics Students)

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Allied		Statistics-I	90	-	-	3

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I/II	I/III	25	75	100

Objective: To study the concepts of measures of dispersion and measures of central tendencies and also to develop the concept of probability distributions.

Course Outcomes: On successful completion of the course ,the students should be able to

CO No.	Course Outcomes	Knowledge Level
CO 1	Find and relate the concepts of moments, skewness and kurtosis and to demonstrate the method of least squares and to classify parabolic, exponential and logarithmic curves.	K1, K2, K3
CO 2	Interpret correlation and regression and to illustrate Karl's Pearson's coefficient of correlation and also the lines of regression and coefficient of regression	K2
CO 3	Develop the statistical techniques used in the theory of attributes and to analyze consistency of data and criteria independence and to interpret Yule's coefficient of association.	K3, K4
CO 4	Explain distribution function and its properties, able to find mathematical expectation and to find the cumulants using generating function.	K2
CO 5	Distinguish discrete and continuous probability distributions and to construct binomial, Poisson distribution	K4, K6

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

CO-PSO mapping (Course Articulation Method)

PSOs COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	2	1
CO2	3	2	3	3	2
CO3	2	2	3	2	1
CO4	2	1	2	1	1
CO5	3	2	3	2	2
Total contribution of COs to PSOs	13	9	14	10	7
Weighted Percentage of COs contribution to PSOs	86.66	60	93.33	66.67	46.66

Course Content**UNIT-1:**

Moments,Skewness and Kurtosis-Curve fitting-method of least squares-Fitting lines-Parabolic, Exponential and Logarithmic curves.

UNIT-2:

Correlation and Regression – Scatter Diagram – Karl Pearson’s coefficient of correlation – Properties – Lines of Regression–Coefficient of Regression and properties–Rank Correlation.

UNIT-3:

Association of Attributes –Consistency of data–Criteria independence – Yule’s Coefficient of Association.

UNIT-4:

Random variable – Distribution function – Properties of Distribution function – Mathematical Expectation – Multiplication theorem of Expectation – Moment generating function – Cumulants– Characteristic function –Properties of Characteristicfunction.

UNIT-5:

Discrete and continuous Probability Distributions - Binomial and Poisson Distribution and their moments,Generating function,characteristic function,properties and simple applications.Normal Distribution –Standard normal distribution and their properties–simple problems.

TextBooks:

1. Arumugam&ThangapandiIsaac,Statistics,New Gamma Publishing House,July 2016 for UnitI,II,III
2. Gupta.S.C and V.K.Kapoor-Fundamentals of Mathematical Statistics,Sultan Chand &sons,NewDelhi.(2002) for (Unit IV &V)

BooksforReference:

1. Vittal,V.R., Mathematical Statistics, Maragatham Publications,2004
2. D.C.Sacheti&KapoorStatistics,Sultan Chand & Sons, New Delhi,2017.

Semester -II

Core II

Differential Equations and Analytical Geometry of Three dimension

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Core-II		Differential Equations and Analytical Geometry of Three dimension	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I	II	25	75	100

Objective: To explain ordinary differential equations with constant and variable coefficients and to describe sphere, intersection of two spheres and tangency of spheres

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcomes	Knowledge Level
CO1	Solve the differential equations which are all solvable for x, y, p and Clairaut's form. Also, to illustrate the method of solving the differential equations of the form $f_1(D)x + g_1(D)y = h_1(t)$, $f_2(D)x + g_2(D)y = h_2(t)$.	K2, K6
CO2	Identify and solve the second order linear differential equation with constant coefficients and to interpret the linear equations of second order with variable coefficients.	K2, K3, K6
CO3	Analyze the 3D-co-ordinate systems and how to find the direction cosines and direction ratios.. Also to find the angle between planes, the length of the perpendicular and angle of bisection.	K1, K4
CO4	Find and classify the equation of lines in different forms and calculate the image of the point, image of a line and to distinguish lines and planes. The angle between the line and plane can be determined. coplanar lines can be shown and the shortest distance between	K1, K2, K5
CO5	The equations of spheres and circles of intersection can be interpreted and	K2, K4

	to illustrate and analyze the tangency of sphere.	
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K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs \ COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	2
CO2	3	2	3	2	1
CO3	3	3	2	3	2
CO4	2	3	3	2	1
CO5	3	1	2	1	1
Total contribution of Cos to PSOs	14	11	13	9	7
Weighted Percentage of COs contribution to PSOs	93.33	73.33	86.66	60	46.66

Course Content

Unit I:

First order higher degree equations -Solvable for x,y,p and Clairaut's Form-Simultaneous Differential equations of the form $f_1(D)x + g_1(D)y = h_1(t)$, $f_2(D)x + g_2(D)y = h_2(t)$

Unit II:

Ordinary Differential Equations-Second Order linear Differential Equations with constant Coefficients-Find the P.I for the function of the form $e^{ax} f(x)$ and $x^n f(x)$ -Linear Equation of second order with Variable coefficients.

Unit III:

Analytical Geometry of 3D -Co-Ordinate system, Direction Cosines, Direction Ratios-Equation of planes in different forms-angle between planes-Length of perpendicular-angle of bisection.

Unit IV:

Equation of a line in different forms-image of a point-image of a line-The plane and the straight line-angle between plane and the line-Coplanar lines-Shortest distance between two lines.

Unit V:

Sphere-Tangent plane-Circle of intersection-Tangency of spheres-Orthogonal spheres.

Text Books:

1. Narayanan.S and T.K.Manikavachagam Pillai-Differential Equations and its applications, S.Viswanathan Printers Pvt.Ltd,2006
2. Manickavachagam Pillai.T.K.,and T.Natarajan-A Text book of Analytical Geometry-Part II-Three dimensions-S.Viswanathan (Printers & Publishers) Pvt.Ltd(2012)

Book For Reference

1. Kandasamy.P and K.Thilagavathi-Mathematics for B.Sc., Vol. III and VI-S.Chand and Co.,New Delhi (2004)
2. Braun .M-Differential equations and their applications (III Edition)Springer-Verlag,Newyork (1983)
3. Boyce. W.E and R.C.Diprima-Elementary Differential Equations and Boundary value problems (VII Editions)-John Wiley and Sons,Inc,Newyork (2001)

Semester -II/IV

Allied Paper -II
Statistics-II (For Mathematics Students)

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Allied		Statistics-II	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
I/II	II/IV	25	75	100

Objective: To know the importance of Correlation and regression and also to explain the basic concepts of various types of distribution.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcomes	Knowledge Level
CO 1	To list out the characteristics of index numbers and to find Laspeyer's and Paache's, Fisher and Bowley's Edgeworth's index numbers. The method to classify and analyse the unit test, commodity reversal test, time reversal test and circular tests can be shown.	K1, K2
CO2	Construct testing of hypothesis and to distinguish null hypothesis and alternative hypothesis. Type I and Type II errors can be classified. The level of significance and test of significance for large samples can be explained.	K2, K4, K6,
CO3	Identify the distributions such as t-distributions and F-distribution. By making use of t-test the single mean and difference of means can be found out. Variance ratio test based on Chi-Square distribution by making use of this the goodness of fit can be decided.	K1, K3, K5
CO4	To find analysis of variance. One way and two way classified data can be explained and to randomize block design. Latin squares can be analysed and constructed.	K1, K4, K5
CO5	To explain statistical quality control and its advantages. Process control can be illustrated by making use of this control chart, range chart, P-chart can be designed	K2, K3

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

CO-PSO mapping (Course Articulation Method)

PSOs \ COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	1
CO2	3	3	3	3	2
CO3	3	2	2	3	2
CO4	2	3	2	3	3
CO5	3	2	3	2	1
Total contribution of COs to PSOs	14	12	13	12	9
Weighted Percentage of COs contribution to PSOs	93.33	80	86.66	80	60

Course Content**UNIT-1:**

Characteristics of index numbers –Laspeyzer’s and Paache’s–Fisher’s and Browley and Edgeworth’s index numbers Tests–Unit Test, Commodity Reversal Test, Time Reversal Test, Circular Test.

UNIT-2:

Testing of Hypothesis– Null hypothesis and Alternate hypothesis –Type I and Type II errors - Critical Region, Level of significance– Test of significance for large samples– Testing a single proportion–Difference of proportions Testing a single mean and Difference of means..

UNIT-3:

Tests based on t-distribution-Single mean and Difference of means–Tests based on F-Distribution–Variance Ratio Test based on Chi-Square Distribution–Independence–Goodness of fit.

UNIT-4:

Analysis of Variance – one way and two way classified data – Basic of experimental design – Randomized Block Design–Latin Square–Simple Problems.

UNIT-5:

Statistical Quality control– Definition–Advantages, Process Control–Control Chart, Mean Chart, Range Chart, P-Chart, Product Control–Sampling Inspection Plans.

Text Books:

1. Statistics–Arumugan&Thangapandi Issac, New Gamma Publications, 2016 (Unit-I, II&III).
2. Gupta. S.C&V.K.Kapoor–Fundamentals of Mathematical Statistics–(2002) Sultan Chand&Sons, New Delhi, for (Unit-IV &V).

Books for Reference:

1. Vittal.P.R–Mathematical Statistics, Maragatham Publications, 2004.
2. DCSacheti&Kapoor– Statistics, Sultan Chands New Delhi, Reprint-2017
3. R.S.N Pillai&Bagavathi, Statistics Theory and Practice, S Chand and Company Ltd, Reprint 2018.

Semester-III
Core-III
SEQUENCES AND SERIES

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Core-III		Sequences And Series	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To acquire basic ideas of classical analysis and to study the behavior of sequences and series.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Analyse the real number system and also to classify rational and irrational numbers. To find the upper bounds, least upper bounds and maximum element and to elaborate triangle inequality and Cauchy-Schwartz Inequality.	K1, K2, K4
CO2	Categorize the sequences as bounded sequences, monotonic sequences, convergent sequences and divergent sequences. Also to find the algebra of limits	K1, K4
CO3	Demonstrate the behavior of monotonic sequences and to apply Cauchy's first limit theorem, Make use of Cauchy's Second limit theorem and Cesaro's Theorem. Construct subsequence and to explain Cauchy's general principle of convergence.	K2, K3, K6
CO4	Interpret the series and to apply n^{th} term test, Comparison test, Kummer's test, D'Alembert's ratio test, Raabe's test, Gauss test and root test to compile the nature of the series.	K2, K3, K6
CO5	Analyse the alternating series. Apply the test for convergence for series of arbitrary terms. Also to identify the power series and to determine the radius of convergence.	K1, K3, K4, K5

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

CO-PSO mapping (Course Articulation Method)

PSOs \ COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	3	3	2	3	2
CO4	3	1	3	2	2
CO5	3	1	2	1	2
Total contribution of COs to PSOs	14	10	13	12	10
Weighted Percentage of COs contribution to PSOs	93.33	66.67	86.67	0.8	66.67

Course Content**UNIT-1:**

Inequalities, Triangle inequalities, Cauchy-Schwartz inequality, Sequences, Bounded Sequences, Monotonic Sequences. (Sec 2.1-2.3, 2.5, 3.1-3.4).

UNIT-2:

Convergent Sequences, Divergent and Oscillating Sequences, The algebra of limits, Behaviour of monotonic Sequences. (Sec 3.5-3.8)

UNIT-3:

Some theorems on limits, Subsequences, Cauchy Sequences, Series of positive terms- Infinite series, Comparison test (Sec 3.9, 3.10, 3.12, 4.1 & 4.2).

UNIT-4:

Kummer's test, Root test and condensation test (Section 4.3, 4.4)

UNIT-5:

Series of arbitrary terms, Alternating Series, Tests for convergence of series of arbitrary terms.

TextBooks:

- ❖ S. Arumugam, A. Thangapandi Issac and A. Somasundaram- "Sequences and series"- Yesdee Publications, Chennai. (First reprint 2021).

Book for Reference:

- Shanti Narayan & Dr. M. D. Raishinghamia, Elements of Real Analysis S. Chand & Co., Revised Edition 16th (2014)
- Ellina Grigorieva- Methods of Solving Sequence and series Problem- Springer Link.
- Richard R. Goldberg "Methods of real analysis" Oxford and IBH Publications Co. Pvt limited, New Delhi, Indian Edition 1975.
- Tom. M. Apostol- Mathematical Analysis, Narosa Publishing house, New Delhi. (Reprint 1985).

Semester -III
Skill Based Core- Paper I
VECTOR CALCULUS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Skill Based Core-I		Vector Calculus	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To lay a good foundation of vector differentiation and vector integration. Also to solve problems related to this.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Classify the vector point function and scalar point function. Determine the derivative of a vector and derivative of product of scalar and vector function.	K2,K5
CO2	Find divergence, curl. Make use of the Laplacian operator.	K1,K3
CO3	Interpret the integration of point function and to illustrate line integral. To solve surface integral.	K5,K6
CO4	Analyze and solve the volume integral. Also to illustrate and make use of Gauss Divergence Theorem to solve problems.	K2, K3,K6
CO5	To solve problems based on Green's theorem and Stoke's Theorem	K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	1	3
CO2	2	2	3	2	1
CO3	3	3	3	3	2
CO4	3	1	2	2	1
CO5	1	1	2	3	3
Total contribution of COs to PSOs	12	10	13	12	10
Weighted Percentage of COs contribution to PSOs	80	66.67	86.67	80	66.67

Course Content

UNIT-1:

Vector point functions, Scalar point functions – Derivative of a vector and derivative of sum of vectors – Derivative of product of a scalar and vector point function – The vector operator ∇ - Gradient

UNIT-2:

Divergence–Curl, solenoidal, irrotational vectors–Laplacian operator.

UNIT-3:

Integration of point function–Line integral–Surface integral.

UNIT-4:

Volume Integral–Gauss divergence theorem(Statement without Proof)–Problems.

UNIT-5:

Green's theorem and Stoke's theorem(Statement without Proof)–Problems.

TextBook:

- ❖ Duraipandian and Laxmi Duraipandian, Vector Analysis-Emerald Publishers (Revised Edition, Reprint 2005).

Books for References:

- Dr. S. Arumugam and others–Vector Calculus, New Gamma Publishing House.(2006).
- Susan J.C–Vector Calculus(4th Edition), Pearson Education, Boston(2012).
- Murray Spiegel-Vector analysis – Schaum Publishing company, New York(2009).
- Dr.M.K. Venkataraman and Mrs.Manorama Sridhar, Vector Calculus and Fourier Series, The National Publishing Company, Chennai-1,(2002)
- R.Gupta, Vector Calculus, FIREWAL Media (An imprint of Lakshmi Publications Pvt.Ltd)-New Edition, Copyright© 2010.

SEMESTER-III
Non -Major Elective Paper I
FUNDAMENTALS OF STATISTICS-I

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Non major-I		Fundamentals of Statistics-I	30	-	-	2

Contact hours per semester:30

Contact hours per week:2

Year	Semester	Internal Marks	External Marks	Total marks
II	III	25	75	100

Objective: To introduce the new concept of Measure of Central Tendency to other major students .Also to study about correlation, regression and to solve simple problems.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Analyse the classification of datas.Also to construct bar diagram and Pie chart.	K3, K6
CO2	Illustrate measure of central tendency and to find mean,median and mode.	K1,K2
CO3	Explain the measure of dispersion .Also to find standard deviation,variance,quartile deviation and to obtain the relationship between them.	K4,K5
CO4	Interpret correlation and to solve rank correlation problems.	K2,K6
CO5	To find solution for regression equations	K1, K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	3	2	3	3	1
CO3	3	3	3	3	3
CO4	3	2	3	3	2
CO5	1	2	2	1	2
Total contribution of COs to PSOs	13	12	14	13	11
Weighted Percentage of COs contribution to PSOs	86.67	80	93.33	86.67	73.33

Course Content

UNIT-1:

Classification of data–BarDiagram–Pie chart.

UNIT-2:

Measures of central tendency:Mean,median,mode(with frequency).

UNIT-3:

Measures of dispersion:Range–standard deviation, Variance–Quartile deviation.

UNIT-4:

Correlation–Rank correlation(Problemsonly)

UNIT-5:

Regression equations(Problemsonly)

TextBook:

- Dr. S. Arumugam, A.ThangapandiIssac- Statistics, New Gamma Publishing House,Palayamkottai.(2016)

Books for Reference:

- S.P.Gupta-ElementaryStatisticalMethods,SultanChand&Sons,(2017).
- T.Veerarajan, FundamentalsofmathematicalStatistics, YesDeePublishing Pvt,Ltd..(2017)
- C.B.Gupta and Vijay Gupta, An Introduction to Statistical Methods, Vikas Publishing House Pvt.Ltd.New Delhi –(1973)

Semester -IV
CORE -IV
ABSTRACT ALGEBRA

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Core		Abstract Algebra	90	-	-	4

Contact hours per semester:90

Contact hours per week:6

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To acquire knowledge about the concept of groups,rings and fields and to study about the concept of homomorphism.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain the definitions of groups and its examples.Also to determine the order of an element.Illustrate about Subgroups.	K2,K4
CO2	Interpret cyclic groups and to find the generators of cyclic subgroups. Illustrate and apply Lagrange's Theorem,Euler's Theorem and Fermat's Theorem.	K1,K3,K6
CO3	Elaborate about Normal Subgroups and group homomorphism.Illustrate Isomorphism ,Automorphism .Also to apply Cayley's theorem wherever required.	K4,K5
CO4	Compare and classify Rings and its types.Illustrate about Integral domain and Fields .To summarize about maximal and minimal ideals.	K1,K6
CO5	Utilize the concept of homomorphism and isomorphism on rings .Also to find kernel of homomorphism and to make use of fundamental theorem.	K3,K5

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	2	1	3	1	2
CO5	2	2	2	1	2
Total contribution of COs to PSOs	12	11	13	10	12
Weighted Percentage of COs contribution to PSOs	80	73.33	86.67	66.67	80

Course Content

UNIT-1: Groups – definition and examples-Elementary properties of groups – subgroup – order of an element– centre of a group –Normaliser and Centralizer – Product of two Subgroups – order of HK – Intersection and union of subgroups

UNIT-2 Cyclic groups–generators of a cyclic group–Cosets and Lagrange’s theorem– Euler’s theorem– Fermat’s theorem.

UNIT-3: Normal Subgroups-Quotient groups – Group Homomorphism – Canonical homomorphism – Kernel of a homomorphism–Isomorphism–Automorphism–Inner automorphism–Permutation groups– Cayley’s theorem.

UNIT-4: Rings: Definition and examples – Types of rings – Elementary properties of a ring – Integral domain – Field – Subrings – Subfields – Ideals – Principal ideal – Quotient ring – Maximal and prime ideals.

UNIT-5: Homomorphism of rings – Isomorphism – Kernel of a homomorphism – Fundamental theorem.

TextBook:

1. S.Arumugam and A.Thangapandi Issac “ Modern Algebra ” - Scitech Publications, Privatelimited.(2008)

Books for Reference:

1. M. L.Santiago, Modern Algebra–McGraw-Hill Education India Pvt. Limited,(2002).
2. T K. Manicka Vachagampillai and others - Modern Algebra – Visvanathan Publishers(2011).
3. Visvanathan Nayak, Modern Algebra-Emerald Publishers, Reprint 1992.

SEMESTER -IV
Skill Based Core-Paper- II
TRIGONOMETRY,LAPLACE TRANSFORMS AND FOURIER SERIES

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-III	Skill Based Core		Trigonometry, Laplace Transforms and Fourier Series	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To understand the concept of Trigonometry and to acquire knowledge about Laplace Transform and its inverse. Also to study the concept of Fourier series and to solve problems by making use of it.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Summarize about Trigonometry and to illustrate about the expansion of $\sin nx$, $\cos nx$, $\sin^n x$, $\cos^n x$	K2,K3
CO2	Obtain the relationship between hyperbolic functions and circular function. Explain about inverse hyperbolic functions.To find summation of the series using C+iS method.	K1,K4
CO3	Illustrate laplace transform	K5
CO4	Solve differential equations with constant coefficients by making use of Laplace Transforms.	K6
CO5	Solve problems based on Fourier series . Identify the odd and even functions and to deduce half range series.	K3,K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	3	2	3	1	2
CO5	3	3	1	1	1
Total contribution of COs to PSOs	14	13	12	10	11
Weighted Percentage of COs contribution to PSOs	93.33	86.67	80	66.67	73.33

Course Content:**UNIT-1:**

Trigonometry: Expansion of $\sin nx, \cos nx, \tan nx$ and expansions of $\sin^n x$ and $\cos^n x$.

UNIT-2:

Hyperbolic functions – Relation between hyperbolic functions and circular functions – Inverse hyperbolic functions – Logarithm of a complex number – Summation of series using $C+iS$ method

UNIT-3:

Laplace transforms.

UNIT-4:

Inverse transforms, Solving linear differential equations with constant coefficients using Laplace Transforms.

UNIT-5:

Fourier Series – Definition, Finding Fourier coefficients for a given periodic function with period 2π and $2l$, odd and even functions, Half range series.

TextBook:

1. Arumugam. SandThangapandi Issac. A – Trigonometry and Fourier Series.
2. T.K. Manickavachagam Pillai and S. Narayanan – Differential equations and its applications, S. Viswanathan Publishers 2011.

Books for reference:

1. T. Veerarajan – Algebra and Trigonometry – YES DEE Publishing pvt. Ltd., Chennai. (2020).
2. Ray Hanna. J – Fourier Series, Transforms and Boundary value Problems, Dover Publications New York, 2008.
3. Dr. M.K. Venkataraman and Mrs. Manorama Sridhar, Vector Calculus and Fourier Series, The National Publishers Company, Chennai (2002).

SEMESTER -IV
Non-Major
Elective -II FUNDAMENTALS OF
STATISTICS-II

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credit (C)
Part-IV	Non Major		Fundamentals of Statistics-II	30	-	-	4

Contact hours per semester:30

Contact hours per week:2

Year	Semester	Internal Marks	External Marks	Total marks
II	IV	25	75	100

Objective: To know the concept of attributes and to study the index numbers and simple problems.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain the theory of Attributes	K3
CO2	Illustrate about index numbers and to determine the weighted index numbers.	K1,K5
CO3	Analyse and predict consumer price index numbers	K6
CO4	Evaluate Time series	K4
CO5	Apply curve fitting for straight line ,parabola and exponential curve	K2

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	2	3	3	3	3
CO2	2	2	3	3	3
CO3	3	3	2	2	2
CO4	3	2	1	2	3
CO5	2	3	1	3	3
Total contribution of COs to PSOs	12	13	11	13	14
Weighted Percentage of COs contribution to PSOs	80	86.67	73.33	86.67	93.33

Course Content:**UNIT-I**

Attributes-Two Attributes

UNIT -II

Index number –weighted index number.

UNIT – III

Consumer Price index number –conversion of index number.Time

UNIT -IV

series –measurement of trends.

UNIT-V

Curve fitting–Straight line –Parabola –Exponential curve.

TextBook:

1. Dr. S. Arumugam, A.Thangapandi Issac- Statistics, New Gamma Publishing House, Palayamkottai (2016).

Books for Reference:

1. S.P.Gupta-Elementary Statistical Methods, Sultan Chand & Sons, 2017).
2. T. Veerarajan Fundamentals of mathematical Statistics, YesDee Publishing Pvt.Ltd.Edition .(2017)

Semester-V
Core-V
LINEAR ALGEBRA

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-V		Linear Algebra	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective:To acquire knowledge about vectors spaces,Inner product space and linear transformations.Also to solve problems in Matrices

Course Outcomes: On successful completion of the course,the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain the definitions and general properties of vector spaces. Also to explain subspace. They know where to apply fundamental theorem of homomorphism.	K1, K2
CO2	Determine the span of a set and to check whether the given set is Linearly dependent or not.Also to find basis and dimensions.	K4
CO3	Illustrate and apply Rank Nullity theorem.Explain the definitions and examples of inner product space.Apply Gram Schmidt Orthogonalization process.	K3,K6
CO4	Construct matrices and also to summarize the elementary transformations.Determine the Inverse of matrix and rank of a matrix. To make use of Cayley Hamilton Theorem.	K2, K6
CO5	Determine Eigen Values and Eigen Vectors. Identify bilinear forms and quadratic forms.Also To deduce Diagonal form from Quadratic form.	K4,K5

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	3	3	2	3	2
CO4	2	1	3	2	2
CO5	2	2	2	1	3

Total contribution of COs to PSOs	12	11	13	12	11
Weighted Percentage of COs contribution to PSOs	80	73.33	86.67	0.8	73.33

Course Content

UNIT-1:

Vector spaces: Definition and examples – Elementary properties – subspaces – linear transformations – Fundamental theorem of homomorphism.

UNIT-2:

Span of a set – linear dependence and independence – basis and dimension.

UNIT-3:

Rank - Nullity theorem – Matrix of a linear transformation – Inner product space – Definition and examples – orthogonality – orthogonal complement – Gram Schmidt orthogonalization process.

UNIT-4:

Matrices – Elementary transformation – Inverse and power of a matrix using Cayley Hamilton's theorem – Inverse and rank of a matrix using elementary transformations.

UNIT-5:

Eigen values and Eigen vectors – Properties and problems – Bilinear forms – Quadratic forms – Reduction of quadratic form to diagonal form.

TextBook:

S.Arumugan & Thangapandi Issac, Modern Algebra - Scitech Publication, Reprint (2008).

Books for Reference:

1. Sharma J. Nand Vashistha A. R. Linear Algebra - Krishna Prakash Nandir 1981.
2. John B. Fraleigh - A first Course in Abstract Algebra 7th edition, Pearson, 2002.
3. N. Ramabhadran & R. Balakrishnan, Textbook of algebra – Vikas Publishing Co. Revised Edition 1985.
4. Ward Cheney and David Kincaid, Linear Algebra - Theory and Applications. Jones and Barlett India PVT Ltd, New Delhi - First Edition (2010)

**Semester-V
Core-VI
REAL ANALYSIS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-VI		Real Analysis	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To acquire knowledge about the real number system and metric spaces. Also to study the concepts of connectedness and compactness.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain about Metric spaces and to construct an open ball .Also to interpret interior	K1,K3
CO2	Interpret about closed sets and to find closure. To determine limit points. Analyze about complete metric space. Discuss about Cantor's intersection theorem and Baire's Category theorem.	K2,K4
CO3	Summarize continuity. Illustrate about uniform continuity.	K3,K5
CO4	Explain about connectedness and to deduce the connected subsets of R .To obtain the relationship between connectedness and continuity	K4,K6
CO5	Illustrate about compactness and to find the connected subsets of R. Illustrate and make use of Heine Borel Theorem .To determine the relationship between compactness and continuity.	K3,K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	3	3	2	3	2
CO4	1	2	3	2	2
CO5	1	2	2	3	3
Total contribution of	10	12	13	14	11

Pag

COs to PSOs					
Weighted Percentage of COs contribution to PSOs	66.67	80	86.67	93.33	73.33

Course Content

UNIT-1:

Metricspaces –Examples –boundedsets –openball–opensets –subspaces–interiorofaset.

UNIT-2:

Closedsets–closure–limitpoints–dense set–complete metricspace–Cantor’s intersection theorem– Baire’s category theorem.

UNIT-3:

Continuity–Homeomorphism–UniformContinuity

UNIT-4:

Connectedness–Connected subsets of \mathbf{R} –Connectedness and continuity–Contraction mapping theorem.

UNIT-5:

Compactness–Compact metric spaces–Compact subsets of \mathbf{R} –Heine Borel theorem–Equivalent characterizations for compactness–Compactness and Continuity.

TextBook:

Dr. S. Arumugan, Modern Analysis–YesDee Publishing Pvt. Ltd. Reprint(2019).

Books for Reference:

1. Richard R. Goldberg–MethodsofRealAnalysis–OxfordandIBHPublishingCo.NewDelhi, Indian edition 1985.
2. R Visvanathan Nayak, Real Analysis–Emerald Publishers, Reprint 1992.
3. Dr. B. S. Vatsa, Introduction to Real Analysis, CBS Publishers and Distributors, New Delhi.

**Semester-V
Core-VII
STATICS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-IX		Statics	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective:To provide the basic knowledge of equilibrium of a particle and to develop a working knowledge to handle practical problems.

Course Outcomes: On successful completion of the course,the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain the forces acting at a point and to apply the parallelogram law of forces, Triangle law of forces and Lami's theorem.	K2,K4
CO2	Interpret parallel forces and moments. Analyse the resultant of two parallel forces and the resultant of two unlike unequal parallel forces.To applyVarignon's theorem.	K1,K6
CO3	Summarize equilibrium of three forces acting on a rigid body and to illustrate three coplanar forces theorem and to make use of the above theorem to solve problems	K3,K5
CO4	Explain about laws of friction.Also to determine the angle of friction and Illustrate about the equilibrium of a particle and to make use of the concepts to solve the problems.	K1,K2,K6
CO5	Interpret the equilibrium of strings.To deduce the equation of catenary and its geometrical properties.	K2,K4

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3

CO2	3	2	3	3	1
CO3	3	3	2	3	3
CO4	1	2	3	2	3
CO5	1	2	1	3	3
Total contribution of COs to PSOs	11	12	12	14	13
Weighted Percentage of COs contribution to PSOs	73.33	80	80	93.33	86.67

Course Content

UNIT-1:

Forces acting at a point–Parallelogram law of forces–Triangle law of forces–Lami’s theorem

UNIT-2:

Parallel forces and moments–resultant of two parallel forces resultant of two unlike unequal parallel forces–Varignon’s theorem

UNIT-3:

Equilibrium of three forces acting on a rigid body–three coplanar forces theorem.

UNIT-4:

Friction–Laws of friction–angle of friction– equilibrium of a particle (i)on a rough inclined plane (ii)under a force parallel to the plane(iii)under any force

UNIT-5:

Equilibrium of strings–equation of the common catenary–tension at any point–geometrical properties of common catenary

TextBook:

M.K. Venkatraman–Statics, Agasthiar Publications, Trichy(2020).

Booksforreference:

1. S.Narayanan,StaticsS.ChandandCompany,NewDelhi(1985).
2. K.ViswanathaNaikandM.Kari,Statics ,EmeraldPublishers,Chennai.
3. I.Rajeswari–Mechanics-SarasPublication,Nagercoil(2016).

Semester-V
Core-VIII
INTEGRAL TRANSFORMS AND Z TRANSFORMS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-VIII		Integral Transforms and Z transforms	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To develop the knowledge of transforms and to solve problems in Fourier transforms and Z transforms.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Apply Fourier transforms and to explain the properties.	K2,K4
CO2	Solve problems on infinite Fourier cosine and Sine Transforms	K1,K6
CO3	Identify and solve Finite Fourier transforms	K3,K5
CO4	Illustrate Z transforms and its properties.	K1,K2,K6
CO5	Utilize inverse Z transforms to solve difference equations.	K2,K4

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	3	2	3	3	1
CO3	1	3	2	2	3
CO4	2	2	3	1	3
CO5	2	3	2	2	3
Total contribution of COs to PSOs	11	13	13	12	13
Weighted Percentage of COs contribution to PSOs	73.33	86.67	86.67	80	86.67

Course Content

UNIT-1:

Fourier Transforms–Properties of Fourier Transforms.

UNIT-2:

Infinite Fourier Cosine and Sine Transforms–Properties.

UNIT-3:

Finite Fourier Transforms.

UNIT-4:

Z-transforms–Properties.

UNIT-5:

Inverse Transforms- Introduction to difference equations and find solution using inverse Z transforms

TextBook:

Singaravelu.A–Engineering mathematics (volumeIII) –MeenakshiAgency,Chennai(2019).

Books for Reference:

1. MuthuKumaraswamy.R- Transforms and Partial Differential Equation Equations–YesDee Publications –Second Edition(2019).
2. Gangatharan,Engineering Mathematics (volume I) –Prentice Hall of India Pvt.Ltd.(2007).
3. Dr.C.Muthulakshmi@Saisikala and R.Ponraj- Transformsand their applications,Charulatha Publication(2020).

Semester-V
Major Elective-I
DISCRETE MATHEMATICS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Non Major - I		Discrete Mathematics	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To study concepts of mathematical logics and to understand the basics of Lattices and Boolean Algebra.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Illustrate and use the statements, notations and connectives. Construct truth table and utilize conditional and biconditional statements.	K2, K3
CO2	Analyze and explain Predicate calculus	K1, K4
CO3	Elaborate Groups and monoids. Also to develop Group codes	K6
CO4	Construct Lattices and special lattices. Analyze and explain Boolean algebra	K5
CO5	Convert From one form to another form (Decimal, Binary, Octal, Hexadecimal). Evaluate Binary addition, subtraction multiplication and division.	K2, K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	1	3
CO2	3	3	3	3	2
CO3	3	3	2	1	3
CO4	2	3	3	3	3

CO5	1	3	2	3	2
Total contribution of COs to PSOs	12	14	13	11	13
Weighted Percentage of COs contribution to PSOs	80	93.33	86.67	73.33	86.67

Course Content

UNIT-1: Mathematical logic – Statements and notation, Connectives, Negation, Conjunction, Disjunction, Statement formula and truth table ,Conditional and biconditional statements. Well defined formulae, tautologies.

UNIT-2: Normal forms - The theory of inference for the statement calculus, The Predicate, Theory of inference for the Predicate Calculus.

UNIT-3: Algebraic structures - Groups and monoids, Simple properties, Group codes.

UNIT-4: Lattices and Boolean algebra -Lattices as posets, Properties of lattices, special lattices, Boolean algebra, Gating networks, Minimal sums of products.

UNIT-5: Number system and codes - Decimal, Binary, Octal, Hexadecimal–Conversion from one to another– Binary addition, subtraction, multiplication and division, BCD, Weighted excess time, Graycode.

TextBook:

J.P. Tremblay and Manohar-Discrete mathematical structures with application to Computer Science (Tata McGrawHill) New Delhi, 43rd edition 2013.

Books for Reference:

1. M. K. Venkataraman and others –Discrete mathematics- The National Publishing Pvt. Ltd. (2000).
2. G. Balaji– Discrete mathematics– Balaji Publishers Chennai (2013).
3. T. Veerarajan–Discrete mathematics Tata McGraw Hill –2009.
4. Garrett Birkhoff-Lattice Theory, American Mathematical Society (1948).
5. M.K. Sen, B.C. Chakraborty, Introduction to Discrete Mathematics, Books and Allied (P) Ltd (2009).

Semester-V
Major Elective-I
OPERATIONS RESEARCH -I

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major elective		Operations Research-I	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	V	25	75	100

Objective: To introduce the various techniques of operations research

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Solve Linear Programming Problem by making use of Graphical method, Simplex method.	K4
CO2	Interpret the concept of duality. Classify primal and dual problems. Utilizing the concept of duality, solve problems on dual simplex method.	K3
CO3	Solve Transportation problems by making use of North – west corner rule, Matrix-Minima method, Vogel's Approximation rule. Evaluate Degeneracy and unbalanced transportation problems.	K2, K5
CO4	Determine the solution for Assignment problems.	K1, K6
CO5	Solve sequencing problems.	K5

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	1	3
CO2	2	1	2	3	3
CO3	2	1	2	3	2
CO4	2	3	1	3	3
CO5	3	3	2	3	3
Total contribution of COs to PSOs	12	11	10	13	14
Weighted Percentage of COs contribution to PSOs	80	73.33	66.67	86.67	93.33

Course Content

UNIT-1:

Linear Programming Problem:Mathematical formulation of LPP–Graphical method,Simplex method–Artificial variable technique.

UNIT-2:

Concept of Duality–Primal and Dual problems–Duality–Dual Simplex method.

UNIT-3:

Transportation Problem:North-west Corner rule–Matrix-Minima method–Vogel’s approximation method–MODI method–Degeneracy and unbalanced Transportation problem.

UNIT-4:

Assignment Problem:Hungarian method –Unbalanced assignment problems.

UNIT-5:

Sequencing Problem: n jobs and two machines – n jobs and three machines – 2 jobs and m machines.

TextBook:

- ❖ KantiSwarup, P. K. Gupta and Manmohan – Operations Research – Sultan Chand and sons,(New Delhi)12thedition(2006)

BooksforReference:

1. GuptaP.KandD.S.Hira–OperationsResearch– S.Chand&Sons Reprint (2012).
2. B. J.RanganathandA. S.Srikantappa–OperationsResearch– YesDeePublishingHouse,Chennai(2017).
3. HamdyA.Taha –Operationsresearch,Anintroduction- 8thEditionPrentice–HallIndia(2006).
4. A.C.S.Kumar, Operation Research, Yes Dee Publications, Chennai, 3rd Reprint 2019.

Semester-VI
Core-IX
COMPLEX ANALYSIS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-IX		Complex Analysis	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To understand the concepts of complex variables and to learn about elementary transformations in complex variables.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain analytic functions and determine the functions of a complex variables and to utilize Cauchy Reimann equations	K2, K3
CO2	Elaborate Bilinear Transformations and classify the elementary transformations. Also to find fixed points.	K4, K5
CO3	Illustrate complex integrations and to make use of Cauchy's Integral Formula	K1, K6
CO4	Explain Series Expansions and to determine Taylor's Series, Laurent's Series. Determine zeros of an analytic function.	K2, K6
CO5	Determine residues and to make use of Cauchy's Residue Theorem. Also to evaluate definite integrals	K4, K5

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	2	3	1
CO3	3	3	3	3	2
CO4	1	2	2	2	2
CO5	1	2	1	1	3
Total contribution of COs to PSOs	10	12	11	12	11
Weighted Percentage of COs contribution to PSOs	66.67	80	73.33	80	73.33

Course Content

UNIT-1: Analytic functions - Functions of a complex variable, Limits, theorems on limit, continuous function, Differentiability, The Cauchy-Riemann equations, Analytic functions, Harmonic functions.

UNIT-2: Bilinear Transformations – Elementary Transformations, Cross Ratio, Fixed Points of Bilinear Transformations, Some Special Bilinear Transformations.

UNIT-3: Complex Integration – Definite Integral, Cauchy's Theorem, Cauchy's Integral Formula, Higher Derivatives.

UNIT-4: Series Expansions – Taylor's Series, Laurent's Series, Zeros of an Analytic Function, Singularities.

UNIT-5: Calculus of Residues– Residues, Cauchy's Residue Theorem, Evaluation of Definite Integrals.

TextBook:

Arumugam.S and T. Issac – “Complex Analysis” – Scitech Publishing House – Chennai, (2002).

Books for Reference:

1. Churchill.R. V. and J.W. Brown – “Complex variables and Applications” – McGraw Hill International Editions – IX Edition, 2013.
2. Ponnuswamy.S “Foundations of Complex Analysis”, Narosa Publication House, New Delhi, II Edition 2005.
3. Duraipandian.P and Lakshmi Duraipandian – “Complex Analysis” – Emerald Publications, Chennai (2001).

**Semester-VI
Core-X
GRAPH THEORY**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-X		Graph Theory	75	0	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce the notion of graph theory and its applications and to learn the techniques in Graph Theory.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Construct graph and to explain its definition. Determine degrees. Also to perform operations on graph	K2,K3
CO2	Classify degree sequence and graphic sequence. Illustrate connectedness, compactness and connectivity.	K4,K5
CO3	Construct Eulerian Graphs and Hamiltonian graphs. Elaborate the characterizations of trees and to find centre of a tree.	K1,K6
CO4	Interpret Planar graphs and to determine chromatic numbers and chromatic index.	K2, K6
CO5	Explain Chromatic Polynomials and the properties of digraphs.	K4

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	1	3	2	3	2
CO4	2	2	1	1	2
CO5	1	2	1	1	3
Total contribution of Cos to PSOs	9	12	10	11	11
Weighted Percentage of COs contribution to PSOs	60	80	66.67	73.33	73.33

Course Content

UNIT-1:

Definition and examples of graphs –degrees- subgraphs–isomorphism–independent sets and coverings–matrices–operations of graphs.

UNIT-2:

Degree sequences–graphic sequences– walks–trails and paths –connectedness and components–connectivity.

UNIT-3:

Eulerian graphs–Hamiltonian graphs, Trees and its characterization–centre of a tree.

UNIT-4:

Planar graphs-Definition and properties–chromatic number and chromatic index.

UNIT-5:

Chromatic polynomials, definition and basic properties of digraphs, paths and connectedness in digraphs.

TextBook:

Arumugam.S&S.Ramachandran–InvitationtoGraphTheory,
ScitechPublications,Chennai,2002.

Booksforreference:

1. Kumaravelu.SandSusheelaKumaravelu –Graphtheory-Nagercoil,2002.
2. NarasinghDeo–Graphtheorywithapplicationtoengineeringandcomputer science, Prentice–HallofIndiapvt.Ltd.,NewDelhi,1979.

**Semester-VI
Core-XI
NUMBER THEORY**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-XI		Number Theory	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective:To highlight the beauties in the world of numbers and to prepare the students for coding through congruence.

Course Outcomes: On successful completion of the course,the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain Peano's theorem and to utilize mathematical induction.Also to make use of binomial theorem	K1,K5
CO2	Illustrate Division Algorithm .Determine GCD .To deduce the Diaphantine equation $ax+by=c$	K3,K5
CO3	Intrepret the fundamental theorem of arithmetic.Explain The Sieve of Eratosthenes and to use Goldbach Conjecture.	K2,K6
CO4	Summarize the basic properties of congruences and to apply Chinese Remainder Theorem	K2, K4
CO5	Elaborate Fermat's Theorem, Wilson's Theorem and to apply Kraitichik Factorization Method.	K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	3	3	3	3	3
CO2	2	2	3	3	1
CO3	1	3	2	3	2
CO4	2	2	1	1	2
CO5	1	2	1	1	3
Total contribution of COs to PSOs	9	12	10	11	11
Weighted Percentage of COs contribution to PSOs	60	80	66.67	73.33	73.33

Course Content

UNIT-1:

Peano's Axioms–Mathematical induction–The Binomial Theorem–Early Number Theory.

UNIT-2:

Division Algorithm–GCD–Euclidean Algorithm–The Diophantine Equation $ax+by=c$.

UNIT-3:

The fundamental Theorem of Arithmetic – The Sieve of Eratosthenes– The Goldbach conjecture.

UNIT-4:

Basic properties of congruences–Linear congruence and The Chinese Remainder Theorem.

UNIT-5:

Fermat's Theorem–Wilson's Theorem–The Fermat–Kraitchik Factorization Method.

TextBook:

David.M.Burton –ElementaryNumberTheory-Tata McGraw Hill Education Pvt. Ltd-
(SixthEdition)-2007.

BooksforReference:

1. IvanNivenand.H,Zuckerman-AnIntroductionto TheoryofNumbers,
CambridgeUniversityPress-2019.
2. Kumaravelu.S, andSusheelaKumaravelu-ElementsofNumber
TheoryNagercoil,2002.

**Semester-VI
Core-XII
DYNAMICS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-XII		Dynamics	60	-	-	4

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To provide a basic knowledge of the behaviour of objects in motion and to develop a working knowledge to handle practical problems.

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Illustrate projectiles and to find the equation of path, range and maximum height and time of flight.	K2, K3
CO2	Elaborate about the collision of elastic bodies. Interpret law of impact and classify direct and oblique impact.	K1, K4
CO3	Determine simple harmonic motion in a straight line. Summarize the composition of SHM of the same period in the same line and along two perpendicular directions.	K2, K6
CO4	Interpret motion under the action of central forces. Derive velocity and acceleration in polar coordinates.	K5, K6
CO5	Obtain the differential equation of central orbit. Also to deduce the pedal equation of central orbit.	K3, K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	3	3	3	3	3
CO2	2	2	3	3	2
CO3	3	3	2	3	2
CO4	2	2	3	1	2
CO5	2	2	2	1	3
Total contribution of COs to PSOs	12	12	13	11	12
Weighted Percentage of COs contribution to PSOs	80	80	93.33	73.33	80

Course Content

UNIT-1:

Projectiles–Equation of path–range–maximum height–time of flight.

UNIT-2:

Collision of elastic bodies–Laws of impact–direct and oblique impact.

UNIT-3:

Simple Harmonic Motion (SHM) in a straight line-Geometrical representation–composition of SHM of the same period in the same line and along two perpendicular directions.

UNIT-4:

Motion under the action of central forces– velocity and acceleration in polar co-ordinates.

UNIT-5:

Differential Equation of central orbit-pedal equation of central orbit–problems to find the law of force towards the pole when the orbit is given.

TextBook:

Venkatraman, M.K.-A TextBook on Dynamics, Agasthiar Publication, Trichy,2020.

Books for Reference:

1. Narayanan, S-Dynamics,S.Chand& company(New Delhi),16thEdition,1986.
2. Duraipandian.P, LaxmiDuraipandian and MuthamizhJayapragasam-Mechanics S.Chand& Company (2003).
3. I.Rajeswari–Dynamics – Saras Publication, Nagercoil, I edition (2019).

**Semester-VI
Core-XIII
NUMERICAL METHODS**

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Core-XIII		Complex Analysis	75	-	-	4

Contact hours per semester:75

Contact hours per week:5

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce finite differences and to solve numerical problems by different methods.

Course Outcomes: On successful completion of the course,the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Obtain solution for numerical algebraic and Transcendental equations by making use of various methods.	K1,K3,K4
CO2	Find finite difference for first and higher order differences. To classify forward and backward differences.	K2,K6
CO3	To apply interpolation formula in Newton's Forward and backward, Guass Forward and backward formula.	K5,K6
CO4	Make use of numerical differentiation and integration in Newton's forward &backward differences for differentiation.Also to utilize Trapezoidal rule and Simpson's 1/3 and 3/8 rule.	K3,K4
CO5	Solve Difference equations and to determine the order and degree of difference equation.Solve linear difference equation and find complementary function and to deduce particular Integral of the function.	K1,K6

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

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	2	3	3	3	3
CO2	2	2	3	3	1
CO3	2	3	2	3	2
CO4	2	2	2	3	2
CO5	1	2	2	2	3
Total contribution of COs to PSOs	9	12	12	14	11
Weighted Percentage of COs contribution to PSOs	73.33	80	80	93.33	73.33

Course Content

UNIT-1:

Solution of Numerical algebraic and Transcendental Equations : Bisection method– Newton’s method. Criterion of order of convergence of Newton’s method. Regula False method – Gauss elimination– Gauss Jacobi– Gauss Seidel method.

UNIT-2:

Finite Difference: First and higher order differences – Forward and backward differences – Properties of Operator – Differences of a polynomial– Factorial Polynomial.

UNIT-3:

Interpolation: Newton’s Forward–backward, Gauss forward–backward interpolation formula– Bessel’s formula. Divided differences – Newton’s divided difference formula – Lagrange’s interpolation formula.

UNIT -4:

Numerical Differentiation and integration : Newton’s forward and backward differences for differentiation- Derivatives using Bessel’s formula- Trapezoidal rule- Simpson’s 1/3 rule & 3/8 rule.

UNIT-5:

Difference equations: Definitions- order and degree of difference equation- Linear difference equation- finding complementary function- particular integral- simple applications.

TextBook:

Venkatraman.M.K- Numerical methods in Science and Engineering National Publishing Company- Edition 1998.

Books for Reference:

1. Kandasamy.P.K.Thilagavathy and K.Gunavathy, Numerical Methods, S.Chand & Company Ltd.Edn.2006.
2. Autar Kaw and Egwwn Enc Kalu– Numerical methods with Application A bidet. Autokaw.com 2nd Edition, 2011.
3. Dr.A.Singaravelu, Statistics & Numerical Methods, Meenakshi Agency (2012).

Semester-VI
Major Elective- III
FUZZY MATHEMATICS

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -III		Fuzzy Mathematics	60	-	-	4

Contact hours per semester:60

Contact hours per week :4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce fuzzy concepts to students and to facilitate the student to study fuzzy operations and fuzzy numbers

Course Outcomes: On successful completion of the course, the students should be able to

CO No.	Course Outcome	Knowledge Level
CO1	Explain Crisp sets and fuzzy sets and illustrate the characteristics and significance of Paradigm Shift.	K1,K2
CO2	Elaborate the Additional properties of α cuts and the extension principle for fuzzy sets.	K1,K4
CO3	Perform fuzzy set operations. Also to determine fuzzy complements, fuzzy intersections and fuzzy unions.	K5,K6
CO4	Determine fuzzy numbers and Linguistic variables. Apply arithmetic operations on intervals and on fuzzy numbers. Construct lattice of fuzzy numbers.	K2,K3,K4
CO5	Analyze and classify fuzzy decision making, individual decision making, Multi person decision making problems.	K5,K6

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

CO-PO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
Cos					
CO1	2	3	3	3	3
CO2	2	1	3	3	1
CO3	2	1	2	3	2
CO4	1	2	2	3	2
CO5	2	2	1	2	3
Total contribution of COs to PSOs	9	9	11	14	11
Weighted Percentage of COs contribution to PSOs	60	60	73.33	93.33	73.33

Course Content

UNIT-1:

Crisp Sets–Fuzzy Sets–Basic Types–Basic Concepts–Characteristics and Significance of Paradigm Shift.

UNIT-2:

Additional properties of α -cuts– representationsof fuzzy sets– Extension principle for fuzzy sets.

UNIT-3:

Fuzzy set operations–Fuzzy complements–Fuzzy intersections:t-norms–Fuzzy Unions: t-conforms –
Combinations of operations.

UNIT-4:

Fuzzy numbers – linguistic variables-arithmetic operations on intervals-arithmetic operations on fuzzy numbers-Lattice of fuzzy numbers-Fuzzy Equations.

UNIT-5:

Fuzzy decision making – Individual Decision Making-Multi-person decision making-fuzzy linear programming.

TextBook:

GeorgeJ.Klir and BoBoYuan– Fuzzy sets and Fuzzy Logic Theory Applications,
Prentice Hall of India,2002,New Delhi.

Book forReference:

GeorgeJ.KlirandTina.A.Folger–Fuzzy sets, uncertainty and Information – Prentice Hall
ofIndia,2003,NewDelhi.

Semester-VI
Major
Elective- IV
OPERATIONS RESEARCH-II

Contact hours per semester:60

Contact hours per week:4

Year	Semester	Internal Marks	External Marks	Total marks
III	VI	25	75	100

Objective: To introduce games and strategies. Also to understand networking problems.

Course Outcomes: On successful completion of the course, the students should be able to

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical	Credits (C)
Part-III	Major Elective -III		Operations Research	60	-	-	4

CO No.	Course Outcome	Knowledge Level
CO1	Interpret the games and strategies. Solve two persons zero sum games. Make use of mixed strategies and dominance property.	K2,K3
CO2	Analyze the replacement of items that deteriorate with time. Illustrate replace montage of a machine taking money value into consideration and elaborate the replacement of items that completely fail suddenly and Staffing problems.	K1,K5
CO3	Explain the queueing models and to classify into (M/M/1:FCFS),(M/M/1:∞/FCFS),(M/M/S/FCFS)	K4,K6
CO4	Compose network scheduling using PERT/CPM. Explain the rules of network construction. Make use of PERT calculation.	K2,K3
CO5	Analyse and solve inventory control problems.	K5,K6

4. K1-Remember, K2-Understand, K3-Apply, K4-Analyze, K5-Evaluate, K6-Create

CO-PSO mapping (Course Articulation Method)

PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
COs					
CO1	2	3	3	2	3
CO2	2	1	3	2	1
CO3	2	1	2	2	2
CO4	2	2	2	2	1
CO5	1	2	1	1	3
Total contribution of COs to PSOs	9	9	11	9	10
Weighted Percentage of COs contribution to PSOs	60	60	73.33	60	66.67

Course Content:

- UNIT-1:** Games and Strategies: Two Person Zero sum Games – The Maximin – Minimax Principle – Games without Saddle Points – Mixed Strategies – Graphical Solution of $2 \times n$ and $m \times 2$ games – Dominance Property.
- UNIT-2:** Replacement of items that deteriorate with time – replace montage of a machine taking money value into consideration – replacement of items that completely fail suddenly and Staffing Problems.
- UNIT-3:** Queueing models: General concept and definitions – characteristics – properties of Poisson process Models ($M/M/1/FCFS$), ($M/M/1:\infty/FCFS$), ($M/M/S/FCFS$).
- UNIT-4:** Networks Scheduling by PERT/CPM: Network and basic components – Rules of Network Construction – Time Calculation in network – Critical Path Method – PERT Calculation.
- UNIT-V:** Inventory Control : Introduction – Types of Inventories – Inventory decisions – Deterministic inventory Problem – EOQ problems without shortages.

Text Book:

Kanti Swarup, P.K. Gupta and Manmohan – Operations Research – Sultan Chand & Sons – 2006, 12th Edition.

Books for Reference:

1. Gupta. P.K and D.S. Hira – Operations Research – S. Chand & sons – VII Edition..
2. B.J. Ranganath and A.S. Srikantappa – Operations Research, Yes Dee Publishing House, Chennai (2017).
3. Hillier, F.S. and G.J. Lieberman – Introduction to Operations Research, 9th Ed., Tata McGraw Hill, Singapore, 2009.
4. Hamdy A. Taha, -Operations Research, An Introduction, 8th Ed., Prentice – Hall India, 2006.
5. Hadley. G. - Linear Programming, Narosa Publishing House, New Delhi, 2002.

