2011

B.Sc (Mathematics) Curriculum & Syllabus

DEPARTMENT OF MATHEMATICS

MADRAS CHRISTIAN COLLEGE

| 2011-12 ONWARDS

MADRAS CHRISTIAN COLLEGE (AUTONOMOUS)

CHENNAI – 600 059

DEPARTMENT OF MATHEMATICS

B.Sc (Mathematics) Degree Programme

Curriculum & Syllabus (1st year)

(With effect from 2011 - 12)

MADRAS CHRISTIAN COLLEGE

Vision

Madras Christian College aspires to be an institution of excellence transforming lives through education with a commitment to service.

Mission

Madras Christian College with the inspiration of the love of God offers to people of all communities, education of the whole person which is congruous with God's revelation in Christ of the true nature of humanity and is appropriate to the needs of India and of the world.

Graduate Attributes (GAs)

The Madras Christian College defines the philosophy underpinning its academic programmes and student life experience on campus through the Graduate Attributes (GA), that describe the knowledge, competencies, values and skills students imbibe for holistic development and contribution to society. These attributes encompass characteristics that are transferable beyond the domain of study into the national and international realm fostered through curricular, co-curricular and extra-curricular engagements.

GA 1: Intellectual Competencies

- Graduates of MCC have a comprehensive and incisive understanding of their domain of study as well as the capability for cross-disciplinary learning.
- They have the ability to apply the knowledge acquired through the curriculum as well as self-directed learning to a broad spectrum ranging from analytical thinking to synthesise new knowledge through research.
- Forming independent individual opinions regarding academic cores and socially relevant issues

GA 2: Professional Ethics

- Graduates of MCC develop ethical and professional behaviour, which will be demonstrated in their chosen careers and constructive citizenship roles.
- They imbibe intellectual integrity and ethics in scholarly engagement and develop a spirit of inclusiveness through interactions with people of special needs and diversity.

GA3: Leadership Qualities

- Graduates of MCC inculcate leadership qualities & attitudes, and team behaviour along democratic lines through curricular, co-curricular and extra-curricular activities
- They develop managerial and entrepreneurial skills to ideate and create new opportunities along with career readiness and capacity to take up various competitive exams.

GA 4: Holistic Skill Development

- Graduates of MCC develop critical thinking, problem-solving, effective communication, emotional and social skills
- They develop digital competency to live, learn and serve in society.

GA 5: Cross-Cultural Competencies

- Graduates of MCC imbibe cross-cultural competencies through engaging with diverse linguistic, ethnic and religious communities providing scope to understand, accept and appreciate individuals at local, national and international levels.
- They develop a global perspective through contemporary curriculum, culture, language and international exchange programmes

GA 6: Service-Oriented Focus

- Graduates of MCC have sensitivity to social concerns and a conviction toward social justice through a commitment to active social engagement.
- They are endowed with a strong sense of environmental awareness through the curriculum and campus eco-system.

GA 7: Value-Based Spiritual Development

- Graduates of MCC are rooted in the principles of ethical responsibility and integrity permeated with Christian values leading to the building of character.
- They develop virtues such as love, courage, unity, brotherhood, industry and uprightness.

Programme Outcomes (POs) for B.Sc Degree Programmes

Programme Outcomes define the minimum level that students are expected to do, achieve and/or accomplish in order to graduate from a particular programme. These Outcomes are a framework to assess the nature of learning activity experienced within the programme. Upon completion of the programme, under graduate students should have shown evidence of being able to

PO		Descripton of PO	Mapped GA
PO 1	**Language Skills**	• Demonstrate oral and written skills to effectively communicate in English and Languages of their choice • Apply reading and listening skills to facilitate access to knowledge resources and understanding	GA1, GA4, GA5
PO 2	**Domain Knowledge**	• Acquire knowledge of basic concepts, theories and processes through study of core courses in respective programmes • Apply and Analyze domain specific knowledge to emerging areas of academia and industry • Assess, adapt and develop domain specific transferrable skills to new/unfamiliar context	GA1, GA33, GA4, GA5
PO 3	**Interdisciplinary knowledge**	• Identify and determine relationships across disciplines • Acquire and apply interdisciplinary knowledge for holistic academic development.	GA1, GA4
PO 4	**Digital skills**	• Acquire computer skills and their application relevant to classroom and self-directed web-based learning • Familiarize with and use domain-related software resources, computational skills and digital tools for data analysis, visualization and interpretation • Ethically apply digital skills to creatively communicate a wide range of ideas and issues related to academic experiences	GA1, GA2, GA3, GA4, GA6
PO 5	**Analytical Skills**	• Develop the ability to think critically and relate learning to academic, professional and real-life problem solving • Apply empirical knowledge and skills to identify and collect quantitative and qualitative data to analyze and formulate evidence-based suggestions and solutions	GA1, GA2, GA4, GA6
PO 6	**Academic Writing Presentation Skills**	• Formulate and document results obtained in laboratory, case studies, project work, field work and internships • Effectively communicate through engaging presentations using methodologies appropriate to the discipline	GA1, GA4, GA5
PO 7	**Innovation and Creativity**	• Demonstrate transferable capabilities and intrapreneurial skills that are relevant to the industry and other employment opportunities • Develop entrepreneurial skills and generate intellectual property	GA1, GA2, GA3
PO 8	**Social Engagement and Responsibility**	• Demonstrate the ability to link classroom learning with social concerns through service learning and outreach programmes. • Enhance positive personality traits to adapt to changing circumstances and demonstrate leadership qualities as an individual and a member of cross-cultural and multi-disciplinary teams.	GA1, GA2, GA5, GA6, GA7

	• Appreciate environmental consciousness and sustainability • Draw valuable insights from one's own spiritual tradition and that of others for peaceful coexistence and general wellbeing

Programme Specific Outcomes (PSOs) for B.Sc (Mathematics)

At the time of graduation the students would be able to:

PSO	Description of PSO
PSO 1	• Inculcate the ability to effectively communicate mathematical problems in English and Languages of their choice • Enhance the reading and listening skills and to facilitate access to knowledge resources and understanding
PSO 2	• Acquire knowledge of basic and essential concepts, theories and methodologies in mathematics • Apply and analyze mathematical knowledge to emerging areas of academia and industry • Assess, adapt and develop analytical reasoning and problem solving skills to new/unfamiliar context
PSO 3	• Identify and determine relationships between Computational Sciences and other disciplines • Acquire and apply interdisciplinary knowledge for holistic academic development.
PSO 4	• Acquire computational and computer skills and their application relevant to classroom and online learning • Make use of mathematical, statistical software resources, computational skills and digital tools for business intelligence, data analysis, visualization and interpretation • Ethically apply digital skills to creatively communicate mathematical concepts and real life applications relevant to the needs and demands
PSO 5	• Develop analytical thinking, logical reasoning ability, critical thinking and relate learning to academic and real-life problem solving • Apply empirical knowledge and computational skills to identify and collect quantitative and qualitative data to analyze and formulate evidence-based suggestions and interpret to solutions
PSO 6	• Formulate and document results obtained in laboratory, case studies, project work, field work and internships • Effectively communicate through engaging presentations using methodologies appropriate to the discipline
PSO 7	• Demonstrate transferable capabilities and intrapreneurial skills that are relevant to the industry and other employment opportunities • Develop entrepreneurial skills and generate intellectual property

PSO 8	• Demonstrate the ability to link classroom learning with social concerns through service learning and outreach programmes. • Enhance positive personality traits to adapt to changing circumstances and demonstrate leadership qualities as an individual and a member of cross-cultural and multi-disciplinary teams. • Appreciate environmental consciousness and sustainability • Draw valuable insights from one's own spiritual tradition and that of others for peaceful coexistence and general wellbeing

Curriculum – B.Sc (Mathematics)

Semester I				
Component		**Course**	**Hours**	**Credits**
Part I		Language I	4	3
Part II		English I	4	3
Part III	Major	Algebra and Trigonometry	5	4
		Calculus	5	4
	Allied I	Physics I	6	5
Part IV	(a)	Basic Tamil I / Advanced Tamil I / General Course I	4	2
	(d)	Value Education	2	1
		Total	**30**	**22**

Semester II				
Component		**Course**	**Hours**	**Credits**
Part I		Language II	4	3
Part II		English II	4	3
Part III	Major	Differential Equations, Laplace Transforms and Fourier Series	5	4
		Differential Geometry and Analytical Geometry of 3 Dimension	5	4
	Allied I	Physics II	6	5
Part IV	(a)	Basic Tamil II /Advanced Tamil II /General Course II	4	2
	(d)	Value Education	2	1
		Total	**30**	**22**

Semester III				
Component		**Course**	**Hours**	**Credits**
Part I		Language III	4	3
Part II		English III	4	3
Part III	Major	Algebraic Structures	5	4
		Multivariate Calculus and Theory of Numbers	5	4
	Allied II	Discrete Mathematics I / Chemistry I	6	5
Part IV	(b) Skill–based	Personality Development	2	–
		Inter Disciplinary (Mathematical Physics)	4	3
		Total	**30**	**22**

Semester IV				
Component		**Course**	**Hours**	**Credits**
Part I		Language IV	4	3
Part II		English IV	4	3
Part III	Major	Linear Algebra	5	4
		Advanced Calculus	5	4
	Allied II	Discrete Mathematics II / Chemistry II	6	5
Part IV	(b) Skill–based	Personality Development	2	3
	(c)	Environmental Studies	4	2
		Total	**30**	**24**

Semester V				
Component		**Course**	**Hours**	**Credits**
Part III	Major	Real Analysis	7	5
		Mathematical Statistics	7	5
		Numerical Methods	6	5
		Elective: Programming in C / Mathematics of Finance	6	5
Part IV	(b) Skill–based	General Elective (Space Science)	4	3
		Total	**30**	**23**

Semester VI				
Component		**Course**	**Hours**	**Credits**
Part III	Major	Complex Analysis	6	5
		Mechanics	6	5
		Linear Programming	5	4
		Elective: Astronomy / Fluid Dynamics	5	4
		Elective: Formal Languages & Graph Theory / Mathematical Modeling	6	5
Part IV	(b) Skill–based	Computer Training	2	3
		Total	**30**	**26**

Component	**Extension Activities**	**Hours**	**Credits**
Part V	NCC/NSS/Sports/Scrub Soc./ Dept. Assn. Activities	–	1
	Grand Total		**140**

Allied and Non–Major Courses offered by the Department

Allied I:(Offered to students of Physics and Chemistry Departments)

Semester I : Allied Mathematics I

Semester II : Allied Mathematics II (for Physics) / Allied Mathematics II (for Chemistry)

Allied II: (Offered to students of Mathematics Department)

Semester III : Discrete Mathematics I

Semester IV : Discrete Mathematics II

General Course: (Offered to students of Departments other than Mathematics)

Semester I : Basic Mathematics

Semester II : Basic Mathematics

Inter Disciplinary: (Offered to students of Mathematics, Physics and Chemistry Departments)

Semester III : Mathematical Physics

General Elective: (Offered to students of all Departments)

Semester V : Space Science

Computer Training: (Offered to students of Mathematics Department)

Semester VI : Computer Training

Environmental Studies:

Semester IV : Environmental Studies (Common to students of all Departments)

Course title:	Algebra and Trigonometry			
Course Code	111MT1M01			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	I			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To solve the polynomial equations and finding the roots of equations by various methods, finding summations of series using binomial, exponential and Logarithmic series, understand the relationship between hyperbolic and trigonometric functions.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Remember the relation between roots and coefficients, Descartes's rule of signs, Binomial, exponential and logarithmic series, expansions of trigonometric series, and logarithms of complex quantities.	PSO2, PSO3, PSO4 PSO5, PSO7	K1		
CO2: Examine the roots of polynomial equations, reciprocal equations, Binomial, Exponential and logarithmic and trigonometric series. Explain symmetric functions of roots, transformation of roots, the solutions by Newton's, Horner's and Cardon's method.	PSO2, PSO3, PSO4 PSO5, PSO7	K2		
CO3: Solve Polynomial equations, Reciprocal equations, series using the concept of Binomial, Exponential and Logarithmic expansions. Apply Newton's, Cardon's,	PSO2, PSO3, PSO4 PSO5, PSO7	K3		

Horner's method, Expansions of trigonometric series to find summation.		
CO4: Analyse the relation between roots and coefficients, Reciprocal equations and its types, Summation of series, and expansions of sin x, cos x, tan x, in terms of Hyperbolic functions.	PSO2, PSO3, PSO4 PSO5, PSO7	K4
CO5: Evaluate Symmetric functions of roots, the roots of equations using Newton's, Cardon's and Horner's method, summation of Binomial, exponential, Logarithmic and trigonometric series.	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Algebra and Trigonometry				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**UNIT I – Theory of Equations:** Introduction to polynomials - Roots of polynomial equations – Imaginary and irrational roots – Relation between roots and coefficients – Symmetric function of the roots. **Chapter 6: Sections 1, 2, 9, 10, 11, 12**	15	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**UNIT II** Transformation of equations – Reciprocal equations **Chapter 6: Sections 13 – 19, 24, 30**	18	C01 CO2 CO3 CO4	K1,K2,K3, K4,K5

	Descartes' rule of signs – Solution by Newton's and Horner's method, Cardon's method of solution of a cubic polynomial equation with real coefficients. **Chapter 1: Section 1**		CO5	
III	**UNIT III** **Series:** Summation of series using Binomial, Exponential and Logarithmic series and approximations**.** **Chapter 3: Section 10, Chapter 4: Sections 1, 3, 6, 7, 9**	13	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**UNIT IV** **Trigonometry** Expansion of $\sin nx, \cos nx, \tan nx, \cos^n x, \sin^n x$ – Expansion of *sin x, cos x, tan x* in terms of x – Hyperbolic functions. **Chapter 3: Sections 1, 2, 3, 4, 5, Chapter 4: Sections 1, 2**	14	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** **Trigonometry** Logarithms of complex quantities – Sums of sines and cosines of *n* angles which are in Arithmetic Progression - Summation of trigonometric series using complex quantities. **Chapter 5: Section 5, Chapter 6: Sections 2, 3**	15	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

1. Algebra, Volume – I, T.K. Manicavachagom Pillay, T. Natarajan and K.S. Ganapathy, S. Viswanathan Publishers, 2004. (for Unit I, unit II, unit III)
2. Mathematics, Volume – I (First Edition), P. Kandasamy and K. Thilagavathy, S. Chand & Co, 2004. (for unit II)
3. Trigonometry, S. Narayanan and T.K. Manicavachagom Pillay, S.Viswanathan Publishers, 2010.(for unit IV, unit V)

Reference Books

1. Algebra, Analytical Geometry and Trigonometry - I Year – Paper I, by P. R. Vittal and V. Malini, Margham Publications, Chennai, 2001.
2. Trigonometry by Hari Kishan, Atlantic, New Delhi, 2005.

Web Resources

1. https://www.youtube.com/watch?v=hxJfu-CHmt8

2. https://www.youtube.com/watch?v=wcLe_SFqamk&list=PLep340oM2dkAsiAiyHREquQrTULZ8VRko
3. https://brilliant.org/wiki/hyperbolic-trigonometric-functions/
4. https://www.youtube.com/watch?v=Z1BlcU1d6Fg

Course Articulation Matrix for Algebra and Trigonometry																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course Title	CALCULUS			
Course Code	111MT1M02			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	I			
Year of Implementation	2011 -2012			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives	To acquire a knowledge of Differential Calculus and Integral Calculus, methods of solving different types of problem thus being enabled by the direction to apply the derived concepts to practical problems.			

CO #	Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)
CO 1	Remember formulae in differential and integral calculus.	PSO1 PSO2 PSO4	K1
CO 2	Examine successive derivatives, extrema of functions, methods of integration and area in polar co-ordinates.	PSO1 PSO2 PSO3 PSO4 PSO5	K2
CO 3	Apply Leibnitz formula to find higher derivatives and solve real world problems using maxima and minima.	PSO1 PSO2 PSO3 PSO4	K3
CO 4	Analyze partial derivatives, extrema of functions, integration by parts, properties of definite integrals and length of a curve.	PSO1 PSO2 PSO3 PSO4 PSO5	K4
CO 5	Construct total derivatives. Justify Euler's theorem, Lagrange's method of undetermined multipliers, Bernoulli's formula and surface of revolution.	PSO1 PSO2 PSO3 PSO4	K5

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**COs**	**BLOOM'S TAXONOMY LEVEL**
I	Introduction to differentiation - Successive differentiation - n_{th} derivative – Leibnitz formula for nth derivative of a product – Partial differentiation – total differential Coefficient– Homogeneous functions – Euler's theorem. **Chapter 3: Sections 1.1 – 1.6, 2.1, 2.2, Chapter 8: Sections 1.1 – 1.6**	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
II	Maxima and minima of functions of 2 variables – Lagrange's method of undetermined multipliers – simple problems. **Chapter 8: Sections 4.1, 5**	**13**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
III	. Introduction to integration - Methods of integration – Integration by parts - Bernoulli's formula. **Chapter 1: Sections 5, 6.1 – 6.6, 7.1 – 7.5, 8, 9, 10, 12, 15.1**	**17**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
IV	Properties of definite integrals – reduction formulae for standard integrals. **Chapter 1: Sections 11, 13.1 – 13.10, 14**	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
V	. Areas in polar coordinates - Length of the curve (Cartesian and polar coordinates) – Area of surface of revolution (Cartesian and polar coordinates). **Chapter 2: Sections 1.4, 4.1, 4.2, 5**	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**

Prescribed Books/Textbooks (1-5 books)

1. **Calculus Vol I , S. Narayanan and T.K. Manicavachagom Pillay, S. Viswanathan Printers and Publishers Pvt Ltd, 2010**
2. **Calculus Vol II, S. Narayanan and T.K. Manicavachagom Pillay, S. Viswanathan Printers and Publishers Pvt Ltd, 2010**

References

1. **Mathematics Vol I, P. Kandasamy and Thilgavathy, S. Chand, New Delhi, 2004.**

2. Calculus, Thomas and Finney, Pearson Education, 9th Edition, 2006.

Suggested Reading

1. Differential Calculus, Shanti Narayan, S.Chand & Company (PVT) LTD, 1987.
2. Integral Calculus, Shanti Narayan & P.K.Mittal, S.Chand & Company (PVT) LTD, 2010.

Web Resources

1. https://archive.nptel.ac.in/courses/111/106/111106146/
2. https://ocw.mit.edu/courses/18-01-calculus-i-single-variable-calculus-fall-2020/

Course Articulation Matrix for Calculus

Co	Programme Outcomes							Programme Specific Outcomes							K Level
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO 1	3	3	2	2	1	-	-	3	3	2	2	1	-	-	K1
CO 2	3	3	3	2	1	-	-	3	3	3	2	1	-	-	K2
CO 3	3	2	3	2	1	-	-	3	2	3	2	1	-	-	K3
CO 4	2	3	3	2	2	-	-	2	3	3	2	2	-	-	K4
CO 5	3	3	2	2	-	-	-	3	3	2	2	-	-	-	K5
Avg.	2.8	2.8	2.6	2	1	-	-	2.8	2.8	2.6	2	1	-	-	
Avg	1.6							1.6							

Syllabus: Differential Equations, Laplace Transforms and Fourier Series				
Unit	**Content**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	UNIT I – Ordinary Differential Equations: Introduction to ordinary differential equations - First order but of higher degree equations – solvable for p, solvable for x, solvable for y – Clairaut's form – simple problems. Second order equation with constant coefficient with particular integrals for eaxxm, eaxsin mx, eaxcos mx. Chapter 1: Sections 5.1 – 5.4, 6; Chapter 2: Sections 1, 2, 3, 4	**15**	**CO1**	K2
II	UNIT II – Second order differential equation with variable coefficients ax2 d2y/dx2 + bx dy/dx + cy = g(x) – method of variation of parameters. Chapter 2: Sections 8, 10	**12**	**CO2**	K3
III	UNIT III – Laplace Transforms: Introduction - Laplace transforms – inverse transform -Application of Laplace to solution of first and second order linear differential equation with constant coefficients. Chapter 5: Sections 1 - 8	**18**	**CO3**	K3
IV	UNIT IV – Partial Differential Equations: Introduction to partial differential equations (PDE) - Formation of PDE by eliminating arbitrary constants and arbitrary functions – complete integral – singular integral – general integral - Standard types 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) – Clairaut's form and Lagrange's equation Pp+Qq = R . (Simple Problems) Chapter 4: Sections 1, 2, 3, 5.1 – 5.4, 6	**12**	**CO4**	K3, K4
V	UNIT V – Fourier Series: Introduction to Fourier series - Definition – Examples of Fourier series – Even or odd functions – Fourier series for even and odd functions – Half range expansions. (Simple problems). Chapter 6: Sections 1, 2, 3, 4, 5	**18**	**CO5**	K3, K4

Prescribed Books/Textbook(s)
Calculus, Volume 3, S. Narayanan and T.K. Manicavachagam Pillai, S. Vishwanathan Publications, 2010.
Reference Books

Engineering Mathematics Volume 3, Dr. M.K. Venkataraman, The National Publishing Company, 2001.
Web Resources 1. https://nptel.ac.in/courses/111106100 2. https://archive.nptel.ac.in/courses/111/106/111106139/ 3. https://nptel.ac.in/courses/111106111

Course Articulation Matrix for Differential Equations, Laplace Transforms and Fourier Series																	
CO	**Programme Outcomes**								**Programme Specific Outcomes**								
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**	**PSO 6**	**PSO 7**	**PSO 8**	**Cog Level**
CO 1	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K2
CO 2	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 3	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 4	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3, K4
CO 5	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3, K4
Avg.	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	

Course title:	Differential Geometry & Analytical Geometry of 3-dimensions			
Course Code	111MT2M02			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	II			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To study the fundamental properties of curve and compute evolute, envelope and linear asymptotes for curves. To study the properties of planes, straight lines and spheres			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Recall the fundamental notions relating to curvature, evolute, linear asymptotes and basic forms of plane, straight line and sphere	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K1		
CO2: Discuss properties of curvature, evolute, linear asymptotes and properties of planes, straight line and sphere	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K2		
CO3: Apply the fundamental notions to compute curvature, evolute, linear asymptotes for a curve. Solve various problems relating to planes, straight lines and circles	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K3		
CO4: Analyse properties of curvature, evolute, linear asymptotes and properties of planes, straight line and sphere	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K4		
CO5: Assess certain properties of of curvature, evolute, linear asymptotes and properties of planes, straight line and sphere	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K5		

Syllabus: Differential Geometry & Analytical Geometry of 3-dimensions				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	UNIT I – Differential Geometry Curvature – Cartesian formula for radius of curvature - The coordinates of the centre of curvature – Evolute and involute. Chapter X: Sections 2.1 – 2.5.	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	UNIT II – Radius of curvature in polar coordinates – p-r equation – Envelopes (definitions and problems only) – Linear asymptotes (definitions and simple problems only). Treatment and content as in (For Units I and II) Calculus, Volume I: S. Narayanan and T K Manicavachagom Pillay, S. Viswanathan Printers and Publishers, 2010. Chapter X: Sections 1.1 – 1.4, 2.6 – 2.8, Chapter XI: Sections 1 – 4, 5.1 – 5.3, 6	14	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	UNIT III – Analytical Geometry of 3-Dimensions The plane – the general equation – several forms of the equations of a plane – angle between planes – length of perpendicular – equation of the planes bisecting the angle between the planes. Chapter II: Sections 1 – 11	17	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	UNIT IV – The Straight Line – symmetrical form – plane and straight line – coplanar lines – shortest distance between two lines. Chapter III: Sections 1 – 7; Section 8 (Sections 8.1, 8.2 are excluded)	16	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	UNIT V – The Sphere – standard form – plane section – equation of sphere passing through a given circle – intersection of two spheres – tangent plane to a sphere. Chapter IV: Sections 1 – 8	16	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

1. Calculus, Volume I: S. Narayanan and T K Manicavachagom Pillay, S. Viswanathan Printers and Publishers, 2010. – For Units I & II
2. A text book of Analytical Geometry – Part II (Three dimensions) – T.K. Manicavachagom Pillay and T. Natarajan , S. Viswanathan (Printers and Publishers) Pvt. Ltd 2007. – For Units III, IV & V

Reference Books

Engineering Mathematics Volume 3, Dr. M.K. Venkataraman, The National Publishing Company, 2001.

Web Resources

5. https://nptel.ac.in/courses/111104095

6. https://www.youtube.com/watch?v=x2ImML0AlRc&list=PL---5YRdtrP_fyX6OS96i-an1GrvClQwF&index=14
7. https://www.youtube.com/watch?v=X75_8pXonF8

Course Articulation Matrix for Differential Geometry & Analytical Geometry of 3-dimensions																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K1
CO 2	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K2
CO 3	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 4	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K4
CO 5	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K5
Avg.	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	
	2								2								

Course title:	Algebraic Structures			
Course Code	111MT3M01			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	III			
Year of Implementation	AY 2024-25			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To understand the concepts of groups and rings and their types. To determine subgroups and normal subgroups of a given group and ideals of a ring. To solve problems pertaining to subgroups and homomorphisms for groups. To differentiate between rings, commutative rings, rings with unit element, integral domains and fields. To understand and give examples of Euclidean rings, polynomial rings, irreducible elements, prime elements etc.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: To recall the definitions of the groups and rings and their various types.	PSO1, PSO2, PSO5,	K1		
CO2: To compare the different types of groups and rings.	PSO1, PSO2, PSO5,	K2		
CO3: To illustrate the proofs of theorems such as Lagrange's Theorem, Cayley's Theorem, the Fundamental theorem of homomorphism etc.	PSO1, PSO2, PSO5,	K3		
CO4: To identify subgroups and normal subgroups of a given group. To categorize ideals of a given ring.	PSO1, PSO2, PSO5,	K4		
CO5: To justify results on groups, subgroups, quotient groups, homomorphisms, ideals, quotient rings etc.	PSO1, PSO2, PSO5,	K5		

Syllabus: Differential Equations, Laplace Transforms and Fourier Series				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	Group Theory: Groups – Subgroups – Counting Principle – Normal Subgroups Chapter 2: Sections 2.1 – 2.6	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

II	Homomorphisms – Automorphisms – Cayley's theorem – Permutation groups. Chapter 2: Sections 2.7 – 2.10 (omit application 1 and 2)	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
III	Ring Theory: Definition and examples of Rings – Some special classes of rings – Homomorphisms. Chapter 3: Sections 3.1 – 3.3	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	Ideals and Quotient rings: More ideals and Quotient ideals – field of quotients of an integral domain. Chapter 3: Sections 3.4 – 3.6	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
V	Euclidean rings: A particular Euclidean ring – Polynomial Rings – Polynomials over the rational field. Chapter 3: Sections 3.7 – 3.10	15	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

Prescribed Books/Textbook(s) Topics in Algebra, Second Edition, I.N. Herstein, Wiley Student edition, 2009.
Reference Books Modern Algebra, M.L. Santiago, Tata McGraw-Hill Publishing Co. Ltd, 2001.
Web Resources 1. https://archive.nptel.ac.in/courses/111/106/111106113/ 2. https://archive.nptel.ac.in/courses/111/106/111106131/

Course Articulation Matrix for Differential Equations, Laplace Transforms and Fourier Series																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level

CO 1	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K2
CO 2	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 3	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 4	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K4
CO 5	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K4
Avg.	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	

Course Title	**MULTIVARIATE CALCULUS AND THEORY OF NUMBERS**			
Course Code	**111MT3M02**			
Credits	**4**			
Hours / Cycle	**5**			
Category	**Mandatory**			
Semester	**IV**			
Year of Implementation	**2011-12**			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Course Objectives	**To acquire a knowledge of mulitiple integrals, vector differentiation and vector integration together with ideas in theory of numbers and methods of solving different types of problems thus being enabled by the direction to apply the derived concepts to practical problems.**			

CO #	**Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K5)**
CO 1	Remember the methods in evaluating double integrals, Jacobian transformation, beta and gamma functions and prime and composite numbers.	**PSO1 PSO2 PSO4**	**K1**
CO 2	Examine triple integral, gradient, line integrals and Euler's totient function.	**PSO1 PSO2 PSO3 PSO4 PSO5**	**K2**

CO 3	Apply double integrals to area, surface area. Classify formulae involving ∇, solve surface integral problems and illustrate number and sum of divisors of a given number.	**PSO1** **PSO2** **PSO3** **PSO4**	**K3**
CO 4	Investigate change of order of integration, properties of special functions, gradient and divergence. Analyze volume integrals and congruences.	**PSO1** **PSO2** **PSO3** **PSO4** **PSO5**	**K4**
CO 5	Evaluate surface area, applications to area, curl of a vector-valued function, theorems on Gauss, Stoke's and Green's and simple problems in number theory.	**PSO1** **PSO2** **PSO3** **PSO4**	**K5**

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**COs**	**BLOOM'S TAXONOMY LEVEL**
I	**Multiple Integral**: Double integral – Polar and Cartesian coordinates – Change of order of integration – Jacobian – Application to area. **Chapter 5: Sections 1, 2.1, 2.2, 3.1, 5.1, Chapter 6: Section 1**	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
II	Triple integral – Volume under triple integral – Surface area. Special functions: Beta and Gamma Functions, their properties and simple problems **Chapter 5: Sections 4, 6.3, 7, Chapter 7: Sections 2.1 – 2.3, 3, 4, 5**	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
III	**Vector Calculus**: Introduction **–** Gradient – Divergent – Curl – Formulae involving □ **–** Invariance. **Chapter: 4**	**12**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
IV	Line, Surface and Volume integrals – Theorems of Gauss, Stokes and Green's (Statements only) – simple problems.	**18**	**CO1** **CO2** **CO3** **CO4**	**K1** **K2** **K3** **K4**

	Chapters: 5, 6		**CO5**	**K5**
V	Prime and Composite numbers – The sieve of Eratosthenes-Divisors of a given number N – Euler's function(N) – Integral part of a real number- The highest power of a prime p contained in n! – the product of r consecutive integers is divisible by r! – Congruences – Numbers in arithmetic progressions – Fermat's Theorem - (statement only) - Wilson's theorem – (statement only) – Simple Problems. **Chapter 5: Sections 1 – 17**	**15**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**

Prescribed Books/Textbooks

1. Calculus, Volume II, S. Narayanan and T.K. Manicavachagom Pillay, S. Vishwanathan Publishers Pvt. Ltd, 2007.
2. Vector Analysis, Schaum's outline series, Murray R. Spiegel., Seymour Lipschutz, Dennis Spellman, Second Edition, McGraw Hill Book Company, 2009.
3. Algebra, Volume II by T.K. Manicavachagom Pillay, T. Natarajan, K.S. Ganapathy, S. Vishwanathan Publishers Pvt. Ltd, 2006.

References

1. Engineering Mathematics, Volume2, Fifth Edition, Dr. M.K. Venkataraman, National Publishing Company, 2004.
2. Elementary Number Theory, Sixth Edition, David M. Burton, Tata McGraw-Hill Pvt. Ltd, 2009.

Suggested Reading

Web Resources

1. https://archive.nptel.ac.in/courses/111/107/111107108/
2. https://ocw.mit.edu/courses/18-024-multivariable-calculus-with-theory-spring-2011/

Course Articulation Matrix for Multivariate Calculus and Theory of Numbers

Co	Programme Outcomes							Programme Specific Outcomes							K Level
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO 1	3	3	2	2	1	-	-	3	3	2	2	1	-	-	K1
CO 2	3	3	3	2	1	-	-	3	3	3	2	1	-	-	K2
CO 3	3	2	3	2	1	-	-	3	2	3	2	1	-	-	K3
CO 4	2	3	3	2	2	-	-	2	3	3	2	2	-	-	K4

CO 5	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**K5**
Avg.	**2.8**	**2.8**	**2.6**	**2**	**1**	**-**	**-**	**2.8**	**2.8**	**2.6**	**2**	**1**	**-**	**-**	
Avg	**1.6**							**1.6**							

Course Title	**DISCRETE MATHEMATICS**			
Course Code	**111MT3A01**			
Credits	**5**			
Hours / Cycle	**6**			
Category	**Allied**			
Semester	**III**			
Year of Implementation	**2011-12**			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Course Objectives	To **acquire a knowledge of different counting techniques that can be used to solve various peoblems in combinatorics and have a thorough understanding of Polya's theory in counting.**			

CO #	**Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K5)**
CO 1	Remember basic combinatorial numbers, generating functions, multinomial number, Euler's function and Polya Theory.	**PSO1 PSO2 PSO4**	**K1**
CO 2	Examine Sterling numbers, recurrence relations, multinomial theorem,	**PSO1 PSO2 PSO3 PSO4 PSO5**	**K2**

	permutations with forbidden positions and necklace problems.		
CO 3	Apply Stirling numbers of first kind, partitions of numbers and illustrate Burnside lemma.	**PSO1** **PSO2** **PSO3** **PSO4**	**K3**
CO 4	Analyze Bell numbers, inventory maps, sieve formula, the menage problem and cycle index of a permutation group.	**PSO1** **PSO2** **PSO3** **PSO4** **PSO5**	**K4**
CO 5	Access properties of Stirling numbers of the second kind, symmetric functions, inclusion-exclusion principle, Fibonacci sequences and Polya's Theorems and their applications.	**PSO1** **PSO2** **PSO3** **PSO4**	**K5**

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**COs**	**BLOOM'S TAXONOMY LEVEL**
I	Basic Combinatorial Numbers – Stirling Numbers of the First Kind – Stirling Numbers of the Second Kind. **Section: I.1**	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
II	Generating Functions and Recurrence Relations – Symmetric Functions. **Sections: I.2 and I.3**	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
III	Multinomials – Multinomial Theorem – Inclusion and Exclusion Principle. **Sections: I.4 and I.5 (up to page 77)**	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**

IV	Euler Function – Permutations with Forbidden Positions – The 'Menage' Problem – Problem of Fibonacci. **Sections: I.5 (from page 77) and I.6**	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
V	Polya Theory – Necklace Problem and Burnside's Lemma – Cycle Index of a Permutation Group – Polya's theorems and their Immediate Applications. **Sections: II.1, II.2 and II.3**	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**

Prescribed Books/Textbooks (1-5 books)

1.Combinatorics Theory and Applications, V. Krishnamurthy, East –West Press. 1989.

References

1.Ian Anderson, Combinatorics of finite sets, Oxford Science Publication, 2011.

Suggested Reading

1.Kenneth P. Boggart, Introductory Combinatorics, Pitman Books Ltd, 1983.

Web Resources

1. https://archive.nptel.ac.in/courses/111/106/111106155/
2. https://ocw.mit.edu/courses/18-212-algebraic-combinatorics-spring-2019/

Course Articulation Matrix for Discrete Mathematics

Co	Programme Outcomes							Programme Specific Outcomes							K Level
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO 1	3	3	2	2	1	-	-	3	3	2	2	1	-	-	K1
CO 2	3	3	3	2	1	-	-	3	3	3	2	1	-	-	K2
CO 3	3	2	3	2	1	-	-	3	2	3	2	1	-	-	K3
CO 4	2	3	3	2	2	-	-	2	3	3	2	2	-	-	K4
CO 5	3	3	2	2	-	-	-	3	3	2	2	-	-	-	K5
Avg.	2.8	2.8	2.6	2	1	-	-	2.8	2.8	2.6	2	1	-	-	
Avg	1.6							1.6							

Course title:	Mathematical Physics			
Course Code	111MT6M02			
Credits	3			
Hours / Cycle	4			
Category	Interdisciplinary			
Semester	III			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	60	0	0	60
Learning Objectives:	To learn about the partial differential equations with applications and to study special functions			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Remember the formation of partial differential equations by eliminating the arbitrary constants. Recall Clairaut's form, Lagrange's linear equation, one dimensional wave equation, one dimensional heat equation, two dimensional heat equation, Bessel's equation, Legendre's equation.	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K1		
CO2: Discuss the formation of partial differential equations by eliminating the arbitrary functions, partial differential equations of higher order	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K2		
CO3: Solve the partial differential equations by direct integration ; Solve partial differential equations of types $f(p,q) = 0$, $z = px + qy + f(p,q)$, $f(z,p,q) = 0$, $f_1(x,p) = f_2(y,q)$ Solve problems related to one dimensional wave equation, one dimensional and two	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K3		

dimensional heat equation. Solve problems related to Bessels' and Legendre's functions.		
CO4 Investigate the equations reducible to standard forms. Categorise non - homogeneous linear equations with constant coefficients. Analyse temperature distribution in a rectangular plate, an infinite plate, a rectangular plate with insulated sides. Analyse the reccurence formulae for Bessel's function and Legendre's polynomial.	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K4
CO5: Construct the solutions for 4 types of partial differential equations, Lagrange's equation, non - homogeneous linear equations with constant coefficients. Construct the derivations and solutions for one dimensional wave and heat equations, two dimensional heat equation. Justify orthogonal property for Legendre's polynomial.	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K5

Syllabus: Differential Geometry & Analytical Geometry of 3-dimensions				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	Introduction – Formation of Partial Differential Equations by Elimination of Arbitrary Functions – Formation of Partial Differential Equations by Elimination of Arbitrary Functions – Types of Solutions of Partial Differential Equations – Solutions by Direct Integration – First Order Partial Differential Equations – Solutions by Direct Integration – First Order Partial Differential Equations – Type I $f(p,q)=0$ - Type II $z=px+qy+f(p,q)$ (Clairaut's Form) - Type III $(z,p,q)=0$ Type IV $f_1(x,p) = f_2(y,q)$ - Equations Reducible to Standard Forms	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	Lagrange's Equation – Partial Differential Equations of Higher Order – Non-homogeneous Linear Equations with Constant Coefficient Chapter 3: Sections 3.11 – 3.13	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

III	Introduction – Derivation of One Dimensional Wave Equation – Solution of Wave Equation – One Dimensional Heat Flow – Solution of One Dimensional Heat Equation Chapter 4: Sections 4.0 – 4.4	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	Two Dimensional Heat equation – Cartesian Form – Temperature Distribution in a Rectangular Plate – Temperature Distribution in an Infinite Plate – Temperature Distribution In Rectangular Plate with Insulated Sides Chapter 4: Sections 4.5 – 4.8	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	Introduction – Bessel Functions (Omit Series Solution) - Legendre's Equation (Omit Series Solution) . Chapter 6: Sections 6.0 – 6.2	12	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

Engineering Mahematics Volume – III by S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, Second Edition, Scitech Publications (India) Pvt. Ltd., Chennai.

Reference Books

1. Engineering Mathematics Third Year – Part B by M.K. Venkataraman, The National Publishing Company, Chennai.
2. Higher Mathematics for Engineering and Science by M.K. Venkataraman, The National Publishing Company, Chennai.
3. Differential Equations, Third Edition by Shepley L. Ross, John Wiley & Sons, 2004.
4. B.D. Gupta, Mathematical Physics, Second Revised Edition, Vikas Publising House Pvt. Ltd. 2004 5. Courant and Hilbert, Mathematical Physics

Web Resources

8. https://onlinecourses.nptel.ac.in/noc22_ma37/preview
9. https://onlinecourses.nptel.ac.in/noc20_ma14/preview

Course Articulation Matrix for Differential Geometry & Analytical Geometry of 3-dimensions

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1

CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course title:	Linear Algebra			
Course Code	111MT4M01			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	IV			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To study the fundamental properties of vector space, dual space, various types of matrices and linear transformations.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Recall the fundamental concepts in vector space, Dimension of vector space, linear transformations and matrix representation of linear transformations	PSO2, PSO3, PSO4 PSO5, PSO7	K1		
CO2: Discuss properties of subspace, inner product space, matrices and different types of linear transformations.	PSO2, PSO3, PSO4 PSO5, PSO7	K2		
CO3: Solve problems related to change of basis and matrix of a linear transformation.	PSO2, PSO3, PSO4 PSO5, PSO7	K3		
CO4: Analyze direct sums and dimensions of vector spaces. Investigate eigen	PSO2, PSO3, PSO4 PSO5, PSO7	K4		

values, rank and determinant of matrices.		
CO5: Evaluate problems based on the theorems of vector spaces, matrices and different types of linear transformations	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Linear Algebra				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**UNIT I – Vector Spaces:** Definitions, examples – Subspaces and Quotient Spaces – Sums and Direct Sums – Linear Independence **Chapter 6: Sections 6.1 – 6.4.**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**UNIT II** Basis and Dimensions – Homomorphisms – Dual Spaces – Inner Product Spaces **Chapter 6: Sections 6.5 – 6.8**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	**UNIT III** Linear Transformations and Matrices: Algebra of Linear Transformations – Eigen values and Eigenvectors **Chapter 7: Sections 7.1 – 7.2**	12	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**UNIT IV** Matrix Algebra – Trace and Transpose of a Matrix – Rank of Matrix **Chapter 7: Sections 7.3, 7.5, 7.6**	14	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** Determinants – Hermitian and Unitary Transformations. **Chapter 7: Sections 7.8, 7.9**	13	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s) Modern Algebra, M.L. Santiago, Tata McGraw-Hill Publishing Co. Ltd, 2001.
Reference Books 1. Topics in Algebra, Second Edition, I.N. Herstein, Wiley Student edition, 2009. 2. Linear Algebra, Second Edition, Serge Lang, Addison Wesley Publishing Co., 1970.
Web Resources 10. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/ 11. https://nptel.ac.in/courses/111104137 12. https://www.youtube.com/watch?v=9pqhfDyzbhw

Course Articulation Matrix for Linear Algebra																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

s

Course title:	Advanced Calculus			
Course Code	111MT4M02			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	IV			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To impart the knowledge of set theory and the concepts of sequences and series with an extension to the ideas of metric spaces and limits of functions. To introduce the notion of Fourier Transforms with its properties and application in evaluating certain integrals of real valued functions.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Remember the basic concepts in sets, sequences and series. Recall fundamentals of metric spaces, different kinds of Fourier transform and its inverse transforms.	PSO 2, PSO 3, PSO 4, PSO 5, PSO 6	K1		
CO2: Examine the operations on sets, the convergence of sequences and series. Discuss properties of Fourier transforms.	PSO 2, PSO 3, PSO 4, PSO 5, PSO 6	K2		
CO3: Illustrate the countable sets, convergent sequences, bounded sequences, monotone sequences, Cauchy sequences, Metric spaces and convergence and absolute convergence of series of real numbers. Apply properties of various Fourier transforms to evaluate certain integrals.	PSO 2, PSO 3, PSO 4, PSO 5, PSO 6	K3		
CO4: Investigate countable sets, convergence and divergence of sequences and series. Analyse limits in metric spaces, and convolution and Parseval's identity of Fourier transforms.	PSO 2, PSO 3, PSO 4, PSO 5, PSO 6	K4		
CO5: Evaluate the least upper bounds and greatest lower	PSO 2, PSO 3, PSO 4, PSO 5, PSO 6	K5		

bounds, limit of sequences and series, limits of functions in real line and metric spaces and certain type of integrals using Fourier transforms.		

Syllabus: Algebra and Trigonometry				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**Sets and Functions :** Sets and elements – Operations on sets – Functions – Real valued functions – Equivalence – Countability – Real numbers – Least upper bounds. **Chapter 1**	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
II	**Sequences of Real Numbers:** Definition of a sequence and subsequence – Limit of a sequence – Convergent sequences – Divergent sequences – Bounded sequences – Monotone sequences – Operations on convergent sequences – Operations on divergent sequences. **Chapter 2: Sections 2.1 – 2.8**	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
III	**Sequences of Real Numbers:** Limit superior and limit inferior – Cauchy sequences. **Series of Real Numbers:** Convergence and divergence; Series with non-negative numbers; Alternating series; Conditional convergence and absolute convergence. **Chapter 2: Sections 2.9, 2.10, Chapter 3: Section 3.1 – 3.4**	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
IV	**Series of Real Numbers:** Tests for absolute convergence; Series whose terms form a non-increasing sequence. **Limits and metric spaces:** Limit of a function on a real line; Metric spaces; Limits in metric spaces. **Chapter 3**: Sections 3.6, 3.7, **Chapter4:** 4.1, 4.2 (In 4.2C examples 4 and 5 are omitted), 4.3	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
V	**Fourier Transform:** Complex form of Fourier integral formula, Properties of Fourier transform, Fourier Cosine and Fourier Sine Transforms, Properties, Convolution, Parseval's identity.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5

	Chapter 6: Sections 9 – 15.			

Prescribed Books/Textbook(s)

1. Methods of Real Analysis, Richard R. Goldberg (Oxford and IBH Publishing Co.), 1970. (for Units I to IV)
2. Calculus, Volume III, S. Narayanan and Manikavasagam Pillai, S. Viswanathan Printers & Publishers Pvt. Ltd, 2010. (for unit V)

Reference Books

1. Principles of Real analysis, Third edition, Walter Rudin, Mc-Graw Hill international edition, 1976.
2. Elements of Real Analysis, Shanti Narayan, M.D. Raisinhhania, S. Chand & Company Ltd., Twelfth Revised Edition, 2011.
3. Sequence and Series, S. Arumugam, Issac, New Gamma Publishing House, 1993
4. Transforms and Partial Differential Equations, Fifth revised edition, G. Balaji, 2010.

Books for further study

1. Real analysis, Volume I, K. Chandrasehhara Rao, K.S Narayan, S. Viswanathan Printers & Publishers Pvt. Ltd., 2008.
2. Introduction to Calculus and Analysis, Volume I, Richard Courant, Fiitz John, Springer, 2010.
3. Transforms and Partial Differential Equations, Fifth revised edition, G. Balaji, 2010.

Web Resources

1. https://ocw.mit.edu/courses/18-100a-real-analysis-fall-2020/pages/lecture-notes-and-readings/
2. https://onlinecourses.nptel.ac.in/noc20_ma51/preview
3. http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_REAL_ANALYSIS.PDF
4. https://ocw.mit.edu/courses/6-003-signals-and-systems-fall-2011/resources/mit6_003f11_lec16/

Course Articulation Matrix for Advanced Calculus

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	3	2	2	-	-	3	1	1	3	2	2	-	K1
CO 2	-	3	1	2	3	2	2	-	-	3	1	2	3	2	2	-	K2
CO 3	-	3	2	2	3	2	1	-	-	3	2	2	3	2	1	-	K3
CO 4	-	3	1	2	3	2	1	-	-	3	1	2	3	2	1	-	K4
CO 5	-	3	2	2	3	2	2	-	-	3	2	2	3	2	2	-	K5
Avg.	-	3	1.4	1.8	3	2	1.6	-	-	3	1.4	1.8	3	2	1.6	-	

Course title:	Discrete Mathematics II			
Course Code	111MT4A01			
Credits	5			
Hours / Cycle	6			
Category	Mandatory			
Semester	IV			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	To understand the Recurrence Relations and Generating Functions. To study the fundamental properties of Lattices.			

Course Outcome(s)	**PSO Addressed**	**Bloom's Taxonomy Levels**
CO1: Recall the fundamental concepts of Techniques of Proof, TF statements, Normal Forms and Lattices.	PSO2, PSO3, PSO4 PSO5, PSO6, PSO7	K1
CO2: Discuss the recurrence relations, connectives and the properties of Lattices.	PSO2, PSO3, PSO4 PSO5, PSO6, PSO7	K2
CO3: Solve problems involving Generating Functions, Truth Tables, New Lattices and Boolean Polynomials.	PSO2, PSO3, PSO4 PSO5, PSO6, PSO7	K3
CO4: Analyze Primitive Recursive Functions, Parsing tree of formulae, Principal Normal Forms, Modular and Distributive Lattices and Karnaugh Maps.	PSO2, PSO3, PSO4 PSO5, PSO6, PSO7	K4
CO5: Evaluate problems using the theorems of Lattices, Replacement Process, Tautological Implications and Mathematical Induction.	PSO2, PSO3, PSO4 PSO5, PSO6, PSO7	K5

Syllabus: Discrete Mathematics II				
Unit	**Content**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	**UNIT I – Mathematical Induction, Recurrence Relations and Generating Functions:** Techniques of Proof – Mathematical Induction – Recurrence – Polynomials and their Evaluations – Recurrence Relations – Generating Functions – Some Common Recurrence Relations – Primitive Recursive Functions – Recursive and Partial Recursive Functions. **Chapter IV: Sections 1 and 2, Chapter V: Sections 1, 2, 3, 6, 7, 8 and 9.**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
II	**UNIT II - Mathematical Logic:** TF Statements – Connectives – Atomic and Compound Statements – Well-Formed Statement Formulae –Parsing – Truth Table of a Formula – Tautology – Tautological Implications and Equivalence of Formulae. **Chapter IX: Sections 1 – 8.**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
III	**UNIT III - Mathematical Logic (Contd...):** Replacement Process – Functionally Complete sets of connectives and Duality law – Normal Forms – Principal Normal Forms. **Chapter IX: Sections 9 – 11, 12.**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
IV	**UNIT IV - Lattices:** Lattices – Some properties of Lattices – New Lattices – Modular and Distributive Lattices. **Chapter X: Sections 1 (omit Example 15, pp No. 10.6), 2, 3 (omit Remark, pp 10.14), 4 (omit Theorem 10 and 17, Example 4, pp 10.23, Example 11, pp 10.24).**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
V	**UNIT V - Boolean Algebra:** Boolean Algebra – Boolean Polynomials – Karnaugh Maps. **Chapter X: Sections 5 (omit Theorem 25), 6, 7 (omit K-Map for 5 and 6 vertices)**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**

Prescribed Books/Textbook(s)

Discrete Mathematics, M.K. Venkataraman, N. Sridharan and N. Chandrasekaran, The National Publishing Company, Chennai, 2003.
Reference Books 3. R. Johnsonbaugh, Discrete Mathematics, 5th Edn., Pearson Education, Asia, 2001. 4. C.L. Liu, Elements of Discrete Mathematics, McGraw Hill, New York, 1985. **Suggested Reading:** 1. J. Truss, Discrete Mathematics for Computer Scientists, 2nd Edn., Pearson Education, Asia, 2000. 2. M.K. Sen and B.C. Chakraborthy, Discrete Mathematics, 2nd Edn., Books and Allied Private Ltd., Kolkata, 2002.
Web Resources 1. https://onlinecourses.nptel.ac.in/noc20_cs37/preview 2. https://onlinecourses.swayam2.ac.in/cec20_ma02/preview 3. https://www.youtube.com/watch?v=g5c7xKcNWr0&list=PL15h-I4HvELJSw75O2ZVe0BKEQuzWBigB 4. https://www.youtube.com/watch?v=A3Ffwsnad0k&list=PLl-gb0E4MII28GykmtuBXNUNoej-vY5Rz

Course Articulation Matrix for Discrete Mathematics II

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	
Avg.	1.225								1.225								

Course title:	**Real Analysis**			
Course Code				
Credits				
Hours / Cycle	7			
Category	Mandatory			
Semester	V			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	105	0	0	105
Learning Objectives:	To impart the knowledge of continuity, topology of metric spaces and the concepts of differentiation and integration and Taylor's series. To introduce the notion convergence and uniform convergence of sequence and series of functions			

Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels
CO1: Recall the basics of metric spaces, calculus and convergence and divergence of sequence and series of functions.	PSO2, PSO3, PSO4, PSO5, PSO6, PSO7	K1
CO2: Discuss the relevance of topology of metric spaces, Differentiation and Integration. Examine the convergence and uniform convergence of sequence and series of functions	PSO2, PSO3, PSO4, PSO5, PSO6, PSO7	K2
CO3: Illustrate continuous function, topological properties of metric spaces, differentiation and integration of functions. Classify convergence and uniform convergence of sequence and series of functions.	PSO2, PSO3, PSO4, PSO5, PSO6, PSO7	K3
CO4: Analyze continuity, open sets, closed sets, connectedness, boundedness, completeness and completeness of metric spaces. Identify properties of differentiation and integration, convergence and uniform convergence.	PSO2, PSO3, PSO4, PSO5, PSO6, PSO7	K4

CO5: Construct continuous functions, topology of metric spaces, properties of differentiation and integration, Taylor's series, and convergence and uniform convergence of sequence and series of functions.	PSO2, PSO3, PSO4, PSO5, PSO6, PSO7	K5

Syllabus: Real Analysis				
Unit	**Content**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	**Continuous functions on Metric Spaces:** Functions continuous at a point on the real line, Reformulation, Functions continuous on a metric space, Open sets, Closed sets, Discontinuous functions on the real line. **Chapter 5**	22	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
II	**Connectedness Completeness and compactness:** More about open sets, Connected sets, Bounded sets and totally bounded sets, Complete metric spaces, Compact metric spaces **Chapter 6: Sections 6.1 – 6.5**	22	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
III	**Connectedness Completeness and compactness:** Continuous functions on a compact metric space, Continuity of inverse functions, Uniform continuity. **Calculus:** Sets of measure zero, Definition of the Riemann integral, Existence of the Riemann integral (Statement of theorem 7.3a only) – Properties of Riemann integral **Chapter 6: Sections 6.6 – 6.8, Chapter 7: Sections 7.1, 7.2, 7.4**	22	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5
IV	**Calculus:** Derivatives, Rolle's theorem, Law of mean, Fundamental theorems of calculus **Taylor Series:** Taylor's theorem. **Chapter 7: Sections 7.5 – 7.8, Chapter 8: Section 8.5**	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5

V	**Sequences and Series of Functions:** Pointwise convergence of sequences of functions – Uniform convergence of sequences of functions – Consequences of uniform convergence – Convergence and uniform convergence of series of functions – Integration and differentiation of series of functions. **Chapter 9: Sections 9.1 – 9.5**	19	CO1, CO2, CO3, CO4, CO5	K1, K2, K3,K4,K5

Prescribed Books/Textbook(s)
Methods of Real Analysis, Richard R. Goldberg, Oxford and IBH Publishing Co., 1970.

Reference Books

1. Modern Analysis, Arumugam, Issac, New Gamma Publishing House, 1993.
2. Elementary Analysis: The Theory of Calculus, Kenneth A. Ross, Springer, 2010.
3. MetricSpaces, Qamrulhasan Ansari, Narosa Publishing House, 2010.

Books for further reading

1. Understanding Analysis, Stephen Abbott, Springer, 2008.
2. Real analysis, Volume II, K. Chandrasekhara Rao, K.S Narayan, S. Viswanathan Printers & Publishers Pvt. Ltd, 2008.
3. Elements of Real Analysis, Shanti Narayan, M.D. Raisinghania, S. Chand & Company Ltd., Twelfth Revised Edition, 2011.

Web Resources

5. https://ocw.mit.edu/courses/18-100a-real-analysis-fall-2020/pages/lecture-notes-and-readings/
6. https://onlinecourses.nptel.ac.in/noc20_ma51/preview
7. http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_REAL_ANALYSIS.PDF

Course Articulation Matrix for Real Analysis

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PS O 1	PS O 2	PS O 3	PS O 4	PS O 5	PS O 6	PS O 7	PS O 8	Cog Level
CO 1	-	3	1	2	3	2	1	-	-	3	1	2	3	2	1	-	K2
CO 2	-	3	1	2	3	3	1	-	-	3	1	2	3	3	1	-	K3
CO 3	-	3	1	2	3	2	1	-	-	3	1	2	3	2	1	-	K3
CO 4	-	3	1	2	3	2	1	-	-	3	1	2	3	2	1	-	K3
CO 5	-	3	2	1	3	2	1	-	-	3	2	1	3	2	1	-	K4
Avg.	-	3	1.2	1.8	3	2.2	1	-	-	3	1.2	1.8	3	2.2	1	-	

Course title:	Mathematical Statistics			
Course Code	111MT5M02			
Credits	5			
Hours / Cycle	7			
Category	Mandatory			
Semester	V			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	105	0	0	105
Learning Objectives:	To study the properties of random variables and distributions. To analyse the given set of data using correlation, regression and tests of significance.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Recall the fundamental notions of random variables, distributions correlation, regression and tests of significance	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K1		
CO2: Compare various types of random variables, distributions and their properties. Discuss correlation, regression and tests of significance	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K2		
CO3: Solve problems related to random variables, distributions, correlation, regression and apply tests of significance to given data set	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K3		
CO4: Analyse various properties of random variables and distributions. Investigate given data set using correlation, regression and tests of significance	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K4		
CO5: Assess the properties of random variables, distributions correlation, regression and tests of significance	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K5		

Syllabus: Differential Geometry & Analytical Geometry of 3-dimensions				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	Discrete and Continuous Probability Distributions: Random variables – Probability distributions – Discrete and Continuous, Mathematical expectation, moments, moment generating function, characteristic function. Chapters 5: Sections 5.1 – 5.5.2, Chapter 7: Sections 7.1 – 7.3.2, 7.3.5	21	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
II	Special Discrete and Continuous Distributions: Introduction – Binomial, Poisson distributions – Normal distribution. Chapter 6: Sections 6.1 – 6.2.4, 6.3 - 6.3.5, Chapter 8: Sections 8.1 – 8.4	21	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
III	Correlation and Regression: Correlation coefficient, linear regression – equations of lines of regression. Chapter 10: Sections 10.1 – 10.6	21	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
IV	Tests of Significance – Large Samples: Introduction – Types of Sampling – Large samples – Testing the significance for a single proportion - Testing of significance for difference of proportions – Sampling of values of a variable – Sampling distribution of the mean – Confidence limits - Testing the significance of difference between standard deviations of two large samples. Chapter 12: Sections 12.1 – 12.8.2	21	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
V	Tests of Significance – Small Samples: Introduction – Chi – square distribution – Student's t – distribution – Snedecor's F distribution (Definitions only) – Properties (Statements only) - Tests of significance based on t, F - distributions, χ^2 test of goodness of fit, χ^2 test of independence. Chapter 13: Sections 13.1 – 13.2.2, 13.5 – 13.7.1, Chapter 15: Sections 15.2 – 15.2.2, 15.3.1, Chapter 16: Sections 16.1 - 16.3.3	21	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)
Mathematical Statistics, J. N. Kapur and H. C. Saxena, 20th Edition, S. Chand & Co. Ltd., New Delhi, 2010.
Reference Books 1. S. C. Gupta & V. K. Kapoor, Fundamental of Mathematical Statistics, 9th Edition, Sultan Chand & Sons, New Delhi, 1994. 2. P. R. Vittal, Mathematical Statistics, Margham Publications, Chennai, 2002..

Web Resources
https://ocw.mit.edu/courses/18-655-mathematical-statistics-spring-2016/ https://www.coursera.org/learn/basic-statistics https://stats.libretexts.org/Bookshelves/Introductory_Statistics

Course Articulation Matrix for Mathematical Statistics																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 2	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K2
CO 3	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 4	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 5	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
Avg.	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	
	2								2								

Course title:	Numerical Methods			
Course Code	111MT5M03			
Credits	5			
Hours / Cycle	6			
Category	Mandatory			
Semester	V			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	To obtain numerical solutions of algebraic and transcendental equations, learn about various interpolating and extrapolating methods, solve initial value problem in differential equations using numerical methods.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		

CO1: Remember various methods of solving algebraic and transcendental equations, difference operators, interpolation formula and formulae for solving ordinary differential equations	PSO2, PSO3, PSO4 PSO5, PSO7	K1
CO2: Examine iterative, bisection, Regular – Falsi, Newton Raphson method and various interpolation formula. Discuss numerical differentiation and integration and various methods to find numerical solution for ordinary differential equations.	PSO2, PSO3, PSO4 PSO5, PSO7	K2
CO3: Solve algebraic and transcendental equation and ODE using specific methods. Apply interpolation formulae, difference operator and concepts in numerical differentiation and integration.	PSO2, PSO3, PSO4 PSO5, PSO7	K3
CO4: Analyze types of algebraic and transcendental equations, summation of series, divided differences, interpolation, derivatives using Newton's difference formula and some methods for solving ODE.	PSO2, PSO3, PSO4 PSO5, PSO7	K4
CO5: Evaluate the difference table, forward, backward, divided differences, ODE using Taylor series, Picard, Euler and Runge – Kutta methods. Assess equations using iterative method, Bisection method, Regular Falsi method, Newton Raphson method.	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Numerical Methods				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**UNIT I** **Algebraic and Transcendental Equations:** Introduction, Errors in numerical computation, Iterative method, Bisection method, Regula-Falsi method, Newton-Raphson method. **Chapter 3: Sections 3.0 – 3.5**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**UNIT II** **Finite Differences:** Difference operators, other difference operators, Error propagation in a difference table, Summation of series. **Chapter 6: Sections 6.0 – 6.3**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	**UNIT III** **Interpolation:** Introduction, Newton's interpolation formulae, Bessels's and Stirling's formula, Lagrange's interpolation formulae, Divided differences, Newton's divided differences formula, Inverse interpolation. **Chapter 7: Sections 7.0 – 7.6**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**UNIT IV** **Numerical Differentiation and Integration:** Introduction, Derivatives using Newton's forward difference formula, Derivatives using Newton's backward difference formula, Numerical integration – Trapezoidal rule, Simpson's one – third, three – eighth rule, Weddle's rule. **Chapter 8: Sections 8.0 – 8.2, 8.5**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** **Numerical Solutions of Ordinary Differential Equations:** Introduction, Taylor's series method, Picard's method, Euler method, Runge-Kutta methods, Predictor-Corrector methods – Milne's method, Adam- Bashforth method. **Chapter 10: Sections 10.0 – 10.7**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

Numerical Methods, S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, SCITECH Publications Pvt. Ltd., Chennai, 2001.
Reference Books 1. Numerical Analysis, B. D. Gupta, Konark Publishers PVT LTD, New Delhi 2003. 2. Numerical Methods, First Edition, P. Kandaswamy, K. Thilagavathy, K. Gunavathi, S. Chand & Company LTD, New Delhi, 1997. 3. Numerical Methods, V. N. Vedamurthy, N.Ch.S.N. Iyengar, Vikas Publishing House Pvt. LTD, New Delhi, 1998.
Web Resources 1. https://archive.nptel.ac.in/courses/111/107/111107105/ 2. 3.

Course Articulation Matrix for Numerical Methods																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course title:	Programming in C			
Course Code	111MT5M04			
Credits	5			
Hours / Cycle	6			
Category	Mandatory			
Semester	V			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	To learn the syntax and functionalities of C Programming and its structure. To gain the knowledge and skills required to create programs and applications using C programming.			

Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels
CO1: Remember and recall the general form of C statements and basis of C programming.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K1
CO2: Discuss functions of various keywords involved in a C program.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K2
CO3: Apply the concepts of loops, arrays, structures, pointers and files in programs to solve mathematical problems	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K3
CO4: Analyze C statements and identify the solution of a mathematical problem with output of a C program.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K4
CO5: Design algorithm and write programs in C language for the given mathematical problems.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K5

Syllabus: Programming in C				
Unit	Content	Hours	COs	Bloom's Taxonomy Level

I	**UNIT I** Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output Operations **Chapters: 2, 3, 4.**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**UNIT II** Decision Making and Branching – Decision Making and Looping **Chapters: 5, 6**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	**UNIT III** Arrays – Character Arrays and Strings **Chapters: 7, 8**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**UNIT IV** User Defined Functions – Structures and Unions **Chapters: 9, 10**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** Pointers – File Management in C **Chapters: 11, 12**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s) Programming in ANSI C (4th Edn.), E. Balagurusamy, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2008.
Reference Books 5. Computer Programming in C, V. Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi, 1994. 6. Programming in C, P. Pandiyaraja, Vijay Nicole Imprints Pvt. Ltd., Chennai, 2005. 7. The C Programming Language, B.W. Kernighan and D.M. Ritchie, Prentice-Hall of India Pvt. Ltd., New Delhi, 1986. 8. Programming with C, B.S. Gottfried, Schaum's Outline Series, Tata McGraw-Hill, New Delhi, 1995.
Web Resources 13. https://nptel.ac.in/courses/106104128 14. https://www.youtube.com/playlist?list=PLRp3GssE9VZP80tWkbF984SDuPfOdZvSg 15. https://www.w3schools.in/category/c-tutorial/

Course Articulation Matrix for Programming in C																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	2	3	3	1	2	-	-	3	2	3	3	1	2	-	K1
CO 2	-	3	3	3	3	1	1	-	-	3	3	3	3	1	1	-	K2
CO 3	-	3	2	3	2	3	1	-	-	3	2	3	2	3	1	-	K3
CO 4	-	3	2	3	2	3	1	-	-	3	2	3	2	3	1	-	K4
CO 5	-	3	2	3	2	3	1	-	-	3	2	3	2	3	1	-	K5
Avg.	-	3	2.2	3	2.4	2.2	1.2	-	-	3	2.2	3	2.4	2.2	1.2	-	

Course Title	**COMPLEX ANALYSIS**			
Course Code	**111MT6M01**			
Credits	**5**			
Hours / Cycle	**6**			
Category	**Mandatory**			
Semester	**VI**			
Year of Implementation	**2011-12**			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	**0**	**0**	**90**
Course Objectives	**To acquire the knolwdge of analytic functions, harmonic functions and conformal mappings together with the idea of Taylor's and Laurent's series. To gain the**			

	knowledge of singularities of analytic functions and their classification and apply this idea in evaluating certain complex-valued and indefinite real-valued integrals.

CO #	Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels (K1 to K5)
CO 1	Remember function of a complex variable, mappings, conformal mappings, contours, convergence of sequence and series of complex numbers and residues at poles.	**PSO1** **PSO2** **PSO4**	**K1**
CO 2	: Examine theorems on limits, linear fractional transformations, derivatives and antiderivatives of analytic functions, absolute and uniform convergence of power series types of isolated singularities.	**PSO1** **PSO2** **PSO3** **PSO4** **PSO5**	**K2**
CO 3	Apply Cauchy-Riemann equations, mappings of upper half plane, Cauchy's integral formula, Taylor's series and Cauchy's residue theorem.	**PSO1** **PSO2** **PSO3** **PSO4**	**K3**
CO 4	Analyze sufficient conditions for analyticity cross-ratios and fixed point, Liouville's theorem and Fundamental theorem of algebra and improper real integrals.	**PSO1** **PSO2** **PSO3** **PSO4** **PSO5**	**K4**
CO 5	Evaluate harmonic functions, special linear fractional transformations, maximum modulus principle, integration and differentiation of power series and definite involving over a unit circle.	**PSO1** **PSO2** **PSO3** **PSO4**	**K5**

SYLLABUS				
UNIT	**CONTENT**	**HOURS**	**COs**	**BLOOM'S TAXONOMY LEVEL**
I	**Analytic functions**: Functions of a Complex variable, Mappings, limits, Theorem on limits, Continuity, derivatives, differentiation formulas, Cauchy Riemann equations, sufficient conditions, Polar coordinates, Analytic functions, Harmonic functions **Chapter 2: Sections 11, 12, 14, 15, 17 - 25**	**16**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
II	Conformal mapping – preservation of angles, Linear fractional transformations, an implicit form, mappings	**16**	**CO1** **CO2**	**K1** **K2**

	of the upper half plane, special linear fractional transformations, $w = z^2$, $w = e^z$. **Chapter 9: Section 94, Chapter 8: Sections 86 – 88, 90, Chapter 2: Section 13**		**CO3** **CO4** **CO5**	**K3** **K4** **K5**
III	. **Integrals**: Contours, Contour integrals, upper bounds for moduli of contour integrals, Anti derivatives, Cauchy Goursat theorem, Proof of the Cauchy Goursat theorem, Simply and Multiply connected domains,– Cauchy integral formula – Derivatives of Analytical functions. Liouville's theorem and Fundamental theorem of Algebra.– Maximum modulus principle. **Chapter 4: Sections 38 – 50**	**20**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
IV	Convergence of sequence, Convergence of series, Taylor's series , Laurent series, Absolute and uniform convergence of power Series, Continuity of sums of power series ,Integration and differentiation of power series. Uniqueness of series representation **Chapter 5: Sections 51 – 60**	**19**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
V	. Residues – Cauchy Residue theorem, Using a single residue, The three types of isolated singular points, Residues at poles, Zeros of analytical functions, Zeros and poles, Evaluation of real improper integrals, improper integrals from Fourier Analysis, Jordans lemma, Definite integrals involving sines and cosines. **Chapter 6: Sections 62 – 69, Chapter 7: Sections 71 – 74, 78**	**19**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**

Prescribed Books/Textbooks (1-5 books)

Complex variables and application Seventh Edition by James Ward Brown and Ruel V. Churchill, Mc-Graw Hill Book Co., International Student Edition, 2003.

References

1.Complex Analysis, Theodore W. gamelan, Springer Verlag, 2008.

2. Complex Analysis, S.Arumugam, A.Thangapandi Isaac, A.Somasundaram,Scitech publications(India)Pvt,Ltd.Dec2010.

3. ComplexAnalysis, T.K.ManicavachagomPillay, Dr.S.P.Rajagopalan, Dr.R.Sattanathan, S.Viswanathan Printers & Publishers Pvt. Ltd., 2008.

Suggested Reading

1.Complex Analysis, S.G.Venkatachalapathy, Margham Publication 2009.

2.Theory of functions of a Complex Variable, Shanti Narayan, Dr. P.K. Mittal, S. Chand and Company Ltd.2010.

Web Resources

1. https://archive.nptel.ac.in/courses/111/103/111103070/
2. https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/

Correlation of POs/PSOs to each CO and make a corresponding mapping table.

Course Articulation Matrix for Complex Analysis

Co	Programme Outcomes							Programme Specific Outcomes							K Level
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO 1	3	3	2	2	1	-	-	3	3	2	2	1	-	-	K1
CO 2	3	3	3	2	1	-	-	3	3	3	2	1	-	-	K2
CO 3	3	2	3	2	1	-	-	3	2	3	2	1	-	-	K3
CO 4	2	3	3	2	2	-	-	2	3	3	2	2	-	-	K4
CO 5	3	3	2	2	-	-	-	3	3	2	2	-	-	-	K5
Avg.	2.8	2.8	2.6	2	1	-	-	2.8	2.8	2.6	2	1	-	-	
Avg	1.6							1.6							

Course title:	Mechanics			
Course Code	111MT6M02			
Credits	5			
Hours / Cycle	6			
Category	Mandatory			
Semester	VI			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	To learn about the bodies at rest or forces in equilibrium and about the motion of bodies under the action of forces			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Recall concurrent system of forces, friction, types of friction, energy. Recall definitions of simple harmonic motion, seconds pendulum, conical pendulum, banked up track, central of force, apse	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K1		
CO2: Discuss triangle of forces, polygon of forces, laws of friction, path of a projectile,	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K2		

composition of two simple harmonic motions, motion of a body on curved track, banked up track, differential equation of a central orbit in Cartesian and p-r coordinates		
CO3: Application of parallelogram of forces, triangle of forces, polygon of forces. Illustration of the force of friction, conservation of energy, the cases with reference to the simple pendulum. Classification of the motion of a body on a vertical curve, outside/ inside of a smooth vertical circle; p-r equation of different curves	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K3
CO4: Analyse moment of a force, ladder problems, conservation of energy. Investigate the range of a projectile with reference to the inclined plane, motion of a body under different conditions, inverse square law	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K4
CO5: Construct Lami's theorem, Varignon's theorem. Justify principle of conservation of energy, cases with respect to the simple pendulum, differential equation of a central orbit. Assess the nature of the motion of a body in different parts.	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K5

Syllabus Mechanics				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	UNIT I – Statics: Concurrent system of forces: Triangle law of forces, Lami's Theorem, Polygon law of forces, Moment of a force, Varignon's Theorem. Chapter 2: Sections 2.1 – 2.9, 2.12 – 2.13, 2.14 – 2.16, Chapter 3: Sections 3.6, 3.7	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	UNIT II – Friction: Laws of friction, Angle of friction, Ladder problems. Chapter 4: Sectio Dynamics - Energy: Kinetic energy, Conservation of energy, Conservation forces. Chapter 3: Sections 3.8 – 3.14ns 4.1 – 4.5	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

III	UNIT III – Projectiles: Trajectory, Horizontal and inclined planes. S.H.M : General solution, Elastic strings, Composition of two S.H.M, Simple Pendulum, Seconds Pendulum. Chapter 5: Sections 5.1 – 5.7, Chapter 8: Sections 8.1 – 8.4, Chapter 9: Sections 9.3 – 9.5	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	UNIT IV – Motion of a particle along a curve: Conical Pendulum, Motion on a curved track, Circular track, Banked up track, Vertical curve, Motion on the outside of a smooth vertical circle, inside a vertical circle. Chapter 9: Sections 9.8 – 9.14	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	UNIT V – Central Orbits: Central forces, Differential equation of a central orbit, Pedal equation, Apse, p-r equation, Inverse square law. Chapter 10: Sections 10.1 – 10.8, 10.11	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

3. Statics, K.Viswanatha Naik, M.S.Kasi, Emerald Publishers, (1992)
4. Dynamics, K. Viswanatha Naik, M.S. Kasi, Emerald Publishers, 1992.

Reference Books

1. Mechanics, P.Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam, S.Chand & Company Ltd publications, 2010.
2. A text book of Statics, Dr. M.K. Venkataraman, Agasthiar Publications, 1994.
3. A text book of Dynamics, Dr. M.K. Venkataraman, Agasthiar Publications ,1994.

Web Resources

16. https://ocw.mit.edu/courses/8-01sc-classical-mechanics-fall-2016/
17. https://www.coursera.org/specializations/introduction-to-mechanics

Course Articulation Matrix for Mechanics

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3

CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course title:	Linear Programming			
Course Code	111MT6M03			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	VI			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To make the students become familiar with the basic principle of LPP and enrich knowledge to formulate and solve an LPP using various methods. To impart Optimization techniques.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: Recall the concepts of general linear programming, degeneracy in linear programming, general primal – dual pair, transportation problem and assignment problem	PSO2, PSO3, PSO4 PSO5, PSO7	K1		
CO2: Explain the mathematical formulation of linear programming problem, fundamental properties of solutions, formulation of a dual problem, existence of solution in transportation problem and basic terms used in sequencing.	PSO2, PSO3, PSO4 PSO5, PSO7	K2		
CO3: Solve the linear programming using graphical method, simplex method, Big – M method	PSO2, PSO3, PSO4 PSO5, PSO7	K3		

and duality principle. Illustrate the degeneracy in transportation problem and special cases in Assignment problem.		
CO4: Analyse the solutions of LPP using graphical method, Big - M method, principal of duality and transportation problem, Assignment problem.	PSO2, PSO3, PSO4 PSO5, PSO7	K4
CO5: Evaluate the LPP problems using graphical method, Simplex method, Duality principle, Transportation algorithm and problem of sequencing.	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Linear Programming				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**Unit I** **Linear programming Problem - Mathematical Formulation - Graphical Solution and Extension:** Introduction - Linear Programming Problem – Mathematical formulation of L.P.P – Illustration on Mathematical formulation of L.P.P. Graphical Solution Method – Some Exceptional Cases – General Linear Programming Problem –Canonical and Standard Forms of L.P.P. **Chapter 2: Sections 2.1 – 2.4, Chapter 3: Sections 3.1 – 3.5**	14	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**Unit II** **Linear programming Problem - Simplex Method:** Introduction - Fundamental Properties of Solutions (Theorems-Statement only)-The Computational Procedure-Use of Artificial Variables (only Big-M Method or Method of Penalties)-Degeneracy in Linear Programming. **Chapter 4: Sections 4.1 – 4.5**	16	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

III	**Unit III** **Duality in Linear Programming:** Introduction – General Primal-Dual Pair-Formulating a Dual Problem- Primal-Dual Pair in Matrix Form-Duality Theorems-Complementary Slackness Theorem-Duality and Simplex Method. **Chapter 5: Sections 5.1 – 5.7**	16	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**Unit IV** **Transportation Problem:** Introduction – LP formulation of the transportation Problem – Existence of solutions in T.P-Duality in Transportation Problem-The Transportation table-Loops in Transportation tables-Triangular Basis in a T.P-Solution of a Transportation Problem –Finding an Initial Basic Feasible Solution –Test for Optimality-Economic Interpretation of u_j and v_j - Degeneracy in Transportation Problem - Transportation Algorithm(Modi Method)-Stepping Stone Solution Method-Some Exceptional Cases. **Chapter 10: Sections 10.1 – 10.15**	16	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** **Assignment Problem:** Introduction- Mathematical Formulation of the problem-Solution Methods of Assignment Problems –Special Cases in Assignment Problem. **Sequencing Problem:** Introduction-Problem of Sequencing-Basic terms Used in Sequencing-Processing n jobs through Two Machines. **Chapter 11: Sections 11.1 – 11.4; Chapter 12: Sections 12.1 – 12.4**	13	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

Numerical Methods, S. Arumugam, A. Thangapandi Isaac, A. Somasundaram, SCITECH Publications Pvt. Ltd., Chennai, 2001.

Reference Books

1. Numerical Analysis, B. D. Gupta, Konark Publishers PVT LTD, New Delhi 2003.
2. Numerical Methods, First Edition, P. Kandaswamy, K. Thilagavathy, K. Gunavathi, S. Chand & Company LTD, New Delhi, 1997.
3. Numerical Methods, V. N. Vedamurthy, N.Ch.S.N. Iyengar, Vikas Publishing House Pvt. LTD, New Delhi, 1998.

Web Resources

1. https://nptel.ac.in/courses/112106134
2. https://www.youtube.com/watch?v=4U3B5lr-MqM
3. https://onlinecourses.swayam2.ac.in/cec23_ma02/preview

Course Articulation Matrix for Linear Programming																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course title:	Astronomy			
Course Code	111MT6M04			
Credits	4			
Hours / Cycle	5			
Category	Mandatory			
Semester	V			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
	75	0	0	75
Learning Objectives:	To understand the fundamentals of spherical trigonometry and apply it to study the motion of celestial bodies and celestial phenomena			

Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels
CO1: Recall the fundamentals of spherical trigonometry and celestial sphere, refraction, planetary motion, measurement of time, cycles of moon, eclipses	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K1
CO2: Discuss the mathematical principles related to celestial sphere, solar system, conversion of time, phases of moon and occurrence of eclipses.	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K2
CO3: Illustrate the applications of trigonometry in the study of celestial sphere and celestial objects, solve problems related to conversion of time	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K3
CO4: Investigate the patterns in the motion of celestial object and its effects on observation, time keeping for astronomical calculations	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K4
CO5: Evaluate the motion of celestial objects and methods of time keeping	PSO2, PSO3, PSO4,PSO5,PSO6,PSO7	K5

Syllabus: Differential Geometry & Analytical Geometry of 3-dimensions				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	Spherical Trigonometry: Sphere – Great circles and small circles – axis and poles of a circle – Distance between two points on a sphere – angle between two circles – Secondaries – angular radius – length of an arc of a small circle – spherical	17	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5

	triangle – cosine formula, sine formula, cotangent formula (without proof) Celestial Sphere: Celestial sphere – diurnal motion, celestial axis and equator – celestial horizon – Zenith and Nadir – Celestial Meridian – Cardinal points – Declination circles – Verticals – Parallactic angle – Rising and setting – Transit or culmination – due east, west, north, south – annual motion of sun – First point of Aries and First point of Libra – Equinoxes and Solstices – Celestial coordinates – Horizontal, Equatorial, Meridian, ecliptic systems – Hour Angle and azimuth at rising and setting – latitude of a place – Circumpolar Star – Twilight. Chapter I: Sections 1 – 8, 11 – 13, 21 – 23, Chapter II: Sections 39 – 82, Chapter III: Sections 111 – 116			
II	Refraction: Laws of refraction – Astronomical refraction – Tangent formula – General effects – Effects on rising or setting – Effect on R.A, declination – effect on small horizontal arc, vertical arc, any small arc – Cassini's Formula – Horizontal refraction Concepts of geocentric, heliocentric parallax, aberration, Precession and Nutation (definitions only) Overview of the universe – The solar system in general – the other planets – comets – galaxies. Chapter IV: Sections 117 – 131, Chapter V: Sections 135, 136, 140 – 145, Chapter VIII: Sections 190, 191, 194, Chapter IX: Sections 195, 196, Chapter X: Sections 204 – 206 Chapter XVII: Sections 327 - 340	15	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
III	Kepler's Laws: Kepler's Laws of planetary motion – Longitude of Perigee – Forward motion of the apse line – eccentricity of earth's orbit – To fix the position of a planet in its elliptical orbit – To express v as a series of u- mean anomaly – Kepler's equation – To express u as a series in m. Planetary Phenomena: Phases of the planets – Relation between sidereal and synodic period of a planet, brightness of the planets. Chapter VI: Sections 146-149,156-160, Chapter XIV: Sections 285 – 297.	15	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
IV	Time: Equation of time – Seasons – Calendar – Conversion of time Chapter VII: Sections 166 – 170, 172 – 189	13	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5
V	Moon: Relation between sidereal and synodic month – elongation – Phases of moon. Eclipses: Umbra and Penumbra – Lunar eclipse – Solar eclipse – Condition for occurrence of a solar eclipse – angular radius of the cross section of the shadow cone where moon enters –	15	C01 CO2 CO3 CO4 C05	K1,K2,K3, K4,K5

	length of earth's shadow – condition for the occurrence of a solar eclipse – ecliptic limits – maximum and minimum number of eclipses near a node - in a year – Saros of Chaldeans Chapter XII: Sections 229-241, Chapter XIII: Sections 256 – 275			

Prescribed Books/Textbook(s) Mathematical Statistics, J. N. Kapur and H. C. Saxena, 20th Edition, S. Chand & Co. Ltd., New Delhi, 2010. Astronomy by S. Kumaravelu and Susheela Kumaravelu, 2005.
Reference Books 1. Text Book on Spherical Astronomy, Sixth Edition, W.M. Smart, VIKAS Publishing House Pvt. Ltd., 1979. 2. Exploration of the Universe, Second Edition, George Abell, 1981.
Web Resources https://stellarium.org/ https://theskylive.com/planetarium

Course Articulation Matrix for Differential Geometry & Analytical Geometry of 3-dimensions																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 2	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K2
CO 3	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 4	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
CO 5	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	K3
Avg.	-	3	3	1	3	1	1	-	-	3	3	1	3	1	1	-	
	2								2								

Course title:	Formal Language and Graph Theory

Course Code	111MT6M06			
Credits	5			
Hours / Cycle	6			
Category	Mandatory			
Semester	VI			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	To understand the fundamental concepts in graph theory and its importance.			

Course Outcome(s)	**PSO Addressed**	**Bloom's Taxonomy Levels**
CO1: Recall the types of grammars, concept of automaton, types of automata, basic definitions and fundamental theorem of graphs.	PSO1, PSO2, PSO3, PSO4 PSO5, PSO7	K1
CO2: Examine the closure properties of grammars in the Chomskian hierarchy, normal form of CFG. Explain the graph structures and their properties and discuss the applicability of those concepts in real life problems.	PSO1, PSO2, PSO3, PSO4 PSO5, PSO7	K2
CO3: Illustrate the relation between grammars, languages and automata. Classify the Eulerian and Hamiltonian circuits.	PSO1, PSO2, PSO3, PSO4 PSO5, PSO7	K3
CO4: Identify the types of grammars and related languages. Analyse the graph isomorphisms, connectivity concepts.	PSO2, PSO3, PSO4 PSO5, PSO7	K4
CO5: Evaluate the types of grammars and construct the corresponding automata. Construct the principles for various graphs and trees.	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Formal Languages and Graph Theory				
Unit	**Content**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	**UNIT I – Phrase-Structure languages, Closure properties:** Four types of grammars, Chomskian hierarchy, Closure operations, Derivation trees, Ambiguity. **Chapter 2: Sections 2.1 – 2.4, Chapter 3: Sections 3.1, 3.2, Chapter 4: Sections 4.1, 4.2**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
II	**UNIT II - Normal form of CFG, Property of CFL:** Auxiliary lemmas, Chomsky Normal form, u-v theorem. **Chapter 4: Sections 4.3, 4.4 (up to Theorem 4.1 and examples 4.10, 4.11, 4.12), 4.5 (up to Theorem 4.3 and example 4.15)**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
III	**UNIT III - Finite State Automata:** Finite Automaton, Non-Deterministic Finite Automaton, Finite Automata and Regular sets, Closure properties of Regular sets, Characterization of the family of Regular sets. **Chapter 5: Sections 5.1 – 5.4 (up to Theorem 5.7 and examples using it)**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
IV	**UNIT IV - Introduction, Paths and Circuits:** Graphs, Incidence and degree of a vertex, Walks, Paths and Circuits, Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling Salesman Problem. **Chapter 1: Sections 1.1 – 1.6, Chapter 2: Sections 2.1 – 2.10**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**
V	**UNIT V - Trees, Fundamental Circuits, Cut-sets and Cut-vertices:** Trees, Properties of trees, On counting trees, Spanning trees, Fundamental circuits, Cut-sets, Properties of cut-sets, Connectivity and separability. **Chapter 3: Sections 3.1 – 3.10, Chapter 4: Sections 4.1 – 4.5**	18	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3, K4,K5**

Prescribed Books/Textbook(s)

1. **Formal Languages and Automata, Rani Siromoney, CLS, 1984.**
2. **Graph Theory with Applications to Engineering and Computer Science, Narsingh Deo, Prentice Hall of India Pvt. Ltd., 2005.**

Reference Books

1. D.P. Acharjya, Theory of Computation, MJP Publications, 2010.
2. 2. Peter Linz, An Introduction to Formal Languages and Automata, Narosa Publications, Fourth Edition, 2010.
3. S.P. Rajagopalan and R. Sattanathan, Graph Theory, Margham Publications, Chennai, 2009.
4. 5. S. Arumugam and S. Ramachandran, Invitation to Graph Theory, SCITECH Publications (India) Pvt. Ltd., Chennai, 2002.

Suggested Reading:

1. Kamala Krithivasan and R. Rama, Introduction to Formal Languages, Automata Theory and Computation, Pearson, Chennai, 2011.
2. S.A. Choudum, A First Course in Graph Theory, Macmillan India Ltd., New Delhi, 1999.

Web Resources

1. https://archive.nptel.ac.in/courses/106/103/106103070/#
2. https://ocw.mit.edu/courses/6-045j-automata-computability-and-complexity-spring-2011/pages/lecture-notes/
3. https://www.iitg.ac.in/dgoswami/Flat-Notes.pdf
4. https://archive.nptel.ac.in/courses/111/106/111106102/
5. http://discrete.openmathbooks.org/dmoi3/sec_trees.html

Course Articulation Matrix for Formal Languages and Graph Theory

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	2	3	1	1	2	-	1	-	2	3	1	1	2	-	1	-	K1
CO 2	1	3	2	1	3	-	1	-	1	3	2	1	3	-	1	-	K2
CO 3	1	2	2	1	3	-	1	-	1	2	2	1	3	-	1	-	K3
CO 4	-	3	1	1	2	-	1	-	-	3	1	1	2	-	1	-	K4
CO 5	-	3	2	1	2	-	1	-	-	3	2	1	2	-	1	-	K5

Avg.	**0.8**	**2.8**	**1.6**	**1**	**2.4**	**-**	**1**	**-**	**0.8**	**2.8**	**1.6**	**1**	**2.4**	**-**	**1**	**-**	
Avg.	**1.2**								**1.2**								

Course title:	Computer Training			
Course Code	111MT6M05			
Credits	3			
Hours / Cycle	2			
Category	Skill Based			
Semester	VI			
Year of Implementation	AY 2011-12			
Course Structure	Theory	Tutorial	Practical	Total Hours
		0	30	30
Learning Objectives:	To impart basic knowledge of MAXIMA in understanding commands for simple mathematical problems. To design mathematical structures using plot functions.			
Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels		
CO1: To recall the basics of MAXIMA and compile simple programs and graphics	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K1		
CO2: Discuss mathematical library functions of MAXIMA	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K2		
CO3: Apply MAXIMA built in functions provided to solve all types of mathematical and scientific problems and to use the graphics.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K3		
CO4: Analyze MAXIMA codes for debugging.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K4		
CO5: Assess MAXIMA codes to handle mathematical concepts.	PSO2, PSO3, PSO4,PSO5, PSO6, PSO7	K5		

Syllabus: Computer Training

Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**UNIT I** Introduction to Maxima, Equations – Find Roots, Roots of Polynomials, Solve Linear Systems, Solve Algebraic Systems, Solve ODE, Initial Value Problems, Boundary Value Problems, Solve ODE with Laplace.	6	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**UNIT II** Algebra – Generate Matrix, Generate Matrix from Expression, Enter Matrix, Invert Matrix, Characteristic Polynomial, Determinants, Eigenvalues, Eigenvectors, Adjoint Matrix, Transpose Matrix.	6	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	**UNIT III** Calculus – integration, Change Variables, Differentiation, Find Limits, Find Minimum, Get Series, Calculate Sum, Calculate Product, Laplace Transform, Inverse Laplace Transform, Greatest Common Divisor, Least Common Multiple, Divide Polynomials, Partial Fractions, Continued Fractions.	6	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**UNIT IV** Simplify – Simplify Expressions, Simplify Radicals, Factor Expression, Factor Complex, Expand Expression, Expand Logarithms, Contract Logarithms, Factorials and Gamma, Trigonometric Simplification, Complex Simplification.	6	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** Plot – Plot 2D, Plot 3D, Plot Format; Numeric – Toggle Numeric Output, To Float, To Bigfloat, Set Precision, Solving Linear Programming Problems – Simplex Methods.	6	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)
Reference Books Maxima 5.25.0 Manual (Internet Source: http://andrejv.github.com/wxmaxima/help.html)
Web Resources 1. https://maxima.sourceforge.io/ 2. file:///C:/maxima-5.47.0/share/doc/wxmaxima/wxmaxima.html

Course Articulation Matrix for Computer Training																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	2	3	2	3	1	-	-	3	2	3	2	3	1	-	K1
CO 2	-	3	2	3	3	3	1	-	-	3	2	3	3	3	1	-	K2
CO 3	-	3	2	3	3	3	1	-	-	3	2	3	3	3	1	-	K3
CO 4	-	3	2	3	3	3	1	-	-	3	2	3	3	3	1	-	K4
CO 5	-	3	2	3	3	3	1	-	-	3	2	3	3	3	1	-	K5
Avg.	-	3	2	3	2.8	3	1	-	-	3	2	3	2.8	3	1	-	

Course title:	Allied Mathematics I (For both Physics and Chemistry)			
Course Code	111MT1A01			
Credits	5			
Hours / Cycle	6			
Category	Allied			
Semester	II			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	To improve problem solving and analytical skills in differentiation and integration, apply the knowledge of direction cosines and direction ratios in straight lines and planes.			

Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels
CO1: Recall the concepts of partial differentiation, Jacobian, definite integrals, direction cosines, directions ratios, reciprocal equations, Fourier series and Cayley Hamilton Theorem.	PSO2, PSO3, PSO4 PSO5, PSO7	K1
CO2: Explain the total differential coefficient, properties of definite integral, even and odd functions, three forms of an equation of a plane, relation between the coefficients and the roots of an algebraic equation.	PSO2, PSO3, PSO4 PSO5, PSO7	K2
CO3: Solve the problems related to maxima and minima of function of two variables, integration of irrational functions, second order linear differential equations with constant coefficients, reciprocal equations, angle between two planes.	PSO2, PSO3, PSO4 PSO5, PSO7	K3
CO4: Analyze the properties of Jacobians, even and odd functions of Fourier series, properties of definite integral. Investigate the problems on equations of a plane and straight line, eigen values , eigen vectors and rank of matrices.	PSO2, PSO3, PSO4 PSO5, PSO7	K4
CO5: Evaluate problems on Lagrange's method of undetermined multipliers, integration of irrational numbers, Half range Fourier series, length of the perpendicular from the point to a plane and eigen values, eigen vectors of a Matrix.	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Allied Mathematics I				
Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**UNIT I** Introduction to Partial Differentiation - Partial Differentiation – Total differential co-efficient - Euler's Theorem – Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers. **Chapter 8: Sections 1.1 – 1.6, 4, 5** Jacobian - Definition and simple problems. **Chapter 6: Sections 1.1, 2.3, 2.4**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**UNIT II** Introduction - Integration of irrational functions - Methods of integration of the following types only: $\int \frac{dx}{\sqrt{ax^2+bx+c}}$, $\int \frac{(px+q)}{\sqrt{ax^2+bx+c}}dx$, $\int \sqrt{ax^2+bx+c}\,dx$, $\int (px+q)\sqrt{ax^2+bx+c}\,dx$, $\int \frac{dx}{(x+k)\sqrt{ax^2+bx+c}}$, $\int \frac{dx}{(ax^2+b)(\sqrt{cx^2+d})}$ Properties of Definite integrals - Integration by parts - Bernoulli's formula. **Chapter 1: Sections 8, 11, 12, 15.1**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	**UNIT III** Second order linear differential equations with constants co-efficients – Methods of finding particular integral of the functions of e^{ax}, $\sin ax$ or $\cos ax$, $e^{ax}V(x)$, x^m. Fourier series – Even and odd functions – Half range Fourier series. **Chapter 2: Sections 1 – 4; Chapter 6: Sections 1 – 5**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**UNIT IV** Analytical geometry of three dimensions: Direction Cosines – direction ratios. The plane: Three forms of an equation of a plane (without derivations) – Angle between the two planes – Length of the perpendicular	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

	from a point to the plane (simple problems only) – The straight line. **Chapter 1: Sections 7, 8; Chapter 2: Sections 1 – 3, 5 – 7, 10; Chapter 3: Sections 1 – 4**			
V	**UNIT V** Theory of equations: Nature of roots – Relation between the coefficients and the roots of an algebraic equation – Transformation of equations – Reciprocal equation. **Chapter 6: Sections 9 – 11, 15, 16** Matrices: Rank of a matrix – Eigen values and Eigen vectors – Cayley Hamilton theorem. **Chapter 2: Sections 11 – 16** **References**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

1. Calculus – Volume I by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2009. (for unit I)
1. Calculus – Volume II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers& Publishers Pvt. Ltd., 2009. (for unit I)
2. Calculus – Volumes II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007. (for unit II)
3. Calculus – Volume III by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007. (for unit III)
4. A Textbook of Analytical Geometry Part - II – Three Dimensions by T. K. Manicavachagom Pillay and T. Natarajan, S. Viswanathan Printers & Publishers Pvt. Ltd., 2009. (for unit IV)
5. Algebra Volume – I by T. K. Manicavachagom Pillay, T. Natarajan, K.S. Ganapathy, S. Viswanathan Printers and Publishers Pvt. Ltd., 2004. (for unit V)
6. Algebra Volume – II by T. K. Manicavachagom Pillay, T. Natarajan, K.S. Ganapathy, S. Viswanathan Printers and Publishers Pvt. Ltd., 2004. (for unit V)

Reference Books

1. Allied Mathematics (in single volume) P. R. Vittal, Margham Publications, Reprint 2005.
2. Allied Mathematics (For Physics, Chemistry and Computer Science Major Courses of Madras University) by A. Singaravelu (Meenakshi Traders), 2001

Web Resources

18. https://archive.nptel.ac.in/courses/111/106/111106100/
19. https://www.uah.edu/images/people/faculty/howellkb/DEText-Ch16.pdf

Course Articulation Matrix for Allied Mathematics I																	
CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5
Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course title:	Allied Mathematics II (for Chemistry)			
Course Code	111MT2A02			
Credits	5			
Hours / Cycle	6			
Category	Allied			
Semester	II			
Year of Implementation	AY 2023-24			
Course Structure	Theory	Tutorial	Practical	Total Hours
	90	0	0	90
Learning Objectives:	Learn to evaluate multiple integrals, the concept of vector differential operators, the applications of Integral theorems. To impart the knowledge of group theory to realize some concepts in chemistry.			

Course Outcome(s)	PSO Addressed	Bloom's Taxonomy Levels
CO1: Remember types of first order partial differential equations, definition of double and triple integrals, gradient, divergence, curl, groups and statement of Gauss divergence, Green's and Stoke's theorem.	PSO2, PSO3, PSO4 PSO5, PSO7	K1
CO2: Examine standard types of PDE, applications of multiple integrals, vector identities, application of integral theorem and the properties of group.	PSO2, PSO3, PSO4 PSO5, PSO7	K2
CO3: Solve PDE of first order, problems on double and triple integral, line, surfaces and volume integrals. Illustrate isomorphism of groups, Cayley's theorem and cyclic groups.	PSO2, PSO3, PSO4 PSO5, PSO7	K3
CO4: Analyze the order and derivative of PDE, change the order of integration, gradient, divergence, curl, integral theorems and properties of groups and cyclic groups.	PSO2, PSO3, PSO4 PSO5, PSO7	K4
CO5: Evaluate standard types of first order PDE, applications of multiple integrals, line, surface and volume integrals, integral theorems and problem in group theory.	PSO2, PSO3, PSO4 PSO5, PSO7	K5

Syllabus: Allied Mathematics II (for Chemistry)

Unit	Content	Hours	COs	Bloom's Taxonomy Level
I	**Unit I** **Partial Differential Equations** Introduction to Partial Differential Equations - Order and derivation of Partial Differential Equations, Different integrals of Partial Differential Equations, Solution of Partial Differential Equations in some simple cases, Standard types of first order Partial Differential Equations (standard types I to IV). **Chapter 4: Sections 1 – 4, 5.1 – 5.4**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
II	**Unit II** **Multiple Integrals** Introduction - Definition of double integral, evaluation of double integral (including changing the order of integration), triple integrals, application of multiple integrals (area enclosed between curves), volume as a triple integral. **Chapter 5: Sections 1, 2, 4, 5.1, 6.3**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
III	**Unit III** **Vector Calculus** Gradient, Divergence and curl, Vector identities, Line integral, Surface integral, Volume integral. **Chapter 2: Sections 1 – 12; Chapter 4: Sections 1 – 5**	18	C01 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
IV	**Unit IV** **Vector Integration** Statement of Gauss divergence theorem, Green's Theorem, Stokes theorem (without proof) and Applications. **Chapter 4: Sections 6 – 10**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5
V	**UNIT V** **Groups** Binary operation, Definition of groups, Abelian group, Infinite group, properties of groups, Composition table for finite sets, Addition modulo m, Multiplication modulo m, Permutation and order of an element, cyclic permutation, Integral powers of an element of a group, Isomorphism of groups, Cayley's theorem, cyclic group, Properties of cyclic groups. **Chapter 8: Section II: 1 – 6**	18	CO1 CO2 CO3 CO4 CO5	K1,K2,K3, K4,K5

Prescribed Books/Textbook(s)

1. Calculus – Volume III by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007. (for Unit I)

2. Calculus – Volume II by S. Narayanan and T. K. Manicavachagom Pillay, S. Viswanathan Printers & Publishers Pvt. Ltd., 2007. (for unit II)
3. Ancillary Mathematics Book III by S.Narayanan and T. K. Manicavachagam Pillay, S. Viswanathan Publishers, 1999. (for Unit III)
4. Ancillary Mathematics Book III by S. Narayanan and T. K. Manicavachagam Pillay, S. Viswanathan Publishers, 1999. (for unit IV)
5. Ancillary Mathematics Book I by S.Narayanan, T. K. Manicavachagom Pillay, Kandaswamy, R. Hanumantha Rao, 1999. (for Unit V)

Reference Books

1. Allied Mathematics by P. R. Vittal, Margham Publications, Reprint 2005.
2. Allied Mathematics – Paper II – Second Semester by P. Kandaswamy and K. Thilagavathy, S. Chand & Co., Reprint 2010.
3. Ancillary Mathematics Paper IV by Arumugam and Isaac , New Gamma Publishing House, 1992.

Web Resources

20. https://archive.nptel.ac.in/courses/111/105/111105122/
21. https://archive.nptel.ac.in/courses/111/101/111101153/

Course Articulation Matrix for Allied Mathematics II (for Chemistry)

CO	Programme Outcomes								Programme Specific Outcomes								
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO 8	Cog Level
CO 1	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K1
CO 2	-	3	2	1	3	1	1	-	-	3	2	1	3	1	1	-	K2
CO 3	-	2	2	1	3	1	1	-	-	2	2	1	3	1	1	-	K3
CO 4	-	3	1	1	2	1	1	-	-	3	1	1	2	1	1	-	K4
CO 5	-	3	2	1	2	1	1	-	-	3	2	1	2	1	1	-	K5

Avg.	-	2.8	1.6	1	2.4	1	1	-	-	2.8	1.6	1	2.4	1	1	-	

Course title:	Basic Mathematics			
Course Code	081MT1G01			
Credits	**2**			
Hours / Cycle	**4**			
Category	**General Course**			
Semester	**II**			
Year of Implementation	**AY 2024-25**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
Course Objectives:	To equip the student with a basic level knowledge of graph algorithms, data structures and real-life situations where these concepts can be applied.			
Course Outcome(s)	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**		
CO1: Recall basic concepts such as sets, functions, matrices and graphs of well-known functions.	**PSO1, PSO2, PSO3**	**K1**		
CO2: Explain the relationship between roots and coefficients, derivatives of simple functions, operations on sets, Compare one-one and onto functions.	**PSO1, PSO2, PSO3**	**K2**		
CO3: Apply the Newton's method to solve for roots of polynomials. Apply Cayley Hamilton Theorem to find the inverse of a matrix.	**PSO1, PSO2, PSO3, PSO6, PSO7**	**K3**		
CO4: Analyse the sum of, Geometric, Binomial, Exponential and Logarithmic series. Analyse the maxima and minima of functions.	**PSO1, PSO2, PSO3, PSO6, PSO7**	**K4**		
CO5: Evaluate the solutions of equations using the relationship between the roots and coefficients of the equation. Evaluate the solutions of first order first degree differential equations.	**PSO1, PSO2, PSO3, PSO6, PSO7**	**K5**		

Syllabus:				
Unit	**Content**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	**Algebra**: Sets and functions – Matrices	**15**	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3,K4,K5**
II	**Roots of Polynomial**: roots – relation between roots and coefficients – Remainder theorem and applications – Newton's Method. **Sequences and Series**: Arithmetic Progression, Geometric Progression and Sum to n terms, Binomial, Exponential and Logarithmic series. **Calculus:** Continuous and discontinuous functions – Graph of y = x, x2, x3, ex, log10x, sin x, cos x and tan x – Derivative of the above functions.	**15**	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3,K4,K5**
III	**Calculus:** Derivative of addition, subtraction, multiplication and quotient of two functions. Geometrical meaning of derivative, maxima and minima. Simple applications in Biology and Physics.	**15**	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3,K4,K5**
IV	**Integration:** Geometrical meaning of integration, Integration of the above functions, Integration of Partial fractions, Definite integration, Integration by parts, areas and volumes involving functions of the above type only.	**15**	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3,K4,K5**
V	**Differential Equations**: First order first degree – Solution of $\frac{dy}{dx} + Py = Q$ where P, Q are functions of x only.	**15**	**CO1 CO2 CO3 CO4 CO5**	**K1,K2,K3,K4,K5**

Reference books for further reading:

1. Applied Mathematics for the managerial, Life and Social Sciences (2nd Edn.), S.T.Tan, Stone Hill College.
2. Algebra, Vol. I by T.K. Manicavachagom Pillay and others, S.Viswanathan Printers & Publishers Pvt. Ltd., 1993
3. Calculus Vol. II by S. Narayanan and others, S.Viswanathan Printers & Publishers Pvt. Ltd., 1999.
4. Calculus Vol. III by S. Narayanan and others, S.Viswanathan Printers & Publishers Pvt. Ltd., 1999.
5. Engineering Mathematics Vol. I by M.K. Venkataraman, National Publishing Co. 1994.

Course Articulation Matrix															
Co	Programme Outcomes							Programme Specific Outcomes							K Level
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	
CO 1	3	3	2	2	1	-	-	3	3	2	2	1	-	-	1
CO 2	3	3	3	2	1	-	-	3	3	3	2	1	-	-	2
CO 3	3	2	3	2	1	-	-	3	2	3	2	1	-	-	3
CO 4	2	3	3	2	2	-	-	2	3	3	2	2	-	-	4
CO 5	3	3	2	2	-	-	-	3	3	2	2	-	-	-	5
Avg.	2.8	2.8	2.6	2	1	-	-	2.8	2.8	2.6	2	1	-	-	
Avg. for PO	1.6							Avg. for PSO	1.6						