

**JAYARAJ ANNAPACKIAM COLLEGE  
FOR WOMEN (AUTONOMOUS)**

**A Unit of the Sisters of St. Anne of Tiruchirappalli  
Accredited with 'A+' Grade (Cycle 4) by NAAC  
DST FIST Supported College  
Affiliated to Mother Teresa Women's University,  
Kodaikanal**

**PERIYAKULAM – 625 601, THENI DT.  
TAMIL NADU.**



**SYLLABUS 2020 - 2023**

**M. SC. MATHEMATICS**



## PG AND RESEARCH DEPARTMENT OF MATHEMATICS

### P.G. PROGRAMME OUTCOMES

PO. NO	UPON COMPLETION OF THIS PROGRAM THE STUDENTS WILL BE ABLE TO
1.	Endow with in-depth knowledge, analyze and apply the understanding of their discipline for the betterment of self and society.
2.	Synthesize ideas from various disciplines, enhance the interdisciplinary knowledge and extend it for research.
3.	Gain confidence and skills to communicate orally/ verbally in research platforms and state a clear research finding.
4.	Develop problem solving and computational skills and gain confidence to appear the competitive examination.
5.	Enhance knowledge regarding research by accumulating practical knowledge in specific areas of research.
6.	Achieve idealistic goals and enrich the values to tackle the societal challenges.

### P.G. PROGRAMME SPECIFIC OUTCOMES

PSO. NO.	UPON COMPLETION OF THE PROGRAM THE STUDENTS WILL BE ABLE TO	PO MAPPED
PSO-1	Solve complex mathematical problems using the knowledge of pure and applied mathematics	PO-1
PSO-2	Involve in research by incorporating the mathematical tools in science and technology	PO-5
PSO-3	Analyze and apply logical arguments to understand and apply mathematical concepts and techniques	PO-3
PSO-4	Model and solve real life problems using mathematical techniques and to develop scientific outlook in other disciplines	PO-4 PO-2
PSO-5	Interpret creatively the mathematical facts and figures to inculcate the individual scholarly research and to crack competitive examinations and procure their professional career	PO-1 PO-5 PO-6

**P.G. COURSE PATTERN (2020 - 2023) (UGC/ TANSICHE/ MTU)**

<b>Sem.</b>	<b>Code</b>	<b>Title of the Course</b>	<b>Hours</b>	<b>Credit</b>
I	20PMA1C01	Algebra - I	6	5
	20PMA1C02	Analysis - I	6	5
	20PMA1C03	Numerical Analysis	6	4
	20PMA1C04	Advanced Calculus	6	5
	20PMA1E1A/ 20PMA1E1B/ 20PMA1E1C	Cryptography/ Combinatorics/ Classical Mechanics	6	4
		<b>Total</b>	<b>30</b>	<b>23</b>
II	20PMA2C05	Algebra - II	6	5
	20PMA2C06	Analysis - II	6	5
	20PMA2C07	Mathematical Statistics	6	5
	20PMA2E2A/ 20PMA2E2B/ 20PMA2E2C	Optimization Theory/ Differential Geometry/ Graph Theory	6	4
	20PMA2GE1	IDC - MATLAB and LaTeX	4	3
	20PSE2S01	Soft Skills	2	1
		<b>Total</b>	<b>30</b>	<b>23</b>
III	20PMA3C08	Field Theory and Lattices	6	5
	20PMA3C09	Topology	6	5
	20PMA3C10	Complex Analysis	6	5
	20PMA3E3A/ 20PMA3E3B/ 20PMA3E3C	Stochastic Process/ Number Theory/ Calculus of Variations	6	4
	20PMA3GE2	IDC - Mathematical Skills	4	3
	20PSE3H02	Human Rights & Duties	2	1
	20PMA3IN1	Internship	-	2*
		<b>Total</b>	<b>30</b>	<b>23+2*</b>
IV	20PMA4C11	Functional Analysis	6	5
	20PMA4C12	Differential Equations	6	5
	20PMA4C13	Operations Research	6	5
	20PMA4R01	Project	12	6
	20PMA4SM1	MOOC'S	-	1*
	20PMA4S01	Comprehensive Examination	-	2*
		<b>Total</b>	<b>30</b>	<b>21+3*</b>
		<b>Total for All Semesters</b>	<b>120</b>	<b>90 + 5*</b>

## CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)

### THEORY

Component	Marks	Marks
Internal Test I	40	Converted to 25
Internal Test II	40	
Seminar	10	
Term Paper	5	
Attendance	5	
<b>Total</b>	<b>100</b>	<b>25</b>

## CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)

**Practical: 40 Marks**

**PASSING MINIMUM**

Semester Examination	
Theory	50% out of 75 Marks (i.e. 37.5 Marks)
Practical	50% out of 60 Marks (i.e. 30 Marks)

### PROJECT WORK

The ratio of marks for Internal and External Examination is 50:50

#### THE INTERNAL COMPONENTS OF PROJECTS

Components	Semester Examination
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
<b>Total</b>	<b>50</b>

#### EXTERNAL VALUATION OF PROJECT WORK

Components	Marks
Project	25
External Viva Voce	25
<b>Total</b>	<b>50</b>

### INTERNSHIP

Components	Marks
Report from the Organization	50
Review & Report	50
<b>Total</b>	<b>100</b>

## **INTERNAL QUESTION PATTERN**

**(Maximum Marks - 40)**

### **PART - A**

10 Questions × 1Mark = 10 Marks

### **PART - B**

2 Questions × 5 Marks = 10 Marks

(Internal Choice and One Question from Each Unit)

### **PART - C**

2 Questions × 10 Marks = 20 Marks

(Open Choice, Two Questions out of Three)

## **EXTERNAL QUESTION PATTERN**

**(Maximum Marks - 75)**

### **PART - A**

10 Questions × 1Mark = 10 Marks

(Two Questions from each Unit)

### **PART - B**

5 Questions × 5 Marks = 25 Marks

(Internal Choice and one set of Question from each Unit)

### **PART - C**

5 Questions × 8 Marks = 40 Marks

(Open Choice Five Questions out of Seven

At least One Question from each Unit)

## ALGEBRA-I

Semester: I

Hours: 6

Code : 20PMA1C01

Credit: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the concept of counting principles.	PSO - 1	K
CO - 2	Apply class equation and Sylow's theorem to solve different problems.	PSO - 3	Ap
CO - 3	Construct ideal rings from the fundamental concepts.	PSO - 4	E
CO - 4	Utilize the results of Euclidian Ring to Gaussian integer.	PSO - 1	C,K
CO - 5	Identify the reducible and irreducible polynomials.	PSO - 5	An, S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		ALGEBRA - I										Hours: 6
Code : 20PMA1C01												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO3	3	4	3	4	3	3	3	3	3	4	3	3.27
CO4	4	3	3	3	3	3	4	3	3	3	3	3.18
CO5	4	3	3	3	4	4	2	3	3	3	4	3.27
<b>Overall Mean Score</b>											<b>3.21</b>	

**Result:** The Score for this Course is **3.21** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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**UNIT I**

Another Counting Principle - Cauchy theorem - Sylow's theorem-Second part of  
- Sylow's theorem-Third part of Sylow's theorem. **(18 Hours)**

**UNIT II**

Direct Products - External direct Product - Internal direct Product - Finite Abelian  
Groups - Every finite Abelian group is the direct product of cyclic groups.  
**(18 Hours)**

**UNIT III**

Ideals and Quotient rings - More Ideals and Quotient rings - The Field of  
Quotients of an integral Domain. **(18 Hours)**

**UNIT IV**

Euclidean Rings - Definition-Principal Ideal Ring - Unique Factorization theorem -  
A Particular Euclidean Ring  $\mathbb{Z}[i]$  - Fermat theorem **(18 Hours)**

**UNIT V**

Polynomial Rings - Division Algorithm - Polynomial Rings over the Rational  
Field -Gauss' Lemma - The Eisenstein Criterion - Polynomial Rings over  
Commutative Rings. **(18 Hours)**

**COURSE BOOK:**

N. Herstein, Topics in Algebra ( 2<sup>nd</sup> Edition), John Wiley & Sons, 2012.

- Unit I** : Chapter 2 : sections 2.11, 2.12.  
(Theorem 2.12.1, Lemma 2.12.1 & 2.12.2 are omitted)
- Unit II** : Chapter 2 : sections 2.13, 2.14
- Unit III** : Chapter 3 : sections 3.4, 3.5, 3.6
- Unit IV** : Chapter 3 : sections 3.7, 3.8
- Unit V** : Chapter 3 : sections 3.9, 3.10, 3.11

**BOOKS FOR REFERENCE:**

1. Surjeet Singh, Modern Algebra, Edition 7, Vikas Publishing House Pvt. Limited, 2005.
2. Vijay K. Khanna., & Bhambri, S. K. A Course in Abstract Algebra. (Fourth Edition). Vikas Publishing House Pvt. Ltd, 2013.



## ANALYSIS - I

Semester: I

Hours: 6

Code : 20PMA1C02

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire basic knowledge of metric spaces and Euclidean spaces.	PSO -1	K
CO - 2	Build a foundation for Topology.	PSO -5	S
CO - 3	Understand the concepts of limits of sequences, series and functions.	PSO -1	K
CO - 4	Determine the continuity of functions.	PSO -3	An
CO - 5	Operate the extended real number system in terms of neighborhoods.	PSO-4	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		ANALYSIS - I										Hours: 6
Code : 20PMA1C02												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	4	3	3	3	4	3	3	3	3	3.18
CO - 2	4	2	3	2	4	4	3	3	3	3	4	3.18
CO - 3	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 4	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 5	3	4	3	4	2	3	3	3	3	4	3	3.18
<b>Overall Mean Score</b>											<b>3.18</b>	

**Result:** The Score for this Course is **3.18** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Finite, countable and uncountable sets - Metric spaces - compact sets - Perfect sets - Connected sets. **(18 Hours)**

### **UNIT II**

Numerical sequences and series - Convergent sequences - subsequences - Cauchy sequences - Upper and lower limits - Some special sequences - Series - Series of nonnegative terms. **(18 Hours)**

### **UNIT III**

The number  $e$  - The root and ratio tests - Power series - Summation by parts - Absolute convergence - addition and multiplication of series - Rearrangements. **(18 Hours)**

### **UNIT IV**

Continuity - Limits of functions - Continuous function - Continuity and compactness - Continuity and connectedness - Discontinuities - Monotonic functions - Infinite limits and limits at infinity. **(18 Hours)**

### **UNIT V**

Differentiation - The derivatives of a real function - Mean value theorems - The continuity of derivatives - L' hospital's rule - Derivatives of higher order - Taylor's theorem - Differentiation of vector valued functions. **(18 Hours)**

### **COURSE BOOK:**

Walter Rudin, Principles of Mathematical Analysis(Third Edition), McGraw - Hill International Book Company, International Student Edition), 1984.

<b>Unit I</b>	:	Chapter 2
<b>Unit II</b>	:	Chapter 3 Section 3.1 to 3.29
<b>Unit III</b>	:	Chapter 3 section 3.30 to 3.55
<b>Unit IV</b>	:	Chapter 4
<b>Unit V</b>	:	Chapter 5

### **BOOKS FOR REFERENCE:**

1. Tom P. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. A. J. White, Real Analysis, An Introduction, Addison Wesley Publishing Co., Inc. 1968.

## NUMERICAL ANALYSIS

Semester: I

Hours: 6

Code : 20PMA1C03

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Perform an error analysis for various numerical methods.	PSO - 1	K,C
CO - 2	Apply numerical methods to obtain approximate solutions to nonlinear equations.	PSO - 3	Ap
CO - 3	Determine the intermediate values in tabulated data using interpolation.	PSO - 3	An, Ap
CO - 4	Develop appropriate numerical methods to solve differential equations.	PSO - 5	S
CO - 5	Evaluate differentials and integrals using different formulae.	PSO - 4	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		NUMERICAL ANALYSIS										Hours: 6
Code : 20PMA1C03												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	4	3	3	3	3	3	4	3	3	3	3	3.27
CO - 4	4	3	3	3	3	3	4	3	3	3	3	3.27
CO - 5	3	4	3	4	3	3	3	3	4	3	3	3.27
<b>Overall Mean Score</b>											<b>3.23</b>	

**Result:** The Score for this Course is **3.23** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Transcendental and polynomial equations - Introduction -Bisection method - Iteration methods based on first degree equation - methods based on second degree equation- Rate of Convergence - Iteration Methods - Methods for Complex roots - Polynomial Equations. **(18 Hours)**

## **UNIT II**

Interpolation and Approximation - Introduction - Lagrange and Newton Interpolations - Finite difference operators - Interpolating polynomials using Finite Differences - Hermite Interpolations. **(18 Hours)**

## **UNIT III**

Numerical Differentiation - Introduction - Numerical Differentiation - Extrapolation methods - partial differentiation. **(18 Hours)**

## **UNIT IV**

Numerical Integration - Methods Based on Interpolation - Composite Integration Methods - Romberg Integration - Double Integration. **(18 Hours)**

## **UNIT V**

Ordinary Differential Equations - Introduction - Numerical Methods - Single step Methods. **(18 Hours)**

## **COURSE BOOK:**

M. K. Jain, S. R. K. Iyengar & R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Pvt. Ltd., Publishers, Third Edition, 1996.

<b>Unit I</b>	:	Chapter 2 Sections 2.1 to 2.8
<b>Unit II</b>	:	Chapter 4 Sections 4.1 to 4.5
<b>Unit III</b>	:	Chapter 5 Sections 5.1 to 5.5
<b>Unit IV</b>	:	Chapter 5 Sections 5.6, 5.7, 5.9, 5.10, 5.11
<b>Unit V</b>	:	Chapter 6 Sections 6.1 to 6.3

## **BOOKS FOR REFERENCE:**

1. John H. Mathews, Numerical Methods for Mathematics, science, and Engineering, Volume 54 of Lecture notes in Physics, Prentice hall, 1992.
2. Shankara Rao K., Numerical Methods for Scientists and Engineers, Prentice Hall of India, 2001.

## ADVANCED CALCULUS

Semester: I

Hours: 6

Code : 20PMA1C04

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop analytic and numerical techniques for solving problems using fundamental theorem of integral calculus.	PSO -5	S,Ap
CO - 2	Analyze the concepts of implicit functions theorems.	PSO -3	An
CO - 3	Evaluate integrals over curves and surfaces.	PSO - 4	E
CO - 4	Explain the concept of differential forms	PSO - 1	K
CO - 5	Deduce Poisson's equation from inhomogeneous wave equation.	PSO -1, PSO -3	S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: I		ADVANCED CALCULUS										Hours: 6
Code : 20PMA1C04												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	4	4	3	3	3	3	4	3.36
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	3	4	2	4	3	3	3	3	3	4	3	3.18
CO - 4	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 5	4	3	4	3	3	3	4	3	4	3	3	3.36
<b>Overall Mean Score</b>											<b>3.23</b>	

**Result:** The Score for this Course is 3.23 (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## UNIT I

Integration -The definite integral -The lower and upper integral of  $f$  over  $R$ - Sets of zero area-Basic Existence theorem for definite integral-Evaluation of definite integrals-Fundamental theorem of integral calculus. **(18 Hours)**

## UNIT II

Differentials of transformations - Local approximations - Differentiable at a point and on an open set - Mean value theorem-Inverses of transformations -Jacobian of  $T$ - The implicit functions theorems- Functional dependence. **(18 Hours)**

## UNIT III

Transformations of multiple integrals - Curves and arc length - Direction cosines for the line - Rectifiable curve - Smoothly equivalent curves - Surfaces and surface area - Smooth surface - Normal to smooth surface - Area of smooth surface -Smoothly equivalent surfaces - Orientable manifold -Integrals over curves and surfaces. **(18 Hours)**

## UNIT IV

Differential forms -Curve functional - Surface functional - Region functional - Line integrals 1-form & 2-form in the  $XY$  plane-3-form in the  $XYZ$  space - Addition and multiplication of forms-Differentiation for forms - Vector analysis -Inner product - The theorems of Green, Gauss and Stokes. **(18 Hours)**

## UNIT V

Exact forms and closed forms - Simply connected set - Applications - Inhomogeneous wave equations-Poisson's equation - Laplace equation - Harmonic functions- Green's first and second identities. **(18 Hours)**

## COURSE BOOK:

R. Creighton Buck, Advanced calculus (THIRD EDITION), McGraw Hill Kogakusha (International Student Edition), 1978.

- Unit I** : Chapter 4 Sections 4.2 & 4.3
- Unit II** : Chapter 7 Sections 7.4 , 7.5 , 7.6 & 7.7
- Unit III** : Chapter 8 Sections 8.3, 8.4, 8.5 & 8.6
- Unit IV** : Chapter 9 Sections 9.2, 9.3 & 9.4
- Unit V** : Chapter 9 Sections 9.5 & 9.6

## BOOKS FOR REFERENCE:

1. LYNNE LOOMIS and SHLOMOSTERN BERG, Advanced Calculus, Revised Edition, Jones and Barlett Publishers, Boston, London.  
[http://people.math.harvard.edu/~shlomo/docs/Advanced\\_Calculus.pdf](http://people.math.harvard.edu/~shlomo/docs/Advanced_Calculus.pdf)
2. Frederick S. Woods, Advanced Calculus, New Edition, Ginn and Company, Newyork.

## CRYPTOGRAPHY

Semester: I

Hours: 6

Code : 20PMA1E1A

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Encrypt and decrypt the hidden messages.	PSO-1	K
CO - 2	Compare asymmetric and symmetric encryption.	PSO-3	E
CO - 3	Analyze the structure and design of Advanced Encryption System.	PSO-3	An
CO - 4	Develop an algorithm for decryption and encryption.	PSO-4	S
CO - 5	Apply the basic techniques to protect data in computer and communication environment.	PSO-5	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		CRYPTOGRAPHY										Hours: 6
Code : 20PMA1E1A												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 4	3	4	3	4	3	3	3	3	3	4	3	3.27
CO - 5	4	3	3	3	4	4	3	3	3	3	4	3.36
<b>Overall Mean Score</b>											3.23	

**Result:** The Score for this Course is **3.23** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Data Encryption Techniques - Introduction - Encryption Methods - Cryptography - Cryptanalysis - Substitution Ciphers - Transposition Ciphers - Steganography. **(18 Hours)**

### **UNIT II**

Data Encryption Standards - Block Ciphers - Block Ciphers Modes of Operation - Feistel Ciphers - Data Encryption Standard - Triple DES - DES Design Criteria - Side Channel Attacks - Other Block Ciphers - Differential Cryptanalysis - Linear Cryptanalysis. **(18 Hours)**

### **UNIT III**

Advanced Encryption Standard - Introduction - Advanced Encryption Standard - Overview of Rijndael - Optimization of the Cipher - Advantages and Limitations of Rijndael - Comparison of AES with Other Ciphers. **(18 Hours)**

### **UNIT IV**

Symmetric Ciphers - Blowfish Encryption Algorithm - RC5 - RC4 - RC6 - Comparison between RC6 and RC5 - Idea. **(18 Hours)**

### **UNIT V**

Public Key Cryptosystems - Introduction - Public Key Encryption - The RSA Algorithm - Timing Attacks. **(18 Hours)**

### **COURSE BOOK:**

V. K. Pachghare, Cryptography and Information Security, PHI Learning Private Limited 2010.

<b>UNIT I</b>	: Chapter 2 Sections 2.1 - 2.7
<b>UNIT II</b>	: Chapter 3 Sections 3.1 -3.10.
<b>UNIT III</b>	: Chapter 4 Sections 4.1 - 4.6
<b>UNIT IV</b>	: Chapter 5 Sections 5.1 - 5.6
<b>UNIT V</b>	: Chapter 7 Sections 7.1 - 7.4

### **BOOKS FOR REFERENCE:**

1. William Stallings, Cryptography and Network Security Principles and Practices, fourth Edition, Prentice Hall.
2. Bruce Schneier, Applied Cryptography, Second Edition, Wiley India.



## COMBINATORICS

Semester: I

Hours: 6

Code : 20PMA1E1B

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the advanced concept of permutations and combinations	PSO-1	K
CO - 2	Compute generating function and apply them to a combinatorial problem	PSO-3	S
CO - 3	Solve linear recurrence relation	PSO-5	An
CO - 4	Apply the inclusion /exclusion principle	PSO-1	Ap
CO - 5	Use poly's theory to count certain configuration in combinatorial aspects.	PSO-5	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		COMBINATORICS										Hours: 6	
Code : 20PMA1E1B												Credits: 4	
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's	
	1	2	3	4	5	6	1	2	3	4	5		
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3	3.18
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3	3.18
CO - 3	4	3	3	3	4	4	3	3	3	3	4	4	3.36
CO - 4	4	3	3	3	3	3	4	3	3	3	3	3	3.18
CO - 5	4	3	3	3	4	4	3	3	3	3	4	4	3.36
<b>Overall Mean Score</b>												<b>3.25</b>	

**Result:** The Score for this Course is **3.25** (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Permutations and combinations: introduction - the rules of sum and product - permutations - combinations - distribution of distinct objects - distribution of non distinct objects Stirling's formula. **(18 hours)**

## **UNIT II**

Generating functions : Introduction - generating functions for combinations - enumerators for permutations - distribution of distinct objects into non-distinct cells - partitions of integers - the Ferrer's graph - elementary relations. **(18 Hours)**

## **UNIT III**

Recurrence relations : introduction - linear recurrence relations with constant coefficients - solutions by the technique of generating functions - a special class of non linear difference equations - recurrence relation with two indices. **(18 Hours)**

## **UNIT IV**

The principle of inclusion and exclusion:- introduction - the principle of inclusion and exclusion - the general formula -Derangements - permutations with restrictions on relative positions - the Rook's polynomials-Permutations with forbidden positions. **(18 Hours)**

## **UNIT V**

Polya's theory of counting -introduction - sets, relations and groups - equivalence classes under permutation groups - equivalence classes of functions - weights and inventories of functions - Polya's fundamental theorem - generalisation of Polya's theorem. **(18 Hours)**

## **COURSE BOOK:**

C. L. Liu, Introduction to Combinatorial Mathematics, McGraw Hill Publishing Company Ltd., 1968.

<b>Unit I</b>	:	Chapter 1 Sections 1.1 to 1.7
<b>Unit II</b>	:	Chapter 2 Sections 2.1 to 2.7
<b>Unit III</b>	:	Chapter 3 Sections 3.1 to 3.5
<b>Unit IV</b>	:	Chapter 4 Sections 4.1 to 4.6
<b>Unit V</b>	:	Chapter 5 Sections 5.1 to 5.7

## **BOOKS FOR REFERENCE:**

1. Anderson, Combinatorial Mathematics. Elarendon Press, 1974.
2. Balaji, G., Discrete Mathematics. (3rd Edition).G. Balaji Publishers.

## CLASSICAL MECHANICS

Semester: I

Hours: 6

Code : 20PMA1E1C

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the elementary principles and Formulate the Lagrangian.	PSO- 1	K
CO - 2	Derive Lagrangian equations from Hamilton's principle.	PSO - 3	An, Ap
CO - 3	Extend Hamilton's principle to nonholonomic system.	PSO - 4	S
CO - 4	Reduce two body problem to one body problem.	PSO - 5	E
CO - 5	Describe planar and spatial motion of rigid body.	PSO - 4	S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		CLASSICAL MECHANICS										Hours: 6
Code : 20PMA1E1C												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	3	4	3	4	3	3	3	3	3	4	3	3.27
CO - 4	4	3	3	3	4	4	3	3	3	3	4	3.36
CO - 5	3	4	3	4	3	3	3	3	3	4	3	3.27
<b>Overall Mean Score</b>											<b>3.25</b>	

**Result:** The Score for this Course is **3.25** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Survey of the elementary principles - Mechanics of a particle, mechanics of a system of particles - Constraints - D' Alembert's Principle and Lagrange's Equations - Velocity - dependent potentials and the dissipation function - Simple applications of the Lagrangian formulation. **(18 Hours)**

## **UNIT II**

Variational principles and Lagrange's Equation - Hamilton's principle - Some techniques of the calculus of variations - Derivation of Lagrangian's equations from Hamilton's Principle. **(18 Hours)**

## **UNIT III**

Extension of Hamilton's principle to non holonomic systems - Advantages of variational principle formulation - Conservation theorems and symmetry properties. **(18 Hours)**

## **UNIT IV**

The two body central force problem - Reduction to the equivalent one body problem- The equations of motion and first integrals - The equivalent one dimensional problem and classification of orbits- The virial theorem - The differential equation for the orbit and integrable power-law potentials - Conditions for closed orbits (Bertrand's theorem). **(18 Hours)**

## **UNIT V**

The Kepler problem - Inverse square law of force - The motion in time in the Kepler problem - The Laplace - Runge - Lenz vector. **(18 Hours)**

## **COURSE BOOK:**

- ❖ Herbert Goldstein, Classical Mechanics (Second Edition), Narosa Publishing House, 2001.

<b>Unit I</b>	:	Chapter 1
<b>Unit II</b>	:	Chapter 2 Sections 2.1-2.3
<b>Unit III</b>	:	Chapter 2 Sections 2.4-2.6
<b>Unit IV</b>	:	Chapter 3 Sections 3.1-3.6
<b>Unit V</b>	:	Chapter 3 Sections 3.7 -3.9

## **BOOKS FOR REFERENCE:**

1. D. E. Rutherford, Classical Mechanics, Oliver Boyd, New York, 2000.
2. J. C. Upadhyaya, Classical Mechanics, Himalaya publishing House, Mumbai, 2003.

## ALGEBRA - II

Semester: II

Hours: 6

Code : 20PMA2C05

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand Module as a generalization of Vector Space.	PSO -1	K
CO - 2	Construct the abelian groups generated by finite number of elements.	PSO - 3	S
CO - 3	Differentiate between linearly independent vectors and linearly dependent vectors.	PSO - 5	An
CO - 4	Find the matrices corresponding to linear transforms.	PSO -1	Ap
CO - 5	Reduce the matrix to rational triangular form and canonical form.	PSO-5	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		ALGEBRA - II										Hours: 6
Code : 20PMA2C05												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.27
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	4	3	3	3	4	4	3	3	3	3	4	3.36
CO - 4	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 5	4	3	3	3	4	4	3	3	3	3	4	3.36
<b>Overall Mean Score</b>												<b>3.27</b>

**Result:** The Score for this Course is **3.27** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Vector spaces - Elementary Basic Concepts - Subspaces - Homomorphism - Isomorphism - Internal direct Sum - Linear Independence - Linear Span - Finite Dimensional vector space - linearly independent vectors - Basis of V - Dual spaces. **(18 Hours)**

## **UNIT II**

Inner Product Spaces - Norm of a vector-Orthogonal vectors-Orthogonal Complement - Orthonormal Set-Modules-Cyclic modules and Finitely generated modules. **(18 Hours)**

## **UNIT III**

Linear transformations -The Algebra of Linear Transformations - Algebra over a field F-Invertible or Regular Transformation - Singular Transformation - Characteristic Roots - Matrices-Algebra of Matrices-Canonical Forms : Triangular Form. **(18 Hours)**

## **UNIT IV**

Canonical Forms : Nilpotent Transformations - A decomposition of V : Jordan Form - Jordan Canonical Form - Rational Canonical Form - Trace and Transpose. **(18 Hours)**

## **UNIT V**

Determinants - The formal Properties in the theory of Determinants - Cramer's Rule for solving the system of linear Equations - Hermitian, Unitary, and Normal Transformations - Real Quadratic Forms. **(18 Hours)**

## **COURSE BOOK:**

I. N. Herstein, Topics in Algebra (Second Edition), John Wiley & Sons, 2012

<b>Unit I</b>	:	Chapter 4 Sections 4.1 - 4.3
<b>Unit II</b>	:	Chapter 4 Sections 4.4 - 4.5
<b>Unit III</b>	:	Chapter 6 Sections 6.1 - 6.4
<b>Unit IV</b>	:	Chapter 6 Sections 6.5 - 6.8
<b>Unit V</b>	:	Chapter 6 Sections 6.9 - 6.11

## **BOOKS FOR REFERENCE:**

1. Vijay K. Khanna., & Bhambri, S. K. A Course in Abstract Algebra. (Fourth Edition). Vikas Publishing House Pvt. Ltd, 2013.
2. Kenneth Hoffman, Ray Kunze, Linear Algebra (Second Edition), Pearson India Education Services Pvt. Ltd.

## ANALYSIS - II

Semester: II

Hours: 6

Code : 20PMA2C06

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Compare the convergence and uniform convergence of sequence of functions	PSO - 3	E
CO - 2	Extend the structure of the real line to complex and vector valued functions on intervals	PSO - 5	S
CO - 3	Derive the properties of analytic functions	PSO - 3	An, Ap
CO - 4	Discuss integration of real valued functions on intervals	PSO - 1	K,C
CO - 5	Develop the Lebesgue integral in several distinct ways	PSO - 4	S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		ANALYSIS - II										Hours: 6
Code : 20PMA2C06												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 2	4	3	3	3	4	4	3	3	3	3	4	3.36
CO - 3	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 4	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 5	3	4	3	4	3	3	3	3	3	4	3	3.27
<b>Overall Mean Score</b>											<b>3.23</b>	

**Result:** The Score for this Course is **3.23** (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

The Riemann - Stieltjes integral - Definition and existence of the integral - properties of the integral - integration and differentiation. **(18 Hours)**

## **UNIT II**

Sequences of series of functions - Discussion of Main Problem - uniform convergence - uniform convergence and continuity - uniform convergence and integration-uniform convergence and differentiation. **(18 Hours)**

## **UNIT III**

Equicontinuous families of functions - The Stone Wierstrass theorem -Some Special Functions- power series - the exponential and logarithmic functions - The trigonometric functions. **(18 Hours)**

## **UNIT IV**

The algebraic completeness of the complex field - Fourier series-The Gamma function - some consequences - Stirling's formula. **(18 Hours)**

## **UNIT V**

The Lebesgue theory- set functions - construction of the Lebesgue Measure - measure spaces - measurable functions - simple functions - integration-comparison with the Riemann integral - integration of complex functions-functions of class  $L^2$ . **(18 Hours)**

## **COURSE BOOK:**

Walter Rudin, Principles of Mathematical Analysis(Third edition) , McGraw-Hill International Company (International Student Edition),1976.

<b>Unit I</b>	:	Chapter 6 Sections 6.1 to 6.22
<b>Unit II</b>	:	Chapter 7 Sections 7.1 to 7.18
<b>Unit III</b>	:	Chapter 7 Sections 7.19 to 7.33 & Chapter 8 Sections 8.1 to 8.7
<b>Unit IV</b>	:	Chapter 8 Sections 8.8 to 8.22
<b>Unit V</b>	:	Chapter 11

## **BOOKS FOR REFERENCE:**

1. Tom P. Apostol, Mathematical Analysis,Narosa Publishing House, New Delhi, 1985.
2. A. J.White, Real Analysis, An Introduction, Addison Wesley Publishing Co., Inc. 1968.



## MATHEMATICAL STATISTICS

Semester: II

Hours: 6

Code : 20PMA2C07

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explore the essentials of Distribution theory	PSO - 1	C
CO - 2	Construct the theory of probability to make inferences	PSO - 3	An, Ap
CO - 3	Promote knowledge of special distributions	PSO - 4	An
CO - 4	Build effective methods of finding the distribution of a function of several random variables	PSO - 5	S
CO - 5	Provide ways of approximation to determine complicated probability density functions	PSO -2	An

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		MATHEMATICAL STATISTICS										Hours: 6
Code : 20PMA2C07												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	3	4	3	4	3	3	3	3	3	4	3	3.27
CO - 4	4	3	3	3	4	4	3	3	3	3	4	3.36
CO - 5	3	3	3	3	4	3	3	3	3	3	4	3.18
<b>Overall Mean Score</b>											<b>3.23</b>	

**Result:** The Score for this Course is **3.23** (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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**UNIT I**

Distributions of Random Variables - the probability set function - random variables - the probability density function - the distribution function - certain probability models - mathematical expectation - some special mathematical expectations -Chebyshev's inequality. **(18 Hours)**

**UNIT II**

Conditional Probability and Stochastic Independence - Conditional Probability - Marginal and conditional distributions - the correlation coefficient - Stochastic independence. **(18 Hours)**

**UNIT III**

Some Special Distributions-The Binomial, Trinomial and multinomial Distributions-The Poisson distribution - The Gamma and Chi-square Distributions - The Normal Distribution - The Bivariate Normal Distribution. **(18 Hours)**

**UNIT IV**

Sampling Theory - Transformations of variables of the discrete type - Transformations of variables of the continuous type - The t and F distributions - Extensions of the change of variable technique - Distributions of order statistics - The moment generating function technique - The distributions of  $\bar{X}$  and  $nS^2/\sigma^2$  - Expectations of functions of random variables. **(18 Hours)**

**UNIT V**

Limiting distributions - Stochastic convergence - Limiting Moment generating functions - The Central Limit Theorem - Some theorems on Limiting distributions. **(18 Hours)**

**COURSE BOOK:**

Robert V. Hogg & Allen T. Craig, Introduction to Mathematical Statistics, IV Edition, Macmillan Publishing Co., Inc. NEW YORK, Collier Macmillan Publishers, 1978.

**Unit I** : Chapter 1 : Sections 1.4 to 1.11

**Unit II** : Chapter 2 : Sections 2.1 to 2.4

**Unit III** : Chapter 3 : Sections 3.1 to 3.5

**Unit IV** : Chapter 4 : Sections 4.1 to 4.9

**Unit V** : Chapter 5 : Sections 5.1 to 5.5

**BOOKS FOR REFERENCE:**

1. Miller and M. Miller, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2004.
2. Jun Shao, Mathematical Statistics, Second Edition, Springer, 2003.

## OPTIMIZATION THEORY

Semester: II

Hours: 6

Code : 20PMA2E2A

Credit: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Acquire knowledge of Fibonacci method for optimization.	PSO - 1	K
CO - 2	Understand constrained optimization techniques through linear and nonlinear programming.	PSO - 1	C
CO - 3	Describe the algorithms and solution analysis.	PSO - 3	An
CO - 4	Solve optimization problems.	PSO - 4	S
CO - 5	Compare the abstract properties of various optimization techniques.	PSO - 3,PSO-1	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		OPTIMIZATION THEORY										Hours: 6
Code : 20PMA2E2A												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 3	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 4	3	4	3	4	3	3	3	3	3	4	3	3.27
CO - 5	4	3	4	3	3	3	4	3	4	3	3	3.36
<b>Overall Mean Score</b>											<b>3.23</b>	

**Result:** The Score for this Course is 3.23 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

One Dimensional Optimization : Introduction - Function Comparison Methods - Polynomial Interpolation Methods - Iterative Methods - Function Comparison Methods : Two Point Equal Interval Search - Method of Bisection - Fibonacci Method - Golden Section Search - Polynomial Interpolation - Quadratic Interpolation - Cubic Interpolation - Iterative Methods: Newton's Method - Secant Method. **(18 Hours)**

### **UNIT II**

Unconstrained Gradient Based Optimization Methods : Introduction - Gradient and Conjugate Gradient Type Algorithms - Method of Steepest Descent - Conjugate Gradient Method - Newton Type Methods : Newton's Method - Marquardt's Method - Quasi Newton Methods : Quasi-Newton Algorithms. **(18 Hours)**

### **UNIT III**

Linear Programming : Introduction - Simplex Method - Case study Equipment Bags - Movement from one extreme point to another - Simplex Algorithm - Case Study Revisited - Revised Simplex Method. **(18 Hours)**

### **UNIT IV**

Finding Initial Solution - Two Phase Simplex Method - Duality - Duality Theory - Dual Simplex Method. **(18 Hours)**

### **UNIT V**

Constrained Optimization Methods: Introduction - Lagrange Multipliers - Kuhn-Tucker Conditions - Convex Optimization - Transformation Methods: Penalty Function Techniques - Method of Multipliers. - Linearization Methods: Linearly Constrained Problems - Cutting Plane Method. **(18 Hours)**

### **COURSE BOOK:**

Mohan C Joshi & Kannan M Moudgalya, Optimization Theory and Practice, Narosa Publishing House, Chennai, 2004.

**Unit I** : Chapter 2 : Sections 2.1.1 - 2.1.3, 2.2.2 - 2.2.5 & 2.3.2 - 2.3.3.

**Unit II** : Chapter 3 : Sections 3.1, 3.2.2 - 3.2.3, 3.3.2 - 3.3.3 & 3.4.2

**Unit III** : Chapter 4 : Sections 4.1 & 4.2.1 - 4.2.5

**Unit IV** : Chapter 4 : Sections 4.3.2 & 4.4.2 - 4.4.3.

**Unit V** : Chapter 5 : Sections 5.1 & 5.1.1 - 5.1.3, 5.2.2, 5.2.3, & 5.3.2 - 5.3.3.

### **BOOKS FOR REFERENCE:**

1. Wiehelm Forst, Dieter Hoffmann, Optimization - Theory and Practice, 2010<sup>th</sup> edition, Springer.
2. Stephen Boyd, Lieven Vandenberghe, Convex Optimization, Cambridge University Press, 2004.

## DIFFERENTIAL GEOMETRY

Semester: II

Hours: 6

Code : 20PMA2E2B

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the basic principles of space curves and surfaces.	PSO - 1	K
CO - 2	Analyze the concept of osculating circles and spheres and their properties.	PSO -3	Ap
CO - 3	Derive differential equations of Geodesics using normal property.	PSO -1	K
CO - 4	Discuss the principal curvature and lines of curvature.	PSO - 4, PSO - 5	An
CO - 5	Describe the local intrinsic property of a surface.	PSO -3	K, Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		DIFFERENTIAL GEOMETRY										Hours: 6
Code : 20PMA2E2B												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 3	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 4	4	4	3	4	4	4	3	3	3	4	4	3.45
CO - 5	3	3	4	3	3	3	3	3	4	3	3	3.63
<b>Overall Mean Score</b>											<b>3.32</b>	

**Result:** The Score for this Course is 3.32 (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Theory of space curves - Representation of space curves - Unique parametric representation of a space curve - Arc length - Tangent and osculating plane - principal normal and binormal - curvature and torsion - Behaviour of a curve near one of its points - The curvature and torsion of a curve as the intersection of two surfaces - contact between curves and surfaces. **(18 Hours)**

### **UNIT II**

Osculating circle and osculating sphere - Locus of centres of spherical curvature - Tangent surfaces, involutes and evolutes - Bertrand curves - Spherical indicatrix - Intrinsic equations of space curves - Fundamental Existence theorem for space curves - Helices. **(18 Hours)**

### **UNIT III**

The first fundamental form and local intrinsic properties of a surface - Definition of a surface- Nature of points on a surface - Representation of a surface-curves on a surface -Tangent plane and surface normal -The general surface of revolution -Helicoids - metric on a surface -The first fundamental form - Direction coefficients on a surface - Families of curve - Orthogonal trajectories -Double family of curves. **(18 Hours)**

### **UNIT IV**

Geodesics on a surface - Geodesics and their differential equations - Canonical geodesic equations - Geodesics on surfaces of revolution - Normal property of Geodesics - Differential equations of geodesics using normal property - Existence theorems - geodesics parallels - geodesics polar co-ordinates - geodesics curvature. **(18 Hours)**

### **UNIT V**

The Second fundamental form and local non intrinsic properties of a surface - Second fundamental form - Classification of points on a surface - principal curvature-lines of curvature - Dupin indicatrix. **(18 Hours)**

### **COURSE BOOK:**

D. Somasundaram, Differential Geometry A First Course, Narosa Publishing House, 2008

<b>Unit I</b>	:	Chapter 1 : Sections 1.1 - 1.10
<b>Unit II</b>	:	Chapter 1 : Sections 1.11 -1.20
<b>Unit III</b>	:	Chapter 2 : Sections 2.1 - 2.13
<b>Unit IV</b>	:	Chapter 3 : Sections 3.1 - 3.10
<b>Unit V</b>	:	Chapter 3 : Sections 3.1 - 3.10

### **BOOKS FOR REFERENCE:**

1. Willmore, An Introduction to Differential Geometry, Oxford University Press, London, 1972.
2. Mittal, Agarwal, Differential Geometry, Thirtieth Edition, Krishna Prakashan, Meerut, 2003.

## GRAPH THEORY

Semester: II

Hours: 6

Code : 20PMA2E2C

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the techniques in Graph Theory.	PSO - 1	K
CO - 2	Represent real life problems in a graph.	PSO-4	Ap
CO - 3	Develop the skill of constructing models using graphs.	PSO - 3	S
CO - 4	Discover solutions to problems using algorithmic approach.	PSO - 3, PSO - 1	An,Ap
CO - 5	Inculcate the spirit of research in network problems.	PSO - 5	S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		GRAPH THEORY										Hours: 6
Code : 20PMA2E2C												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	4	4	3	3	3	3	3	3	4	3	3.27
CO - 3	3	3	4	3	3	3	3	3	4	3	3	3.18
CO - 4	4	3	4	3	3	3	4	3	4	3	3	3.36
CO - 5	4	3	3	3	4	4	3	3	3	3	4	3.36
<b>Overall Mean Score</b>											<b>3.27</b>	

**Result:** The Score for this Course is **3.27** (High Relationship)

#### Note:

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Trees and Connectivity - Definitions and simple properties - bridges - Spanning trees - Connector problems - Shortest path problems - Cut vertices and connectivity. **(18 Hours)**

### **UNIT II**

Euler Tours and Hamiltonian Cycles- Euler Tours - The Chinese postman Problem - Hamiltonian Graphs - The Travelling Salesman Problem. **(18 Hours)**

### **UNIT III**

Matchings - Matchings and Augmenting paths - The Marriage Problem - The Personnel Assignment Problem. **(18 Hours)**

### **UNIT IV**

Planar Graphs - Plane and Planar Graphs - Euler's Formula - The Platonic Bodies - Kuratowski's theorem - Non-Hamiltonian Plane Graphs - The Dual of a plane Graph. **(18 Hours)**

### **UNIT V**

Colouring - Vertex Colouring - Vertex Colouring Algorithms - Critical Graphs - Cliques - Edge colouring - Map colouring. **(18 Hours)**

### **COURSE BOOK:**

John Clark & Derek Allan Holton, A First Look At Graph Theory, Allied Publishers Ltd., 1995

<b>Unit I</b>	:	Chapter 2
<b>Unit II</b>	:	Chapter 3
<b>Unit III</b>	:	Chapter 4 Sections 4.1 to 4.3
<b>Unit IV</b>	:	Chapter 5
<b>Unit V</b>	:	Chapter 6

### **BOOKS FOR REFERENCE:**

1. R. Balakrishnan and K. Ranganathan, A Textbook of Graph Theory, Springer International Edition, New Delhi, 2008.
2. F. Harary, Graph Theory, Addison - Wesley, Reading, Mass, 1969.



## IDC - MATLAB and LaTeX

Semester: II

Hours: 4

Code : 20PMA2GE1

Credits: 3

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand basic programming techniques.	PSO- 1	K,C
CO - 2	Create array and matrix and perform operations in it.	PSO - 3,PSO-2	Ap, S
CO - 3	Write programs to solve ODE and Numerical Integration.	PSO - 4,PSO-2	S
CO - 4	Plot with special graphics.	PSO - 5,PSO-2	An,Ap
CO - 5	Report work in scientific typesetting in LaTeX.	PSO - 1,PSO-2	S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : II		IDC - MATLAB and LaTeX										Hours: 4
Code : 20PMA2GE1												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	3	3	3	3	3	4	3	3	3	3	3.18
CO - 2	3	3	4	3	4	3	3	4	4	3	3	3.36
CO - 3	3	4	3	4	3	3	3	4	3	4	3	3.27
CO - 4	4	3	3	3	4	4	3	4	3	3	4	3.45
CO - 5	4	3	3	3	4	3	4	4	3	4	3	3.45
<b>Overall Mean Score</b>											<b>3.34</b>	

**Result:** The Score for this Course is **3.34** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Starting with MATLAB - Creating Arrays - Creating A One-dimensional Array (Vector) - Creating Two-dimensional Array (Matrix) - Notes About Variables In MATLAB - The Transpose Operator - Array Addressing - Using A Colon : In Addressing Arrays - Adding Elements To Existing Variables - Deleting Elements - Built-in Functions For Handling Arrays - Strings And Strings As Variables - Mathematical Operations with Arrays. **(12 Hours)**

## **UNIT II**

Using Script Files and Managing Data - Programming in MATLAB - Relational And Logical Operators - Conditional Statements - The Switch-case Statement - Loops - Nested Loops And Nested Conditional Statements - The Break And Continue Commands - Polynomials, Curve Fitting, and Interpolation **(12 Hours)**

## **UNIT III**

Applications in Numerical Analysis: Solving an Equation with One Variables - Finding a Minimum or a Maximum of a Function - Numerical Integration - ODE . Three-Dimensional Plots: Line Plots - Mesh and Surface Plots - Plots With Special Graphics. **(12 Hours)**

## **UNIT IV**

Document layout and Organization - document class, page style, parts of the document, Displayed Text - centering and indenting, lists, Theorem - like declarations, Tables. **(12 Hours)**

## **UNIT V**

Mathematical formulas - Mathematical environments, main elements of Math mode, Mathematical symbols, Additional elements, Fine-tuning mathematics, Drawing pictures with LaTeX. **(12 Hours)**

## **COURSE BOOKS:**

1. “**MATLAB An Introduction with Application**” by **A. Gilat**, John Wiley & Sons, fourth edition, 2010.
2. “**A Guide to LATEX**” by **H. Kopka and P. W. Daly**, Third Edition, Addison-Wesley, London, 1999.

<b>Unit I</b>	:	Chapter 1: Sections: 1.1 - 1.9 (Book 1)
		Chapter 2: Sections: 2.1- 2.10 (Book 1)
		Chapter 3 : Sections: 3.1- 3.9(Book 1)
<b>Unit II</b>	:	Chapter 4 : Sections: 4.1- 4.5(Book 1)
		Chapter 6: Sections: 6.1- 6.6 (Book 1)
		Chapter 8 : Sections: 8.1- 8.6(Book 1)
<b>Unit III</b>	:	Chapter 9 : Sections: 9.1- 9.4(Book 1)
		Chapter10: Sections: 10.1- 10.3(Book 1)
<b>Unit IV</b>	:	Chapter 3: Sections: 3.1- 3.3 (Book 2)
		Chapter 4 : Sections : 4.2,4.3,4.5 & 4.8 (Book 2)
<b>Unit V</b>	:	Chapter 5 : Sections : 5.1- 5.5 (Book 2)
		Chapter 6 : Sections : 6.1 (Book 2)

## **BOOKS FOR REFERENCE:**

1. A. Gilat & J. Wiley, MATLAB, An Introduction with Applications, Fifth Edition, May 2016.
2. Stefan Kottwitz, Packt, LaTeX Beginner’s Guide, March 2011.

## SOFT SKILLS

Semester: II

Hours: 2

Code : 20PSE2S01

Credit: 1

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Develop their social, interpersonal, cognitive, ethical, professional, reading and communication skills	PSO-1	K
CO - 2	Increase their self-esteem and confidence.	PSO-2,4	Ap
CO - 3	Achieve their short and long term goals.	PSO-3	Sy
CO - 4	Prepare and formulate their resumes wisely.	PSO-4	Ap
CO - 5	Face the mock group discussions and interviews with a challenge and choose their right career.	PSO-5	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: II		SOFT SKILLS										Hours: 2
Code : 20PSE2S01												Credit: 1
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO - 1	4	4	4	4	4	5	4	4	4	4	5	4.18
CO - 2	4	4	4	4	4	5	4	4	4	4	5	4.18
CO - 3	4	4	4	4	4	5	4	4	4	4	5	4.18
CO - 4	4	4	4	4	4	5	4	4	4	4	5	4.18
CO - 5	4	4	4	4	4	5	4	4	4	4	5	4.18
<b>Overall Mean Score</b>											<b>4.18</b>	

**Result:** The Score for this Course is **4.18** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I: SOFT SKILLS**

Introduction - Soft skills - Importance of soft skills - Selling your soft skills - Attributes regarded as soft skills - Soft skills - Social - Soft skills - Thinking - Soft skills - Negotiating - Exhibiting your soft skills - Identifying your soft skills - Improving your soft skills - will formal training enhance your soft skills - Soft Skills training - Train yourself - Top 60 soft skills - Practicing soft skills - Measuring attitude. **(6 Hours)**

## **UNIT II: CAREER PLANNING**

Benefits of career planning - Guidelines for choosing a career - Myths about choosing a career - Tips for successful career planning - Developing career goals - Final thoughts on career planning - Things one should know while starting career and during his/her career. **(6 Hours)**

## **UNIT III: ART OF LISTENING AND SPEAKING**

Two ears, one mouth - Active listening - Kinds of Listening, Common - poor listening habits - Advantages of listening - Listening Tips. Special features of Communication - Process - Channels of Communication - Net Work - Barriers - Tips for effective communication and Powerful presentation - Art of public speaking - Public Speaking tips - Over coming fear of public speaking. **(6 Hours)**

## **UNIT IV: ART OF READING AND WRITING**

Good readers - Benefits - Types - Tips - The SQ3R Technique - Different stages of reading - Rates of Reading - Determining a student's reading rate - Increasing reading rate - Problems with reading - Effective reader - Importance of writing - Creative writing - Writing tips - Drawbacks of written communication. **(6 Hours)**

## **UNIT V: PREPARING CV / RESUME**

Meaning - Difference among Bio-data, CV and Resume - The terms - The purpose of CV writing - Types of resumes - Interesting facts about resume - CV writing tips - CV/Resume preparation - the dos - CV/Resume preparation - the don'ts - Resume check up - Design of a CV - Entry level resume - The content of the resume - Electronic resume tips - References - Power words - Common resume blunders - Key skills that can be mentioned in the resume - Cover letters - Cover letter tips. **(6 Hours)**

## **COURSE BOOK:**

- ❖ Dr. K. Alex, Soft Skills, Chand & Company Pvt. Ltd., New Delhi.

**BOOKS REFERENCE:**

1. Dr. T. Jeya Sudha & Mr. M.R. Wajida Begum : Soft Skills/Communication Skills, New Century Book House (P) Ltd., Chennai.
2. S. Hariharen, N. Sundararajan & S.P. Shanmuga Priya : Soft Skills, MJP Publishers, Chennai.

**CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)****THEORY:**

<b>COMPONENT</b>	<b>MARKS</b>
Internal test I	40
Internal test II	40
Seminar	10
Term Paper	5
Attendance	5
<b>Total</b>	<b>100</b>

**CONTINUOUS INTERNAL ASSESSMENT COMPONENT (CIA)****Passing Minimum: 50% out of 100****INTERNAL QUESTION PATTERN****(Maximum Marks-40)****Part - A**

10 Questions × 1Mark = 10 Marks

**Part - B**

2 Questions × 5 Marks = 10 Marks

(Internal Choice and One Question from Each Unit)

**Part - C**

2 Questions × 10 Marks = 20 Marks

(Open Choice, Two Questions out of Three)

## FIELD THEORY AND LATTICES

Semester: III

Hours: 6

Code : 20PMA3C08

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Familiarize with the concept of field extensions.	PSO - 3 & PSO - 1	K
CO - 2	Elucidate the normal extensions and identify the fixed fields of Galois groups.	PSO - 3	C
CO - 3	Analyse the concept of finite fields.	PSO - 1 & PSO - 3	An
CO - 4	Explain clearly about Lattices and types of lattices.	PSO - 3	Ap
CO - 5	Acquaint with the properties of lattices and Boolean Algebra.	PSO - 1 & PSO - 3	K, C

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		FIELD THEORY AND LATTICES										Hours: 6
Code : 20PMA3C08												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	4	3	4	3	3	3	4	3	4	3	3	3.36
CO-2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO-3	4	3	4	3	3	3	4	3	4	3	3	3.36
CO-4	3	3	4	3	3	3	3	3	4	3	3	3.18
CO-5	4	3	4	3	3	3	4	3	4	3	3	3.36
<b>Overall Mean Score</b>											<b>3.3</b>	

**Result:** The Score for this Course is: **3.3** (High Relationship)

**Note:**

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Extension Fields - finite extensions - algebraic extensions - algebraic and transcendental elements - the transcendence of  $e$  - roots of polynomials.

**(18 Hours)**

### **UNIT II**

More about roots - the elements of Galois theory - normal extensions - fixed fields - Galois groups.

**(18 Hours)**

### **UNIT III**

Solvability by radicals - Finite Fields.

**(18 Hours)**

### **UNIT IV**

Lattices - Partially ordered sets - Lattices - Modular lattices - Schreier's theorem.

**(18 Hours)**

### **UNIT V**

Decomposition theory for lattices with ascending chain condition - Independence - complemented lattices - Boolean algebras.

**(18 Hours)**

### **COURSE BOOKS:**

1. I.N. Herstein, Topics in Algebra, John Wiley & Sons, Second Edition, 2002.
2. Nathan Jacobson, Lectures in Abstract Algebra, Affiliated East-West Press Pvt. Ltd., 1971.

Unit I : Chapter - 5: Sections 5.1, 5.2 & 5.3 (Book 1)

Unit II : Chapter - 5: Sections 5.5 & 5.6 (Book 1)

Unit III : Chapter - 5: Section 5.7 & Chapter - 7: Section 7.1 (Book 1)

Unit IV : Chapter - 7: Sections 7.1 to 7.4 (Book 2)

Unit V : Chapter - 7: Sections 7.5 to 7.8 (Book 2)

### **BOOKS FOR REFERENCE:**

1. Surjeet Singh, Modern Algebra, Edition 7, Vikas Publishing House Pvt. Limited, 2005.
2. Vijay K. Khanna, Lattices and Boolean Algebras, Vikas Publishing House Pvt. Ltd., 1997.



## TOPOLOGY

Semester: III

Hours: 6

Code : 20PMA3C09

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Understand the basic topological concepts.	PSO - 3	K
CO - 2	Extend the notion of continuous functions in topological spaces.	PSO - 3	Ap
CO - 3	Explain compactness and connectedness of topological spaces.	PSO - 4	An
CO - 4	Familiarize with the separation axioms.	PSO - 3	K, Ap
CO - 5	Use the properties of normal and regular spaces in proving theorems.	PSO - 4	C, K

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		TOPOLOGY										Hours: 6
Code : 20PMA3C09												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	3	3	4	3	3	3	3	3	4	2	2	3.00
CO-2	3	3	4	3	3	3	2	3	4	2	2	2.91
CO-3	3	4	3	4	3	1	3	3	2	4	3	3.00
CO-4	3	3	4	3	3	2	2	3	4	2	2	2.82
CO-5	3	4	3	4	2	3	3	3	2	4	2	3.00
<b>Overall Mean Score</b>											<b>2.95</b>	

**Result:** The Score for this Course is: **2.95** (Moderate Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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**UNIT I**

Topological spaces - basis for a topology - order topology - product topology on  $X \times Y$  - subspace topology - closed sets and limit points. **(18 Hours)**

**UNIT II**

Continuous functions - product topology - metric topology - the metric topology continued. **(18 Hours)**

**UNIT III**

Connected spaces - connected subspaces of the real line - components and local connectedness. **(18 Hours)**

**UNIT IV**

Compact spaces - compact subspaces of the real line - limit point compactness. **(18 Hours)**

**UNIT V**

The countability axioms - separation axioms - normal spaces - Urysohn lemma - Urysohn Metrization theorem - Tietze Extension theorem - Tychonoff theorem. **(18 Hours)**

**COURSE BOOK:**

James. R. Munkres, Topology, PHI Learning Private Ltd., New Delhi, Second Edition, 2014.

Unit I : Chapter - 2: Sections 12 to 17

Unit II : Chapter - 2: Sections 18 to 21

Unit III: Chapter - 3: Sections 23 to 25

Unit IV: Chapter - 3: Sections 26 to 28

Unit V: Chapter - 4: Sections 30 to 35

Chapter - 5: Section 37

**BOOKS FOR REFERENCE:**

1. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Co.; New York, 1963.
2. S.T.Hu, Elements of General Topology, Holden Day Inc., New York, 1965.

## COMPLEX ANALYSIS

Semester: III

Code : 20PMA3C10

Hours: 6

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Represent complex numbers algebraically and geometrically.	PSO - 3	C
CO - 2	Determine the differentiability of complex functions.	PSO - 3	S
CO - 3	Identify the removable and essential singularities of a function.	PSO - 3	An
CO - 4	Express analytic functions in terms of power series.	PSO - 3	E
CO - 5	Evaluate complex line integrals and some infinite real integrals.	PSO - 3	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		COMPLEX ANALYSIS										Hours: 6
Code : 20PMA3C10												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	3	2	4	3	3	3	3	2	4	3	3	3.00
CO-2	3	2	4	3	3	3	2	3	4	3	3	3.00
CO-3	2	3	4	3	2	3	3	3	4	2	2	2.64
CO-4	3	2	4	2	2	3	3	3	4	3	3	2.91
CO-5	3	2	4	3	3	3	2	3	4	2	3	2.91
<b>Overall Mean Score</b>											<b>2.89</b>	

**Result:** The Score for this Course is: **2.89** (Moderate Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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**UNIT I**

The spherical representation - limits and continuity - analytic functions - polynomials - rational functions - sequences - series - uniform convergence - power series - Abel's limit theorem. **(18 Hours)**

**UNIT II**

Arcs and closed curves - analytic functions in region - conformal mapping - length and area - linear group - cross ratio - symmetry. **(18 Hours)**

**UNIT III**

Line integrals - rectifiable arcs - line integrals as functions of arcs - Cauchy's theorem for a rectangle - Cauchy's theorem in disk - Cauchy's integral formula - The index of a point with respect to a closed curve - the integral formula - higher derivatives. **(18 Hours)**

**UNIT IV**

Removable singularities - Taylor's theorem - zeros and poles - the local mapping - The maximum principle - The residue theorem - The argument principle - evaluation of definite integrals. **(18 Hours)**

**UNIT V**

Harmonic functions - definition and basic properties - the mean value property - Poisson's formula - Schwarz's theorem - Weierstrass's theorem - The Taylor's series - The Laurent's series. **(18 Hours)**

**COURSE BOOK:**

Lars V. Ahlfors, Complex Analysis, Mc Graw Hill Student Edition, Third Edition, 1979.

Unit I : Chapter - 1 : Section 2.4 & Chapter - 2 : Sections 1.1 to 2.5

Unit II : Chapter - 3 : Sections 2.1 to 2.4 & 3.1 to 3.3

Unit III: Chapter - 4 : Sections 1.1 to 1.5 & 2.1 to 2.3

Unit IV: Chapter - 4 : Sections 3.1 to 3.4 & 5.1 to 5.3

Unit V : Chapter - 4 : Sections 6.1 to 6.4 & Chapter - 5 : Sections 1.1 to 1.3

**BOOKS FOR REFERENCE:**

1. S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House Pvt. Ltd., Second Edition 2005.
2. V. Karunakaran, Complex Analysis, Narosa Publishing House Pvt. Ltd., Second Edition 2005.

## STOCHASTIC PROCESS

Semester: III

Hours: 6

Code : 20PMA3E3A

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Provide Mathematical models for random experiments.	PSO - 3	C
CO - 2	Familiar with important tools of Applied Probability theory.	PSO - 2	Ap
CO - 3	Develop ideas on the application of Markov chains and Markov process.	PSO - 3	An
CO - 4	Benefit with more details on Renewal Process.	PSO - 4	K
CO - 5	Solve various mathematical problems using limiting behaviour.	PSO - 3 & PSO - 4	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		STOCHASTIC PROCESS										Hours: 6
Code : 20PMA3E3A												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	3	3	4	3	2	2	3	3	4	3	3	2.82
CO-2	2	2	3	3	4	3	3	4	3	2	2	2.82
CO-3	3	3	4	3	2	3	3	2	4	3	3	3.00
CO-4	3	4	2	4	3	2	3	3	2	4	4	3.10
CO-5	3	4	4	4	2	3	2	3	4	4	3	3.27
<b>Overall Mean Score</b>											<b>3.00</b>	

**Result:** The Score for this Course is: **3.00** (Moderate Relationship)

**Note:**

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

$\text{Mean Score of Cos} = \frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	$\text{Mean Overall Score for Cos} = \frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Random Variables and Stochastic Processes - Introduction - Probability Generating Function - Stochastic Process: An introduction - Markov chain - Definition and examples - Higher transition probabilities. **(18 Hours)**

### **UNIT II**

Generalisation of independent Bernoulli trials: Sequence of chain - Dependent trails - Classification of states and chains - Determination of higher transition probabilities - Stability of a Markov system - Graph theoretic approach. **(18 Hours)**

### **UNIT III**

Poisson Process - Poisson process and Related Distributions - Generalisations of Poisson process - Birth and Death Process - Markov process with discrete state space. **(18 Hours)**

### **UNIT IV**

Renewal Process - Renewal process in Discrete time - Renewal process in continuous time - Renewal equation. **(18 Hours)**

### **UNIT V**

Stopping time: Wald's equation - Elementary Renewal theorems - Renewal theorems - Delayed and equilibrium renewal process. **(18 Hours)**

### **COURSE BOOK:**

J. Medhi, Stochastic Process, New Age International Publishers, Third Edition, 2009.

Unit I : Chapter - 1 & Chapter - 2 : Sections 1.1.1, 1.1.2, 1.5, 2.1, 2.2

Unit II : Chapter - 2: Sections 2.3 to 2.7

Unit III: Chapter - 3: Sections 3.1 to 3.5

Unit IV: Chapter - 6 : Sections 6.1 to 6.3

Unit V : Chapter - 6 : Sections 6.4 to 6.6

### **BOOKS FOR REFERENCE:**

1. U. Narayan Bhat, Elements of Applied Stochastic Processes, Second Edition, John Wiley & Sons, New York, 1972.
2. Howard M. Taylor, Samuel Karlin, An Introduction to Stochastic Modeling, Third Edition, Academic Press Limited, New York, 1994.  
<https://www.sciencedirect.com/book/9780126848854/an-introduction-to-stochastic-modeling>

## NUMBER THEORY

Semester: III

Hours: 6

Code : 20PMA3E3B

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Explain the concepts of arithmetic functions and Dirichlet multiplication.	PSO - 4	C
CO - 2	Determine multiplicative inverse, modulo n to solve linear congruences.	PSO - 3	An
CO - 3	Produce rigorous arguments of number theory and promote in writing proofs of theorems.	PSO - 3 & PSO - 4	Ap
CO - 4	Evaluate the law of quadratic reciprocity and quadratic residues.	PSO - 2	E
CO - 5	Assess with partition functions.	PSO - 3	K

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		NUMBER THEORY										Hours: 6
Code : 20PMA3E3B												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	3	4	3	4	3	2	3	3	3	4	3	3.18
CO-2	3	3	4	3	2	3	2	3	4	3	3	3.00
CO-3	3	4	4	4	2	3	3	3	4	4	2	3.27
CO-4	2	3	3	2	4	2	3	4	3	3	3	2.91
CO-5	3	3	4	3	3	3	3	2	4	2	3	3
<b>Overall Mean Score</b>											<b>3.07</b>	

**Result:** The Score for this Course is: **3.07** (Moderate Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I: ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION**

The Mobius function - Euler totient function - a relation connecting  $\phi$  and  $\mu$  - a product formula for  $\phi(n)$  - the Dirichlet product of arithmetic functions - Dirichlet inverses and the Mobius inversion formula - the Mangoldt function - Multiplicative function - multiplicative functions and Dirichlet Multiplication - The inverse of a completely multiplicative function - Liouville's function - The divisor functions - Generalised convolutions - Formal Power series - The Bell series of an arithmetical function - Bell Series and Dirichlet multiplication - derivatives of arithmetical functions - The Selberg identity. **(18 Hours)**

## **UNIT II: AVERAGES OF ARITHMETICAL FUNCTIONS**

The big oh notation - asymptotic equality of functions - Euler's summation formula - Some elementary asymptotic formulas - average order of  $d(n)$  - average order of the divisor functions  $\sigma_\alpha(n)$  - average order of  $\phi(n)$  - an application to the distribution of lattice points visible from the origin - average order of  $\mu(n)$  and of  $\Lambda(n)$  - the partial sums of a Dirichlet product - applications to  $\mu(n)$  and  $\Lambda(n)$  - another identity for the partial sums of a Dirichlet product. **(18 Hours)**

## **UNIT III: CONGRUENCES**

Definition and basic properties of Congruences - Residue classes and complete residue system - Linear congruences - reduced residue systems and the Euler - Fermat theorem - polynomial congruences modulo  $p$  - Lagrange's theorem - applications of Lagrange's theorem - Simultaneous Linear Congruences: The Chinese remainder theorem - applications of the Chinese remainder theorem - Polynomial congruences with prime power moduli - the principle of cross classification - a decomposition property of reduced residue systems. **(18 Hours)**

## **UNIT IV: QUADRATIC RESIDUES AND QUADRATIC RECIPROCITY LAW**

Quadratic residues - Legendre's symbol and its properties - evaluation of  $(-1/p)$  and  $(2/p)$  - Gauss' Lemma - the quadratic reciprocity Law - applications of the reciprocity law - the Jacobi symbol - Applications to Diophantine equations. **(18 Hours)**

## **UNIT V: PARTITION FUNCTION**

Partitions - graphs - Formal power series and Euler's identity - Euler's formula, Jacobi's formula - a divisibility property. **(18 Hours)**



### **COURSE BOOKS:**

1. Tom M. Apostol, Introduction to Analytic Number Theory, Springer International Student Edition, 1998.
2. Niven Herbert S. Zuckerman, Introduction to the Theory of Numbers, Wiley Eastern University Edition, 1984.

Unit I : Chapter 2 Section 2.2 - 2.19 (Book 1)

Unit II : Chapter 3 Section 3.2 - 3.12 (Book 1)

Unit III : Chapter 5 Section 5.1 - 5.11 (Book 1)

Unit IV : Chapter 9 Section 9.1- 9.8 (Book 1)

Unit V : Chapter 10 Section 10.1-10.6 (Book 2)

### **BOOKS FOR REFERENCE:**

1. Elementary Number Theory, David M Burton, Seventh edition.  
<https://www.pdfdrive.com/elementary-number-theory-7th-ed-by-david-m-burton-e58704232.html>
2. Basic Number Theory, S. B. Malik, First edition, 1998.  
<https://www.madrasshoppe.com/basic-number-theory-sb-malik-9780706987492-9834.html>

## CALCULUS OF VARIATIONS

Semester: III

Hours: 6

Code : 20PMA3E3C

Credits: 4

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Apply the concept of variation to solve problems on Mechanics.	PSO - 3	Ap
CO - 2	Analyze movable boundary for a functional dependent on two functions.	PSO - 3	C
CO - 3	Describe special kinds of Kernels and Fredholm alternatives.	PSO - 1	E
CO - 4	Familiar with successive approximation.	PSO - 3	K
CO - 5	Synthesize initial value problem and boundary value problem.	PSO - 3	S

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		CALCULUS OF VARIATIONS										Hours: 6
Code : 20PMA3E3C												Credits: 4
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	3	3	4	3	3	2	3	2	4	3	3	3.00
CO-2	3	3	4	2	3	3	3	3	4	3	2	3.00
CO-3	4	2	3	3	3	3	4	3	3	3	3	3.09
CO-4	2	3	4	2	3	2	3	3	4	2	3	2.82
CO-5	3	3	4	3	2	3	2	3	4	2	3	2.91
<b>Overall Mean Score</b>											<b>2.96</b>	

**Result:** The Score for this Course is: **2.96** (Moderate Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

The concept of Variation and its properties - Euler's equation - Variational properties for functional - Functionals dependent on higher order derivatives - Functions of several independent variables - Some applications to problems of mechanics. **(18 Hours)**

### **UNIT II**

Movable boundary for a functional dependent on two functions - One sided variations - Reflection and Refraction of extremals - Diffraction of light rays. **(18 Hours)**

### **UNIT III**

Introduction - Definition - Regularity conditions - Special kinds of Kernels - Eigen values and eigen functions - Convolution integral - Reduction to a system of algebraic equations - Examples - Fredholm alternative - Examples - An approximation method. **(18 Hours)**

### **UNIT IV**

Method of successive approximations - Iterative scheme - Examples - Volterra integral equations - Examples - Some results about the resolvent kernel - The method of solution of Fredholm equation - Fredholm first theorem - Examples. **(18 Hours)**

### **UNIT V**

Initial value problems - Boundary value problem - Examples - Singular integral equations - The Abel integral equations - Examples. **(18 hours)**

### **COURSE BOOK:**

1. A. S. Gupta, Calculus of Variations with Applications, PHI, New Delhi, 2005.
2. Ram P. Kanwal, Linear Integral Equations, Theory and Techniques, Academic Press, New York, 1971.

Unit I : Book 1: Chapter - 1 : Sections 1.1 - 1.7

Unit II : Book 1: Chapter - 2 : Sections 2.1 - 2.5

Unit III : Book 2: Chapter - 1 : Sections 1.1 - 1.5  
Chapter - 2 : Sections 2.1 - 2.5

Unit IV : Book 2: Chapter - 3 : Sections 3.1 - 3.5  
Chapter - 4 : Sections 4.1 - 4.3

Unit V : Book 2: Chapter - 5 : Sections 5.1 - 5.3  
Chapter - 8 : Sections 8.1 - 8.2

### **BOOKS FOR REFERENCE:**

1. <https://www.pdfdrive.com/calculus-of-variations-d185491426.html>
2. R. K.Sharma, Calculus of Variations, Scientific International Publishers & Distributors, 2017.

## IDC - MATHEMATICAL SKILLS

Semester: III

Hours: 4

Code : 20PMA3GE2

Credits: 3

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Calculate solutions for numerical problems.	PSO - 1	K, C
CO - 2	Understand and apply the concept of transformation.	PSO - 3	K, Ap
CO - 3	Solve optimization problems.	PSO - 3	Ap
CO - 4	Carry statistical analysis of a given data.	PSO - 3	An
CO - 5	Develop problem solving skills and crack competitive examinations.	PSO - 5	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		IDC - MATHEMATICAL SKILLS										Hours: 4
Code : 20PMA3GE2												Credits: 3
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	2	4	4	4	2	3	2	2	4	4	3	3.09
CO-2	3	3	4	3	2	3	3	3	4	2	3	3.00
CO-3	3	3	4	2	4	3	3	4	4	3	3	3.27
CO-4	4	3	3	3	3	3	4	3	4	3	4	3.36
CO-5	3	3	4	4	3	2	3	3	4	4	3	3.27
<b>Overall Mean Score</b>											<b>3.20</b>	

**Result:** The Score for this Course is **3.20** (High Relationship)

**Note:**

Mapping	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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**UNIT I**

Arithmetic Progression and Geometric Progression. **(12 Hours)**

**UNIT II**

Transformation of Equations - Increasing and decreasing the roots of a given equation - Roots with signs changed - Roots multiplied by a given number.

**(12 Hours)**

**UNIT III**

Game Theory - Introduction - Optimal solution Two-person zero- sum games - Rules for determining a saddle Point- Games without saddle Points.

**(12 Hours)**

**UNIT IV**

Theory of attributes - Attributes - consistency of data- independence and association of data.

**(12 Hours)**

**UNIT V**

Permutations and Combinations - A simple combinatorial application. **(12 Hours)**

**COURSE BOOK:**

Book Compiled by the Staff.

**BOOKS FOR REFERENCE:**

1. Algebra, Vol. I, T. K. Manicavachagam Pillai, T. Natarajan and K. S. Ganapathy, S. Viswanathan (Printers & Publishers) Pvt. Ltd., 2011.
2. Operations Research, P K. Gupta and Man Mohan, V Edition, Sultan Chand & Sons Publishers, New Delhi, 1986.
3. A first Look at Graph Theory, John Clark and Derek Allan Holtan, Allied Publishers Ltd., 1995.
4. Statistics, Arumugam and Issac, New Gamma Publishing House, 2011.
5. Permutations and Combinations, Ramesh Chandra, e-book.

## HUMAN RIGHTS AND DUTIES

Semester: III

Hours: 2

Code : 20PSE3H02

Credit: 1

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Discuss the Meaning and Definitions of Human Rights and Historical Evolution of Human Rights.	PSO - 5	K, A, E
CO - 2	Explain the Human Rights Education and Constitutional Provision for protection of Human Rights in India.	PSO - 5	K, A, E
CO - 3	Assess the Human Rights Activities in India	PSO - 5	K, A, E
CO - 4	Analyse the Welfare Acts of Women in India.	PSO - 5	K, A, E
CO - 5	Evaluate the need of Welfare Acts for the protection of Human Rights in India.	PSO - 5	K, A, E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: III		HUMAN RIGHTS AND DUTIES										Hours: 2
Code : 20PSE3H02												Credit: 1
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-2	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-3	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-4	5	5	5	5	5	3	2	3	3	2	5	3.90
CO-5	5	5	5	5	5	3	2	3	3	2	5	3.90
<b>Overall Mean Score</b>											<b>3.90</b>	

**Result:** The score for this course is **3.90** (High Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Introduction - Meaning and Definitions of Human Rights - Historical Evolution of Human Rights - Universal Declaration of Human Rights 1948-Human Rights Day.

**(6 Hours)**

## **UNIT II**

Human Rights Education - Constitutional Provision for protection of Human Rights in India - Fundamental Rights and Directive principles of State Policy - Fundamental Duties - Protection of Human Rights Act of 1993.

**(6 Hours)**

## **UNIT III**

Human Rights Activities in India - National Human Rights Commission - State Human Rights Commission - Structure - functions - Human Rights courts - Role of NGOs - Amnesty - People's Watch.

**(6 Hours)**

## **UNIT IV**

The Child Marriage Restraint Act, 1929 - Amended in 1978 - The Special Marriage Act, 1954 - The Hindu Marriage Act, 1955 - The Hindu Adoption and Maintenance Act, 1956 - The Hindu Succession Act, 1956 - The Hindu Minority and Guardianship Act, 1956 - Suppression of Immoral Traffic in Women and Girls Act, 1956 - Devadasis Abolition Act, 1958 - The Hindu Widow Remarriage Act, 1959 - The Dowry Prohibition Act, 1961 - The Maternity Benefit Act, 1961.

**(6 Hours)**

## **UNIT V**

The Medical Termination of Pregnancy Act, 1971 - Criminal Law (Amendment) Act, 1983 - The Family Courts Act, 1984. Indecent Representation of Women Prohibition Act, 1986 - Dissolution of Muslim Marriage Act, 1939 and Muslim Women's (Protection of Rights in Divorce) Act, 1986 - Prohibition of Sati Act and Sati Prevention Act, 1987 - Abolition of Female Infanticide - Self Respect Marriage Act - Hindu Women's Property Act - The Tamil Nadu Prohibition of Harassment of Women Act, 1998 - (Protection of Children from Sexual Offences) POCSO Act 2012.

**(6 Hours)**

## **COURSE BOOK:**

- Human Rights and Duties - Dr. P. Floras Mary & Dr. V. Santhi, Pandiyanadu Cultural Foundation, 3/26, Nellaiyappa Puram, 1<sup>st</sup> Street, Thirunagar, Madurai, 2021.
- Website: [pandiyanadu.in](http://pandiyanadu.in).

## **BOOKS FOR REFERENCE**

1. Justice Iyer, Dr. Ambedkar and The Dalit Future, B.R. Publishing Co, New Delhi.  
1990
2. Bajwa, G.S, Human Rights in India, Anmol Publications Pvt. Ltd., New Delhi, 1995.
3. Paramasivam Sivagami, Human Rights - A Study, Sriram Computer Printer & offset,  
Salem, Tamilnadu, 1998.
4. Rajendar Mangari The Protection Of Human Rights Act and Relating Laws, Book  
Agency, Hyderabad - 1., 1999.
5. Jayapalan, N, Women and Human Rights, Atlantic Publishers and Distributors,  
New Delhi. , 2001.



## FUNCTIONAL ANALYSIS

Semester: IV

Hours: 6

Code : 20PMA4C11

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Illustrate the elementary concepts of Functional analysis.	PSO - 1	K
CO - 2	Convert a linearly independent set into an orthonormal set.	PSO - 1	S
CO - 3	Apply the ideas from the theory of Hilbert spaces to Fourier series.	PSO - 3	An
CO - 4	Describe the various kinds of operators.	PSO - 3	C
CO - 5	Apply the spectral theory to the resolution of integral equations.	PSO - 3 & PSO - 4	Ap

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV		FUNCTIONAL ANALYSIS										Hours: 6
Code : 20PMA4C11												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	4	3	3	2	3	3	4	3	2	2	3	2.91
CO-2	4	3	2	3	2	3	4	3	2	2	3	2.82
CO-3	3	2	4	3	3	2	3	2	4	3	3	2.91
CO-4	4	3	4	3	3	3	3	3	4	2	2	3.1
CO-5	3	4	4	4	3	3	2	3	4	4	2	3.27
<b>Overall Mean Score</b>											<b>3.00</b>	

**Result:** The Score for this Course is: **3.00** (Moderate Relationship)

**Note:**

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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### **UNIT I**

Banach spaces - definition and some examples - continuous linear transformation - The Hahn- Banach theorem - the natural imbedding on  $N$  in  $N^{**}$  - the open mapping theorem - the conjugate of an operator. **(18 Hours)**

### **UNIT II**

Hilbert spaces - definition and some simple properties - orthogonal complements - orthonormal sets - the conjugate space  $H^*$ . **(18 Hours)**

### **UNIT III**

The adjoint of an operator - self-adjoint operators - normal and unitary operators - projections. **(18 Hours)**

### **UNIT IV**

Matrices - determinants and the spectrum of an operator - the spectral theorem - a survey of the situation. **(18 Hours)**

### **UNIT V**

General preliminaries on Banach algebras - definition and examples - regular and singular elements - topological divisors of zero - the spectrum - the formula for the spectral radius - the radical and semi simplicity. **(18 Hours)**

### **COURSE BOOK:**

**George. F. Simmons, Introduction to Topology and Modern Analysis**, Tata Mc Graw Hill Publishing Company Ltd., New Delhi, Edition 2004.

UNIT I : Chapter - 9: Sections 46 - 51

UNIT II : Chapter - 10: Sections 52 - 55

UNIT III : Chapter - 10: Sections 56 - 59

UNIT IV : Chapter - 11: Sections 60 - 63

UNIT V : Chapter - 12: Sections 64 - 69

### **BOOKS FOR REFERENCE:**

1. K. Chandrasekhara Rao, Functional Analysis, Narosa Publishing House Pvt. Ltd., Second Edition 2006.
2. <https://www.scribd.com/doc/255092052/Functional-Analysis-Walter-Rudin>

## DIFFERENTIAL EQUATIONS

Semester: IV

Hours: 6

Code : 20PMA4C12

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Get acquaint with the ordinary and partial differential equations	PSO - 1, PSO - 3	K, S
CO - 2	Acquire the knowledge of finding the approximate solutions of the differential equations	PSO - 4	K, Ap
CO - 3	Understand the existence and uniqueness property of solutions of first and higher order differential equations	PSO - 3	C, An
CO - 4	Solve the partial differential equations using different methods	PSO - 3	K, Ap
CO - 5	Infer the initial and boundary value problems and the methods to solve them	PSO - 3, PSO - 4	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV		DIFFERENTIAL EQUATIONS										Hours: 6
Code : 20PMA4C12												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	4	3	4	3	3	2	4	2	4	3	2	3.09
CO-2	3	4	2	4	3	3	3	3	2	4	3	3.09
CO-3	2	3	4	2	3	3	3	3	4	2	3	2.91
CO-4	3	3	4	3	2	2	3	2	4	3	3	2.91
CO-5	2	2	4	4	3	3	2	3	4	4	3	3.09
<b>Overall Mean Score</b>											<b>3.02</b>	

**Result:** The Score for this Course is: **3.02** (Moderate Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Linear Equations with variable coefficients: Initial value problems for the homogenous equation - Solutions of the homogenous equation - The Wronskian and linear independence - reduction of the order of a homogenous equation - The non-homogenous equation - Homogenous equations with analytic coefficients - the Legendre equation - justification of the power series method. **(18 Hours)**

## **UNIT II**

Linear equations with regular singular points: Introduction - The Euler equation - Second order equations with regular singular points - an example - Second order equations with regular singular points - the general case - A convergence proof - The exceptional cases - The Bessel equation. **(18 Hours)**

## **UNIT III**

Existence and uniqueness of solutions to first order equations: Exact equations - The method of successive approximations - The Lipschitz condition - Convergence of the successive approximations - Non-local existence of solutions. **(18 Hours)**

## **UNIT IV**

Cauchy's method of characteristics - compatible systems of first order equations - Charpit's method. **(18 Hours)**

## **UNIT V**

Linear partial differential equations with constant coefficients - equations with variable coefficients. **(18 Hours)**

## **COURSE BOOKS:**

1. Earl A. Coddington, An Introduction to Ordinary Differential Equations, PHI Learning Private Limited, 2012.
2. Ian Sneddon, Elements of Partial Differential Equations, McGraw-Hill International Student Edition, 1982.

Unit I	: Chapter - 3: Sections 3 - 9 (Book 1)
Unit II	: Chapter - 4: Sections 1 - 7 (Book 1)
Unit III	: Chapter - 5: Sections 3 - 7 (Book 1)
Unit IV	: Chapter - 2: Sections 8 - 10 (Book 2)
Unit V	: Chapter - 3: Sections 4 - 5 (Book 2)

## **BOOKS FOR REFERENCE:**

1. S. G. Deo and V. Raghavendra, Ordinary Differential Equations and Stability Theory, Tata McGraw-Hill Publishing Company Ltd., 1987.
2. M. D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Ltd., 2006.

## OPERATIONS RESEARCH

Semester: IV

Hours: 6

Code : 20PMA4C13

Credits: 5

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Formulate network models and solve using algorithms.	PSO - 2 & PSO - 3	K
CO - 2	Convert and solve the practical situation into non linear programming problems.	PSO - 1 & PSO - 3	S
CO - 3	Compute critical path in network problems.	PSO - 4	C
CO - 4	Apply and extend queuing models to analyze real life problems.	PSO - 3 & PSO - 4	Ap
CO - 5	Solve nonlinear programming problems.	PSO - 1 & PSO - 3	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV		OPERATIONS RESEARCH										Hours: 6
Code : 20PMA4C13												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	3	3	4	4	4	3	3	4	4	3	3	3.45
CO-2	4	3	4	3	3	3	4	3	4	3	3	3.36
CO-3	2	3	4	2	3	3	3	3	4	3	3	3
CO-4	3	3	4	3	3	3	3	3	4	3	3	3.18
CO-5	4	3	4	3	3	3	4	3	4	2	3	3.27
<b>Overall Mean Score</b>											<b>3.25</b>	

**Result:** The Score for this Course is: **3.25** (High Relationship)

**Note:**

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

$\text{Mean Score of Cos} = \frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	$\text{Mean Overall Score for Cos} = \frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## **UNIT I**

Network models - scope of network applications - network definitions - minimal spanning tree algorithm - shortest route problem - short route algorithms - maximal flow model - maximal flow algorithm. **(18 Hours)**

## **UNIT II**

Network models (continued) - minimum cost capacitated flow problem - linear programming formulation - capacitated network simplex algorithm - CPM and PERT - network representation - critical path computations - construction of the time schedule - determination of the floats. **(18 Hours)**

## **UNIT III**

Queuing systems - why study queues? - elements of queuing model - role of exponential distribution - derivation of exponential distribution - pure birth and death models - generalised Poisson queuing model - specialized Poisson queues steady-state measures of performance - single server models (M/M/1) : (GD/ $\infty$ / $\infty$ ) - waiting time distribution for (M/M/1):(FCFS/ $\infty$  / $\infty$  ) - (M/M/1): (GD/N/ $\infty$ ) - multiple server models - (M/M/c) : (GD/ $\infty$ / $\infty$ ), (M/M/c) : (GD/N/ $\infty$ ) - self service model (M/M/ $\infty$ ):(GD/ $\infty$ / $\infty$ ) - self service model - machine serving model (M/M/R) : (GD/K/K) (R<K). **(18 Hours)**

## **UNIT IV**

Classical optimization theory - introduction - unconstrained problems - necessary and sufficient conditions - Newton - Raphson method - constrained problems - equality constraints - Jacobian method - Lagrangian method - inequality constraints - extension of the Lagrangian method - the Kuhn - Tucker conditions. **(18 Hours)**

## **UNIT V**

Non linear programming algorithms - unconstrained algorithms - direct search method - gradient method - constrained algorithms - separable programming - quadratic programming - geometric programming - stochastic programming - linear combination method. **(18 Hours)**

## **COURSE BOOK:**

Hamdy. A. Taha, Operations Research - An Introduction, Prentice Hall of India Private Ltd., New Delhi, (VI Edition) (2000).

Unit I	: Chapter - 6 : Sections 6.1 - 6.5
Unit II	: Chapter - 6 : Sections 6.6 - 6.7
Unit III	: Chapter - 17: Sections 17.1 - 17.6 (up to 17.6.4 only)
Unit IV	: Chapter - 20: Sections 20.1- 20.3
Unit V	: Chapter - 21: Sections 21.1 - 21.2 (up to 21.2.5 only)

**BOOKS FOR REFERENCE:**

1. Frederick S. Hiller, Gerald J. Liebman, Bodhibrata Nag, Preetam Basu, Introduction to Operations Research, Sixth Edition, Tata McGraw Hill Education Private Limited, New Delhi, 1995.
2. Kanti Swarup, P. K. Gupta and Man Mohan, Operations Research, Eighth Edition, Sulltan Chand & Sons, New Delhi, 1997.

## PROJECT

Semester: IV

Hours: 12

Code : 20PMA4R01

Credits: 6

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Cultivate abstract thinking.	PSO - 1	C
CO - 2	Acquire knowledge in their area of interest.	PSO - 3	K
CO - 3	Develop confidence in self learning.	PSO - 5	E
CO - 4	Gain experience in deductive reasoning.	PSO - 4	An
CO - 5	Promote techniques of research.	PSO - 5	S, C

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV		PROJECT										Hours: 12
Code : 20PMA4R01												Credits: 6
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	4	3	3	3	2	3	4	2	3	3	2	2.90
CO-2	3	3	4	3	3	3	3	3	4	3	3	3.18
CO-3	4	4	3	4	5	5	3	3	2	3	4	3.63
CO-4	3	5	4	5	3	3	2	3	4	3	3	3.45
CO-5	4	2	3	2	4	4	3	3	3	2	4	3.09
<b>Overall Mean Score</b>											<b>3.25</b>	

**Result:** The Score for this Course is: **3.25** (High Relationship)

#### Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

#### Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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## COMPREHENSIVE EXAMINATION

Semester: IV

Credits: 2

Code : 20PMA4S01

### COURSE OUTCOMES:

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO - 1	Promote competency in Mathematics.	PSO - 5	E
CO - 2	Contemplate with important tools to solve problems in Pure and Applied Mathematics.	PSO - 1	C
CO - 3	Improve self learning.	PSO - 3	K
CO - 4	Have an understanding on the use of mathematical concepts.	PSO - 3 & PSO - 5	Ap
CO - 5	Equip themselves to appear for NET/SET Examinations.	PSO - 5	E

### RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester: IV		COMPREHENSIVE EXAMINATION										Credits: 2
Code : 20PMA4S01												
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO-1	4	3	2	3	4	4	2	3	2	2	4	3
CO-2	4	3	3	3	2	3	4	3	3	3	4	3.55
CO-3	3	3	4	3	2	3	3	3	4	2	3	3
CO-4	4	3	4	3	4	4	3	3	4	4	4	3.64
CO-5	4	3	3	3	4	4	3	2	3	3	4	3.27
<b>Overall Mean Score</b>											<b>3.29</b>	

**Result:** The Score for this Course is: **3.29** (High Relationship)

**Note:**

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

**Values Scaling:**

$\text{Mean Score of Cos} = \frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	$\text{Mean Overall Score for Cos} = \frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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