



# SACRED HEART COLLEGE (AUTONOMOUS)

Tirupattur – 635 601, Tamil Nadu, S.India

Resi : (04179) 220103

College : (04179) 220553

Fax : (04179) 226423

Ready for  
Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 \* Affiliated to Thiruvalluvar University, Vellore \* Autonomous since 1987  
Accredited by NAAC (4<sup>th</sup> Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

## PG & Research Department of Mathematics

**Sacred Heart College (Autonomous),**

**Tirupattur, Vellore District - 635 601**

Affiliated to Thiruvalluvar University, Vellore  
Accredited by NAAC (4th Cycle – under RAF) with  
CGPA of 3.31/4 at 'A+' Grade



UG Programme (Mathematics)

2021-22 onwards

## **Program Outcomes – UG Programme**

### **OUTCOME-BASED EDUCATION (OBE)**

#### **LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)**

**OBE** is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no single specified style of teaching or assessment in OBE; instead, classes, opportunities and assessments should all help the students achieve the specific outcomes

Outcome Based Education, as the name suggests depends on Outcomes and not Inputs. The outcomes in OBE are expected to be measurable. In fact each Educational Institute can state its own outcomes. The ultimate goal is to ensure that there is a correlation between education and employability

**Outcome –Based Education (OBE):** is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve, stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

#### **Some important aspects of the Outcome Based Education**

**Course:** is defined as a theory, practical or theory cum practical subject studied in a semester.

**Course Outcomes (COs):** are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally three or more course outcomes may be specified for each course based on its weightage.

**Programme:** is defined as the specialization or discipline of a Degree.

**Programme Outcomes (POs):** Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

#### **Programme Specific Outcomes (PSOs):**

PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

**Programme Educational Objectives (PEOs):** The PEOs of a programme are the statements that describe the expected achievement of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after Graduation.

## **Programme Outcomes at SHC**

### **Programme Outcomes at Undergraduate Level**

#### **Undergraduates will be able to:**

- PO1:** Discuss their new knowledge and understanding; apply new ideas in order to acquire employability/self-employment
- PO2:** Pursue higher learning programmes and become entrepreneurs
- PO3:** Recognize moral and ethical values and be socially responsible citizens in the society
- PO4:** Apply analytical, technical, problem solving, critical thinking skills, and decision-making skills in solving real life problems in one's life and in the society.
- PO5:** Direct their own self-learning through MOOC courses, co-curricular activities, industrial exposures and field trainings
- PO6:** Develop their own broad conceptual background in Biological sciences, Computing sciences, Languages and culture, Management studies, Physical sciences, etc.
- PO7:** Demonstrate communication skills both oral and written in personal and academic pursuits

### **Programme Specific Outcomes - B.Sc Mathematics**

**PSO1: Solid Foundation in Knowledge:** Bachelor Degree in Mathematics is the culmination of in-depth knowledge of many core branches of mathematics, viz. Algebra, Calculus, Geometry, Differential Equations, Mechanics, Real and Complex Analysis including some related areas like Numerical Methods, Mathematical modelling, Operation Research, Probability and Statistics. Thus, this programme helps students in building a solid foundation for further higher studies and research in Mathematics.

**PSO2: Competency in Skills:** The skills and knowledge gained has intrinsic beauty, which leads to proficiency in analytical reasoning, critical understanding, analysis and synthesis in order to solve theoretical and practical problems. This can orient students towards applications of mathematics in other disciplines and moreover, can also be utilized in modelling and solving real life problems.

**PSO 3: Problem Solving:** Students undergoing this programme learn to logically question assertions, to recognize patterns and to distinguish between essential and irrelevant aspects of problems. This helps them to learn behave responsibly in a rapidly changing interdependent society.

**PSO4: Interdisciplinary and Research Skills:** Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non- mathematicians.

**PSO 5: Proficiency in Employments:** This programme will help students to enhance their employability for Government jobs, jobs in banking, insurance and investment sectors, data analysis jobs, and jobs in various other public and private enterprises.

**Department of Mathematics**  
**Proposed Internal Components**  
**For the Batch 2021 – 22**

<b>Under Graduate Programme</b>		
<b>Components</b>		<b>Marks</b>
I CA		15
II CA		15
Attendance		5
MCQ-30 questions- 60 minutes-online/offline	30	5
Problem Solving Session	15	5
Test Series(Unit Tests/Cycle Tests/Pre CA Tests)	15	5
<b>Total</b>		<b>50</b>

### Pattern of CA Question Paper (UG)

Section A	
Answer ALL the Questions	$6 \times 2 = 12$ Marks
Section B	
Answer ALL the Questions Either or Type	$3 \times 6 = 18$ Marks
Section C	
Answer ANY TWO Questions Out of Three Questions	$2 \times 10 = 20$ Marks

### Pattern of Semester Question Paper (UG)

Section A	
Answer ALL the Questions	$10 \times 2 = 20$ Marks
Section B	
Answer ALL the Questions Either or Type	$5 \times 7 = 35$ Marks
Section C	
Answer ANY THREE Questions Out of FIVE Questions	$3 \times 15 = 45$ Marks

**Total Marks for Each Subject is**

Continuous Internal Assessment 50 Marks + End Semester Examination 50

**Total = 100 Marks**

**Common Programme Structure under CBCS B.A., B.Sc., Programmes**

Part	Course		No. of Courses	Total No. of Hours	Total No. of Credits	Total
I	Tamil/Hindi/Urdu/French		4	20	12	20 (12)
II	General English		4	20	12	20 (12)
III	Main Core		16	86	86	124 (110)
	Main Electives		2	10	6	
	Allied		4	24	16	
	Non Major Elective		2	4	2	
IV	Life Education	Personal Skills Social Skills Employability Skills – I Employability Skills – II	4	8	4	16 (10)
		Value Education – I/ Christian Religion – I Value Education – II/ Christian Religion - II	2	4	2	
		Environmental Science	1	2	1	
		Human Rights	1	2	1	
		Communicative English	2		2	
V	Extension	Outreach Program			2	
		Groups and Movements			2	
VI	Extra Credit Course	Self Study Papers – I Self Study Paper - II	2		4*	
		Certificate Course	3		6*	
		Project Work/Internship			2*	
	<b>Total</b>			180	(148+6*)	180 (148+6*)

**\*\*Subject to the maximum of additional 6 credits**

**PG & RESEARCH DEPARTMENT OF MATHEMATICS**  
**SACRED HEART COLLEGE (AUTONOMOUS)**  
**B. Sc., Mathematics Programme Structure 2021-22**

Sem	Course Code	Course Title	Type	Hrs/Wk	Credits	Marks		
						Int	SE	Total
I	M116	Differential Calculus	MC	5	5	50	50	100
	M117	Algebra and Trigonometry	MC	5	5	50	50	100
	AP1XX	Allied - Physics - I	Allied	6	4	50	50	100
II	M214	Integral Calculus	MC	5	5	50	50	100
	M215	Differential Equations and Fourier Series	MC	5	5	50	50	100
	AP2XX	Allied Physics - II	Allied	6	4	50	50	100
III	M315	Vector Calculus	MC	5	5	50	50	100
	M316	Solid Geometry and Transforms	MC	5	5	50	50	100
	ACH3XX	Allied Chemistry -I	Allied	6	4	50	50	100
IV	M415	Numerical Methods	MC	5	5	50	50	100
	M416	Algebraic Structures - I	MC	5	5	50	50	100
	ACH4XX	Allied Chemistry - II	Allied	6	4	50	50	100
V	M541	Algebraic Structures - II	MC	6	6	50	50	100
	M542	Real Analysis - I	MC	6	6	50	50	100
	M543	Mechanics	MC	5	5	50	50	100
	M544	Probability and Statistics	MC	6	6	50	50	100
	M545A	Number Theory Mathematical Modeling with Difference and Differential Equations Fuzzy Algebra	DSE	5	3	50	50	100
	M545B							
M545C								
NMA504	Mathematics for Competitive Examinations-I	NME	2	1	50	50	100	
VI	M643	Linear Algebra	MC	6	6	50	50	100
	M644	Real Analysis - II	MC	6	6	50	50	100
	M645	Complex Analysis	MC	6	6	50	50	100
	M646A	Resource Management Techniques Graph Theory Discrete Mathematics	DSE	5	3	50	50	100
	M646B							
M646C								



	M647	Mathematical Statistics	MC	5	5	50	50	100
	NMA604	Mathematics for Competitive Examinations-II	NME	2	1	50	50	100
		<b>Total</b>		124	110+6*			

**MC – Main Core**

**DSE – Discipline Specific Elective**

**NME – Non-Major Elective**

<b>Semester</b>	<b>III</b>	<b>V</b>	<b>VI</b>	<b>Credits</b>
<b>Title of the Certificate Course</b>	Mathematical Logic	Mathematical Modeling with Spreadsheet	Scilab for Mathematical Computations	<b>2*+2*+2*</b>
<b>Title of Self Study Course</b>	Mathematical Aptitude - I Mathematical Competence Course	Mathematical Aptitude - II	-	<b>2*+2*</b>
	-	Individual Project/ Group project	-	<b>2*</b>
<b>MOOC Courses</b>	MOOC Courses are approved by the Department of Mathematics			Number of Credits awarded as per the recommendation of NPTEL

**\*\*Subject to the maximum of additional 6 credits**

**Programme Structure – B.Sc. Mathematics (2021-22)**

**Semester I**

Part	Type	Course Code	Title of the Course	Paper	Hours	Credit	CIA	Sem	Total
I	Language		Tamil/Hindi/Urdu/French	I	5	3	50	50	100
II	Language		General English	I	5	3	50	50	100
III	Main Core	M116	Differential Calculus	I	5	5	50	50	100
III	Main Core	M117	Algebra and Trigonometry	II	5	5	50	50	100
III	Allied		Allied Physics - I	I	6	4	50	50	100
IV	Life Education		Personal Skills	I	2	1	-	-	100*
			Christian Religion - I/Value Education – I	I	2	1	-	-	100*
			Communicative English	I		1	-	-	100*
Total					30	23			

**\*Internal Paper**

**Semester II**

Part	Type	Course Code	Title of the Course	Paper	Hours	Credit	CIA	Sem	Total
I	Language		Tamil/Hindi/Urdu/French	II	5	3	50	50	100
II	Language		General English	II	5	3	50	50	100
III	Main Core	M214	Integral Calculus	III	5	5	50	50	100
III	Main Core	M215	Differential Equations and Fourier Series	IV	5	5	50	50	100
III	Allied		Allied Physics - II	II	6	4	50	50	100
IV	Life Education		Social Skills	II	2	1	-	-	100*
			Christian Religion – II/ Value Education – II	II	2	1	-	-	100*
			Communicative English	II		1	-	-	100*
Total					30	23			

**\*Internal Paper**

**Semester III**

Part	Type	Course Code	Title of the Course	Paper	Hours	Credit	CIA	Sem	Total
I	Language		Tamil/Hindi/Urdu/French	III	5	3	50	50	100
II	Language		General English	III	5	3	50	50	100
III	Main Core	M315	Vector Calculus	V	5	5	50	50	100
III	Main Core	M316	Solid Geometry and Transforms	VI	5	5	50	50	100
III	Allied		Allied – III: Allied Chemistry - I	I	6	4	50	50	100
IV	Life Education		Employability Skills – I	III	2	1	-	-	100*
			Environmental Science	I	2	1	-	-	100*
VI	Extra Credit Course (Self Study Paper)		Mathematical Aptitude – I Mathematical Competence Course			2*			
VI	Extra Credit Course (Certificate Course)		Mathematical Logic			2*			
			Total		30	22+4*			

\*Internal Paper

**Semester IV**

Part	Type	Course Code	Title of the Course	Paper	Hours	Credit	CIA	Sem	Total
I	Language		Tamil/Hindi/Urdu/French	IV	5	3	50	50	100
II	Language		General English	IV	5	3	50	50	100
III	Main Core	M415	Numerical Methods	VII	5	5	50	50	100
III	Main Core	M416	Algebraic Structures - I	VIII	5	5	50	50	100
III	Allied		Allied – IV: Allied Chemistry -II	II	6	4	50	50	100
IV	Life Education		Employability Skills – II	IV	2	1	-	-	100*
			Human Rights	I	2	1	-	-	100*
V	Extension		Outreach Program			2			
			Groups and Movements			2			
			Total		30	26+1*			

\*Internal Paper

### Semester V

Part	Type	Course Code	Course	Paper	Hours	Credit	CIA	Sem	Total
III	Main Core	M541	Algebraic Structures – II	IX	6	6	50	50	100
III	Main Core	M542	Real Analysis – I	X	6	6	50	50	100
III	Main Core	M543	Mechanics	XI	5	5	50	50	100
III	Main Core	M544	Probability and Statistics	XII	6	6	50	50	100
III	Main Elective	M545A M545B M545C	Number Theory Mathematical Modeling with Difference and Differential Equations Fuzzy Algebra	I	5	3	50	50	100
III	Non-Major Elective	NMA504	(Offered to other Departments) Mathematics for Competitive Examinations-I	I	2	1			100*
VI	Extra Credit Course (Self Study Paper)		Mathematical Aptitude – II			2*			
VI	Extra Credit Course		Individual Project/ Group project			2*			
VI	Extra Credit Course (Certificate Course)		Mathematical Modeling with Spreadsheet			2*			
			Total		30	27+6*			

**\*Internal Paper**

### Semester VI

Part	Type	Course Code	Title Of the Course	Paper	Hours	Credit	CIA	Sem	Total
III	Main Core	M643	Linear Algebra	XIII	6	6	50	50	100
III	Main Core	M644	Real Analysis – II	XIV	6	6	50	50	100
III	Main Core	M645	Complex Analysis	XV	6	6	50	50	100
III	Main Elective	M646A M646B M646C	Resource Management Techniques Graph Theory Discrete Mathematics	II	5	3	50	50	100
III	Main Core	M647	Mathematical Statistics	XVI	5	5	50	50	100
III	Non-Major Elective	NMA604	Mathematics for Competitive Examinations- II		2	1			100*
VI	Extra Credit Course (Certificate Course)		Scilab for Mathematical Computations			2*			
			Total		30	27+2*			

**\*Internal Paper**

### Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S.No.	Level	Parameter	Description
1.	K1	Knowledge/Remembering	It is the ability to remember the previously learned.
2.	K2	Comprehension/Understanding	The learner explains ideas or concepts.
3.	K3	Application/Applying	The learner uses information in a new way.
4.	K4	Analysis/Analysing	The learner distinguishes among different
5.	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6.	K6	Synthesis/Creating	The learner creates a new product or point of view.

**Year/Semester: I Yr/ I SEM**  
**Credits: 5**

**Code: M116**  
**Hours/Week: 5**

## **Differential Calculus**

**Objective:** To develop problem solving skills in Calculus and provide base for higher mathematics.

### **Unit - I: Successive Differentiation**

Successive differentiation – Leibnitz’s Formula – Maxima and Minima (Problems Only).  
(Chapter III: Sections 1.1 to 1.6, 2.1, 2.2; Chapter V: Sections 1.1 to 1.3)

### **Unit - II: Rolle’s and Mean Value Theorems**

Rolle’s Theorem (Problems Only) – Mean Value Theorem (Problems Only) – Indeterminate forms.  
(Chapter VI: Sections 1, 2.1, 4.1 to 4.6)

### **Unit - III: Partial Differentiations**

Taylor’s theorem – Cauchy’s form of Remainder – Taylor’s and Maclaurin’s series – Partial differentiation – Euler’s theorem on homogenous functions.  
(Chapter VII: Sections 1.2 to 1.4; Chapter VIII: Sections 1.1, 1.2, 1.6)

### **Unit - IV: Curvature and Evolutes**

Curvature – Radius of curvature – Centre of curvature – Evolutes and Involutives –  $p-r$  equation.  
(Chapter X: Sections 2.1 to 2.7)

### **Unit - V: Envelopes and Asymptotes**

Envelopes – Asymptotes Parallel to the axis – Another method for finding asymptotes – Asymptotes by inspection – Intersections of a curve with its asymptotes.  
(Chapter X: Sections 1.1 to 1.4, Chapter XI: Sections 1 to 7)

### **Book for Study**

1. S. Narayanan and T. K. Manicavachagom Pillay, Calculus, Volume I, S. Viswanathan (Printers and Publishers), PVT Ltd, Chennai, 2011.

### **Books for Reference**

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc, 2002.
2. Dennis, D. Berkley, Calculus, Saunders College Publishing, New York, 1984.
3. Hilde Brand, Francis. B, Advanced Calculus for Applications, Prentice Hall Pvt. Ltd, New Delhi, 1977.
4. John. M. H, Ohm Steel, Advanced Calculus, Eurasia Publishing House, New Delhi, 1970.
5. P. Kandasamy and K. Thilagavathi, Mathematics for B. Sc Volume I & II, S. Chand & Co, New Delhi, 2004.
6. A. K. Sharma, Differential Calculus, Discovery Publishing House, New Delhi, 2004.

7. G. B. Thomas and R. L. Finney, Calculus, Pearson Education, 2007.

E-learning source: <http://www.learnerstv.com/Free-maths-Video-lectures-ltv295-Page1.htm>, <https://online.math.uh.edu/HoustonACT/videocalculus/>

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	classify the maxima and minima of the function.	K2
CO2	demonstrate mean value theorem for differentiable functions.	K3
CO3	developing the Euler's theorem of homogeneous function.	K6
CO4	finding the curvature and analyze evolutes of the curve in Cartesian and Polar coordinates.	K4, K5
CO5	identify and build the Envelopes and Asymptotes of the curve.	K1, K3

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	1	3	2	2	1	3	3	3	2	2	2.17
2	2	2	2	3	3	3	2	3	3	2	3	2	2.50
3	2	3	2	2	3	2	3	2	3	2	3	2	2.42
4	2	3	2	3	3	2	3	2	3	2	3	2	2.50
5	2	3	2	3	3	2	3	2	3	2	2	2	2.42
Mean Overall Score												2.40	
Result												High	



**Year/Semester: I Yr /I SEM**  
**Credits: 5**

**Code: M117**  
**Hours/Week: 5**

### **Algebra and Trigonometry**

**Objective:** To solve various types of algebraic equations, derive trigonometric identities and find real imaginary parts of complex trigonometric expression.

#### **Unit - I: Summation of Series**

Summation of Binomial Series, Exponential Series, Logarithmic Series and approximation problems (without proof of Theorems).  
(Chapters 2, 3, and 4: Pages 2.1-2.16, 3.1-3.15, 4.1- 4.16).

#### **Unit - II: Theory of Equations**

Formation of an equation - Fundamental Theorem in the theory of equations- Relation between the roots and coefficients of an equation - Imaginary roots and irrational roots - Reciprocal equation.  
(Chapter 6: Pages 6.1 - 6.37).

#### **Unit - III: Theory of equations (contd...)**

Transformation of Equation - Multiplication of roots by  $m$  - Diminishing the roots of an equation - Removal of a term - Descartes's Rule of signs - Descartes's rule of signs for negative roots of an equation - Horner's Method - Newton's Method. (Chapter 6: Pages 6.38 - 6.67).

#### **Unit - IV: Trigonometry**

Expansions for  $\sin n\theta, \cos n\theta$  and  $\tan n\theta$  - Expansions for  $\cos^n \theta, \sin^n \theta$  and  $\cos^m \theta \sin^n \theta$  in terms of sines and cosines of multiple of  $\theta$  - Expansions of  $\sin \theta, \cos \theta, \tan \theta$  in ascending powers of  $\theta$ .  
(Chapter 7: Pages 7.1 - 7.30).

#### **Unit - V: Trigonometry (contd...)**

Hyperbolic functions - Relations between circular and hyperbolic functions - Inverse hyperbolic functions.  
(Chapter 7: Pages 7.31 - 7.60).

#### **Book for Study**

1. P.R. Vital and V. Malini, Algebra and Trigonometry - I, Margham Publications - Reprint 2015.

#### **Books for Reference**

1. S. Arumugam and A. Thangapandi Issac, Algebra and Trigonometry, New Gamma Publishing House, July 2011.
2. G. Britto Antony Xavier, V. Balaji, S.U. Vasantha Kumar, B. Govindan, Mathematical Sciences, Jayalakshmi publications, second Edition 2015.

3. W.S. Burnside and A.W. Panton, The Theory of Equations, Dublin University Press, 1954.
4. P. Duraipandiyar, S. Udayabaskaran Allied Maths, Vol.1, Muhil publishers, First Edition, 1997.
5. P. Kandasamy, K. Thilagavathy, Mathematics for B.Sc., First semester, volume - I, S. Chand and company Ltd, First Edition, 2004.

E -Learning source: <http://www.sosmath.com/trig/hyper/hyper03/hyper03.html>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	list summation of various series.	K1
CO2	understand the importance of real and complex roots of the equation.	K2
CO3	finding the roots of the equation by various methods.	K5
CO4	formulate the Trigonometric series.	K6
CO5	determine and point out the relation between circular and hyperbolic function.	K3, K4

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	2	2	1	3	2	3	1	3	3	3	2	2	2.25
2	2	3	2	3	3	3	2	3	3	2	2	2	2.50
3	2	3	2	2	3	3	2	2	3	3	3	2	2.50
4	2	2	2	3	3	2	3	2	3	2	3	2	2.42
5	2	3	2	3	3	2	3	2	3	2	2	2	2.42
Mean Overall Score												2.42	
Result												High	

**Year/Semester: I Yr/II SEM**  
**Credits: 5**

**Code: M214**  
**Hours/Week: 5**

## **Integral Calculus**

**Objective:** To develop problem solving skills in Calculus and provide base for higher mathematics.

### **Unit - I: Integration of Rational Functions**

Integration by partial fractions – Integration of rational algebraic functions.  
(Chapter 1, Sections 7.3 - 7.5)

### **Unit - II: Integration of Trigonometric Functions**

Integration of Irrational functions – Integration of Trigonometric functions.  
(Chapter 1: Sections 8 and 9)

### **Unit - III: Definite Integrals**

Properties of definite integrals – Reduction Formulae – Bernoulli's Formula.  
(Chapter 1: Sections 11, 13, 15.1)

### **Unit - IV: Double and Triple Integrals**

Double and Triple integrals (Cartesian and Polar forms) – Changing the order of integration – Applications of double and triple integrals in finding area and volume.  
(Chapter 5: Sections 2.1, 2.2, 3.1, 4, 5.1 - 5.4, 6.1 - 6.3 (Problems Only)).

### **Unit - V: Improper Integrals**

Beta and Gamma functions– Applications of beta and gamma functions in evaluation of double and triple integrals.  
(Chapter 7: Sections 2.1 - 2.3, 3 - 6 (Problems only))

### **Book for Study**

1. S. Narayanan and T. K. Manicavachagom Pillay, Calculus, Volume II,
2. S. Viswanathan (Printers and Publishers), PVT Ltd, Chennai, 2012.

### **Books for Reference**

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons (Asia) Pvt. Ltd, 2002.
2. Dennis, D. Berkley, Calculus, Saunders College Publishing, New York, 1984.
3. John. M. H, Ohm Steel, Advanced Calculus, Eurasia Publishing House, New Delhi, 1970.
4. P. Kandasamy and K. Thilagavathi, Mathematics for B. Sc Volume I & II, S. Chand & Co, New Delhi, 2004.
5. A. K. Sharma, Differential Calculus, Discovery Publishing House, New Delhi, 2004.
6. G. B. Thomas and R. L. Finney, Calculus, 9<sup>th</sup> edition, Pearson Education, Delhi, 2005.

**E-learning source:** <http://www.learnerstv.com/Free-maths-Video-lectures-ltv295-Page1.htm>, <https://online.math.uh.edu/HoustonACT/videocalculus/>

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	identify the techniques to solve the integration of Rational function.	K1
CO2	understand the techniques to solve the integration of Trigonometry function.	K2
CO3	applying the Bernoulli's formula to get the solution of the integral of the function.	K3
CO4	evaluate and deduce the concept of double and triple integrals.	K4, K5
CO5	integrate of double and triple integral by Beta and Gamma function.	K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	2	2	1	3	2	3	1	3	3	3	2	2	2.25
2	2	3	2	3	3	3	2	2	3	2	2	2	2.42
3	2	3	2	2	3	3	2	2	3	2	3	2	2.42
4	2	2	3	3	3	1	3	2	3	2	3	2	2.42
5	2	3	2	3	3	2	3	2	3	2	2	2	2.42
Mean Overall Score													2.38
Result													High

**Year/Semester: I Yr / II SEM**  
**Credits: 5**

**Code: M215**  
**Hours / Week: 5**

## **Differential Equations & Fourier Series**

**Objectives:** To help the learners to solve standard types of ordinary and partial differential equations

### **Unit - I: Differential Equations of First Order**

Exact differential equations- integrating factors-equations of first order but of higher degree - equations solvable for  $p$ ,  $y$  and  $x$  - Clairaut equation.

(Book 1: Chapter 1, Sections 1.3, 1.4 and 1.7)

### **Unit - II: Linear Equations of Higher Order**

Linear equations of higher degree with constant coefficients - homogeneous linear equations - variation of parameters - simultaneous linear differential equations. (Book 1: Chapter 2, Sections 2.1 - 2.4, Type D in 2.5, 2.6 and 2.7)

### **Unit - III: Partial Differential Equations**

Partial differential equations - formation - solution - Lagrange's method - standard forms - Charpit's method.

(Book 1: Chapter 4, Sections 4.1-4.5)

### **Unit - IV: Applications of Differential Equations**

Applications - orthogonal trajectories-growth and decay - dynamical problems with variable mass.

(Book 1: Chapter 6, Sections 6.1, 6.2 and 6.12)

### **Unit - V: Fourier Series**

Definition - even and odd functions - half-range Fourier series - development in cosine series - development in sine series.

(Book 2: Chapter 6: Sections 6.1 - 6.5)

### **Books for Study**

1. S. Arumugam, Issac, "Differential Equations and Applications", New Gamma Publishing House, Palayamkottai, 2011.
2. S. Narayanan and T.K. Manickavachagam Pillay, Calculus (Volume III),
3. S. Viswanathan Publishers Pvt., Ltd., Chennai, 2011.

### **Books for Reference**

1. Gupta, Malik and Mittal Differential Equations-Pragati Prakashan, Fourth Edition, 1997.
2. S. Narayanan and T. K. Manicavachagam, Differential Equations and its Applications - S. Viswanathan (printers & publishers) Pvt. Ltd., 1996
3. Richard Bronson, Differential Equations - Schaum's Outline Series, McGraw Hill,

Second Edition, 1994

**E - Learning source:** <http://ocw.mit.edu/courses/mathematics/indexhtm>,  
<http://tutorial.math.lamar.edu/Classes/DE/DE.aspx>,<https://ocw.mit.edu/courses/mathematics/18-03-differential-equations-spring-2010/>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the genesis of ordinary as well as partial differential equations and name the applications in real world.	K1, K2
CO2	apply various techniques of getting exact solutions of certain solvable first order differential equations and linear differential equations of second order.	K3
CO3	find solution of first order linear partial differential equations using Lagrange's method and eliminating constant and functions..	K4, K5
CO4	solve second order linear partial differential equations with constant coefficients.	K3
CO5	formulate mathematical models in the form of ordinary differential equations and to get the solution of the problem. Fourier Cosine and Fourier Sine series.	K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	2	2	1	3	3	3	1	3	3	3	2	2	2.33
2	2	3	2	3	3	3	2	3	3	2	2	2	2.50
3	3	2	2	2	3	3	2	3	2	3	3	2	2.50
4	2	2	2	3	3	2	3	2	3	2	3	2	2.42
5	3	3	2	3	3	2	3	2	3	2	2	2	2.50
Mean Overall Score												2.45	
Result												High	

Year/Semester: II Yr /III SEM

Credits: 5

Code: M315

Hours/Week: 5

## Vector Calculus

**Objective:** To develop deep understanding of key concepts followed by problems of applied mathematics, which are essential tools of modern applied mathematics.

### Unit - I: Vector Differentiation

Velocity of a particle - Examples - Scalar and Vector point functions - Level surfaces - Directional derivative of a scalar point function - Gradient of a scalar point function - Summation notation for gradient - Gradient of  $f(r)$ .

(Chapter 1: Sec 1.5 - 1.6 and Chapter 2: Sec 2.1 - 2.6, Chapter 2, Examples Section 2.13 - subsection 2.3 - 2.4).

### Unit - II: Divergence and Curl

Divergence and curl of a vector point function - Scalar potential - Summation notation for divergence and curl - Divergence and curl of  $f(r) \bar{r}$  - Laplacian differential operator - Other Differential operators - Divergence and curl of a gradient - Divergence and curl of a curl - Examples.

(Chapter 2: Sec 2.7 - 2.13, Chapter 2, Examples Section 2.13 - subsection 2.7 - 2.11).

### Unit - III: Line, Surface and Volume Integrals

Line integrals - Line integral along an arc C - Surface integrals - Volume integrals - Examples.

(Chapter 3: Sec 3.1, 3.5, 3.6, 3.8, Omit Parabolic Cylinder type problems in Example 3.5).

### Unit - IV: Integrals Theorems

Gauss divergence theorems without proof.

(Chapter 4: Sec 4.2, Examples 4.8).

### Unit - V: Integrals Theorems (Contd...)

Green's theorems in plane without proof - Stoke's theorem without proof.

(Chapter 4: Sec 4.4, 4.5, Examples 4.8).



## Book for Study

1. P. Duraipandian and Kayalal Pachaiyappa, Vector Analysis, S Chand and Company Limited, Ram Nagar, New Delhi, 2018.

## Books for Reference

1. Abosos Ali Shaikh, Vector Analysis with Applications, Narosa publications, New Delhi, 2009.
2. M.L.Khanna, Vector Analysis, Jai PrakashNath and Co, 8th Edition, Meerut City, 1986.
3. Murray R. Spiegel, Seymour Lipschutz, Dennis Spellman, Vector Analysis, Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. M.D. Rajasinghania and others, Vector Algebra, S.Chand & Company Pvt.Ltd, Ram Nagar New Delhi, 1999.
5. P.R. Vittal, Vector Analysis, Margham publications, Chennai, 1997.

E- Learning source: <http://www.math.hmoedu/calculus/tutorials/vector> analysis

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the definition of Scalar and Vector point's functions and find the directional derivative of a Scalar point function.	K2
CO2	find the solenoidal and irrotational of the vector point function.	K6
CO3	evaluate the line integrals, surface integrals and volume integrals.	K5
CO4	describe inter-relationship among the line integral, surface integral and triple integral formulation.	K1
CO5	apply and analyze Greens', Gauss and Stokes theorem.	K3, K4

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	2	2	1	3	2	3	1	3	3	3	2	2	2.25
2	3	3	2	3	3	3	2	3	3	2	3	2	2.67
3	2	3	2	3	3	3	2	3	2	3	3	2	2.58
4	2	3	2	3	3	2	3	2	3	2	3	2	2.50
5	2	3	2	3	3	2	3	2	3	3	2	2	2.50
Mean Overall Score												2.50	
Result												High	

**Year/Semester: II Yr /III SEM**  
**Credits: 5**

**Code: M316**  
**Hours/Week: 5**

### **Solid Geometry and Transforms**

**Objective:** To make the students understand the basic concepts in two dimensional, three dimensional geometry, Laplace and Fourier transforms and to make them solve problems in these fields of study.

#### **Unit - I: Plane**

First degree equation - Determination of a plane - Plane perpendicular to a given direction - Planes parallel to given lines and through given points - Equation  $P + \lambda P' = 0$  - Second degree homogeneous equation - Co planarity of the lines through a point - Perpendicular to a plane - positions of points with reference to a Plane - Sums .

(Book 1 : Chapter 3: Sections 3.1 to 3.9, 3.12)

#### **Unit - II: Straight lines**

Equation of a straight line - Conditions for various situations of a line - Angle between a plane and a line - Projection of a line - Perpendicular drawn to a line - Shortest distance between two skew lines.

(Book 1 : Chapter 4: Sections 4.1 to 4.6)

#### **Unit - III: Straight lines (Continued)**

Lines intersecting a given line - Lines of intersection of three planes - Equation of two given skew lines - Sums.

( Book 1 : Chapter 4: Sections 4.7 to 4.9, 4.11)

#### **Unit - IV: Laplace Transforms**

Laplace transforms - Inverse Laplace transforms - Solution of differential equations using Laplace transforms.

(Book 3 : Chapter 3, Sections 3.0-3.3)

#### **Unit - V: Fourier Transforms**

Infinite Fourier Transforms : Fourier sine transforms- Fourier cosine transforms-Linear property-Change of scale property-Shifting property-Modulation property-Convolution and Derivative theorems-Problems.

(Book-2 : Chapter 2 , Pages 158-185).

#### **Books for Study**

1. P. Duraipandian and KayalalPachaiyappa, Analytical Geometry 3D, Muhil Publishers, Revised Edition 2009..
2. J.K. Goyal and K.P.Gupta, Laplace and Fourier Transforms, PragatiPrakashan Publishers,1995.
3. S. Arumugam, Issac, "Differential Equations and Applications", New Gamma Publishing House, Palayamkottai, 2011.

**Books for Reference:**

1. P.K. Jain and Khalil Ahmed, Analytical Geometry of three dimensions, Wiley Eastern limited, 1991.
2. M. Pillai & others, Analytical Geometry, part II 3D, S.Viswanathan & co, Chennai, 1984.

**E-learning Source:** <http://mathworld.wolfram.com>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	relate between plane and straight line in 2D and 3D.	K2
CO2	examine the two dimensional, three dimensional geometry and solve problems in these areas	K1, K3
CO3	analyze the uses of solid geometry in different scientific fields.	K4
CO4	find the solution of ODE using Laplace transforms.	K5
CO5	define the Fourier transform and its properties and convolution theorem and perform problems by Fourier transform.	K1, K6

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	3	2	1	2	2	3	1	3	3	3	2	2	2.25
2	2	3	2	3	3	3	2	3	3	2	2	2	2.50
3	2	3	2	2	3	3	2	2	2	3	3	3	2.50
4	2	3	3	2	3	2	3	3	3	2	3	2	2.58
5	2	3	2	3	3	2	3	2	3	2	2	2	2.42
Mean Overall Score												2.45	
Result												High	

**Year/Semester: II Yr /IV SEM**  
**Credits: 5**

**Code: M415**  
**Hours/Week: 5**

## **Numerical Methods**

**Objective:** To introduce the scientific computation techniques to the students.

### **Unit – I: Transcendental and Polynomial Equations**

Introduction – Bisection Method -Iteration methods based on first degree equation-Iteration methods based on second degree equation-Rate of convergence. (Without proof of formulae).

(Chapter 2: Sections 2.1 to 2.5)

### **Unit – II: System of linear Algebraic Equations**

Introduction - Direct Methods - Error Analysis for Direct methods - Iteration Methods (Without proof of formulae).

(Chapter 3: Sections 3.1 to 3.4)

### **Unit – III: Interpolation and Approximation**

Introduction - Lagrange and Newton interpolations – Finite difference operators-Interpolating polynomials using finite differences – Hermite interpolation – Piecewise and Spline interpolation – Bivariate interpolation (Without proof of formulae).

(Chapter 4: Sections 4.1 to 4.7)

### **Unit – IV: Numerical Differentiation**

Introduction – Numerical Differentiation – Optimum choice for step-length – Extrapolation methods – Partial Differentiation (Without proof of formulae). (Chapter 5: Sections 5.1 to 5.5)

### **Unit – V: Numerical Integration**

Numerical integration - Methods based on interpolation - Methods based on undetermined co-efficients - Composite integration methods – Romberg Integration – Double integration (Without proof of formulae).

(Chapter: Sections 5.6 to 5.11)

### **Book for Study**

1. M.K Jain, S.R.K Iyengar, and R.K Jain, Numerical Methods for Scientific and Engineering Computation, New age International Publisher, India, 2012.

## Books for Reference

1. E. Balagurusamy, Numerical Methods, Tata McGraw Hill Publishing Company, New Delhi, 2004.
2. P. Kandasamy, K. Thilagavathi, K. Gunavathi, Numerical Methods, S. Chand & Company Ltd, New Delhi, 1997.
3. S.S. Sastry, Introductory methods of Numerical Analysis, 3-e, Prentice Hall Pvt Ltd, New Delhi, 2000.
4. A. Singaravelu, Numerical Methods, Meenakshi Publications, Chennai, 2002.

**E-learning source:** <http://nptel.ac.in/courses/122102009/>,  
<http://www.math.ust.hk/~machas/numerical-methods.pdf>

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	find numerical solution to algebraic and transcendental equation.	K5
CO2	devise numerical solutions of system of linear equations and to check the accuracy of the solution.	K6
CO3	apply various interpolating and extrapolating methods to find numerical solution.	K3
CO4	understand the concept of numerical differentiation.	K2
CO5	define integration formulas and analyze the integrals by using Trapezoidal and Simpson's formula.	K1, K4

## Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	2	3	1	3	2	3	1	3	3	3	2	2	2.33
2	2	3	2	3	3	3	2	3	3	2	2	2	2.50
3	3	3	3	2	3	3	2	2	3	3	3	2	2.67
4	2	2	2	3	3	2	3	2	3	2	3	2	2.42

5	2	3	2	3	3	2	3	2	3	2	2	2	2	2.42
Mean Overall Score													2.47	
Result													High	

**Year/Semester: II Yr/IV SEM**  
**Credits: 5**

**Code: M416**  
**Hours/Week: 5**

### **Algebraic Structures - I**

**Objective:** To acquire the knowledge of basic concept of some of the fundamental algebraic structures on Groups and Subgroups, Permutation Groups, Normal Subgroups and Factor Groups and Group Homomorphism's.

#### **Unit - I: Groups, Finite Groups and Subgroups**

Definition and Examples of Groups - Elementary Properties of Groups - Historical Note. Terminology and Notation - Subgroup Tests - Examples of Subgroups. (Chapters 2, 3)

#### **Unit - II: Cyclic and Permutation Groups**

Properties of Cyclic Groups - Classification of Subgroups of Cyclic Groups. Definition and Notation - Cycle Notation - Properties of Permutations - A Check Digit Scheme Based on  $D_5$ . (Chapters 4, 5)

#### **Unit - III: Isomorphism's, Cosets and Lagrange's Theorem**

Motivation - Definition and Examples - Cayley's Theorem - Properties of Isomorphism's - Automorphism's - Properties of Cosets - Lagrange's Theorem and Consequences - An Application of Cosets to Permutation Groups - The Rotation Group of a Cube and a Soccer Ball. (Chapters 6, 7).

#### **Unit - IV: External Direct Products, Normal Subgroups and Factor Groups**

Definition and Examples - Properties of External Direct Products - The Group of Units Modulo  $n$  as an External Direct Product - Applications. Normal Subgroups- Factor Groups - Applications of Factor Groups - Internal Direct Products. (Chapters 8, 9).

#### **Unit - V: Group Homomorphism's and Finite Abelian Groups**

Definition and Examples - Properties of Homomorphism's - The First Isomorphism Theorem. The Fundamental Theorem - The Isomorphism Classes of Abelian Groups - Proof of the Fundamental Theorem. (Chapters 10, 11).

#### **Book for Study**

1. Joseph A. Gallian, Contemporary Abstract Algebra, 4<sup>th</sup> Ed., Narosa Publishing House, 1999.

#### **Books for Reference**

1. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
2. S.Arumugam and A.Thandapani, Modern Algebra, SciTech Publications Pvt. Ltd.
3. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
4. N. Herstein, Topics in Algebra, John Wiley and sons, 2-e, New Delhi, 2006.
5. John B. Fraleigh, A First Course in Abstract Algebra, 7-e, Pearson Education Publication, New Delhi 2003.
6. Saunders Maclane and Garrett Birkoff, Algebra, 2-e, Macmillan Publishing Co.inc, New York, 1979.
7. Serge Lang, Algebra, Addition Wesley Publishing Company, London 1965.
8. Surjeeth Singh and Quazi Zameeruddin, Modern Algebra 2-e, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.

**E - Learning source:** <http://mathworld.wolfram.com>

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the fundamental concept of groups, subgroups and related theorems.	K2
CO2	define cyclic and permutation groups and its properties.	K1
CO3	establish Lagrange's theorem.	K3
CO4	categorize internal and external direct products.	K4
CO5	consider finite abelian group and develop their properties of homomorphism	K5, K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
2	2	2	1	3	2	3	1	3	3	3	2	2	2.25
2	2	3	2	3	3	3	2	3	3	2	2	2	2.50
3	2	3	2	2	3	3	2	2	3	3	3	2	2.50
4	2	2	2	3	3	2	3	2	3	2	3	2	2.42
5	2	3	2	3	3	2	3	2	3	2	2	2	2.42



Mean Overall Score	2.42
Result	High

**Year/Semester: III Yr /V SEM**  
**Credits: 6**

**Code: M541**  
**Hours/Week: 6**

### **Algebraic Structures - II**

**Objective:** To acquire the knowledge of basic concept of some of the fundamental algebraic structures on Rings and Integral Domains, Ideals, Factor Rings and Polynomials.

#### **Unit - I: Rings and Integral Domains**

Definition - Examples of Rings - Properties of Rings - Subrings. Definition and Examples - Fields - Characteristic of a Ring.  
 (Chapter 12, 13).

#### **Unit - II: Ideals and Factor Rings**

Ideals - Factor Rings - Prime Ideals and Maximal Ideals.  
 (Chapter 14).

#### **Unit - III: Ring Homomorphism's and Polynomial Rings**

Definition and Examples - Properties of Ring Homomorphism's - The Field of Quotients - The Division Algorithm and Consequences.  
 (Chapter 15, 16).

#### **Unit - IV: Factorization of Polynomials**

Reducibility Tests - Irreducibility Tests- Unique Factorization in  $Z[x]$  - Weird Dice: An Application of Unique Factorization.  
 (Chapter 17).

#### **Unit - V: Divisibility in Integral Domains**

Irreducible, Primes - Historical Discussion of Fermat's Last Theorem - Unique Factorization Domains- Euclidean Domains.  
 (Chapter 18).

#### **Book for Study**

1. Joseph A. Gallian, Contemporary Abstract Algebra, 4<sup>th</sup> Ed., Narosa Publishing House, 1999.

#### **Books for Reference**

1. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
2. S.Arumugam and A.Thandapani, Modern Algebra, SciTech Publications Pvt. Ltd.
3. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.

4. N. Herstein, Topics in Algebra, John Wiley and sons, 2-e, New Delhi, 2006.
5. John B. Fraleigh, A First Course in Abstract Algebra, 7-e, Pearson Education Publication, New Delhi 2003.
6. Saunders MacLane and Garrett Birkhoff, Algebra, 2-e, Macmillan Publishing Co. Inc, New York, 1979.
7. Serge Lang, Algebra, Addison Wesley Publishing Company, London 1965.
8. Surjeeth Singh and Quazi Zameeruddin, Modern Algebra 2-e, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.

**E - Learning source:** <http://mathworld.wolfram.com>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	analyze and demonstrate examples of ideals and factor rings.	K2, K4
CO2	define isomorphism and homomorphism for groups and rings.	K1
CO3	categorize various canonical types of groups and rings.	K4
CO4	apply and perform the reducibility and irreducibility tests for factorization of polynomials.	K3, K6
CO5	prove the divisibility of integral domain	K5

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	1	3	2	2	2	2	3	3	3	3	2.42
2	3	2	1	3	3	2	2	3	3	3	3	2	2.5
3	3	2	1	3	3	3	2	3	3	3	2	2	2.5
4	3	2	2	3	3	3	2	3	3	3	3	2	2.67
5	3	2	2	3	3	2	2	3	3	2	2	2	2.42
	Mean Overall Score												2.50
	Result												High

**Year/Semester: III Yr /V SEM**

**Credits: 6**

**Code: M542**

**Hours/Week: 6**

### **Real Analysis - I**

**Objective:** To study the real number system, point set topology, limits and continuity, derivatives of real-valued functions.

#### **Unit - I: Real Number System**

Upper bounds, maximum element, least upper bound - The completeness axiom - Some properties of the supremum - Properties of the integers deduced from the completeness axiom - The Archimedean property of the real number system - Rational number with finite decimal representation - Finite decimal approximation to real numbers - Infinite decimal approximation to real numbers - Absolute values and the triangle inequality - The Cauchy-Schwarz inequality - Plus and minus infinity and the extended real number system  $R^*$  - Finite and infinite sets - Countable and uncountable sets - Uncountability of the real number system - Set algebra - Countable collection of countable sets. (Chapter 1: Sections 1.10 to 1.20) (Chapter 2: Sections 2.11 to 2.15, Related Problems).

#### **Unit - II: Point Set Topology**

Introduction - Euclidean space in  $R^n$  - Open balls and open sets in  $R^n$  - Structure of open sets in  $R^1$  - Closed sets - Adherent points, Accumulation points - Closed sets and adherent points - Bolzano Weierstrass theorem (without proof) - Cantor intersection theorem.

(Chapter 3: Sections 3.1 to 3.9, Related Problems).

#### **Unit - III: Limits and Continuity**

Introduction - Convergent sequences in a metric space - Cauchy sequences - Complete metric spaces - Limit of a function - Continuous functions - Continuity of composite functions - Examples of continuous functions.

(Chapter 4: Sections 4.1 to 4.5, 4.8, 4.9, 4.11, Related Problems).

#### **Unit - IV: Continuity**

Continuity and inverse images of open or closed sets - Functions continuous on compact sets - Topological mappings - Bolzano's theorem - Uniform continuity - Uniform continuity and compact sets - Fixed point theorem for contractions. (Chapter 4: Sections 4.12 to 4.15, 4.19 to 4.21, Related Problems).

## Unit - V: Derivatives

Introduction - Definition of derivative - Derivatives and continuity - Algebra of derivatives - The chain rule - One-sided derivatives and infinite derivatives - Functions with non-zero derivatives - Zero derivatives and local extrema - Rolle's theorem - The Mean Value theorem for derivatives - Intermediate Value theorem for derivatives - Taylor's formula with remainder.

(Chapter 5: Sections 5.1 to 5.12, Related Problems).

### Book for Study

1. Tom M. Apostol, *Mathematical Analysis*, Indian student second edition, Narosa Publishing House, Chennai, 20<sup>th</sup> Reprint, 2002.

### Books for Reference

1. P. N. Arora and Ranjit Singh, *First course in Real Analysis*, Third edition, Sultan Chand and Sons Publishers, New Delhi, 1981.
2. S. Arumugam, *Modern Analysis*, New Gamma Publishers, Palayamkottai, 1993.
3. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
4. Robert G. Bartle and Donald R. Sherbert, *Introduction to Real Analysis* by 2-e John Wiley and Sons, 2000.
5. Richard R. Goldberg, *Methods of Real Analysis*, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1970.

**E-Learning source:** [mathworld.wolfram.com/Analysis.html](http://mathworld.wolfram.com/Analysis.html).

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand and validate the basic properties of real number system such as least upper bound properties and Archimedean properties.	K2, K6
CO2	identify the continuity of a function.	K1
CO3	define and focus on open set, closed set, connected sets, continuous set adherent points and accumulation points.	K1, K4
CO4	establish famous theorems such as Bolzano's theorem and Fixed point theorem.	K3
CO5	evaluate derivatives of real valued function using Rolle's theorem, Mean value theorem and Taylor's formula.	K5

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	2	3	2	2	2	2	3	3	3	3	2.5
2	3	2	1	2	3	2	2	3	2	3	2	2	2.25
3	3	2	2	3	3	3	2	2	3	3	2	2	2.5
4	2	2	1	2	3	3	2	3	3	3	2	2	2.33
5	3	2	1	3	3	2	2	3	3	2	2	2	2.33
	Mean Overall Score												2.38
	Result												High

**Year/Semester: III Yr/VSEM**

**Credits: 5**

**Code: M543**

**Hours/Week: 5**

## **Mechanics**

**Objective:** To introduce the study of the motion of particles or bodies under the influence of forces and to provide a basic knowledge of behavior of objects in motion.

### **Unit - I: Kinematics**

Velocity - Velocity of a particle describing a circle - Resultant velocity - Relative velocity - Acceleration - Rectilinear motion - Rectilinear motion with a constant acceleration - Coplanar motion - Velocity and Acceleration in a coplanar motion - Angular velocity - Relative Angular velocity.

(Chapter 1: Sections 1.2 to 1.4)

### **Unit - II: Forces on a particle and on a rigid body**

Newton's laws of motion - Forces - Types of forces - Resultant of two forces on a particle - Resultant of three forces related to triangle acting at a point - Resultant of several forces acting on a particle - Equilibrium of a particle - Equilibrium of a particle under three forces - Equilibrium of a particle under several forces. (Chapter 2: Sections 2.1, 2.2 and Chapter 3: Section 3.1)

### **Unit - III: Frictional Forces**

Friction - Laws of friction - Cone of friction and angle of friction - Limiting equilibrium of a particle on an inclined plane - Problems involving frictional forces. (Chapter 3: Section 3.2 and Chapter 5: Section 5.2 excluding 5.2.1)

### **Unit - IV: Simple Harmonic Motion**

Simple harmonic motion - Projection of a particle having a uniform circular motion - Composition of two simple harmonic motions of same period - Simple harmonic motion along a horizontal line -- Motion under gravity in a resisting medium. Simple pendulum - Seconds pendulum.

(Chapter 12: Sections 12.1, 12.2, 12.4 and Chapter 15: Section 15.6).

### **Unit - V: Projectiles and Impact**

Forces on a projectile - Displacement as a combination of vertical and horizontal displacements - Nature of trajectory - Results pertaining to the motion of a projectile - Maximum horizontal range for a given velocity - Two trajectories with a given speed and range - Projectile projected horizontally- Impulsive Force - Conservation of linear momentum- Impact of Spheres - Laws of Impact - Impact of Two Smooth Spheres - Direct impact of two smooth spheres.

(Chapter 13: Section 13.1 and Chapter 14: Sections 14.1, 14.2, 14.3).

**Book for Study:**

1. P.Duraipandian, LaxmiDuraipandian, MuthamizhJayapragasam, Mechanics, 6-e, S.Chand and Company Ltd., 2005.

**Books for Reference:**

1. V.Dharmapadam, Statics, S.Viswanathanpvt.Ltd. Madras, 1974.
2. A.V. Dharmapadam, Dynamics, S. Viswanathan Pvt. Ltd. 1981
3. R.C.Hibbler, Engineering Mechanics, Statics and Dynamics, Macmillan Publishing Company.
4. S.L.Loney, Principle of mechanics, Macmillan and Company Ltd, 1969
5. T.Natarajan, T.GovindaRajan, G. R.Venkataraman, K.Muthuswamy, Statics, Rochouse and sons, Madras, Chand and Company Ltd, New Delhi 1970.

**E-Learning source:**

<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=3628>

**Course Learning Outcomes:**

By the end of the semester, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	bringout the fundamental concepts of Kinematics.	K1
CO2	understand Forces on a rigid body.	K2
CO3	solving the problems involving frictional forces and outline their applications.	K3, K4
CO4	prove rectilinear motion under varying forces.	K5
CO5	hypothesize projectile and impact.	K6

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	2	3	2	3	2	2	3	3	2	3	2.42
2	3	2	2	2	3	2	2	3	2	3	2	2	2.33
3	3	2	2	3	3	2	2	2	2	3	2	2	2.33
4	2	2	2	2	3	3	2	3	2	3	2	2	2.33



5	2	2	2	3	3	2	2	3	3	2	2	2	2.33
Mean Overall Score												2.35	
Result												High	

**Year/Semester: III Yr/VSEM**  
**Credits: 6**

**Code: M544**  
**Hours/Week: 6**

### **Probability and Statistics**

**Objective:** To develop the statistical concepts and introduce the techniques of analysis and inference used for research in social and life sciences.

#### **Unit - I: Probability**

Basic Terminology - Mathematical probability - Axiomatic approach to probability -Some Theorems on Probability - Conditional Probability -Multiplication theorem of Probability - Independent events - Multiplication theorem of Probability for Independent events -- Pair wise independent events.

(Chapter 3: Sections 3.3, 3.4, 3.8 to 3.15: Omit section 3.14)

#### **Unit - II: Random variables and Distribution functions**

Introduction - Distribution Function - Discrete Random Variable - Continuous Random Variable - Two Dimensional Random Variables.

(Chapter 5: Sections 5.1 to 5.5 ; Omit Subsections 5.4.2, 5.5.6, 5.5.7)

#### **Unit - III: Mathematical Expectation and Generating functions**

Introduction - Mathematical Expectation - Expected value of Function of a Random Variable - Properties of Expectation - Properties of Variance - Covariance - Some Inequalities involving Expectation - Moment Generating Function - Cumulants - Characteristic Function - Chebychev's Inequality - Bernoulli Law of Large Numbers.

(Chapter 6: Sections 6.1 to 6.7; Chapter 7: Sections 7.1, 7.2, 7.3, 7.5, 7.7.1: Omit Subsections 7.3.2, 7.3.3)

#### **Unit - IV: Discrete and Continuous Distributions**

Bernoulli distribution - Binomial distribution - Poisson distribution - Normal distribution -Rectangular distribution - Gamma distribution.

(Chapter 8: Sections 8.3 to 8.5; Chapter 9: Sections 9.2 , 9.3 & 9.5: Omit Subsections 9.2.12 to 9.2.15)

#### **Unit - V: Correlation and Regression**

Meaning of Correlation - Scatter diagram -Karl Pearson's Coefficient of Correlation - Calculation of the Correlation Co-efficient for a Bivariate Frequency Distribution - Probable Error of Correlation Co-efficient - Rank correlation - Linear Regression.

(Chapter 10: Sections 10.2 to 10.7; Chapter 11: Section 11.2)

### Book for Study

1. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11-e, Sultan Chand & Sons, New Delhi, 2009.

### Books for Reference

1. Murray R. Spiegel, Statistics, 2-e, McGraw Hill Book Company, New Delhi, 1992.
2. Richard A. Janson, Miller, Friends, Probability and statistics for engineers, 6-e Pearson Education Pvt. Ltd. Delhi, 2001.
3. Sheldon Ross, A First course in probability, 6-e Pearson Education Pvt. Ltd. Delhi, 2014.
4. William - Feller, An introduction to probability theory and its applications, 3-e, Wiley eastern limited, New Delhi, 1968.

E - Learning source: <http://mathword.wolfram.com>

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the basic concepts of probability and various probabilities.	K2
CO2	classify and perform discrete and continuous random variable and their probability distribution.	K2, K6
CO3	define expectation and moment generating function and focus their properties.	K1, K4
CO4	establish discrete and continuous distributions such as Binomial, Poisson, normal, uniform and gamma distribution.	K3
CO5	find the correlation coefficient, rank correlation and fitting of regression lines by least square method.	K5

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	1	2	3	2	2	2	2	2	3	3	2	2.2
2	2	2	2	3	2	2	2	2	3	3	3	2	2.33
3	1	1	2	3	3	3	2	2	2	2	3	2	2.08
4	2	2	2	3	3	3	2	2	2	3	3	2	2.42
5	3	2	2	3	3	3	2	3	2	3	3	3	2.67
Mean Overall Score												2.34	
Result												High	

**Year/Semester: III Yr /V SEM**

**Code: M545A**

**Credits: 3**

**Hours/Week: 5**

### **Number Theory (Elective)**

**Objective:** To study the divisibility, primes, congruence's and arithmetic functions in number theory.

#### **Unit - I: Divisibility**

Introduction - Divisibility, Greatest Common Divisor, Euclid's Algorithm, Greatest Common Divisor via Euclid's Algorithm - Least Common Multiple - Representation of Integers, Decimal Representations of Integers, Binary Representations of Integers. (Chapter 2: Sections 2.1 to 2.4, Related Problems).

#### **Unit - II: Primes**

Introduction - Primes, Prime counting function, prime number theorem, Test of primality by trial division -Sieve of Eratosthenes, Canonical Factorization, Fundamental theorem of arithmetic,Sieve of Eratosthenes, Determining the canonical factorization of a natural number. (Chapter 3: Sections 3.1 to 3.3, Related Problems).

#### **Unit - III: Congruences**

Introduction - Congruences and Equivalence Relations, Equivalence Relations - Linear Congruences - Linear Diophantine Equations and the Chinese Remainder Theorem. (Chapter 4: Sections 4.1 to 4.4, Related Problems)

#### **Unit - IV: Congruences (continued)**

Polynomial Congruences - Modular Arithmetic: Fermat's Theorem - Wilson's Theorem and Fermat Numbers - Pythagorean Equation. (Chapter 4: Sections 4.5 to 4.8, Related Problems)

#### **Unit - V: Arithmetic Functions**

Introduction - Sigma function, Tau function, Dirichlet product - Dirichlet Inverse, Mobius function, Euler's Function, Euler's Theorem, An application of algebra (Chapter 5: Sections 5.1 to 5.3, Related Problems).

#### **Book for Study**

1. Neville Robinns, Beginning Number Theory, 2<sup>nd</sup> Ed., Narosa Publishing House Pvt. Limited, Delhi, 2006.

#### **Books for Reference**

1. David M. Burton, Elementary Number Theory 6<sup>th</sup> Dd., Tata McGraw-Hill Edition, Indian reprint, 2007.
2. Neville Robinns, Beginning Number Theory, 2<sup>nd</sup> Ed., Narosa Publishing House Pvt. Limited Delhi, 2007.
3. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, Applications of Abstract Algebra with Maple, CRC Press, Boca Raton, 2000.

**E-Learning source: [mathworld.wolfram.com/topics/Number Theory.html](http://mathworld.wolfram.com/topics/Number%20Theory.html)**

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	describe the basic concepts of divisibility	K1
CO2	perform equivalence relation	K6
CO3	establish Fermat's theorem	K3
CO4	Analyze and evaluate congruence relations	K4, K5
CO5	define arithmetic functions and illustrate applications	K1, K2

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	2	2	2	3	2	3	3	3	3	3	2.58
2	3	3	2	2	3	2	2	3	2	3	2	3	2.5
3	3	2	2	2	3	2	2	2	2	3	2	2	2.25
4	3	3	2	2	3	3	2	3	2	2	2	2	2.42
5	2	3	2	3	3	2	2	3	3	2	2	3	2.5
	Mean Overall Score												2.45
	Result												High

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**Year/Semester: III Yr / V SEM**  
**Credits: 3**

**Code: M545B**  
**Hours/Week: 5**

### **Mathematical Modeling with Difference and Differential Equations (Elective)**

**Objective:** To discuss the mathematical modeling through difference equations, differential equations, calculus of variations and dynamical programming.

#### **Unit - I: Mathematically Modeling Discrete Processes**

Difference Equations - Linear Difference equation with constant coefficients - Solution of Homogeneous Equations - Difference Equation: Equilibria and Stability - Introduction to Discrete Models - Linear Models - Population Model involving growth - Newton's Law of cooling - Bank Account problem - Drug delivery problem - Economic Model - Arms Race Model - Linear Prey Predator problem. (Book 1: Chapter 2: Sec 2.1 - 2.3).

#### **Unit - II: Mathematically Modeling Discrete Processes (Contd...)**

Non Linear Models - Density Dependent Growth Models - The Learning Model - Miscellaneous Examples.  
(Book 1: Chapter 2: Sec 2.4 - 2.5).

#### **Unit - III: Continuous Models using Ordinary Differential Equations**

Formation of various continuous models - Carbon Dating - Drug distribution in the body - Growth and Decay of current in an L-R Circuit - Rectilinear Motion under Variable Force - Mechanical Oscillations - Dynamics of Rowing - Arms Race Models - Mathematical Model of Influenza Infection - Epidemic Models (Book 1: Chapter 3: Sec 3.2).

#### **Unit - IV: Mathematical Models through Ordinary Differential Equations (Contd...)**

Miscellaneous Examples  
(Book 1: Chapter 3: Sec 3.7).

#### **Unit - V: Mathematical Models through Ordinary Differential Equations of Second Order**

Mathematical Modeling of Planetary Motions - Mathematical Modeling of Circular Motion and Motion of Satellites - Mathematical Modeling through Linear Differential Equations of Second Order - Rectilinear motion.  
(Book 2: Chapter 4: Sec 4.1, 4.2 and 4.3.1).

#### **Books for Study**

1. Sandip Banerjee, Mathematical Modeling - Models, Analysis and Applications, CRC Press (Taylor & Francis Group), A Chapman & Hall Book.
2. J. N. Kapur, Mathematical Modeling, New Age International (P) Ltd., Publishers, Reprint 2018.

#### **Books for Reference**

1. Belinda Barnes, Glenn Robert Fulford, Mathematical Modelling with case studies, Chapman & Hall/CRC, 2009.
2. Brian Albright, Mathematical Modeling with Excel, Jones and Bartlet Publishers, LLC, First Indian Edition, 2010.
3. Dilwyn Edwards, Mike Hamson, Guide Mathematical Modelling, PALGRAVE, St.Martin's Press, LLC, Reprint 2007.
4. Glenn Fulford, Peter Forrester, Arthur Jones Modelling with Differential and Difference Equations, Cambridge University Press 1997.
5. R.Robert Huckfeldt, C.W.Kohfeld, Thomas W.Likens, Dynamic modeling An Introduction, SAGE Publications, 1982.
6. Elizabeth S. Allman and John A. Rhodes, Mathematical Models in Biology: An Introduction, Cambridge University Press, 2004.
7. Reinhard Illner, C. Sean Bohun, Samantha McCollum, Thea van Roode, Mathematical Modelling A Case Studies Approach, American Mathematical Society First Indian Edition, 2011.

**E-Learning source:** [https://people.maths.bris.ac.uk/~madjl/course\\_text.pdf](https://people.maths.bris.ac.uk/~madjl/course_text.pdf)

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	create mathematical models of empirical or theoretical phenomena in domains such as the physical, natural or social science.	K6
CO2	understand the analytical approach to problems in their future endeavours.	K2
CO3	assess and articulate what type of modeling techniques are appropriate for a given physical system.	K5
CO4	make predictions of the behavior of a given physical system based on the analysis of its mathematical model.	K4
CO5	recognise the power of mathematical modelling and analysis and be able to apply their understanding to their further studies.	K1, K3

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	3	2	3	2	3	3	3	3	2	2.67
2	3	3	2	2	3	2	3	3	2	3	2	3	2.58
3	3	3	3	2	3	2	3	2	2	3	2	2	2.5
4	3	3	2	2	3	3	2	3	3	3	2	2	2.58
5	2	3	2	3	3	2	2	3	3	2	2	3	2.5
	Mean Overall Score												2.57
	Result												High



**Year/Semester: III Yr /V SEM**  
**Credits: 3**

**Code: M545C**  
**Hours/Week: 5**

### **Fuzzy Algebra (Elective)**

**Objective:** This course aims to introduce fuzzy algebra, fuzzy graphs, fuzzy relations, fuzzy logic, fuzzy composition and initiate the learners into the application of these ideas.

#### **Unit - I**

Introduction- Fuzzy subsets-Lattices and Boolean Algebras-  $L$  fuzzy sets-operations on fuzzy  $\alpha$  level sets - properties of fuzzy subsets of a set - Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and product-Cartesian product of fuzzy subsets.

Text Book-1: Sections 1.1-1.13

#### **Unit - II**

Fuzzy relations on sets and fuzzy sets – compositions of fuzzy relations – properties of the min-max composition – fuzzy graphs.

Text Book-2: Sections 6.1-6.2

#### **Unit - III**

Introduction- Algebra of fuzzy relations-logic-connectives - Some more connectives.

Text Book-1: Sections 2.1-2.5

#### **Unit - IV**

Introduction-fuzzy subgroup-homomorphic image and Pre-image of subgroupoid - Fuzzy invariant subgroups-fuzzy subrings.

Text Book-1: Sections 3.1-3.5

#### **Unit - V**

Fuzzy subfields and Fuzzy subspaces – fuzzy subspace – fuzzy algebras over fuzzy field

Text Book-1: Sections 4.1-4.3

#### **Book for Study**

1. S.Nanda and N.R.Das "Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi.
2. H.J. Zimmermann, "Fuzzy Set theory and its applications, Springer.

#### **Books for Reference**

1. George J. Klir and Yuan B, *Fuzzy Sets and Fuzzy Logic: Theory and Applications*, Prentice Hall India Private Ltd, 2007.

2. Pundir and Pundir, *Fuzzy sets and their Applications*, A Pragati Edition, 2006.
3. Timothy J. Ross, *Fuzzy logic with engineering Applications*, McGraw Hill Inc. New Delhi, 2004.
4. V. Novak, *Fuzzy Sets and their Applications*, Adam Hilger, Bristol, 1969.

E - Learning source:

<http://nptel.ac.in/courses/105108081/module9/lecture36/lecture.pdf>

Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	describe the fuzzy set operations	K1
CO2	analyze and justify the fuzzy relations.	K4, K5
CO3	illustrate their knowledge on algebra and their extensions and applications	K2
CO4	formulate fuzzy graphs from fuzzy relations and would relate to ordinary graphs.	K6
CO5	establish fuzzy algebraic theorems over fuzzy field.	K3

#### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	1	3	2	2	2	2	2	3	3	2	2.17
2	3	2	1	3	2	3	2	3	2	3	3	2	2.42
3	3	2	1	3	3	3	2	3	3	3	2	2	2.5
4	3	3	2	3	3	3	2	3	3	3	3	2	2.75
5	3	2	2	3	3	2	2	3	3	2	2	2	2.42
	Mean Overall Score												2.45
	Result												High

**Year/Semester: III Yr /V SEM**

**Code: NMA504**

**Credit: 1**

**Hours/Week: 2**

**Non-Major Elective  
Mathematics for Competitive Examinations-I**

**Objective:** To prepare the students for competitive examinations

**Unit-I**

Average-Problems on numbers.  
(Chapters 6, 7)

**Unit-II**

Ratio and proportion.  
(Chapter12)

**Unit -III**

Time and work-Time and distance.  
(Chapters 15, 17).

**Unit-IV**

Simple interest and compound Interest.  
(Chapters 21, 22).

**Unit- V**

Permutations and combinations.  
(Chapter 30).

**Book for Study**

1. Dr. R.S. Aggarwal, Quantitative Aptitude (for Competitive Examinations), Revised Edition, S. Chand and Company Ltd., Ram Nagar, New Delhi, Reprint 2012.

**E-learning source:** [www.tcyonline.com/tests/mathematics-competitive-exam](http://www.tcyonline.com/tests/mathematics-competitive-exam)

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	To approach competitive examinations with less anxiety and fear.	K2
CO2	To Enrich their knowledge and to develop their logical reasoning thinking ability.	K5
CO3	To develop skill to meet the competitive examinations for better job opportunity.	K6
CO4	To Analyze the Problems logically and approach the problems in a different manner	K1, K4
CO5	To Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.	K3

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	3	2	3	3	3	3	3	2	3	2.75
2	3	3	3	3	2	2	2	3	2	2	2	3	2.5
3	3	2	2	3	2	2	3	2	2	3	2	2	2.33
4	3	3	2	3	3	2	2	3	2	3	2	2	2.5
5	2	2	2	3	3	2	2	3	3	2	2	3	2.42
Mean Overall Score												2.5	
Result												High	

**Question paper pattern:** 100 Objective type questions each carrying 0.75 mark for semester examinations.

**Mathematical Aptitude - II (SSP)**

**Objective:** To prepare the Students for Competitive Examinations.

**Unit - I**

Time and Distance - Problem on Trains.(Chapters 17, 18).

**Unit - II**

Boats and Streams - Simple Interest.(Chapters 19, 21).

**Unit - III**

Compound Interest - Calendar (Chapters 22, 27).

**Unit - IV**

Permutation and Combination - Probability (Chapters 30, 31).

**Unit - V**

True Discount - Banker's Discount (Chapters 32, 33).

**Book for Study**

1. Dr. R.S. Agarwal, Quantitative Aptitude (For Competitive Examinations), Revised Edition, S. Chand and Company Ltd., Ram Nagar, New Delhi, Reprint 2012.

**Books for Reference**

1. R.V. Praveen, Quantitative Aptitude and Reasoning, Second Edition, Eastern Economy Edition, PHI Learning Private Limited, New Delhi, 2013.

E - Learning source: [www.tcyonline.com/tests/mathematics-competitive-exam](http://www.tcyonline.com/tests/mathematics-competitive-exam)

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	To approach competitive examinations with less anxiety and fear.	K2
CO2	To Enrich their knowledge and to develop their logical reasoning thinking ability.	K5

CO3	To develop skill to meet the competitive examinations for better job opportunity.	K6
CO4	To Analyze the Problems logically and approach the problems in a different manner	K1, K4
CO5	To Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.	K3

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	3	2	3	3	3	3	3	2	3	2.75
2	3	3	3	3	2	2	2	3	2	2	2	3	2.5
3	3	2	2	3	2	2	3	2	2	3	2	2	2.33
4	3	3	2	3	3	2	2	3	2	3	2	2	2.5
5	2	2	2	3	3	2	2	3	3	2	2	3	2.42
	Mean Overall Score												2.5
	Result												High

### Question Paper Pattern

- There will be 50 objective type questions: each question carries 1 Mark.

**Year/Semester: V**

**Credits: 2#**

**Hours/ Sem: 30 Hrs/Sem**

**Certificate Course -Mathematical Modeling with Spreadsheet**

**Objective:** To analyze the long term behavior of discrete and continuous dynamical systems numerically and graphically using Spreadsheet.

**Unit - I**

Difference Equations - Dynamical Systems - Long Term Behavior and Equilibria, Growth of a Bacteria Population.

(Chapter 4, Sections: 4.1, 4.2, 4.3)

**Unit - II**

A Linear Predator - Prey Model - A Nonlinear Predator-Prey Model - Epidemics (Chapter 4, Sections: 4.4, 4.5, 4.6)

**Unit - III**

Formation of Differential Equations - Newton's Law of Cooling - Euler's method (Chapter 5, Sections: 5.1, 5.2)

**Unit - IV**

Quadratic Population Model - Volterra's Principle

(Chapter 5, Sections: 5.3, 5.4)

**Unit - V**

Lanchester Combat Models - Eigen Values

(Chapter 5, Sections: 5.5, 5.6)

**Book for Study**

1. Brian Albright, Mathematical Modeling with Excel, Jones & Bartlett, Student Edition, 2012.

**Books for Reference**

1. Allman, E.S, and J.A.Rhodes, Mathematical models in Biology, An Introduction, Cambridge, UK, Cambridge University Press, 2004.
2. Coleman,C.S, Combat Models, In modules in applied mathematics, Vol.1, Differential Equations Models, ed, W.F.Lucas, new York, NY, Springer-Verlag, 1983.
3. M.M.Meerschaert, Mathematical Modeling, 2<sup>nd</sup>ed, San Diego, CA, Academic press, 127, 1999.

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	enhance the links between mathematics, technology and other sciences inorder to enhance the power of mathematics for the simulation of physical phenomena with the help of mathematical modeling techniques with spread sheet.	

**Year/Semester: III Yr/VI SEM**  
**Credits: 6**

**Code: M643**  
**Hours/Week: 6**

## **Linear Algebra**

**Objective:** To study the transformations, Matrices, Systems of Linear Equations, Determinants and Diagonalization in Vector Space.

### **Unit-I: Vector Spaces**

Introduction - Vector Spaces - Subspaces - Linear Combinations and Systems of Linear Equations - Linear Dependence and Linear Independence - Bases and Dimension.  
(Chapter 1: Sections 1.1 to 1.6)

### **Unit-II: Linear Transformations and Matrices**

Linear Transformations, Null Spaces and Ranges - The Matrix Representation of a Linear Transformation - Composition of Linear Transformations and Matrix Multiplication - Invertibility and Isomorphisms.  
(Chapter 2: Sections 2.1 to 2.4)

### **Unit - III: Matrix Operations and Systems of Linear Equations**

Elementary Matrix Operations and Elementary Matrices - The Rank of a Matrix and Matrix Inverses - Systems of Linear Equations-Theoretical Aspects - Systems of Linear Equations-Computational Aspects.  
(Chapter 3, Sections 3.1 to 3.4)

### **Unit - IV: Diagonalization**

Eigenvalues and Eigenvectors - Diagonalizability - Invariant Subspaces and the Cayley-Hamilton Theorem.  
(Chapter 5, Sections: 5.1, 5.2 and 5.4)

### **Unit - V: Inner Product Spaces**

Inner Products and Norms - The Gram-Schmidt Orthogonalization Process and Orthogonal Compliments - The Adjoint of a Linear Operator - Normal and Self-Adjoint Operators.  
(Chapter 6, Sections: 6.1 to 6.4)

### **Book for Study**

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, Fourth Edition, Pearson India Education Service Pvt Ltd, New Delhi(2007).

### **Books for Reference**

1. S. Arumugam and A. Thandapani, Modern Algebra, SciTech Publications Pvt. Ltd.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.
4. N. Herstein, Topics in Algebra, John Wiley and sons, 2-e, New Delhi, 2006.



5. John B. Fraleigh, A First Course in Abstract Algebra, 7-e, Pearson Education Publication, New Delhi 2003.
6. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.
7. Saunders MacLane and Garrett Birkhoff, Algebra, 2-e, Macmillan Publishing Co. Inc, New York, 1979.
8. Santiago, Modern Algebra, Arul Publications, Madras, 1988.
9. Serge Lang, Algebra, Addition Wesley Publishing Company, London 1965.
10. Surjeeth Singh and Quazi Zameeruddin, Modern Algebra 2-e, Vikas Publishing House Pvt. Ltd., New Delhi, 1975.

**E - Learning source:** <http://mathworld.wolfram.com>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the concept of vector spaces and its bases.	K2
CO2	analyze the matrix representation of the linear transformation.	K4
CO3	find the rank of the matrix	K5
CO4	establish Cayley Hamilton theorem	K3
CO5	define the orthonormal basis and develop Gram-Schmidt orthogonalization process.	K1, K6

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	2	3	2	3	2	3	3	3	3	2	2.58
2	3	3	2	2	3	2	3	2	2	2	2	3	2.42
3	2	2	2	2	2	2	3	2	2	3	2	2	2.17
4	3	2	2	2	3	3	2	3	3	3	2	2	2.5
5	2	2	2	3	3	2	2	3	3	2	2	3	2.42
	Mean Overall Score												2.42
	Result												High

**Year/Semester: III Yr /VI SEM**  
**Credits: 6**

**Code: M644**  
**Hours/Week: 6**

## **Real Analysis - II**

**Objectives:** To study on infinite series, test of convergence, rearrangement of Series, sequence of functions, uniform convergence and power series.

### **Unit - I: Infinite Series**

Introduction - Convergent and divergent sequences of complex numbers - Limit superior and limit inferior of a real valued sequence - Monotonic sequences of real numbers - Infinite series - Inserting and removing parentheses - Alternating series.

(Chapter 8: Sections 8.1 - 8.7, Related Problems)

### **Unit - II: Test of Convergence**

Absolute and conditional convergence - Real and imaginary parts of a complex series - Test for convergence of series with positive terms - The geometric series - The integral test - The big oh and little oh notations - The ratio test and the root test - Dirichlet's test and Abel's test - Partial sums of the geometric series  $\sum z^n$  on the unit circle  $|z| = 1$ .

(Chapter 8: Sections 8.8 - 8.16, Related Problems)

### **Unit - III: Rearrangement of Series**

Rearrangements of series - Riemann's theorem on conditionally convergent series - Subseries - Double sequences - Double series - Rearrangement theorem for double series - A sufficient condition for equality of iterated series - Multiplication of series - Cesaro summability - Infinite products - Euler's product for the Riemann zeta function.

(Chapter 8: Sections: 8.17- 8.27)

### **Unit - IV: Sequence of Functions**

Point wise convergence of sequences of functions - Examples of sequences of real-valued functions - Definition of uniform convergence - Uniform convergence and continuity - The Cauchy condition for uniform convergence - Uniform convergence of infinite series of functions - Uniform convergence and differentiation - Sufficient conditions for uniform convergence of a series - Uniform convergence and double sequences - Mean convergence.

(Chapter 9: Sections 9.1 - 9.6, 9.10-9.13, Related Problems)

### **Unit - V: Power Series**

Power series - Multiplication of power series - The substitution theorem - Reciprocal of a power series - Real power series - The Taylor's series generated by a function - Bernstein's theorem.

(Chapter 9: Sections 9.14 - 9.20, Related Problems).

### **Book for Study**

1. Tom M. Apostol, Mathematical Analysis, Indian student second edition, Narosa Publishing House, Chennai, 20<sup>th</sup> Reprint, 2002.

### **Books for Reference**

1. P. N. Arora and Ranjit Singh, First course in Real Analysis, Third edition, Sultan Chand and Sons Publishers, New Delhi, 1981.
2. S. Arumugam, Modern Analysis, New Gamma Publishers, Palayamkottai, 1993.
3. E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4. Robert G. Bartle and Donald R. Sherbert, Introduction to Real Analysis by 2-e John Wiley and Sons, 2000.
5. Richard R. Goldberg, Methods of Real Analysis, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1970.

**E-Learning source: [mathworld.wolfram.com/Analysis.html](http://mathworld.wolfram.com/Analysis.html).**

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand properties of the real line and that of sequence and infinite series.	K2
CO2	apply the ratio, root, alternating series and various tests to determine convergence and absolute convergence of an infinite series of real numbers.	K3
CO3	define the properties of rearrangement of series, and its infinite products.	K1
CO4	find the uniform convergence of a sequence of functions.	K5
CO5	outline the concept of power series and formulate related results.	K4, K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	2	3	2	3	2	3	3	3	3	2	2.58
2	2	2	2	2	3	3	3	2	2	2	2	3	2.33
3	2	3	2	2	2	3	3	3	2	3	2	3	2.5
4	2	3	2	3	3	3	2	3	3	3	3	2	2.67
5	3	2	2	3	3	2	2	3	3	2	2	3	2.5
	Mean Overall Score												2.52
	Result												High

Year/Semester: III Yr /VI SEM  
Credits: 6

Code: M645  
Hours/Week: 6

## Complex Analysis

**Objective:** Upon completing this course the students will be able to use Cauchy's theorem to test for analyticity and compute a derivative, work with standard complex functions (mapping properties, derivatives), compute contour integrals using definition and Cauchy integral theorems, compute Taylor and Laurent series expansions of functions and apply the Residue theorem in the evaluation of integrals.

### Unit -I: Analytic Functions

Functions of a complex variable – Limits – Theorems on limit – Continuous functions – Differentiability – The Cauchy-Riemann equations – Analytic functions – Harmonic functions. (Chapter 2: Sections 2.1 - 2.8).

### Unit-II: Conformal Mapping and Bilinear Transformations

Conformal mapping – Elementary transformations – Bilinear transformations – Cross ratio – Fixed points of bilinear transformations – The mapping  $w = z^2$ ,  $w = e^z$ ,  $w = \sin z$ .

(Chapter 2: Section 2.9, Chapter 3: Sections 3.1- 3.4, Chapter 5: Sections 5.1, 5.3, 5.4)

### Unit-III: Complex Integration

Definite integral – Cauchy's theorem – Cauchy's integral formula – Higher derivatives. (Chapter 6: Sections 6.1 - 6.4)

### Unit-IV: Series Expansions

Taylor's series – Laurent's series – Zeros of an analytic function.

(Chapter 7: Sections 7.1 - 7.3)

### Unit- V: Singularities and Calculus of Residues

Singularities – Residues – Cauchy's residue theorem

(Chapter 7: Section 7.4, Chapter 8: Section 8.1 - 8.2)

### Book for Study

1. S.Arumugam, A.Thangapandi Isaac, A.Somasundaram, Complex Analysis, Scitech Publications (India) PVT LTD, Chennai, Reprint, May 2011.

### Books for Reference

1. Goyal, Gupta, Functions of a Complex Variable, Pragati Prakashan, Meerut, 2003.
2. T.K. Manicavachagom Pillay, Dr. S.P. Rajagopalan, Dr. R. Sattanathan, Complex Analysis, S. Viswanathan Pvt., Ltd, Chennai, 2011.
3. S.Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, New Delhi, 2000.
4. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Company LTD, New Delhi, 2001.
5. Murray R. Spiegel, Seymour Lipschutz, John J. Schiller, Dennis Spellman, Complex Variables, Schaum's Outlines, Second Edition, New Delhi, 2010.

E-Learning source: <http://math.sfsu.edu/beck/papers/complex.pdf>,  
<http://www.math.ku.dk/noter/filer/koman-12.pdf>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the significance of differentiability and analyzing of complex function leading to the Cauchy-Riemann equations.	K2, K4
CO2	define the concept of conformal mapping and cross ratio and fixed points of bilinear transformation.	K1
CO3	learn the role of Cauchy theorem and Cauchy integral form in evaluation of contour integrals, apply Liouville's theorem in fundamental theorem of algebra .	K3, K5
CO4	express the Taylor and Laurent series expansion of analytic function.	K2
CO5	categorize the nature of singularities, poles and residues and perform the application of Cauchy residue theorem.	K4,

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	2	3	3	3	3	3	3	3	2	2	2.67
2	3	2	2	2	3	3	3	2	2	2	2	3	2.42
3	2	2	2	2	3	3	3	3	3	3	2	3	2.58
4	3	2	2	3	3	3	2	3	3	3	3	2	2.67
5	3	2	2	3	3	2	2	3	3	2	2	3	2.5
	Mean Overall Score												2.57
	Result												High

**Year/Semester: III Yr /VI SEM**

**Credits: 3**

**Code: M646A**

**Hours/Week: 5**

### **Resource Management Techniques (Elective)**

**Objective:** To develop the skill of formulation of LPP and different techniques to solve it. To know the applications of Transportation and Assignment problems. To study the optimizing problems in Sequencing, Networking and Inventory control.

#### **Unit - I Linear Programming Problem**

Introduction - Formulation of the Problem - Illustration on Mathematical Formulation of LPPs. Graphical Solution Method - Simplex method -- Duality theory.

(Book 1: Chapters 2, 3, 4, 6(6.1 - 6.3))

#### **Unit - II Transportation Problem**

Transportation -Balanced and Unbalanced problems - Assignment Problem - Balanced and Unbalanced problems.

(Book 2: Chapter 9, Sections: 9.1, 9.2, 9.3, 9.4, 9.5; Chapter 10, Sections -10.1, 10.2, 10.3, 10.4)

#### **Unit - III Sequencing Problem**

Problems with n jobs through 2 machines - Problems with n jobs through 3 machines- Problems with n jobs through m machines.

(Book 3: Chapter 12: Sections 12.1 -12.6)

#### **Unit -IV Inventory Control**

Inventory models: Introduction - Deterministic models- single item static models with and without shortages- Single item static model with single price break- Quantity discounts.(Problems only).

(Book 2: Chapter 14, Sections: 14.1 - 14.10)

#### **Unit -V Network Scheduling by PERT/CPM**

Introduction -Basic terms - Rules of Network Construction -Numbering the events - Time Analysis - Critical Path Method (CPM) - Programme Evaluation and Review Technique (PERT).

(Book 1: Chapter 15, Sections: 15.1-15.8)

#### **Books for Study:**

1. S. Kalavathy, Operations Research - Vikas Publishing House Pvt. Ltd., 4<sup>th</sup> Edition, Second Reprint 2018.
2. J. K. Sharma, Operations Research Theory & Applications - Trinity Press, India, Sixth edition, 2016.
3. KantiSwarup, P. K. Gupta, Man Mohan, Operations Research - Sultan Chand & Sons, Reprint 2013.

#### **Books for Reference:**

1. Hamdy A. Taha, Operations Research - An Introduction, Pearson, Seventh edition, 2014.
2. P. K Gupta, Problems in Operations Research, 2-e, S. Chand & Sons, New Delhi, 1983.

3. R. Pannerselvam, Operations Research, Prentice Hall of India Pvt. Ltd., New Delhi, 2005.
4. S. D. Sharma, Operations Research, KedarNath Ram Nath and Co, Meerut, 1998.

E – Learning source: [http://cs.bme.hu/fcs/operations\\_research.pdf](http://cs.bme.hu/fcs/operations_research.pdf)

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	describe the concepts involved in solving linear programming problems which are widely used in business operations.	K1
CO2	apply mathematical techniques used in optimizing transportation and assignment problems.	K2
CO3	solve job sequencing problems.	K3
CO4	breakdown different inventory models	K4
CO5	evaluate PERT, CPM problems and develop applications	K5, K6

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	2	3	3	3	3	3	3	3	2	2	2.67
2	3	3	2	2	2	3	2	2	2	2	2	3	2.33
3	3	2	2	2	3	3	2	3	3	2	2	3	2.5
4	3	3	2	3	3	3	2	3	3	3	2	2	2.67
5	3	2	2	3	3	2	2	3	3	2	2	3	2.5
	Mean Overall Score												2.53
	Result												High



**Year/Semester: III Yr /VI SEM**

**Credits: 3**

**Code: M646B**

**Hours/Week: 5**

### **Graph Theory (Elective)**

**Objective:** To study the basic concepts of Graph Theory such as Trees, planarity, Coloring, directed graphs and know the applications to Travelling Salesman Problem, teleprinter's problem, maximum network flow and arborescence.

#### **Unit - I: Basic Concepts of Graph**

What is a graph? - Application of graphs - Finite and Infinite graphs - Incidence and degree - Isolated Vertex, Pendant Vertex and Null graph - Isomorphism - Sub graphs - Walks, Paths and Circuits - Connected graphs, disconnected graphs and components - Euler graphs - Operations on graphs - More on Euler graphs - Hamiltonian Paths and Circuits - The Travelling Salesman Problem.

(Chapter 1: Except 1.6, Chapter 2: 2.1 - 2.10 (Except 2.3))

#### **Unit - II: Trees**

Trees - Some properties of trees - Pendant Vertices in a tree - distance and centers in a tree - Rooted and Binary tree - On Counting trees - Spanning trees.

(Chapter 3: 3.1 - 3.7)

#### **Unit - III: Cut Sets and Planar Graph**

Cut-Sets - Some properties of a cut set - All cut sets in a graph - Fundamental circuits and Cut - Sets - Connectivity and Separability - Network flows - Combinatorial Vs. Geometric graph - Planar graphs - Kuratowski's two graphs - Different Representation of a planar graph.

(Chapter 4: 4.1 - 4.6, Chapter 5: 5.1 - 5.4).

#### **Unit - IV: Colouring and Matching**

Incidence matrix - Submatrices of  $A(G)$  - Chromatic number - Chromatic partitioning - Chromatic Polynomial - Matchings.

(Chapter 7: 7.1 - 7.2, Chapter 8: 8.1 - 8.4).

#### **Unit - V: Digraphs**

What is a directed graph? - Some types of digraphs - Digraphs and binary relations - Directed paths and Connectedness-Euler Digraphs-Trees with directed edges.

(Chapter 9: (9.1 - 9.6))

#### **Book for Study**

1. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science -Prentice-Hall of India, 2001.

## Books for Reference

1. Douglas B. West, Introduction to Graph Theory – Prentice - Hall of India, 2001.
2. Gary Chartrand and Ping Zhang, Introduction to Graph Theory – Tata McGraw-Hill, 2006.
3. Harary F, Graph Theory – Addison -Wesley Publishing Company, 1989

E – Learning source: <http://cs.bme.hu/fcs/graphtheory.pdf>

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	define the graphs along with types and their examples .	K1
CO2	understand the types of tree.	K2
CO3	establish the coloring theorems for graphs and make graph matching.	K3, K6
CO4	classify and analyze types of digraphs.	K2, K4
CO5	assess the real world problems using graphs.	K5

## Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	2	2	2	3	2	3	3	3	2	2	2.5
2	3	2	2	2	3	3	3	3	3	2	2	3	2.58
3	3	3	2	2	2	2	3	3	2	2	2	3	2.42
4	3	3	2	3	2	3	2	3	3	2	3	2	2.58
5	3	2	2	3	3	2	2	3	3	2	2	3	2.5
	Mean Overall Score												2.52
	Result												High

**Year/Semester: III Yr /VI SEM**

**Code: M646C**

**Credits: 3**

**Hours/Week: 5**

### **Discrete Mathematics (Elective)**

**Objective:** Prepare students to develop mathematical foundations to understand , create mathematical arguments and focuses on the Formal languages , Automata, Lattices, Boolean Algebra and Graph Theory.

#### **Unit - I:Mathematical logic**

Connectives - well formed formulas - Tautology- Equivalence of formulas - Tautological implications - Duality law- Normal forms - Predicates - Variables - Quantifiers - Free and bound Variables - Theory of inference for predicate calculus.

Chapter 1- Sections - 1-2, 1-2.7, 1-2.9, 1-2.10, 1-2.11, 1-3, 1-5.1, 1-5.2, 1-5.4, 1-6.4

#### **Unit - II:Relations And Functions**

Composition of relations - Composition of functions - Inverse functions , one-to- one, onto, one to-one & onto functions - Hashing functions - Permutation function - Growth of functions.-Algebra structures: Semi groups, Free semi groups, Monoids.

Chapter 2- Sections - 2-3.5, 2-3.7, 2-4.2, 2-4.3, 2-4.6, Chapter 3- Sections-3-2, 3-5, 3-5.3

#### **Unit - III:Formal Languages and Automata**

Regular expressions - Types of grammar - Regular grammar and finite state automata - Context free and sensitive grammars.

Chapter 3- Sections 3-3.1, 3-3.2 Chapter 4- Section 4-6.2

#### **Unit - IV: Lattices And Boolean Algebra**

Partial ordering - Poset - Lattices - Boolean algebra - Boolean functions -Theorems - Minimization of Boolean functions (Karnaugh Method only).

Chapter 4- Section 4-1.1, 4-2, 4-3, 4-4.2

#### **Unit - V: Graph Theory**

Directed and undirected graphs - Paths - Reachability - Connectedness - Matrix representation - Euler paths - Hamiltonian paths - Trees - Binary trees - theorems and applications.

Chapter 5- Section 5-1.1, 5-1.2, 5-1.3, 5-1.4

#### **Book for Study**

1. J.P Tremblay and R.P Manohar, Discrete Mathematical Structures with applications to computer science, Mc.Graw Hill, 1975.

#### **Books for Reference**

1. Oscar Levin, Discrete Mathematics, 3rd Edition,2016.
2. B. A. Davey & H. A. Priestley (2002). *Introduction to Lattices and Order* (2<sup>nd</sup>edition). Cambridge University Press.

3. Edgar G. Goodaire & Michael M. Parmenter (2018). *Discrete Mathematics with Graph Theory* (3rd edition). Pearson Education.
4. Rudolf Lidl & Günter Pilz (1998). *Applied Abstract Algebra* (2nd edition). Springer.
5. Kenneth H. Rosen (2012). *Discrete Mathematics and its Applications: With Combinatorics and Graph Theory* (7th edition). McGraw-Hill.
6. C. L. Liu (1985). *Elements of Discrete Mathematics* (2nd edition). McGraw-Hill.

E - Learning source: <https://nptel.ac.in/courses/106/106/106106094/>  
<https://nptel.ac.in/courses/111/107/111107058/>

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	analyze and perceive various graph theoretic concepts and familiarize with their applications.	K4, K5
CO2	describe about partially ordered sets, Boolean algebra, lattices and their types.	K1
CO3	apply Karnaugh map for simplifying the Boolean expression	K3
CO4	demonstrate the skill to construct simple mathematical proofs and to validate .	K2, K6
CO5	achieve greater accuracy , clarity of thought and language.	K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	2	3	3	3	3	3	3	3	2	2	2.67
2	3	2	2	2	3	3	3	2	2	2	2	3	2.42
3	2	2	2	2	3	3	3	3	3	3	2	3	2.58
4	3	2	2	3	3	3	2	3	3	3	3	2	2.67
5	3	2	2	3	3	2	2	3	3	2	2	3	2.5

	Mean Overall Score	2.57
	Result	High

**Year/Semester: III Yr/VI SEM**  
**Credits : 5**

**Code: M647**  
**Hours/Week: 5**

### **Mathematical Statistics**

**Objective:** To apply statistical techniques for interpreting and drawing conclusion for business problem.

#### **Unit - I: Multiple and Partial Correlation**

Partial correlation – Partial correlation coefficient – Partial correlation in case of four variables – Multiple correlations – Multiple regression.

(Chapter 16: Pages 16.1 - 16.21)

#### **Unit - II: Time Series**

Components of time series – Secular trend – Seasonal variation – Cyclical variation – Irregular variation – Measures of trend – Graphic Method – Semi average method – Moving average method – Period of moving average – Method of least squares – Measures of seasonal variation – Method of averages – Moving average method – Ratio to a moving average method – Ratio to trend method - Deseasonalization.

(Chapter 37: Pages 37.1 - 37.22)

#### **Unit-III: Sampling**

Sampling: Sampling methods, sampling error and standard error – Relationship between sample size and standard error. Testing hypothesis: Testing of means and proportions – Large and small samples – z-test and t-test.

(Chapter 24: Pages 24.1 - 24.44, 26.1 - 26.45).

#### **Unit- IV: F- Test**

Testing equality of population variances – Analysis of variance – One way and two way classification.

(Chapter 27: Pages 27.1 - 27.29).

#### **Unit-V: Chi square Test**

Chi-square distribution – Characteristics and application – Test of goodness of fit and test of independence – Test of homogeneity.

(Chapter 28: Pages 28.1 - 28.44).

**Note: The Proportion between theory and problem shall be 1:4.**

**Book for Study**

1. P.R. Vittal and V. Malini, Statistical and Numerical Methods, Margham publications, Chennai, reprint 2017.

### Books for Reference

1. S.C. Gupta and V.K. Kapoor, Fundamental of Mathematical Statistics, 11-e, Sultan Chand & Sons, New Delhi, 2004.
2. S.P. Gupta, Statistics Methods, Sultan Chand & Sons, New Delhi 2000.
3. Richard I Levin and David S. Rubit, Statistics for Management, Seventh edition, Pearson Education, New Delhi, 2001.
4. D.C. Sancheti and V.K. Kapoor, Business Statistics 2-e, Sultan Chand & Sons, New Delhi 1979.

E - Learning source: <http://www.collegestats.org/>

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	calculate the partial and multiple correlation coefficients for three variables.	K3
CO2	time series data, its applications to various field and components of time series, fitting of trend by moving average method, Measurement of seasonal indices by ratio and trend, ratio to moving average methods.	K6
CO3	define random sample from a distribution, sampling distribution..	K1
CO4	understand one way and two way analysis of variance.	K2
CO5	testing of goodness of fit and evaluate the test of independence.	K4, K5

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	3	2	3	2	3	2	3	3	3	2	2	2.5

2	2	3	2	3	3	2	2	3	3	2	3	3	2.59
3	3	3	2	3	2	2	3	3	2	2	2	3	2.25
4	3	3	2	3	2	3	2	3	3	2	3	2	2.58
5	3	3	3	3	2	3	1	3	3	3	2	3	2.67
	Mean Overall Score												2.52
	Result												High

**Year/Semester: III Yr /VI SEM**

**Credit: 1**

**Code: NMA604**

**Hours/Week: 2**

**Elective: II**

**Non-Major Elective**

**Mathematics for Competitive Examinations - II**

**Objective:** To prepare the students for competitive examinations.

**Unit-I**

Profit and Loss-Partnership.

(Chapters 11, 13)

**Unit-II:**

Problems on trains - Boats and streams.

(Chapters 18, 19)

**Unit -III**

Problems on Calendars and Clocks.

(Chapters 27, 28).

**Unit-IV**

Probability- True Discount.

(Chapters 31, 32).

**Unit- V**

Data interpretation problems- Tabulation- Bar graphs.

(Chapters 36 and 37).

**Book for Study**

1. Dr. R.S. Aggarwal, Quantitative Aptitude (for Competitive Examinations), Revised Edition, S. Chand and Company Ltd., Ram Nagar, New Delhi, Reprint 2012.

**E-learning source:** [www.tcyonline.com/tests/mathematics-competitive-exam](http://www.tcyonline.com/tests/mathematics-competitive-exam)

**Course Learning Outcomes:**

This course will enable the students to:



CO Number	CO Statement	Knowledge Level
CO1	To approach competitive examinations with less anxiety and fear.	K2
CO2	To Enrich their knowledge and to develop their logical reasoning thinking ability.	K4
CO3	To develop skill to meet the competitive examinations for better job opportunity.	K6
CO4	To Analyze the Problems logically and approach the problems in a different manner	K1, K5
CO5	To Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.	K3

### Mapping of CO with PO and PSO

	CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
	1	3	3	3	3	2	3	2	3	3	3	2	2	2.67
	2	3	2	2	3	3	2	2	3	3	2	3	3	2.58
	3	3	2	3	3	2	2	2	3	2	2	2	3	2.42
	4	3	3	2	3	2	3	2	3	3	2	3	2	2.58
	5	3	2	3	3	2	3	3	3	3	3	2	3	2.75
		Mean Overall Score												2.6
		Result												High

**Question paper pattern:** 100 Objective type questions each carrying 0.75 mark for semester examinations

Year/Semester: III Yr/VI SEM

Credits: 2#  
Certificate Course

Hours/Sem: 30 Hrs/Sem

### SCILAB for Mathematical Computations

**Objective:** To acquire the practical knowledge of SCILAB for solving the Matrix, polynomials and differential equations.

#### Unit - I

Login - Talking between Scilab and the Editor - Basic Commands - Linear Algebra - Loops and Conditionals - Help in Scilab.

(Chapter 1: Sections 1.1 - 1.7).

#### Unit - II

Matrices and Vectors - Solving Equations - Creating Matrices - Systems of Equations.

(Chapter 2: Section 2.2).

#### Unit - III

Plotting Lines and Data - Adding a Line - Hints for Good Graphs - Graphs - Function Plotting - Component Arithmetic - Printing Graphs - Saving Graphs. (Chapter 3: Sections 3.2, 3.3).

#### Unit - IV

Evaluation of Polynomials - Polynomials - Linear Least Squares (Heath Computer Problem).

(Chapter 6: Sections 6.2, 6.3, 6.4).

#### Unit - V

Differential Equations - Scalar ODE's - Order 2 ODE's.

(Chapter 8: Sections 8.2).

#### Book for Study

1. Graeme Chandler and Stephen Roberts, Scilab Tutorials for Computational Science, 2002.

#### Books for Reference

1. Scilab for very beginners, Scilab Enterprises, S.A.S, 143, bis rue Yves Le Coz - 78000 Versailles (France).
2. K. S. Surendran, SCILAB FOR DUMMIES, Version 2.6.
3. Some notes on SCILAB, Universite de Nice Sophia-Antipolis.

#### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	solve problems in matrices using scilab.	K3

CO2	solve simple problems in ODE and PDE	K3
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### **Self-Study Courses**

The Department may offer Self Study Papers. Students may be permitted to credit at most two Self Study Papers with the approval of Departmental Consultative Committee and Controller of Examinations.

The purpose of the course is to permit the student to study a course of the student's choice. The students shall study on their own under the guidance of a faculty member. No formal lectures need be delivered. The syllabus of the course and mode of assessments shall be approved by the Departmental Consultative Committee and forwarded to the Controller of Examinations preferably before the commencement of the semester. The self-study paper of 1 credit can be considered as one elective course. One Faculty member approved by the Head of the Department shall be responsible for the periodic monitoring and evaluation of the course.

### **Assessment for Self-Study Course**

The Faculty member approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through Continuous Assessment (as decided by the Departmental Consultative Committee) and End Semester Examination (internal). A committee consisting of the Head of the Department, the Faculty Member and another senior Faculty member nominated by the Head of the Department shall assign the grades to the students based on their relative performance.

### **Certificate Course**

Certificate courses are to be conducted either by faculty members or outside resource persons with 30 hours of class, outside the working hours, with due payment collected from stake holders only for remuneration to course teachers. Lab fee/study material cost if any has to be collected separately. Amount to be collected depends on the strength of participants. There will not be any final examination. Assessment will be done through assignment/quiz/mini project work.

**UG ALLIED COURSES (CBCS) - MATHEMATICS**  
**FOR THE CANDIDATES ADMITTED FROM 2021-2022**

Year/ Sem	Course Code	Programme	Title of the Course	Hrs/ Wk	Cre dits	Marks		
						Int	SE	Tot al
IYr/ I SEM	AM114A	B.Sc., Physics	Allied Mathematics - I	6	4	50	50	100
IYr/ I SEM	AM114B	B.Sc., Chemistry	Allied Mathematics - I	6	4	50	50	100
IYr/ I SEM	AM114C	B.Sc., Computer Science	Allied Mathematics - I	6	4	50	50	100
IYr/ I SEM	AM114D	BCA	Mathematical Foundations - I	6	4	50	50	100
IYr/ II SEM	AM114E	BBA	Allied Business Mathematics	6	4	50	50	100
IYr/ II SEM	AM214A	B.Sc., Physics	Allied Mathematics - II	6	4	50	50	100
IYr/ II SEM	AM214B	B.Sc., Chemistry	Allied Mathematics - II	6	4	50	50	100
IYr/ II SEM	AM214C	B.Sc., Computer Science	Allied Mathematics - II	6	4	50	50	100
IYr/ II SEM	AM214D	BCA	Mathematical Foundations - II	6	4	50	50	100
IYr/ I SEM	AM214E	BBA	Allied Business Statistics	6	4	50	50	100
IYr/ III SEM	AM310A	B.Com	Allied Business Mathematics	6	4	50	50	100
IYr/ III SEM	AM310B	B.Com (CA)	Allied Business Mathematics	6	4	50	50	100
IYr/ III SEM	AM310C	B.Sc., Bio-Che, Microbiology	Bio Statistics -I	6	4	50	50	100
IYr/ III SEM	AM310D	B.Sc. Psychology	Statistical Methods for Psychology	6	4	50	50	100
IYr/ IV SEM	AM409A	B.Com	Allied Business Statistics	6	4	50	50	100
IYr/ IV SEM	AM409B	B.Com (CA)	Allied Business Statistics	6	4	50	50	100
IYr/ IV SEM	AM409C	B.Sc., Bio-Che., Microbiology	Bio Statistics -II	6	4	50	50	100

**Year/Semester: I Yr /I SEM**  
**Credits: 4**

**Code: AM114A**  
**Hours/Week: 6**

### **Allied Mathematics – I (Physics)**

**Objective:** To make the students become familiar with the tools in Mathematics to solve problems in different related fields.

#### **Unit – I: Matrices**

Eigen values and Eigen vectors – Cayley-Hamilton theorem (statement only) – Problems based on Cayley-Hamilton theorem – Eigen values of Symmetric Matrices – Diagonalization of a matrix.

(Book – I: Chapter 3: Pages: 151 to 164)

#### **Unit – II: Theory of Equations**

Nature of roots – Relation between roots and coefficients of an algebraic equation – Transformation of equations – Reciprocal equations – Horner's method – Newton's method.

(Book – I: Chapter 2: Pages: 59 – 84 and 89 – 99)

#### **Unit – III: Trigonometry**

Expansions of  $\sin n\theta$ ,  $\cos n\theta$ ,  $\tan n\theta$ ,  $\sin^n\theta$ ,  $\cos^n\theta$  – Expansions of  $\sin\theta$ ,  $\cos\theta$ ,  $\tan\theta$  in ascending powers of  $\theta$  – Hyperbolic functions – Relation between circular and hyperbolic functions – Inverse hyperbolic functions – Logarithm of complex numbers – Real and imaginary parts of  $\sin(a+ib)$ ,  $\cos(a+ib)$ ,  $\tan(a+ib)$ ,  $\tan^{-1}(a+ib)$  (Book – I: Chapter 5: Pages: 220 - 263)

#### **Unit – IV: Differential Calculus**

Leibnitz formula for the  $n^{\text{th}}$  derivative (without proof) – Jacobian – Curvature and radius of curvature in Cartesian and polar form –  $p-r$  equations (polar form only). (Book – I: Chapter 6: Pages: 277 - 285 and 296 - 305 and 310 - 317)

#### **Unit – V: Integral calculus**

Reduction formulae – Multiple integrals – Evaluation of double, triple integrals (Book – II: Chapter 1: Pages 73 - 94; Chapter 3: Pages: 162 - 175)

#### **Books for Study**

1. S. Narayanan, R. Hanumantha Rao and T.K. Manicavachagom Pillai, Ancillary Mathematics, Volume – I, S. Viswanathan printers, Chennai, 2011.
2. S. Narayanan, P. Kandhasamy, R. Hanumantha Rao and T.K. Manicavachagom Pillai, Ancillary Mathematics, Volume – II, S. Viswanathan printers, Chennai, 2010.

## Books for Reference

1. P. Balasubramaniam, K. G. Subramanian, Ancillary Mathematics, Volume - I, Tata McGraw - Hill publishing company limited, New Delhi, 1996.
2. P. Durai Pandian, S. Udaya Baskaran, Allied Mathematics, Volume - I, Muhil publishers, 1<sup>st</sup> Edition, Chennai, 1997.
3. P. Kandasamy and K. Thilagavathy, Allied Mathematics volume - I, Volume - II, S. Chand & Company, New Delhi, 2004.
4. Shanti Narayan, P.K. Mittal, Differential Calculus, S. Chand & Co, New Delhi, 2005.
5. A. Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001.
6. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai, 1999.

E-Learning source: [http://mathforum.org/library/drmath/sets/elem\\_2d](http://mathforum.org/library/drmath/sets/elem_2d)

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	find eigen value and corresponding eigen vectors for a square matrix.	K5
CO2	employ Horner's method and Newton's method to solve the cubic equation and check the accuracy of the solution.	K3
CO3	define and understand the relation between circular and hyperbolic functions and exponent of Trigonometric and hyperbolic function.	K1, K2
CO4	focus on the curves in Cartesian and Polar Coordinates spaces.	K4
CO5	formulate the double integrals and triple integrals and formulation of problems.	K6

## Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	1	3	2	2	1	3	2	3	2	2	2.17
2	2	2	2	2	3	3	2	3	2	2	3	2	2.33
3	2	3	2	3	3	2	3	2	3	1	3	2	2.42
4	2	3	2	3	3	2	3	2	3	2	3	2	2.50
5	2	3	2	2	3	2	3	2	3	2	3	2	2.42

Mean Overall Score	2.37
Result	High

**Year/Semester: I Yr /II SEM**  
**Credits: 4**

**Code: AM214A**  
**Hours/Week: 6**

### **Allied Mathematics - II (Physics)**

**Objective:** To make the students become familiar with the tools in Mathematics to solve problems in different related fields.

#### **Unit - I: Differentiation of Vectors**

Differentiation of vectors - Differential operators - Directional derivative - Gradient - Divergence and curl - Formula involving operator  $\nabla$ .  
 (Chapter 8: Pages: 329 - 363)

#### **Unit - II: Integration of Vectors**

Line integrals - Surface integrals - Volume integrals - Statements of Gauss divergence, Green's, Stoke's theorems and its applications - verifications.  
 (Chapter 8: Pages: 364 - 390, 395 - 418 excluding Green's theorem in space- problems)

#### **Unit - III: Partial Differential Equations**

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solutions of standard types of first order equations:  $f(p, q) = 0, f(x, p) = g(-, q), \frac{\partial}{\partial x}(x, p, q) = 0, f(y, p, q) = 0, f(z, p, q) = 0: z = px + qy + f(p, q)$  - Lagrange method of solving linear partial differential equations.

(Chapter 6: Pages: 252 - 274)

#### **Unit - IV: Laplace Transforms**

Definition - Laplace transforms of  $e^{at}, \cos at, \sin at, \cosh at, \sinh at, t^n, e^{at}f(t), t^n f(t), f'(t), f''(t)$  and inverse Laplace transforms - Solving differential equations of second order with constant coefficients using Laplace transform.

(Chapter 7: Pages: 289 - 317 excluding simultaneous equations - problems)

#### **Unit - V: Fourier Series**

Definition - Finding Fourier coefficients for a given periodic function with period  $2\pi$  - Odd and even function - Half range Fourier series.

(Chapter 2: Pages: 123 - 150)

## Book for Study

1. S. Narayanan, P. Kandhasamy, R. Hanumantha Rao and T.K. Manickavasagam Pillai, Ancillary Mathematics, Volume II, S. Viswanathan Printers, Chennai 2010.

## Books for Reference

1. P. Balasubramaniam, K. G. Subramanian, Ancillary Mathematics, Volume - I, Tata McGraw - Hill publishing company limited, New Delhi, 1996.
2. P. Durai Pandian, S. Udaya Baskaran, Allied Mathematics, Volume - I, Muhil publishers, 1<sup>st</sup> Edition, Chennai, 1997.
3. P. Kandsamy and K. Thilagavathy, Allied Mathematics volume - I, Volume - II, S. Chand & Company, New Delhi, 2004.
4. Shanti Narayan, P.K. Mittal, Differential Calculus, S. Chand & Co, New Delhi, 2005.
5. A. Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001.
6. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai, 1999.

E-Learning source: [http://mathforum.org/library/drmath/sets/elem\\_2d.html](http://mathforum.org/library/drmath/sets/elem_2d.html)

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	discuss and analyze the concept of gradient, divergence and curl and its properties.	K2, K4
CO2	recognize the importance of Green's, Gauss and Stoke's theorem in vector integrals.	K1
CO3	find solution of first order linear partial differential equations using Lagrange's method.	K5
CO4	solve the ordinary differential equations by using Laplace Transform.	K3
CO5	develop Fourier series of the periodic functions.	K6

## Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	1	3	2	2	1	3	3	3	2	2	2.17
2	2	3	2	2	3	2	3	2	3	2	3	2	2.42



3	3	3	2	2	3	3	3	2	3	2	3	2	2.58
4	3	3	2	2	3	1	3	3	2	3	2	1	2.33
5	3	2	1	2	1	2	2	2	2	2	1	3	1.92
Mean Overall Score													2.28
Result													High

**Year/Semester: I Yr /I SEM**  
**Credits: 4**

**Code: AM114B**  
**Hours/Week: 6**

### **Allied Mathematics - I (Chemistry)**

**Objective:** To make the students become familiar with the tools in Mathematics to solve problems in different related fields.

#### **Unit - I: Theory of Equations**

Formation of equations – Relation between roots and coefficients – Diminishing the roots of equations – Removal of terms – Reciprocal equation – Descarte’s rule of signs – Horner’s method – Newton’s method.

(Chapter 2: Pages: 27 – 70)

#### **Unit - II: Trigonometry**

Expansion of sine and cosine – Powers of sine and cosine – Hyperbolic functions – Relation among hyperbolic functions – Inverse hyperbolic functions – Logarithm of complex numbers.

(Chapter 3: Pages 71 – 100).

#### **Unit - III: Matrices**

Determinant of a matrix – Characteristic equation of a matrix – Characteristic vectors of a matrix – Cayley-Hamilton theorem – Inverse of a matrix – Diagonalization of a matrix.

(Chapter 4: Pages: 106 - 166).

#### **Unit - IV: Differential Calculus**

Radius of curvature – Radius of curvature in polar coordinates – Radius of curvature in p-r equation – Co-ordinate of the centre of curvature.

(Chapter 5: Pages: 167 – 202)

#### **Unit - V: Multiple Integrals**

Double integrals – Double integral in polar coordinates – Triple integrals.

(Chapter 6: Pages 203 – 222)

## Books for Study

1. G. Britto Antony Xavier, V. Balaji, S.U. Vasantha Kumar, B. Govindan, Mathematical Sciences , Jayalakshmi Publications, Second Edition, 2015

## Books for Reference

1. S. Narayanan, R. Hanumantha Rao and T.K. Manicavachagom Pillai, Ancillary Mathematics, Volume - I, S. Viswanathan printers, Chennai, 2011.
2. S. Narayanan, P. Kandhasamy, R. Hanumantha Rao and T.K. Manicavachagom Pillai, Ancillary Mathematics, Volume- II, S. Viswanathan printers, Chennai, 2010.
3. P. Balasubramaniam, K. G. Subramanian, Ancillary Mathematics, Volume - I, Tata McGraw - Hill publishing company limited, New Delhi, 1996.
4. P. Durai Pandian, S. Udaya Baskaran, Allied Mathematics, Volume - I, Muhil publishers, 1<sup>st</sup> Edition, Chennai, 1997.
5. P. Kandsamy and K. Thilagavathy, Allied Mathematics Volume - I, Volume - II, S. Chand & Company, New Delhi, 2004.
6. Shanti Narayan, P.K. Mittal, Differential Calculus, S.Chand& Co, New Delhi, 2005.
7. A. Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001.
8. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai, 1999.

E-Learning source: [http://mathforum.org/library/drmath/sets/elem\\_2d](http://mathforum.org/library/drmath/sets/elem_2d)

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	illustrate theory of equations and find the roots of the equations applying Honor's method and Newton's method.	K3, K5
CO2	understand the concept hyperbolic and inverse hyperbolic functions.	K2
CO3	define diagonalization of a matrix.	K1
CO4	point out the radius of curvature and center of curvature	K4
CO5	facilitate double and triple integrals.	K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	2	2	3	3	2	3	2	2	3	2	2.33
2	2	3	2	3	3	2	3	2	3	1	3	2	2.42
3	3	2	1	3	2	2	1	3	2	3	2	2	2.17
4	2	3	2	3	3	2	3	2	3	2	3	2	2.50
5	2	3	2	2	3	2	3	2	3	2	3	2	2.42
Mean Overall Score												2.37	
Result												High	

**Year/Semester: I Yr /II SEM**

**Code: AM214B**

**Credits: 4**

**Hours/Week: 6**

### Allied Mathematics - II (Chemistry)

**Objective:** To make the students become familiar with the tools in Mathematics to solve problems in different related fields.

#### **Unit - I: Graphs**

What is a graph? - Application of graphs - Finite and Infinite graphs - Incidence and degree - Isolated Vertex, Pendant Vertex and Null graph - Isomorphism - Sub graphs - Walks, Paths and Circuits - Connected graphs, disconnected graphs and components - Euler graphs - Operations on graphs - More on Euler graphs - Hamiltonian paths and circuits - The traveling salesman problem.

(Book 1: Chapter 1(Except 1.6), Chapter 2: 2.1 - 2.10 (Except 2.3))

#### **Unit - II: Probability**

Probability - Random experiment - Event - Sample space - Measurement of probability - Classical approach - Relative frequency theory of probability - conditional probability - Baye's theorem.

(Book 2, Chapter 18: pages 737 - 759)

#### **Unit - III: Partial Differential Equations**

Elimination of arbitrary constants - Elimination of arbitrary functions - Standard forms - Lagrange's equation.

(Book 3: Chapter 9: Pages: 275 - 302)

### Unit – IV: Laplace Transforms

Properties of Laplace transform – Inverse Laplace transform – Partial fractions – Differential equations.

(Book 3: Chapter 10: Pages: 303 – 335).

### Unit – V: Fourier Series

Properties of integration – Odd and even functions – Half range Fourier series. (Book 3: Chapter 11: Pages: 341 – 360)

### Books for Study

1. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science –Prentice–Hall of India, 2001.
2. R.S.N. Pillai and Bagavathi, Statistics, S.Chand & co Ltd., New Delhi, seventh revised edition, 2010.
3. G. Britto Antony Xavier, V. Balaji, S.U. Vasantha Kumar, B. Govindan, Mathematical Sciences , Jayalakshmi Publications, Second Edition, 2015.

### Books for Reference

1. P. Balasubramaniam, K. G. Subramanian, Ancillary Mathematics, Volume – I, Tata McGraw – Hill publishing company limited, New Delhi, 1996.
2. P. Duraipandian, S. UdayaBaskaran, Allied Mathematics, Volume – I, Muhil publishers, 1<sup>st</sup> Edition, Chennai, 1997.
3. P. Kandsamy and K. Thilagavathy, Allied Mathematics Volume – I, Volume – II, S. Chand & Company, New Delhi, 2004.
4. Shanti Narayan, P.K. Mittal, Differential Calculus, S. Chand & Co, New Delhi, 2005.
5. A. Singaravelu, Allied Mathematics, Meenakshi Agency, Chennai, 2001.
6. P.R. Vittal, Allied Mathematics, Margham Publications, Chennai, 1999.

E-Learning source: [http://mathforum.org/library/drmath/sets/elem\\_2d](http://mathforum.org/library/drmath/sets/elem_2d)

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	define Graphs and its types.	K1
CO2	understand the concept of probability and Baye's theorem.	K2
CO3	solve differential equations using standard forms.	K3
CO4	evaluate the ODE using Laplace and inverse Laplace transforms.	K5

CO5	point out the odd and even function and develop the Fourier expansion series.	K4, K6
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### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	1	3	3	2	1	3	3	3	3	2	2.42
2	3	2	1	1	3	2	1	2	2	2	1	3	1.92
3	3	3	2	2	3	3	3	2	3	2	3	2	2.58
4	3	3	2	2	3	1	3	3	2	3	2	1	2.33
5	3	2	1	2	1	2	2	2	2	2	1	3	1.92
Mean Overall Score												2.23	
Result												High	

**Year/Semester: I Yr /I SEM**

**Credits: 4**

**Code: AM114E**

**Hours/Week: 6**

### Allied Business Mathematics (BBA)

**Objective:** To expose tools in Mathematics to solve problems related to business and to introduce the optimization techniques to solve problems arising in business.

#### Unit - I: Determinant

Determinant - Rank - Solving a system of linear equations - Cramer's rule - Input and output analysis.

(Book 1: Part - I, Chapter 4, Page 164 - 210).

#### Unit - II: Differentiation

Differentiation of standard functions from first principles - First and second order derivatives - Maxima and minima - Application to business problems. (Book 1: Part - I, Chapters 6, Page: 247 - 281, Chapter 7 282 - 296)

#### Unit - III: Integration

Determining indefinite and definite integrals using definition - Integration by parts - Partial fraction method - Applications.

(Book 1: Part - I, Chapter 8, Page: 303 - 322)

#### Unit - IV: Linear Programming Problem

Scope and uses of operations research - Formulations of linear programming problems - Basic solution - Basic feasible solution - Optimal solution - Graphical solution-Simplex

solution of linear programming problems (**only feasible region**). (Book 2: Chapter 17, Page: 698 – 736)

### Unit – V: Transportation Problem

North West corner method – Least cost method – Vogel’s approximation method Initial Basic Feasible Solution (IBFS problems only) – Assignment problem (balanced problems only).

(Book 2: Chapters 18 and 19)

### Books for Study

1. P.A. Navnitham, Business Mathematics and Statistics for B.B.A/B.B.M, Jai Publishers, Trichy, August 2018.
2. P.A. Navnitham, Business Statistics for B.Com and B.Com.(C.A.), Jai Publishers, Trichy, July 2011.

### Books for Reference

1. S.S. Chadha, R.N. Agarwal, Business Mathematics, S. Chand & Company Ltd, Ram Nagar, New Delhi, 1996.
2. P.K. Gupta, D.S. Hira, Operations Research, S. Chand & Company Ltd, New Delhi, 2005.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Statistics, Sultan Chand & Sons, New Delhi, 2007.
4. S.P. Gupta, Elementary Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
5. J.K. Sharma, Operations Research, 2-e, Mcmillian India Ltd, 2003.
6. Sundaresan and Jayaseelan, An introduction to Business Mathematics, Sultan Chand and Company, New Delhi, 1988.

E – Learning source: [http://www.math.above.com/od/business math/](http://www.math.above.com/od/business%20math/)

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	apply Cramer’s rule to solve system of equations.	K3
CO2	classify maxima and minima of functions	K2
CO3	define definite integrals and solve by partial fraction method	K1
CO4	find basic feasible solution for LPP models using graphical and simplex method.	K5
CO5	focus and perform on Transportation and	K4, K6

Assignment problems.
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**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	1	3	2	2	2	3	2	3	2	2	2.33
2	3	2	1	3	2	2	1	3	1	2	2	3	2.08
3	3	2	1	3	1	2	2	3	2	2	2	3	2.17
4	3	3	1	3	2	2	2	3	2	3	2	3	2.42
5	3	2	1	3	2	2	3	2	3	3	2	3	2.42
Mean Overall Score													2.28
Result													High

**Year/Semester: IIYr / III SEM**

**Credits: 4**

**Code: AM310A**

**Hours/Week: 6**

### **Allied Business Mathematics (B.Com)**

**Objective:** To expose tools in Mathematics to solve problems related to business and to introduce the optimization techniques to solve problems arising in business.

#### **Unit - I: Determinant**

Determinant - Rank - Solving a system of linear equations - Cramer's rule - Input and output analysis.

(Book 1: Part - I, Chapter 4, Page 164 - 210).

#### **Unit - II: Differentiation**

Differentiation of standard functions from first principles - First and second order derivatives - Maxima and minima - Application to business problems. (Book 1: Part - I, Chapters 6, Page: 247 - 281, Chapter 7 282 - 296)

#### **Unit - III: Integration**

Determining indefinite and definite integrals using definition - Integration by parts - Partial fraction method - Applications.

(Book 1: Part - I, Chapter 8, Page: 303 - 322)

#### **Unit - IV: Linear Programming Problem**

Scope and uses of operations research - Formulations of linear programming problems - Basic solution - Basic feasible solution - Optimal solution - Graphical solution-Simplex solution of linear programming problems (**only feasible region**). (Book 2: Chapter 17, Page: 698 - 736)

#### **Unit - V: Transportation Problem**

North West corner method - Least cost method - Vogel's approximation method Initial Basic Feasible Solution (IBFS problems only) - Assignment problem (balanced problems only).

(Book 2: Chapters 18 and 19)

#### **Books for Study**

1. P.A. Navnitham, Business Mathematics and Statistics for B.B.A/B.B.M, Jai Publishers, Trichy, August 2018.
2. P.A. Navnitham, Business Statistics for B.Com and B.Com.(C.A.), Jai Publishers, Trichy, July 2011.

#### **Books for Reference**

1. S.S. Chadha, R.N. Agarwal, Business Mathematics, S. Chand & Company Ltd, Ram Nagar, New Delhi, 1996.
2. P.K. Gupta, D.S. Hira, Operations Research, S. Chand & Company Ltd, New Delhi, 2005.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Statistics, Sultan Chand & Sons, New Delhi, 2007.



4. S.P.Gupta, Elementary Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
5. J.K. Sharma, Operations Research, 2-e, Mcmillian India Ltd, 2003.
6. Sundaresan and Jayaseelan, An introduction to Business Mathematics, Sultan Chand and Company, New Delhi, 1988.

E - Learning source: <http://www.math.above.com/od/business math/>

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	apply Cramer's rule to solve system of equations.	K3
CO2	classify maxima and minima of functions	K2
CO3	define definite integrals and solve by partial fraction method	K1
CO4	find basic feasible solution for LPP models using graphical and simplex method.	K5
CO5	focus and perform on Transportation and Assignment problems.	K4, K6

### Mapping of CO with PO and PSO

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	1	3	2	2	2	3	2	3	2	2	2.33
2	3	2	1	3	2	2	1	3	1	2	2	3	2.08
3	3	2	1	3	1	2	2	3	2	2	2	3	2.17
4	3	3	1	3	2	2	2	3	2	3	2	3	2.42
5	3	2	1	3	2	2	3	2	3	3	2	3	2.42
Mean Overall Score												2.28	
Result												High	

**Year/Semester: II Yr /III SEM**  
**Credits: 4**

**Code: AM310B**  
**Hours/Week: 6**

### **Allied Business Mathematics (B.Com (CA))**

**Objective:** To expose tools in Mathematics to solve problems related to business and to introduce the optimization techniques to solve problems arising in business.

#### **Unit - I: Determinant**

Determinant - Rank - Solving a system of linear equations - Cramer's rule - Input and output analysis.

(Book 1: Part - I, Chapter 4, Page 164 - 210)

#### **Unit - II: Differentiation**

Differentiation (problems only) - Uses of derivatives - Maxima and minima - Application to business problems.

(Book 1: Part - I, Chapters 6, Page: 255 - 259, Chapter 7, Page: 282 - 294)

#### **Unit - III: Integration**

Determining indefinite and definite integrals using definition - Integration by parts - Partial fraction method - Applications.

(Book 1: Part - I, Chapter 8, Page: 303 - 322)

#### **Unit - IV: Linear Programming Problem**

Scope and uses of operations research - Formulations of linear programming problems - Basic solution - Basic feasible solution - Optimal solution - Graphical solution-Simplex solution of linear programming problems (**only feasible region**).

(Book 2: Chapter 17, Page: 698 - 736)

#### **Unit - V: Transportation Problem**

North West corner method - Least cost method - Vogel's approximation method Initial Basic Feasible Solution (**IBFS problems only**).

(Book 2: Chapters 18)

#### **Books for Study**

1. P.A. Navnitham, Business Mathematics and Statistics for B.B.A/B.B.M, Jai Publishers, Trichy, August 2018.
2. P.A. Navnitham, Business Statistics for B.Com and B.Com. (C.A.), Jai Publishers, Trichy, July 2011.

#### **Books for Reference**

1. S.S. Chadha, R.N. Agarwal, Business Mathematics, S.Chand & Company Ltd, Ram Nagar, New Delhi, 1996.
2. P.K. Gupta, D.S.Hira, Operations Research, S. Chand & Company Ltd, New Delhi, 2005.
3. S.C. Gupta and V.K.Kapoor, Fundamentals of Statistics, Sultan Chand & Sons, New Delhi, 2007.
4. S.P. Gupta, Elementary Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
5. J.K. Sharma, Operations Research, 2-e, Mcmillian India Ltd, 2003.

6. Sundaresan and Jayaseelan, An introduction to Business Mathematics, Sultan Chand and Company, New Delhi, 1988.

E - Learning source: [http://www.math.above.com/od/business math/](http://www.math.above.com/od/business%20math/)

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	apply Cramer's rule to solve system of equations.	K3
CO2	classify maxima and minima of functions	K2
CO3	define definite integrals and solve by partial fraction method	K1
CO4	find basic feasible solution for LPP models using graphical and simplex method.	K5
CO5	focus and perform on Transportation problems.	K4, K6

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	1	3	2	2	2	3	2	3	2	2	2.33
2	3	2	1	3	2	2	1	3	1	2	2	3	2.08
3	3	2	1	3	1	2	2	3	2	2	2	3	2.17
4	3	3	1	3	2	2	2	3	2	3	2	3	2.42
5	3	2	1	3	2	2	3	2	3	3	2	3	2.42
Mean Overall Score												2.28	
Result												High	

**Year/Semester: I Yr /II SEM**  
**Credits: 4**

**Code: AM214E**  
**Hours/Week: 6**

### **Allied Business Statistics (BBA)**

**Objective:** To use statistical tools in business and arrive at possible inferences relating to population under study.

#### **Unit - I: Representation of Data and Measures of Central Tendency**

Representation of data by diagram – Graphical representation – Frequency distribution. Averages: Simple and weighted – Median – Mode – Geometric mean and harmonic mean – Properties and uses.

(Part - II, Chapters 6: Page: 98-147, Chapter 7: Page: 159-285 )

#### **Unit - II: Measures of Dispersion**

Measures of dispersion: Range – Quartile deviation – Standard deviation and co-efficient of variation.

(Part - II, Chapters 8, Page: 305-368)

#### **Unit - III: Correlation and Regression**

Correlation: Meaning and definition – Scatter diagram – Pearson's co-efficient of correlation – Rank correlation – Regression: Meaning and linear prediction – Difference between correlation and regression – Regression in two variables – Uses.

(Part - II, Chapters 12: Page: 503-534, Chapter 13: 540-571)

#### **Unit - IV: Index Numbers**

Index Numbers: Meaning – Uses – Methods of construction – Aggregate and relative types – Tests for index numbers – Cost of living index.

(Part - II, Chapter 10, Page: 444-488)

#### **Unit - V: Analysis of Time Series**

Time Series: Meaning – Components – Methods of estimating trend – Graphic – Semi average – Moving average and least square method.

(Part - II, Chapter 14, Page: 579-601)

#### **Book for Study**

1. P.A. Navnitham, Business Mathematics and Statistics, Jai Publishers, Trichi, 2011.

#### **Books for Reference**

1. S.S.Chadha, R.N.Agarwal, Business Mathematics, S. Chand & Company Ltd, Ram Nagar, New Delhi, 1996.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Statistics, Sultan Chand & Sons, New Delhi, 2007.
3. S.P.Gupta, Elementary Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
4. Sundaresan and Jayseelan, An introduction to Business Mathematics, Sultan Chand & Company, New Delhi, 1988.
5. P.R.Vittal, Business Mathematics and Statistics, Margham Publication, Chennai, 2011.

E- Learning source: <http://www.college stats.org/>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	graphically represent and calculate mean, median and mode.	K2, K3
CO2	define range, Quartile deviation, standard deviation and coefficient of variation	K1
CO3	find correlation coefficient and regression	K5
CO4	perform case study and test for Index numbers and cost of living index	K4, K6
CO5	estimate the trend line by using average, moving average and least square method	K2

**Mapping of CO with PO and PSO**

CO	Programme Outcomes (PO)							Programme Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	1	1	3	2	3	3	3	3	3	3	2	2.42
2	1	2	1	3	3	3	2	3	3	3	3	3	2.50
3	2	2	1	3	2	2	2	3	3	3	3	3	2.42
4	2	3	1	3	2	3	2	3	3	3	3	3	2.58
5	2	2	1	3	2	3	2	3	3	3	3	3	2.50
Mean Overall Score												2.48	
Result												High	

**Year/Semester: II Yr /IV SEM**  
**Credits: 4**

**Code: AM409A**  
**Hours/Week: 6**

### **Allied Business Statistics (B. Com)**

**Objective:** To use statistical tools in business and arrive at possible inferences relating to population under study.

#### **Unit - I: Representation of Data and Measures of Central Tendency**

Representation of data by diagram - Graphical representation - Frequency distribution. Averages: Simple and weighted - Median - Mode - Geometric mean and harmonic mean - Properties and uses.

(Part - II, Chapters 6: Page: 98-147, Chapter 7: Page: 159-285 )

#### **Unit - II: Measures of Dispersion**

Measures of dispersion: Range - Quartile deviation - Standard deviation and co-efficient of variation.

(Part - II, Chapters 8, Page: 305-368)

#### **Unit - III: Correlation and Regression**

Correlation: Meaning and definition - Scatter diagram - Pearson's co-efficient of correlation - Rank correlation - Regression: Meaning and linear prediction - Difference between correlation and regression - Regression in two variables - Uses.

(Part - II, Chapters 12: Page: 503-534, Chapter 13: 540-571)

#### **Unit - IV: Index Numbers**

Index Numbers: Meaning - Uses - Methods of construction - Aggregate and relative types - Tests for index numbers - Cost of living index.

(Part - II, Chapter 10, Page: 444-488)

#### **Unit - V: Analysis of Time Series**

Time Series: Meaning - Components - Methods of estimating trend - Graphic - Semi average - Moving average and least square method.

(Part - II, Chapter 14, Page: 579-601)

#### **Book for Study**

1. P.A. Navnitham, Business Mathematics and Statistics, Jai Publishers, Trichi, 2011.

#### **Books for Reference**

1. S.S. Chadha, R.N. Agarwal, Business Mathematics, S. Chand & Company Ltd, Ram Nagar, New Delhi, 1996.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Statistics, Sultan Chand & Sons, New Delhi, 2007.
3. S.P.Gupta, Elementary Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
4. Sundaresan and Jayseelan, An introduction to Business Mathematics, Sultan Chand & Company, New Delhi, 1988.
5. P.R.Vittal, Business Mathematics and Statistics, Margham Publication, Chennai, 2011.

E- Learning source: <http://www.collegestats.org/>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	graphically represent and calculate mean, median and mode.	K2, K3
CO2	define range, Quartile deviation, standard deviation and coefficient of variation	K1
CO3	find correlation coefficient and regression	K5
CO4	perform case study and test for Index numbers and cost of living index	K4, K6
CO5	estimate the trend line by using average, moving average and least square method	K2

**Mapping of CO with PO and PSO**

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	1	1	3	2	3	3	3	3	3	3	2	2.41
2	1	2	1	3	3	3	2	3	3	3	3	3	2.5
3	2	2	1	3	2	2	2	3	3	3	3	3	2.42
4	2	3	1	3	2	3	2	3	3	3	3	3	2.58
5	2	2	1	3	2	3	2	3	3	3	3	3	2.5
Mean Overall Scores												2.48	
Result												High	

**Year/Semester: II Yr /IV SEM**  
**Credits: 4**

**Code: AM409B**  
**Hours/Week: 6**

### **Allied Business Statistics (B.Com (CA))**

#### **Objective:**

To use statistical tools in business and arrive at possible inferences relating to population under study.

#### **Unit - I: Representation of Data**

Meaning and Scope of Statistics - Collection of data - Methods of Collection of Primary data - Sources of Secondary data - Classification and Tabulation - Diagrams and Graphs.  
(Part - II, Chapters 1,3,5,6)

#### **Unit - II: Measures of Central Tendency**

Averages: Simple and Weighted - Median - Mode - Geometric Mean - Harmonic Mean (Direct method only).  
(Part - II, Chapter 7, Page: 159-268 [Problems only])

#### **Unit - III: Measures of Dispersion**

Measures of dispersion: Range - Quartile deviation - Standard deviation and co-efficient of Variation (Direct method only).  
(Part - II, Chapter 8, Page: 305 - 368)

#### **Unit - IV: Index Numbers**

Index Numbers: Meaning - Uses - Methods of construction - Aggregate and relative types - Tests for index numbers - Cost of living index.  
(Part - II, Chapter 10, Page: 444-488).

#### **Unit - V: Time Series**

Time Series: Meaning - Components - Methods of estimating trend - Graphic - Semi average - Moving average and least square method.  
(Part - II, Chapter 14, Page: 579-601)

#### **Book for Study:**

1. P.A. Navnitham, Business Mathematics and Statistics for B.B.A/B.B.M, Jai Publishers, Trichy, July 2011.

#### **Books for Reference:**

1. S.S.Chadha, R.N.Agarwal, Business Mathematics, S.Chand & Company Ltd., Ram Nagar, New Delhi, 1996.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Statistics, Sultan Chand & Sons, New Delhi, 2007.
3. S.P.Gupta, Elementary Statistical Methods, Sultan Chand & Sons, New Delhi, 2005.
4. Sundaresan and Jayseelan, An introduction to Business Mathematics, Sultan Chand & Company, New Delhi, 1988.
5. P.R.Vittal, Business Mathematics and Statistics, Margham Publication, Chennai, 2011.



E- Learning source: <http://www.college stats.org/>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	graphically represent and calculate mean, median and mode.	K2, K3
CO2	define range, Quartile deviation, standard deviation and coefficient of variation	K1
CO3	find correlation coefficient and regression	K5
CO4	perform case study and test for Index numbers and cost of living index	K4, K6
CO5	estimate the trend line by using average, moving average and least square method	K2

**Mapping of CO with PO and PSO**

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	1	1	3	2	3	3	3	3	3	3	2	2.42
2	2	1	2	3	2	3	3	3	3	3	3	2	2.5
3	1	2	1	3	3	2	2	3	3	3	3	3	2.42
4	2	3	1	3	2	3	2	3	3	3	3	3	2.58
5	2	2	1	3	2	3	2	3	3	3	3	3	2.5
Mean Overall Scores												2.5	
Result												High	

**Year/Semester: I Yr /I SEM**  
**Credits: 4**

**Code: AM114D**  
**Hours/Week: 6**

### **Mathematical Foundations - I (BCA)**

**Objective:** To make the students familiar in Mathematics which are essential for developing computer applications.

#### **Unit - I: Symbolic Logic**

Proposition – Logical operators – Conjunctions – Disjunction – Negation – Conditional and bi-conditional operators – Converse – Inverse – Contra positive – Logically equivalent – Tautology and contradiction – Arguments and validity of arguments.

(Pages 1.1 - 1.50)

#### **Unit - II: Set Theory**

**Sets:** Set operations – Venn diagrams – Properties of sets – Number of elements in a set – Cartesian product.

**Relations:** Equivalence relation – Equivalence class – Partially and totally ordered sets.

**Functions:** Types of functions – Composition of functions.

(Pages 2.1 - 2.38, 3.1 - 3.23, 4.1 - 4.35)

#### **Unit - III: Binary Operations**

Types of binary operations: Commutative – Associative – Distributive and identity – Permutations and combinations.

(Pages 6.1 - 6.10, 7.1 - 7.53)

#### **Unit - IV: Applications of Differentiation**

Tangent and normal – Angle between two curves – Maximum and minimum values (second derivative test) – Curvature and radius of curvature.

(Pages 14.1 - 14.53, 15.1 - 15.22)

#### **Unit - V: Two Dimensional Geometry**

Slope of a straight line – Concurrent lines – Angle between two lines – Condition for parallel and perpendicular lines – Pair of straight lines – Circles – Conics (parabola, ellipse and hyperbola) [simple problems only].

(Pages 25.25 - 26.31, 27.1 - 27.18, 28.1 - 28.17, 28.41 - 28.53, 28.98 - 28.114).

#### **Book for Study**

1. P.R.Vittal, Mathematical Foundations, Margham Publications, Chennai, 2011.

#### **Books for Reference**

1. P.Duraipandian and Laxmi Duraipandian, Analytical Geometry Two dimension, Emerald Publication 1992.
2. Manicavasagam Pillay & Natarajan, Analytical Geometry Part I - Two dimension, S. Viswanathan (printers & publication) Pvt Ltd., 1991.

**E -Learning source: <http://www.mathfoundation.com>**

## Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	discuss logic and propositional calculus and basic logical operations and build binary operations	K2, K3
CO2	define the basic concepts of set theory, relations, functions and binary operations and represent using Venn diagrams	K1
CO3	classify maxima and minima of the functions	K2
CO4	find the angle between two lines and analyze the conditions for parallel and perpendicular lines	K4, K5
CO5	performing curvature and radius of curvature	K6

## Mapping of CO with PO and PSO

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	1	3	3	3	3	3	3	3	3	3	2.75
2	2	3	1	3	3	3	3	3	3	3	3	3	2.75
3	2	2	1	2	3	3	2	2	3	2	3	2	2.25
4	3	2	1	3	2	3	2	3	2	2	3	2	2.33
5	2	3	1	2	3	2	2	3	2	3	2	3	2.33
Mean Overall Scores													2.48
Result													High

**Year/Semester: I Yr /II SEM**  
**Credits: 4**

**Code: AM214D**  
**Hours/Week: 6**

### **Mathematical Foundations - II (BCA)**

**Objective:** To make the students become familiar with the tools in Mathematics to solve problems in several relevant fields.

#### **Unit - I: Matrices**

Multiplication of matrices - Singular and non-singular matrices - Adjoint of a matrix, Inverse of a matrix - Symmetric and skew symmetric - Hermitian and skew-Hermitian - Orthogonal and unitary matrices - Rank of a matrix - Solution of simultaneous linear equations by (i) Cramer's rule (ii) Matrix inversion method. (Pages 8.1 to 8.84, 8.130 to 8.141)

#### **Unit II: Matrices (Continued)**

Characteristic equation of a Matrix - Cayley-Hamilton theorem - Matrix of linear transformation: Reflection about the x, y axes and the line  $y = x$  - Rotation about the origin through an angle - Expansion or Compression - Shears - Translation. (Pages 8.97 to 8.122, 9.1 to 9.30)

#### **Unit - III: Integration and its Applications**

Reduction Formula for  $\int x^n e^{ax} dx, \int \sin^n x dx, \int \cos^n x dx, \int x^m (1-x)^n dx$  - Definite integrals - Applications of integration: (i) Area under plane curves (ii) Volume of solid of revolution. (Pages 18.1-18.32, 19.1-19.26, 21.1-21.12, 22.1-22.8)

#### **Unit - IV: Analytical Geometry of Three Dimensions**

Planes: General equations of a plane - plane passing through a point - Intercept form - Normal form - Angle between two planes - Perpendicular distance - Equation of the plane passing through three points. (Pages 29.1 - 29.38)

#### **Unit - V: Analytical Geometry of Three Dimensions (Continued)**

Spheres: Equation of Sphere - Section of a sphere by a plane - Equation of circle - Intersection of two spheres - Orthogonality of two spheres (excluding radical plane and coaxial systems)- Cones (simple problems only). (Pages 31.1 - 31.47, 32.1 - 32.11)

#### **Book for Study:**

1. P.R. Vittal, Mathematical Foundations, Margham Publications, Chennai, 2011.

**Books for Reference:**

1. P. Duraipandian & Others, Analytical Geometry Three dimension, Emerald Publication, Reprint 1992.
2. T.K. Manicavachagam Pillay and Natarajan, Analytical Geometry Part II, Three dimensions, S. Viswanathan (printers & publication) Pvt. Ltd., 1991.

E - Learning source: <http://www.mathfoundation.com/>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	find the solutions of simultaneous linear equations by applying Cramer's rule and matrix inversion method.	K3, K5
CO2	find eigen values, eigen vectors and diagonalizable the matrix.	K5
CO3	establish area under plane curves and volume of a solid revolution.	K3
CO4	define and analyse the equation of a plane and spheres.	K1, K4
CO5	discuss and perform problems on equation of sphere and equation of cone.	K2, K6

**Mapping of CO with PO and PSO**

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	1	2	2	2	2	3	2	3	2	2	2.25
2	3	3	1	2	2	2	2	3	2	3	3	2	2.33
3	3	2	1	2	3	3	2	2	3	3	2	2	2.33
4	3	3	1	3	3	2	2	3	3	3	2	2	2.5

5	3	3	1	3	3	2	2	3	3	3	2	2	2.5
Mean Overall Scores												2.38	
Result												High	

**Year/Semester: I Yr /I SEM**  
**Credits: 4**

**Code: AM114C**  
**Hours/Week: 6**

### **Allied Mathematics – I (Computer Science)**

**Objective:** To understand the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving. Understand some basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

#### **Unit – I: Logic and Proofs**

Logic – Propositional Equivalences – Methods of Proof.  
(Chapter I: Sections: 1.1 to 1.15; Page no: 1-15, 20-26, 56-73, Problems only)

#### **Unit – II: Mathematical Reasoning, Induction and Recursion**

Sequences and Summations – Mathematical Induction – Recursive Definitions. (Chapter III: Sections: 3.1 to 3.4; Page: 225-233, 238-251, 256-266, Problems only)

#### **Unit – III: Combinatorics**

The Basics of Counting – The Pigeonhole Principle – Permutations and Combinations – Binomial Coefficients – Generalized Permutations and Combinations.  
(Chapter IV: Sections: 4.1 to 4.5; Page: 301-310, 313-318, 320-324, 327-333, 335-341, Problems only, No Algorithms)

#### **Unit – IV: Graphs**

Introduction to Graphs – Graph Terminology – Representing Graphs and Graph Isomorphism –Connectivity – Euler and Hamilton Paths – Shortest Path Problems (Chapter VIII: Sections: 8.1 to 8.6; Page: 537-543, 545-554, 557-563, 567-575, 577-585, 593-601.)

#### **Unit – V: Modeling Computation**

Languages and Grammars – Finite State Machines with output – Finite State Machines with no output – Language Recognition.  
(Chapter XI: Sections: 11.1 - 11.4; Page: 739- 748, 751-756, 758-764, 765-773, Problems only)

#### **Book for Study**

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw Hill Pub. Co. Ltd., New York, Tenth reprint 2006.

#### **Books for Reference**

1. Ralph. P. Grimaldi, Discrete and Combinatorial Mathematics: An Applied Introduction, Pearson Education Asia, Delhi, 4th Edition, 2007.
2. Seymour Lipschutz and Mark Lipson, Discrete Mathematics, Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Sankar. K, Discrete Mathematics for Computer Scientists and Mathematicians, Indian Publishers, Chennai, First Revised Edition, 2004.
4. Tremblay J.P. and Manohar R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
5. Thomas Koshy, Discrete Mathematics with Applications, Elsevier Publications, 2006.

E - Learning source: <http://mathword.wolfram.com>

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand the concept of logic and propositional calculus and basic logical operations.	K2
CO2	discuss the uses of mathematical reasoning, induction and regression	K1
CO3	apply diverse counting strategies to solve varied problems involving strings, find permutations and combinations	K3, K5
CO4	represent graphs, develop Euler and Hamiltonian paths.	K2, K6
CO5	analysis about language and grammar in finite state automata.	K4

**Mapping of CO with PO and PSO**

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	1	2	2	2	2	3	2	3	2	2	2.08
2	3	3	1	3	2	2	2	3	2	3	2	2	2.33
3	3	2	1	3	3	3	2	2	3	3	2	2	2.42
4	2	3	1	3	3	2	2	3	3	3	3	2	2.5
5	3	3	1	3	3	3	3	3	3	3	3	2	2.75
Mean Overall Scores												2.42	
Result												High	



**Year/Semester: I Yr /II SEM**  
**Credits: 4**

**Code: AM214C**  
**Hours/Week: 6**

### **Allied Mathematics - II (Computer Science)**

**Objective:** To train the students in mastering the techniques of various branches of Mathematics and to motivate the students to apply the techniques in their respective major subjects.

#### **Unit - I: Algebraic and Transcendental equations**

Solving algebraic and transcendental equations - Bisection - False position and Newton-Raphson method - Solving simultaneous equations - Introduction- Gauss elimination - Finding inverse of a matrix using Gauss elimination methods - Iterative methods - Gauss-Jacobi and Gauss-Seidal methods (Problems only). (Book 1, Chapter III: Sec 2: pages 82 to 85, Sec 4,5: pages 91 to 106; Chapter IV: Sec 1,2,3: pages 113 to 126, Sec 6: pages 140 to 146)

#### **Unit - II: Interpolation & Numerical Differentiation and Integration**

Introduction - Linear Interpolation - Newton Gregory forward and backward interpolation formula - Lagrange's interpolation formula - Numerical integration - Trapezoidal rule and Simpson's 1/3 rule (Problems only).  
(Book 1, Chapter VI: Sec 1-4: pages 193 to 206; Chapter VIII: Sec 4: pages 253 to 262; Chapter IX: Sec 7,8: pages 280 to 284, Sec 10, pages 285 to 295)

#### **Unit - III: Ordinary Differential Equations**

Solving differential equations (First order differential equation only) - Solutions by Taylor's series - Euler's method - Runge-Kutta 2nd and 4th order method - Milne's predictor correct method (Problems only).  
(Book 1, Chapter XI: Sec 6,7: pages 336 to 340, Sec 10-15, pages 350 to 365, Sec 20, pages 371 to 380)

#### **Unit - IV: Probability**

Probability - Conditional probability - Baye's theorem - Applications of Binomial, Poisson, Normal distributions (Problems only).  
(Book 2, Chapter 18: pages 737 to 759; Chapter 19: pages 769 to 801)

#### **Unit - V: Correlation & Curve Fitting**

Correlation coefficient - Rank correlation (Problems only).  
(Book2, Chapter 12: pages 396 to 443)  
Curve fitting by least square methods - Fitting a straight line, parabola, power curve and exponential curves. (No derivation, Numerical problems only). (Book 1, Chapter 1: Sec 1.6-1.9, pages 24 to 44)

### Books for Study

1. M.K. Venkataraman, Numerical Methods in Science and Engineering, The National publishing co., Madras, 1987.
2. R.S.N. Pillai and Bagavathi, Statistics, S.Chand& co Ltd., New Delhi, seventh revised edition, 2010.

### Books for Reference

1. Arumugam Issac, Numerical Analysis with programming in C, new Gamma publication house, Palayamkottai, 2011.
2. A. Singaravelu, Numerical Methods, Meenakshi Agency, Chennai, New revised edition 2007.
3. K. Sankara Rao, Numerical Methods for Science and Engineering, third edition, 2011.

E - Learning source: <http://mathword.wolfram.com>

### Course Learning Outcomes:

By the end of the semester, the students will be able to

CO Number	CO Statement	Knowledge Level
CO1	compute and interpret a variety of numerical algorithms using appropriate technology, and compare the viability of different approaches to the numerical solution of problems arising in roots of solution of non-linear equations, interpolation and approximation, numerical differentiation and integration, solution of linear systems.	K2
CO2	find the solutions of ordinary differential equations by Euler and Runge Kutta methods.	K5
CO3	define probability distribution (discrete and continuous) and apply to a variety of problems in various diversified fields.	K1, K3
CO4	perform problems on correlation and curve fitting by least square method	K6
CO5	point out correlation coefficient and rank correlation	K4

### Mapping of CO with PO and PSO

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	2	1	2	3	3	2	3	2	3	2	2	2.33
2	3	3	1	2	3	2	2	3	2	3	2	2	2.33
3	2	2	1	3	3	3	2	2	3	3	2	2	2.33
4	3	2	1	3	2	3	2	3	3	3	3	2	2.5
5	2	3	1	3	3	3	3	3	3	3	3	2	2.67
Mean Overall Scores												2.43	
Result												High	

**Year/Semester: II Yr /III SEM**  
**Credits: 4**

**Code: AM310C**  
**Hours/Week: 6**

### **Bio Statistics - I (Bio Chemistry)**

**Objective:** To develop the importance of Bio-Statistics in the scientific design of experiments and in the objective collection, processing, analysis and interpretation of scientific investigation in the life sciences

#### **Unit- I: Collection, Classification and Presentation of Data**

Collection of data - Data - Class intervals - Frequency - Frequency distribution  
Presentation of data - Tabular presentation - Graphic presentation - Diagrammatic presentation.

(Chapter 3 to 5)

#### **Unit -II: Measures of Central Tendency**

Mean - Median - Mode - Measures of average of position.

(Chapter 6)

#### **Unit -III: Measures of Dispersion**

Definition - Types of measures of dispersion - Range - Quartile deviation - Mean deviation - Standard deviation - Variance - Coefficient of Variance.

(Chapter 7)

#### **Unit- IV: Correlation and Regression**

Correlation - Scatter diagram - Karl Pearson's correlation coefficient - Spearman's rank correlation coefficient - Regression.

(Chapter 10)

#### **Unit-V: Vital Statistics**

Introduction - Uses of vital statistics - Systems for collection of vital statistics - Measures of vital statistics - Morality rate - Fertility rate.

(Chapter 17: Pages 340-349)

#### **Book for Study**

1. Veer Bala Rastogi, Fundamentals of Bio-Statistics, Ane Books Pvt. Ltd, Second Edition, New Delhi, Reprint 2011.

#### **Books for Reference**

1. P.N Arora and P.K Malhan, Bio-Statistics, Himalaya Publishing House, Mumbai, 1996.
2. S.P. Gupta, Statistical methods, Sultan Chand and Sons, New Delhi, 2004
3. N. Gurumani, An introduction to Bio-Statistics, 2-e, MJP Publishers, Chennai, 2005.
4. R.S.N. Pillai Bagavathi, Statistics, S.Chand and Company Ltd, 2007
5. Ronald N. Forthofer, Eun Sul Lee and Micheal Hernandez, Bio-Statistics, 2-e, Academic press, 2007.
6. P. Ramakrishnan, Bio-Statistics, Saras Publications, Nagercoil, 2007.

**E-learning Source: <http://stat.fsu.edu/dpati/5172>**

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	graphically represent and calculate mean, median and mode.	K2
CO2	define range, Quartile deviation, standard deviation	K1
CO3	perform correlation coefficient and regression	K6
CO4	measure of vital statistics - mortality rate and fertility rate.	K5
CO5	focus and calculate the variance and coefficient of variance	K3, K4

**Mapping of CO with PO and PSO**

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	1	2	2	2	2	3	2	3	2	2	2.25
2	3	3	1	2	2	2	2	3	2	3	2	2	2.25
3	3	2	1	2	3	3	2	2	3	3	2	2	2.33
4	3	3	1	3	3	2	2	3	3	3	2	2	2.5
5	3	3	1	3	3	2	2	3	3	3	2	2	2.5
Mean Overall Scores												2.37	
Result												High	

**Year/Semester: II Yr /IV SEM**  
**Credits: 4**

**Code: AM409C**  
**Hours/Week: 6**

### **Bio Statistics - II (Bio Chemistry)**

**Objective:** To develop the skills needed for bio sciences.

#### **Unit -I: Probability**

Introduction - Definition of probability - Basic concepts of Probability - Problems - Probability Distribution - Binomial - Poisson - Normal distribution, Measures of Deviation from Normal Distribution. (Chapters 8 and 9)

#### **Unit - II: Test of Hypothesis and Test of Significance**

Statistical inference - Test of significance - Student's 't'-test - Types of 't' test. (Chapters 12 and 13)

#### **Unit -III: Analysis of Variance (ANOVA)**

Introduction - Test of ANOVA - One way analysis of variance - F - test. (Chapter 11)

#### **Unit - IV: Chi- Square Test**

Introduction - Definition - Significance of chi-square test - Probability value from chi-square. (Chapter 14)

#### **Unit - V: Nonparametric or Distribution-Free Statistical Test**

Introduction - Sign test - Wilcoxon signed rank test - Wilcoxon rank sum test - The Mann Whitney test - The Kolmogorov - Smirnov goodness of fit test - The Spearman's Rank Correlation Coefficient. (Chapter 15)

#### **Book for Study**

1. Veer Bala Rastogi, Fundamentals of Bio-Statistics, Ane Books Pvt. Ltd, Second Edition, New Delhi, Reprint 2011.

#### **Books for Reference**

1. P.N Arora and P.K Malhan, Bio-Statistics, Himalaya Publishing House, Mumbai, 1996.
2. S. P. Gupta, Statistical methods, Sultan Chand and Sons, New Delhi, 2004
3. N. Gurumani, An introduction to Bio-Statistics, 2-e, MJP Publishers, Chennai, 2005.
4. R.S.N. Pillai Bagavathi, Statistics, S.Chand and Company Ltd, 2007
5. Ronald N. Forthofer, Eun Sul Lee and Micheal Hernandez, Bio-Statistics, 2-e, Academic press, 2007.
6. P.Ramakrishnan, Bio-Statistics, Saras Publications, Nagercoil, 2007.

**E - Learning source: <http://stat.fsu.edu/dpati/5172>**

### Course Learning Outcomes:

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand basic concepts of a random variable and its probability distributions.	K2
CO2	perform problems in inferential statistics.	K6
CO3	test significance – student’s t-test	K4
CO4	establish the one way analysis of variance – F-test	K3
CO5	define non parametric statistical test and find Spearman rank correlation coefficient	K1, K5

### Mapping of CO with PO and PSO

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	3	3	1	2	2	3	2	3	2	3	2	3	2.42
2	3	3	1	3	2	2	3	3	2	3	2	2	2.42
3	3	2	1	2	3	3	2	2	3	3	3	2	2.42
4	3	3	1	3	3	2	2	3	3	3	2	3	2.58
5	3	3	1	3	3	3	3	3	3	3	3	2	2.75
Mean Overall Scores												2.52	
Result												High	

**Year/Semester: II Yr /III SEM**  
**Credits: 4**

**Code: AM310D**  
**Hours/Week: 6**

### **Statistical Methods for Psychology**

#### **UNIT I: Introduction to the Statistics**

Meaning of statistics-Importance of Statistics in Psychology -Parameters and Estimates- Descriptive Statistics- Inferential Statistics-Variables and their types; **Levels of measurement:** Nominal Scale- Ordinal Scale- Interval Scale- Ratio Scale; **Frequency tables:** Making a Frequency Table -Frequency tables for Nominal Variables- Grouped Frequency Tables.

**Frequency Graphs:** Histogram, Frequency Polygon.

#### **UNIT II: Central Tendency and Variability**

**Central Tendency:** The Mean- from Frequency Distributions - Assumed Mean Method- Properties of Mean. Median - Calculation of Median from Ungrouped data- Calculation of Median from a Frequency Distribution. The Mode- Calculation of Mode in a Frequency Distribution. Comparison of Mean, Median and Mode- Guidelines for the Use of Central Tendencies.

**Variability:** the Range- Calculation of Range- the Average Deviation- Calculation of the Average Deviation. The Semi Interquartile Range- Calculation of Q1, Q3 and Quartile Deviation. The variance and the Standard Deviation- Methods of Calculating the Variance and the Standard Deviation from Ungrouped data- Calculation of Standard Deviation from Grouped data- Calculation of Standard Deviation from Assumed Mean.

#### **UNIT III: The Normal Distribution and Correlation**

**The Normal Distribution:** Properties of the Normal Curve- Areas under the Normal Curve- Importance of Normal Distribution- Skewness- Kurtosis- Importance of measures of Skewness and Kurtosis.

**The Correlation:** the Concept of Correlation- the Scatter Plot- the Product Moment Correlation- Calculation of Product Moment Correlation- Spearman's Rank- Difference Correlation Co-efficient- Properties of Correlation Co-efficient.

#### **UNIT IV: THE Hypothesis Testing and the Inferential Statistics**

**Hypothesis Testing:** the Core logic of Hypothesis Testing -the Hypothesis Testing Process- One Tailed and Two Tailed Hypothesis Tests. Decision Errors: Type I Error- Type II Error.

**Inferential Statistics:** t' Tests- the t' test for a Single Sample- the t' test for a Dependent Means- Assumptions of Single Sample and the t' Test for a Dependent Means. The t' test for Independent Means: the Distribution of Differences between Means- Hypothesis Testing with a 't' test for Independent Means.

#### **UNIT V: Non-Parametric Methods**

**The Chi-Square:** Degrees of Freedom- Test of the Hypothesis of Normality- Calculation of the Chi-Square for 2x2 tables- Yates' Correction for Continuity- Assumptions of the Chi Square test.



**The Non-parametric Methods:** Sign test- Assumptions and Uses of Sign Test- the Median Test- Run Test- the Kolmogorov and Smirnov Two Sample test- Precautions of the use of the Non-parametric tests. 10

**Book for Study:**

Howell, D. (2012). *Statistical method for psychology* (8th ed.). Delhi, India: Cengage Learning.

**Books for References:**

1. Agresti, A., & Finlay, B. (2013). *Statistical methods for the social sciences*. Hoboken, NJ: Pearson Education
2. Aron, A., Aron, E. N., & Coups, E. J. (2006). *Statistics for psychology* (4th ed.). New Delhi, India: Pearson India Education Services Pvt Ltd.
3. Heiman, G. (2013). *Basic statistics for the behavioral sciences* (7th ed.). Belmont, CA: Cengage Learning.
4. Bear, G., King, B.M., & Minium, E. W. (2008). *Statistical reasoning in psychology and education*. Bengaluru, India: Wiley India Private Limited.
5. Gupta, S.P. (1999). *Statistical methods* (3rd ed.). New Delhi, India: Sultan Chand & Sons.
6. Garrett, H. E. (2006): *Statistics in psychology and education*. New Delhi, India: Paragon International Publishers.

**Course Learning Outcomes:**

This course will enable the students to:

CO Number	CO Statement	Knowledge Level
CO1	understand basic concepts of a random variable and its probability distributions.	K2
CO2	graphically represent and calculate mean, median and mode.	K2, K3
CO3	perform hypothesis testing and problems on inferential statistics	K6
CO4	Outline of normal distribution, skewness and kurtosis	K4
CO5	define non parametric statistical test and find Spearman rank correlation coefficient	K1, K5

### Mapping of CO with PO and PSO

CO	Program Outcomes (PO)							Program Specific Outcomes (PSO)					Mean Scores of Cos
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	
1	2	2	1	3	3	3	3	3	3	3	3	2	2.58
2	3	1	1	3	2	3	3	3	2	3	3	3	2.5
3	1	2	1	3	3	2	2	3	3	2	2	3	2.25
4	2	3	1	3	2	3	2	3	3	3	3	3	2.58
5	3	2	1	3	2	3	2	3	3	3	3	2	2.5
Mean Overall Scores												2.48	
Result												High	