

**DEPARTMENT OF MATHEMATICS (UG)**

**RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)**

Rathinam Techzone, Pollachi Road, Eachanari, Coimbatore – 641021



Syllabus for

B.Sc. Mathematics

(I, II, III, IV, V & VI Semester)

2017-2018 Batch on-wards

**Vision and Mission of the Institution:**

VISION

A world renowned INDUSTRY-INTEGRATED INSTITUTION that imparts knowledge, skill, and research culture in young men and women to suit emerging young India.

MISSION

To provide quality education at affordable cost, and to maintain academic and research excellence with a keen focus on INDUSTRY-INTEGRATED RESEARCH AND EDUCATION.

MOTTO

Meaningful INDUSTRY-READY education and research by all means

**Vision and Mission of the Department:**

VISION

The Department aspires to the highest standards of excellence in teaching, through preparing students for learning Pure, Applied and Industrial Mathematics for the Challenging Growth of Science and Technology.

MISSION

The Mission of the Department is to provide an environment where students can learn and become competent users of mathematics and mathematical application. Also to provide Quality Education, Research and Consultancy by Providing Highly Skilled mathematical Knowledge along with the Industrial collaboration.

## **Program Educational Objectives (PEO)**

**PEO 1: Mathematical knowledge.** Students will be able to demonstrate an understanding of the foundations of Mathematics as well as the ability to think logically and technically.

**PEO 2: Problem solving skills.** Students Will be able formulate, analyze, and solve problems through analytical and computational techniques and apply them to other discipline.

**PEO 3: Industry Collaboration.** Students will undergo industry training as internship and they will get chance to do their doing Project from industry they will be learning Mathematics and its application with respect to industry needs, by which their employability is increased.

**PEO 4: Employability Skill:** Students will get lifelong learning and successful careers using their mathematical and statistical skills and then to design Mathematical Model for Engineering and Technology for real time problems.

### Mapping of Institute Mission to PEO

Institute Mission	PEO's
Imparting Knowledge and Skill	PEO1, PEO2
Research Culture	PEO2
Industry collaboration	PEO3
Emerging young India	PEO4

### Mapping of Department Mission to PEO

Department Mission	PEO's
Imparting Critical thinking ability to become more Competency	PEO1, PEO2
Analytical Knowledge with Industry collaboration	PEO3, PEO4
Research Culture	PEO1

### Program Outcomes (PO):

- P01** : Ability to gain knowledge in foundational areas of Mathematics with respect to Industry needs
- P02** : Ability to communicate Mathematical concepts Accurately, Precisely and Effectively so as to make good communication with needy
- P03** : Ability to develop Mathematical thinking skills of students this increases the critical thinking ability by which chance of getting employed increased.
- P04** : Ability to apply Mathematical Knowledge and be able to solve Mathematical Problems using technology.
- P05** : Ability to understand the pedagogical knowledge specific to Mathematics teaching and learning.
- P06** : Ability to differentiate between valid and invalid mathematical reasoning so as to have individuality among students.
- P07** : Ability to develop mathematical ideas based on basic axioms by means to help non mathematician or layman who don't have knowledge of mathematics to get benefited.
- P08** : Ability to implement mathematical techniques to solve theoretical and applied problems with the help of industry input.

### Correlation between the POs and the PEOs

Program Outcomes	PEO1	PEO2	PEO3	PEO4
P01 :			√	
P02 :	√			
P03 :		√		√
P04 :				√
P05 :	√			
P06 :	√	√		√
P07 :	√			
P08 :		√	√	

Components considered for Course Delivery is listed below:

- |                              |   |      |
|------------------------------|---|------|
| 1. Class room Lecture        | - | I    |
| 2. Laboratory class and demo | - | II   |
| 3. Assignments               | - | III  |
| 4. Mini Project              | - | IV   |
| 5. Project                   | - | V    |
| 6. Online Course             | - | VI   |
| 7. External Participation    | - | VII  |
| 8. Seminar                   | - | VIII |
| 9. Internship                | - | IX   |

**Mapping of POs with Course Delivery:**

Program Outcomes	Course Delivery								
	I	II	III	IV	V	VI	VII	VIII	IX
P01	√		√						√
P02	√					√		√	
P03		√	√	√					
P04	√	√				√			
P05	√						√		
P06						√			
P07	√		√		√				
P08	√			√	√				√

**RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)**

*Scheme of curriculum for  
B.Sc. Mathematics*

for the students admitted in the Batch during 2017 - 2018

Board of Studies – Mathematics (UG)

S.No	Sem	Part	Type	Subject	Credit	Hour	Int	Ext	Total
1	1	I	L1	Language – I	3	6	40	60	100
2	1	II	E1	English for Communication	3	6	40	60	100
3	1	III	C1	Core - I – Algebra	4	6	40	60	100
4	1	III	C2	Core - II – Calculus	4	5	40	60	100
5	1	III	A1	Allied – I - Statistics for Mathematics I	4	5	40	60	100
6	1	IV	AEC1	Ability Enhancement Compulsory Course-I – Environmental Studies @	2	2	50	-	50
7	1	VI	VAC	Value Added Course - I@	2#	-	100#	-	100#
1	2	I	L2	Language – II	3	6	40	60	100
2	2	II	E2	English for Mathematics	3	6	40	60	100
3	2	III	C3	Core - III – Trigonometry, Vector Calculus & Fourier Series	4	6	40	60	100
4	2	III	C4	Core IV – Analytical Geometry	5	5	40	60	100
5	2	III	A2	Allied – II - Statistics for Mathematics II	4	5	40	60	100
6	2	IV	AEC2	Ability Enhancement Compulsory Course-II – Value Education Human Rights @	2	2	50	-	50

7	2	VI	VAC	Value Added Course - II@	2#	-	100#	-	100#
1	3	III	C5	Core - V – Statics	4	6	40	60	100
2	3	III	C6	Core - VI- Differential Equation	4	6	40	60	100
3	3	III	A3	Allied - III - Physics – I	4	6	40	60	100
4	3	IV	S1	Skill Enhancement Courses – I - Numerical Methods Using C++	4	5	40	60	100
5	3	IV	SP1	Skill Lab – I - Numerical Methods Using C++	3	3	40	60	100
6	3	IV	AEC3	Ability Enhancement Compulsory Course-III – (Tamil / Advanced Tamil (OR) Non-major elective-1 (Yoga for Human Excellence) / Women’s Rights / Career Enhancement – I) @	2	2	50	-	50
7	3	VI	VAC	Value Added Course - III@	2#	-	100#	-	100#
8	3	VI	IDL	Inter Department Learning – I#	2#	2	-	100#	100#
1	4	III	C7	Core - VII – Dynamics	5	6	40	60	100
2	4	III	C8	Core - VIII – Modern Algebra-I	4	6	40	60	100
3	4	III	A4	Allied - IV - Physics – II	4	6	40	60	100
4	4	IV	S2	Skill Enhancement Courses – II – Mathematica	4	5	40	60	100
5	4	IV	SP2	Skill Lab – II - Mathematica	3	3	40	60	100
6	4	IV	AEC4	Ability Enhancement Compulsory Course-IV – (Tamil / Advanced Tamil (OR) Non-major elective-II (General Awareness) / Career Enhancement – II) @	2	2	50	-	50



7	4	VI	VAC	Value Added Course - IV@	2#	-	100#	-	100#
8	4	VI	IDL	Inter Department Learning - II#	2#	2	-	100#	100#
1	5	III	C9	Core - IX - Real Analysis - I	5	5	40	60	100
2	5	III	C10	Core X - Complex Analysis - I	4	5	40	60	100
3	5	III	C11	Core - XI - Modern Algebra - II	5	5	40	60	100
4	5	III	EL1	Elective - I	4	5	40	60	100
5	5	III	EL2	Elective - II	4	5	40	60	100
6	5	III	CP1	Industrial Training	2	-	-	50	50
7	5	IV	S3	Skill Enhancement Courses - III - Operation Research I	4	5	40	60	100
8	5	VI	VAC	Value Added Course - V@	2#	-	100#	-	100#
1	6	III	C12	Core XII - Real Analysis - II	5	6	40	60	100
2	6	III	C13	Core - XIII - Complex Analysis - II	5	6	40	60	100
3	6	III	EL3	Elective - III	4	6	40	60	100
4	6	III	CP2	Core Project	8	6	40	160	200
5	6	IV	S4	Skill Enhancement Courses - IV - Operation Research II	4	6	40	60	100
6	6	V	EX	Extension Activity@	2	-	50	-	50
					140	180	1210	2290	3500

Note :

1. Learning the courses - Programming in C, Web Technology, Database & SQL, Software Engineering and Career Enhancement Course - student shall appear for the NSDC Certification - Junior Software Developer.

@ - No End Semester Examination, only Internal Exam.

# - No Internal Examination, only End Semester Exam.

**Mapping of Courses and POs:**

**S**- Strong Correlation **M** – Medium Correlation **B** – Blank

Course Code	Course Name	Program Outcomes							
		P01	P02	P03	P04	P05	P06	P07	P08
17BMA13A	Core - I – Algebra	M	S	M		M	S	S	M
17BMA13B	Core - II – Calculus		M	S	S	S	M		M
17BMA1AA	Allied – I - Statistics for Mathematics I	S	S	S	S	M	S	S	S
17BMA23A	Core - III – Trigonometry, Vector Calculus & Fourier Series	M	S	M	S	S	S	M	S
17BMA23B	Core IV – Analytical Geometry	M	M	M	S	S	M	M	S
17BMA2AB	Allied – II - Statistics for Mathematics II	S	S	S	S	M	S	S	S
17BMA33A	Core - V – Statics	S	S	M	S	S	S		
17BMA33B	Core - VI- Differential Equation	S	S	S	S	S	S	S	S
17BMA3AB	Allied - III - Physics – I	S	S	S	M	S	S	M	
17BMA3ZA	Skill Enhancement Courses – I - Numerical Methods Using C++	S	S	S	S	M	S	M	S
17BMA3ZP	Skill Lab – I - Numerical Methods Using C++	S	S	S	S	S	S	S	S
17BMA43A	Core - VII – Dynamics	S	S	M	S	S	S	M	

17BMA43B	Core - VIII – Modern Algebra-I		S	M	S	S	S	S	S
17BMA44AB	Allied - IV - Physics – II	S	S	S	M	S	S	M	
17BMA4ZA	Skill Enhancement Courses – II – Mathematica	S	S	S	S	M	S	M	S
17BMA4ZP	Skill Lab – II - Mathematica	S	S	S	S	S	S	S	S
17BMA53A	Core - IX - Real Analysis – I		S	M	M	S	S	S	
17BMA53B	Core X – Complex Analysis -I		S	M	M	S	S	S	
17BMA53C	Core – XI - Modern Algebra-II		S	M	S	S	S	S	S
17BMA5EA	Elective - I (L.A / D.M / G.T)	S	S	S	S	S	S	M	S
17BMA5EE	Elective - II ( N.T / F. M / R.App. M)	S	S	S	S	S	S	M	S
17BMA53V	Industrial Training	S	S	S	S	S	S	S	S
17BMA5ZC	Skill Enhancement Courses – III - Operation Research I	S	S	S	S	S		S	S
17BMA63A	Core XII – Real Analysis – II		S	M	M	S	S	S	
17BMA63B	Core - XIII - Complex Analysis – II		S	M	M	S	S	S	
17BMA6EC	Elective – III ( As. / Comb. / C. T)	S	S	S	S	S	S	M	S
17BMA63V	Core Project	S	S	S	S	S	S	S	S
17BMA6ZD	Skill Enhancement Courses – IV - Operation Research II	S	S	S	S	S		S	S

**Semester: I**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA13A	Core - I –Algebra	4	5	1	0	Theory

**Introduction:** This paper focuses on the convergence and divergence of different types of series, also discusses the standard methods of solving both polynomial and transcendental type equations.

**Course Outcome:**

CO1	: To become proficient in expansion and summation of theorems.
CO2	: To acquire knowledge of concepts of roots and coefficients of equation.
CO3	: To acquire skills to solve the sum of the power of the roots.
CO4	: To become proficient in increase or decrease the roots of the given equation.
CO5	: To become proficient in problem solving skill involved matrices.

**Unit I:** [12 Periods]

Binomial theorem for rational index (statement only)- application and binomial theorem to summation of series- exponential theorem (statement only)- summation of series the logarithmic series summation

**Unit II:** [12 Periods]

Theory of equation – roots of equation (result only) - relation between roots and coefficients- symmetric functions of the roots of an equation

**Unit III:** [12 Periods]

Newton’s theorem on sum of the power of the roots (statement and problems only) – transformation of equation – reciprocal equation

**Unit IV:** [12 Periods]

To increase or decrease the roots of the given equation by a given quantity removal of the term – Descartes rule of signs

**Unit V:** [12 Periods]

Matrices – special types of matrices – characteristic roots and characteristic vectors diagonalisation of a matrix

**Textbook:**

1. T.K. Manikavachagam Pillai, T. Natarajan and K.S. Ganapathi, "Algebra Volume I", S. Viswanathan Pvt. Ltd, 2004. [Unit I to Unit IV]
2. P.Kandasamy, K.Thilagavathi, " Mathematics for B.Sc Branch -I, Volume I", S. Chand and Company Pvt.Ltd, 2015. [Unit V]

Contents:

Unit I	Chapter-5	Page Number :124-130, 143-152, 191-207, 224-230,
Unit II	Chapter-6	Page Number : 282-307.
Unit III	Chapter-6	Page Number : 309-327.
Unit IV	Chapter-6	Page Number : 327-337, 351-354.
Unit V	Chapter-1	Page Number : 3-8 .
Chapter-4		Page Number : 57-97.

References:

1. N.P. Bali, " Algebra", Laxmi Publications pvt. Ltd, New Delhi, 2009.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√		√				
C02	√	√	√					
C03	√	√	√	√			√	
C04	√		√		√			
C05	√		√			√		√

**Semester: I**

Subject Code	Subject Title	Cred it	Lecture	Tutorial	Practical	Type
17BMA13B	Core - II – Calculus	4	5	1	0	Theory

**Introduction:** This paper presents the idea of curvatures, integration of different types of functions, its geometrical applications, double, triple integrals and improper integrals.

**Course Outcome:**

CO1	: To gain knowledge of differentiation and its applications
CO2	: To acquire basic knowledge of integration
CO3	: To become proficient in multiple integrals
CO4	: To acquire skills of applications of multiple integrals
CO5	: To gain concepts of change of variables in Beta and Gamma functions.

**Unit I:** [12 Periods]  
Curvature-radius of curvature in Cartesian and polar forms-evolutes and envelopes- pedal equations- total differentiation- Euler’s theorem on homogeneous functions.

[12 Periods]

**Unit II:**  
Integration of  $f'(x)/f(x)$ ,  $f'(x) \sqrt{f(x)}$ ,  $(px+q)/\sqrt{ax^2 + bx + c}$ ,  $[\sqrt{(x-a)/(b-x)}]$ ,  $[\sqrt{(x-a)(b-x)}]$ ,  $1/[\sqrt{(x-a)(b-x)}]$ ,  $1/(a\cos x + b\sin x + c)$ ,  $1/(a\cos^2 x + b\sin^2 x + c)$ , Integration by parts [12 Periods]

**Unit III:**  
Reduction formulae- problems- evaluation of double and triple integrals- applications to calculations of areas and volumes-areas in polar coordinates.

[12 Periods]

**Unit IV:**  
Change of order of integration in double integral- Jacobions.- change of variables in double and triple integrals.

[12 Periods]

**Unit V:**  
Notion of improper integrals, their convergence, simple tests for convergence simple problems, Beta and Gamma integrals-their properties, relation between them- evaluation of multiple integrals using Beta and Gamma functions.

**Textbook:**

1. Narayanan and T.K.M. Pillai. “Calculus vol 1 and vol 2- S.” Viswanathan Publishers,2013.

Contents:

	Unit	Chapter	Page No
[Calculus Vol 1]	I	10	291 to 323
[Calculus Vol 2]	II	1	1 to 78
[Calculus Vol 2]	III	5	203 to 250
[Calculus Vol 2]	IV	6	251 to 269
[Calculus Vol 2]	V	7	270 to 300

Reference Book:

1. P. Kandasamy&K.Thilagarathy, "Mathematics for BSc – Vol I and. II" S.Chand and Co-2004.
2. G.B. Thomas, R.L.Finney, "Calculus and Analytical Geometry," 6th edition, Narasa Publication House, New Delhi-1984
3. S.T. Tan, "Applied calculus," 5th edition, Tamson Learning-2002.
4. N.P. Bali, "Integral Calculus," Laximi Publication, New Delhi.
5. Thomas, "Calculus," 11th edition, Dorling Kindersley india Pvt.Ltd-2008

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01		√	√	√		√		√
C02		√		√		√		√
C03	√			√		√		√
C04	√			√		√	√	√
C05		√		√	√		√	

**Semester: I**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA1AA	Allied - I – Statistics for Mathematics- I	4	5	0	0	Theory

**Introduction:** This course introduces Statistical concepts that enable the students to understand mathematical aspects of statistics.

**Course Outcome:**

CO1	: To gain knowledge of various types of data, also classification & Tabulation of data.
CO2	: To acquire knowledge on solving problems related to Measure of Central Tendency.
CO3	: To understand relationship between variables by using Correlation & Regression.
CO4	: To understand the basic concepts of probability and related results.
CO5	: To gain knowledge on Distribution such as Normal, Binomial, Poisson.

**Unit I:** [12 Periods]  
Concepts of a statistical population and sample from a population, quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and by diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods)

[12 Periods]

**Unit II:**  
Measures of Central tendency – Mean, Median, Mode – simple problems. Measures of Dispersion – Range, Quartile Deviation, Mean Deviation, Standard Deviation

[12 Periods]

**Unit III:**  
Pearson’s correlation co-efficient - Spearman’s Rank correlation co-efficient, Regression – concepts - Regression lines - Analysis of Variance - One way and Two way classification.

[12 Periods]

**Unit IV:**  
Random experiments, trial, sample space, events. Approaches to probability - Classical, empirical, subjective and axiomatic. Addition rules of probability. Conditional probability, independence of events and multiplication rule of probability. Bayes theorem and its applications.

[12 Periods]

**Unit V:**  
Binomial, Poisson, Normal Probability Distribution – Simple Problems.



**Textbook:**

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical statistics , Sultan chand&Sons, Educational Publishers, New Delhi, 2011.
2. S.P.Gupta, Statistical Methods, Sultanchand&Sons, Educational Publishers, New Delhi, 2015.

**Contents:**

Unit-I	: Chapter 1,3,4,5,6	Text Book II
Unit-II	: Chapter 7,8	Text Book II
Unit-III	: Chapter 10,11 (Volume I), Chapter 5(Volume II)	Text Book II
Unit-IV	: Chapter 3, Sections 3.1	Text Book I
Unit-V	: Chapter 2 (Volume II),	Text Book II

**Reference Books:**

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Applied Statistics, Educational Publishers, New Delhi, 2012.
2. G.V. Shenoy, V.K. Srivastava and S.C.Sharma, New Age International (Pvt.Ltd) Publishers, New Delhi,2014.
3. R.S. Bhardwaj, Business Statistics, Published by Anurag Jain for Excel books, Second Edition, New Delhi, 2008.
4. N.P. Bali, Statistics (Maths Series), Laxmi Publications pvt.Ltd, New Delhi.
5. D.N. Elhance, Fundamentals of Statistics, KitanMahal Publishers, New Delhi, 2002.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√						√	√
C02		√			√		√	
C03	√		√	√		√		√
C04	√		√				√	√
C05	√		√		√	√		√

**Semester: I**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
-	MS- Office	2	0	0	0	VAC

**Introduction:** This paper provides the knowledge about MS-Word, excel, PowerPoint, Access.

**Course Outcome:**

CO1	:	To learn and apply to create a document for passage.
CO2	:	To learn and apply Working on Web page development, Key board shortcut.
CO3	:	To learn and apply Basics of MS Excel and Mathematical and Statistical operations.
CO4	:	To Learn and apply about MS Access.
CO5	:	To learn and apply to create a PowerPoint presentation.

**UNIT-I**

MS-WORD: Word processing overview-creating and editing documents-formatting document-working with header and footnotes.

**UNIT-II**

Creating report and news letter-creating table and merging document-creating web page-macros-keyboard shortcuts-menus-custom toolbars.

**UNIT-III**

MS-EXCEL: Spread sheet overview-creating worksheet-managing and analyzing complex worksheet-creating charts form template-sharing data between applications.

**UNIT-IV**

MS-ACCESS: Data base over view-creating data base – modifying table and creating form-filtering and quering tables-creating reports and mailing lables-sharing information between applications.

**UNIT-V**

MS-POWERPOINT: Basics-using text-adding visual elements-charts and tables-drawing-clip art-sounds-animation-apply time transitions to slides.

**Reference Books:**

1. Microsoft office 2003-Michael Desmond first edition, 2004.

**Semester: II**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA23A	Core - III – Trigonometry, Vector Calculus and Fourier series	4	5	1	0	Theory

**Introduction:** This paper presents the circular functions, hyperbolic functions, Differentiation of functions in scalar that enable the students to learn about the expansion of trigonometric functions.

**Course Outcome:**

CO1	: The learner will acquire basic concepts of roots and coefficients of equation
CO2	: The learner will acquire skills of solving problems in transformation of equations
CO3	: The learner will gain knowledge of trigonometric functions and related problems
CO4	: To become proficient in Types of sets, inequalities and sequences
CO5	: To gain knowledge in Vectors and its Scalar fields.

**Unit I:** [12 Periods]

Expansion in Series – Expansion of  $\cos^n\theta$ ,  $\sin^n\theta$  in a series of cosines and sines of multiples of  $\theta$  – Expansions of  $\cos n\theta$  and  $\sin n\theta$  in powers of sines and cosines .Expansion of  $\sin \theta$ ,  $\cos\theta$  and  $\tan \theta$  in powers of  $\theta$  – hyperbolic functions and inverse hyperbolic functions.

[12 Periods]

**Unit II:**

Logarithm of complex quantities - summation of series – when angles are in arithmetic progression –  $C + iS$  method of summation – method of differences.

[12 Periods]

**Unit III:**

Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl.

**Unit IV:**

Integration of vectors – line integral – surface integral – Green’s theorem in the plane – Gauss divergence theorem – Stokes theorem – (Statements only) - verification of the above said theorems.

[12 Periods]

**Unit V:**

Periodic functions – Fourier series of periodicity  $2\pi$  – half range series.

**Textbook:**

1. T.K. Manichavasagam Pillai and S.Narayanan," Trigonometry", Viswanathan Publishers and Printers Pvt. Ltd,2013. [Unit I&II]
2. P.Duraipandian and Kayalal Pachaiyappa," Vector Calculus", Muhil Publishers, 2009. [Unit III &IV].
3. G. Balaji, " Transforms and Partial Differential Equations", G. Balaji Publishers, 2014. [Unit V]

**Contents:**

Unit I	Chapter-3	Page Number	: 61-66, 77-83,
	Chapter-4	Page Number	: 93-105.
Unit II	Chapter-5	Page Number	: 122 -141.
Unit III	Chapter-1,2,3	Page Number	: 1-65.
Unit IV	Chapter-5&6	Page Number	: 98-204.
Unit V	Chapter-2	Page Number	: 2.1-2.46, 2.120-2.144.

**Reference :**

1. Kandasamy. P, Thilagavathi. K, " Mathematics for B.Sc. Branch I", Volume I II and IV - S.Chand and Company Ltd, New Delhi, 2004.
2. P.Duraipandian and LaxmiDuraipandian, " Vector Analysis", Emerald Publishers, 2003.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√		√	√			√
C02	√	√		√	√			
C03	√	√			√		√	
C04	√		√			√	√	
C05	√	√	√		√		√	

**Semester: II**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA23B	Core - IV – Analytical Geometry	4	5	1	0	Theory

**Introduction:** This paper gives emphasis to enhance student knowledge in two dimensional and three Dimensional analytical geometry. Particularly about two dimensional conic sections in polar coordinates and the geometrical aspects of three dimensional figs, viz, sphere, cone and cylinder, Coincides. That enables the students to learn and visualize the fundamental ideas about co-ordinate geometry.

**Course Outcome:**

CO1	: To understand the basic concepts of circles, parabola, ellipse and hyperbola as a 2 dimensional objects.
CO2	: To Understand the basic concepts of straight lines and its co-planarity as a 3 dimensional objects
CO3	: To acquire knowledge of Sphere and its properties as a 3 dimensional objects
CO4	: To acquire knowledge of representing cone and right circular cone in polar co-ordinates.
CO5	: To acquire knowledge on solving problems related to geometry of two dimensions and three dimension.

**Unit I:** [12 Periods]  
Analytical geometry of 2D-Polar Equations -directrix- chord tangent- normal- Problems.

**Unit II:** [12 Periods]  
Analytical Geometry 3D-straight lines-co planarity of straight-line-shortest distance (S.D) and equation of S.D between two lines.

**Unit III:** [12 Periods]  
Sphere: standard equation of sphere-results based on the properties of a sphere-tangent plane to a sphere- equation of a circle.

**Unit IV:** [12 Periods]  
Cone and cylinder: Cone whose vertex is at the origin- envelope cone of a sphere-right circular cone.

**Unit V:** [12 Periods]  
Cylinder : Equation of a cylinder- Enveloping cylinder - right circular cylinder

**Textbook:**

1. P. DuraiPandian&KayalalPachaiyappa, “Analytical Geometry 2D” year of publication, Emrald Publishers, Chennai. 2009.[Unit I].
2. P. DuraiPandian&KayalalPachaiyappa, “Analytical Geometry 3D”year of publication,Emrald Publishers, Chennai. 2009. [Unit II to Unit V].

**Reference Book:**

1. T.K. M. Pillai and Others “Analytical Geometry of 2D “– Viswanathan Publications- 2010
2. T.K. M. Pillai and Others “Analytical Geometry of 3D” – Viswanathan Publications- 2009
3. ShanitNarayan “Analytical Solid Geometry”, S.Chand& Company Publication-1983.
4. P. Krishnamurthy, “Analytical Geometry and Calculus vol 2”, 1st edition, K.V. Publication- 1995
5. G.B. Thomas, R.L.Finney, “Calculus and Analytical Geometry”, 6th edition, Narasa Publication House, New Delhi-1984

Contents

For

- UNIT I CHAPTER-10section 10.1 – 10.8  
 UNIT II CHAPTER-4section 4.1-4.2, 4.6,4.8,4.9,4.12  
 UNIT III CHAPTER-5section 5.1-5.2,5.4  
 UNIT IV CHAPTER-6 section 6.1,6.2,6.3,6.5  
 UNIT V CHAPTER-6section 6.6,6.7

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√		√		√			
C02		√	√	√	√	√	√	
C03		√	√		√			
C04	√		√	√	√			
C05			√		√			√

**Semester: II**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA2AB	Allied : II Statistics For Mathematics- II	4	5	0	0	Theory

**Introduction:** This paper introduces Applied Statistical concepts and mathematical Analysis. That enables the students to understand mathematical aspects of applied statistics.

**Course Outcome:**

CO1	:	To gain knowledge about properties of estimator and basic concepts of Population, sample & statistic.
CO2	:	To acquire knowledge construction of Hypothesis & Corresponding test.
CO3	:	To acquire knowledge on solving problems related to Non Parametric Test.
CO4	:	To acquire knowledge about Distribution such as Normal, t, Chi-square & its application.
CO5	:	To acquire knowledge about Sampling Methods

**Unit I:** [12 Periods]

Concepts of parameter, random sample and its likelihood. Properties of estimators - Un biasedness, Efficiency, Consistency and sufficient condition for consistency. Sufficiency, Factorization theorem, CR Inequality

**Unit II:** [12 Periods]

Test of hypothesis: Statistical hypothesis - simple and composite hypothesis, Null and Alternative hypothesis - Sample and Parameter Space - Two Types of errors - Critical Region - Power Test (Concept only). Test of significance - exact tests based on t, chi-square and F distributions - simple applications.

**Unit III:** [12 Periods]

Analysis of variance; one way, two way classifications, Total sum of squares, between sum of squares and within sum of squares - Assumptions - ANOVA table.

Elementary ideas on, non - parametric tests - Run, Sign and Mann Whitney U tests - Simple Problems

**Unit IV:** [12 Periods]

Test of Significance - test based on the case- Normal, t, Chi square, f Distributions simple application

**Unit V:** [12 Periods]

Census and Sampling, Principal steps in a sample survey, different types of sampling, Organization and execution of large scale sample surveys, errors in sampling (Sampling and non sampling errors) preparation of questionnaire, simple random sampling with and without replacement, Systematic stratified and cluster sampling (Theory only).

**Text Book:**

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Mathematical statistics , Sultan chand&Sons, Educational Publishers, New Delhi, 2011.
2. S.P.Gupta, Statistical Methods, Sultanchand&Sons, Educational Publishers, New Delhi, 2015.

**Contents:**

- Unit-I : Chapter 17 Sections 17.2.1,17.2.2,17.2.3 Text Book I  
Unit-II : Chapter 18 Sections 18.1-18.3 Text Book II  
Unit-III : Chapter 5,11(Volume II), Text Book II  
Unit-IV : Chapter 3,4,5 (Volume II), Text Book II  
Unit-V : Chapter 4 (Volume I), Text Book II

**Reference Books:**

1. S.C.Gupta, V.K.Kapoor, Fundamentals of Applied Statistics, Educational Publishers, New Delhi, 2012.
2. G.V. Shenoy, V.K. Srivastava and S.C.Sharma, New Age International (Pvt.Ltd) Publishers, New Delhi,2014.
3. R.S. Bhardwaj, Business Statistics, Published by Anurag Jain for Excel books, Second Edition, New Delhi, 2008.
4. N.P. Bali, Statistics (Maths Series), Laxmi Publications pvt. Ltd, New Delhi.
5. D.N. Elhance, Fundamentals of Statistics, KitanMahal Publishers, New Delhi, 2002.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√		√		√	√	√	
C02		√			√			√
C03		√		√			√	√
C04		√			√		√	√
C05		√			√			√



**Semester: II**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
-	SPSS	2	0	0	0	VAC

**Introduction:** This paper provides the knowledge about handling statistical data using SPSS.

**Course Outcome:**

CO1	:	To learn and apply to create and edit a data sheet
CO2	:	To learn and apply creating Charts and Descriptive statistics.
CO3	:	To learn and apply Basics of MS Excel and Mathematical and Statistical operations.
CO4	:	To Learn and apply about MS Access.
CO5	:	To learn and apply to create a PowerPoint presentation.

**Unit -I**

Introduction - Sample files – Opening a Data file – Running an Analysis – viewing Results – Creating Charts – Multiple Response (define variable sets) – Transform (Recode into same variable, Recode into different variable).

**Unit - II**

Graph (Bar, Line, Dot, Pie Charts) - Descriptive Statistics (Frequency, Descriptive, Cross tabs)

**Unit - III**

Compare Means (One-Sample t-test, Independent-Sample t-test, Paired-Sample t-test, One-Way ANOVA).

**Unit - IV**

Correlation (Bivariate, Partial) –Regression (Linear) Non-Parametric Test (Binomial, Runs,

**Unit - V**

Chi-Square, One sample K-S test, Two sample K-S test) – Multivariate Analysis -Data Reduction (Factor Analysis) - Discriminant Analysis – Cluster Analysis.

**Reference Books:**

1. SPSS for windows step by step by Darren George

**Semester: III**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA33A	Core - V – Statics	4	5	1	0	Theory

**Introduction:** This paper contains the nature of forces acting on a surface, friction and centre of gravity.

**Course Outcome:**

C01	:	To acquire knowledge about Forces, types of Forces, Equilibrium of forces and also lami's theorem.
C02	:	To become proficient in Resolution of forces.
C03	:	To demonstrate an ability to apply fundamental rigid body mechanics concepts to set up and solve engineering mechanics problems such as equilibrium and force balance problems for single and assemblies of rigid bodies.
C04	:	To have basic idea about Couples, Parallel planes and its Equilibrium.
C05	:	To gain knowledge about coplanar forces for single or couple system.

**Unit I:** [12 Periods]

Introduction - Forces - types of Forces - Equilibrium of two forces - Forces acting at a point - Parallelogram law of forces - Analytical expression for resultant of two forces acting at a point- triangle law of forces- Perpendicular triangle law of forces- Converse of the Triangle law of forces - The polygon law of forces - Lami's theorem - Simple problems.

**Unit II:** [12 Periods]

Resolution of forces - components of a force along two given directions- Theorem on resolved parts- Resultant of any number of forces acting at a point- Resultant of any number of coplanar forces acting at a point - Conditions of Equilibrium of any number of forces acting upon a particle- Simple problems.

**Unit III:** [12 Periods]

Parallel forces & Moments : Introduction- The resultant of two like parallel forces acting on a rigid body- The resultant of two unlike & unequal parallel forces acting on a rigid body- Resultant of a number of parallel forces acting on a rigid body - Moment of a force - Geometrical representation of a moment - sign of the moment - unit of moment - Varignon's theorem of Moments.

**Unit IV:** [12 Periods]

Couples- Equilibrium of two couples - Equivalence of two couples - Couples in parallel planes - Resultant of coplanar couples - Resultant of a couple and a force - Simple problems.

**Unit V:** [12 Periods]

Coplanar forces - Reduction of any number of coplanar forces - Conditions for a system of forces to reduce to a single force or to a couple- Equation to the line of action of the resultant .

### Text Book

1. Dr. M.K.Venkataraman, Statics, Agasthiar Publications, Trichy, 15<sup>th</sup> edition, 2012.

### Contents:

Unit-I	: Chapter 2	: sections 2.1 - 2.10
Unit-II	: Chapter 2	: sections 2.11-2.16
Unit-III	: Chapter 3	: sections 3.1-3.4, 3.7, 3.9-3.12
Unit-IV	: Chapter 4	: sections 4.1- 4.10
Unit-V	: Chapter 5	: sections 5.1, 5.3, 5.5, 5.8, 5.9

### References Books

1. A.V.Dharmapadam, Statics, S.Viswanathan Printers and Publishing Pvt., Ltd, 2011.

### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√		√	√
C02	√	√	√		√			√
C03	√	√		√			√	√
C04	√				√	√		
C05	√				√			

**Semester: III**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA33B	Core - VI – Differential Equations	4	5	1	0	Theory

**Introduction:** This paper presents the method of solving ordinary differential Equations of First Order and Second Order, Partial Differential equations. Also it deals with solution using Laplace Transforms, its inverse and Application of Laplace Transform in solving ordinary Differential Equations with constant coefficients and Fourier series.

**Course Outcome:**

CO1	:	To become proficient in formation of differential equation by using rules.
CO2	:	To acquire knowledge in solving first order higher degree equations.
CO3	:	To become proficient in ODE from second order to higher order equations.
CO4	:	To become proficient in PDE.
CO5	:	To acquire skills in Homogeneous linear equation.

**Unit I:** [12 Periods]

Differential Equations and their formation- Solution of differential equation - Rules to form the differential equation from a given equation is x and y containing arbitrary constants- Simple problems.

**Unit II:** [12 Periods]

First order higher degree equations- solvable for x, y, p- Clairaut's form - Simultaneous equations  $F_1(D)x + F_2(D)y = F(t)$  and  $G_1(D)x + G_2(D)y = G(t)$   $F_1, F_2, G_1, G_2$  are rational functions of  $D = d/dt$  and  $F, G$  are explicit functions of t.

**Unit III:** [12 Periods]

Ordinary differential equations: General solution of Second order ODE with constant coefficients - Higher order equations.

**Unit IV:** [12 Periods]

Partial differential equations: Formation by elimination of arbitrary constants and arbitrary functions - General, particular and complete solutions.

Partial differential equations :Singular and general solutions of first order equations the standard form:  $f(p, q) = 0$ ,  $f(x, p, q) = 0$ ,  $f(y, p, q) = 0$ ,  $f(z, p, q) = 0$ ,  $f(x, p, q) = g(y, q)$ ,  $z = p(x) + q(y) + f(p, q)$  and Lagrange's method of solving linear PDE  $Pp + Qq = R$ .

**Unit V:** [12 Periods]

Homogeneous Linear Equation - Introduction – Reduction of the Homogeneous linear Equation into linear equation - with constant co-efficient - Simple problems

**Text book**

1. N.P.Bali, Differential Equations, Lakshmi Publications Ltd, New Delhi, 10<sup>th</sup> edition, 2006 ( Units I.II and V).

2. P. Kandasamy, K. Thilagavathi, Mathematics for B. Sc - Branch – I, Volume III, S. Chand and Company Ltd, New Delhi, 2004 (Unit IV).

**Contents:**

Unit I	- Chapter I, page no: 1-20
UnitII	- Chapter 7 page no: 326-355,
Chapter 9	page no: 400-428
Unit III	- Chapter
UnitIV	- Chapter I page no: 117-162
UnitV	- Chapter 5 page no: 286-308

**References Books:**

1.T. Veerarajan, Transforms and Partial differential equations, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2<sup>nd</sup> reprint, 2012.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√					√		√
C02		√	√		√	√		
C03		√	√		√	√		
C04		√	√	√	√	√		
C05		√	√	√	√		√	√

**Semester: III**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA3ZA	Skill Enhancement Courses- I Numerical Methods Using C++	4	5	0	0	Theory

**Introduction:** This paper presents methods to solve linear algebraic and transcendental equations and system of linear equations. Also Interpolation by using finite difference formulae.

**Course Outcome:**

C01	:	To learn class structure, member functions & data members.
C02	:	To Learn the Application of Numerical Methods with respect to C ++.
C03	:	To become proficiency to solve numerical algebraic and transcendental equation.
C04	:	To become familiar with operators.
C05	:	To become familiar with numerical differentiation and integration.

**Unit I:** [15 Periods]  
Evolution of C++ - applications of C++ - structure of C++ program. Tokens – keywords – identifiers and constants, Basic data types - operators in C++ - Functions in C++ - Classes and Objects, Constructors and Destructors.

[15 Periods]

**Unit II:**  
Operator Overloading: Introduction – defining operator overloading – overloading unary operators – overloading binary operators - overloading binary operators using friends – rules for overloading operators.

Working with Files: Introduction – Classes for File Stream Operations - Opening and Closing a File – Detecting End-of-file – More about open( ): File Modes – File Pointers and their Manipulations – Sequential Input and Output Operations – Updating a File: Random Access.

[10 Periods]

**Unit III:**  
The solution of numerical algebraic and transcendental Equations: Bisection method - RegulaFalsi Method - Newton Raphson method - Solution of simultaneous linear algebraic equations: Gauss elimination Method - Gauss Jordan Method - Gauss Jacobi Method - Gauss Seidel Method

[10 Periods]

**Unit IV:**  
Finite Differences- operators - Forward and Backward difference tables - Central difference Interpolation formulae: Gauss forward and backward formulae - Lagrange’s formula

[10 Periods]

**Unit V:**

Numerical Differentiation: Newton's forward and backward formula - Numerical Integration: Trapezoidal rule - Simpson's 1/3rd and 3/8th rules.

**Text book**

2. Dr. P. Kandasamy, K. Thilagavathi and K. Gunavathi, Numerical methods, S. Chand and Company Pvt Ltd, New Delhi, 2012.

**Contents:**

Unit-I : Chapter 3: sections 3.1, 3.3, 3.4

: Chapter 4: sections 4.2 & 4.8, 4.9

Unit-II : Chapter 5: sections 5.1

Chapter 7: sections 7.1,7.3,7.4

Chapter 8: sections 8.7

Unit-III : Chapter 9: sections 9.2, 9.3, 9.7, 9.9, 9.13 & 9.14

Unit-IV : Chapter 11: sections 11.5-11.7,11.9,11.11-11.13,11.14,11.15

Unit-V : Chapter 12.1 - 12.9

**References Books:**

1. K. SankaraRao, Numerical Methods for Scientists and Engineers, PHI Learning Pvt. Ltd, New Delhi, 2011.
2. Curtis F. Gerald, Patrick O. Wheatley, Applied Numerical Analysis, Dorling Kindersley Pvt Ltd, New Delhi, Seventh Edition.
3. E. Balagurusamy, Numerical Methods, Tata MC Graw Hill Pub Co. Ltd, New Delhi, Eighteenth Edition.
4. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, Mc Graw Hill Education Pvt. Ltd, New Delhi, 2017.
5. T. Veerarajan, T. Ramachandran, Numerical Methods with Programs in C, Tata Mc Graw Hill Education Pvt. Ltd, New Delhi, 2010.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√							√
C02				√		√		
C03	√	√			√			
C04	√			√	√			
C05	√		√			√	√	√



**Semester: III**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
<b>17BMA3ZP</b>	<b>Skill Lab – Numerical Methods Using C++</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>Practical</b>

**Introduction:** This paper presents method to solve linear algebraic and transcendental equations and system of linear equations. Also Interpolation by using finite difference formulae with C++.

**Course Outcome:**

C01	:	To learn class structure, member functions & data members.
C02	:	To Learn the concept of inheritance, types and example problems.
C03	:	To Learn the concepts of polymorphism, types and problems.
C04	:	To Learn the concepts of File handling.
C05	:	To Learn the Application of Numerical Methods with respect to C ++.

**List of Practical:**

1. Newton Raphson Method.
2. Simultaneous equations- Gauss Elimination.
3. Gauss Forward and Backward formulae.
4. Lagrange's formulae.
5. Numerical integration-Trapezoidal rule.
6. Numerical integration-Simpson's rules.
7. Ordinary differential equation-Euler method.
8. Ordinary differential equation- RungeKutta Second order.
9. Elliptic Equation.
10. Bender-Schmidt Method.

**Reference Book:**

1. Object Oriented Programming in C++ : E. Balagurusamy, TATA McGraw Hills, 5<sup>th</sup> Edition, 2010

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√		√				√	
C02	√	√			√			√
C03	√			√	√			
C04	√				√			√
C05						√		√

**Semester: III**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA3AB	Allied - III MECHANICS, HEAT, SOUND, MAGNETISM AND ELECTRICITY	4	5	1	0	Theory

**Introduction:** This paper provides the knowledge about mechanics, properties of matter and sound, thermal physics and also to know about the light, electricity and electromagnetism.

**Course Outcome:**

CO1	: To acquire the knowledge of motion of rigid body's.
CO2	: To determine and apply elasticity with respect to real life applications.
CO3	: To gain knowledge about interference.
CO4	: To understand the mathematical computation for gas and to determine the thermal conductivity through black body radiation.
CO5	: To understand the principles of Ballistic Galvanometer for charging and discharging of current.

**Unit I:** [12 Periods]

**Mechanics**

Composition of two simple harmonic motions along a line and at right angles – Lissajou's figures, uniform circular motion - Acceleration of a particle in a circle - Centripetal and centrifugal forces - Banking on curved tracks. Projectile - Motion in horizontal plane - Maximum height – Time of flight – Range – to prove the path of the Projectile is a parabola – Range and time of flight in a horizontal plane.

**Unit II:** [12 Periods]

**Properties of matter and sound**

Elasticity: Elastic constants – Bending of beams – Young's modulus by uniform and non uniform bending – Energy stored in a stretched wire – Torsion in a wire – Determination of rigidity modulus – Torsional oscillation – Static torsion.

Sound: interference of sound waves – Beats – Doppler Effect – Applications – Ultrasonics – Piezoelectric method – Applications.

[12 Periods]

**Unit III:**

Condition for interference – Young's double slit experiment – Interference due to transmitted light – Air wedge – Newton's rings – Determination of refractive index of a liquid – Diffraction - Diffraction at a single slit – Transmission grating – Polarization – Production and analysis of circularly and elliptically polarized light – Optical activity – Specific rotation – Half shade polarimeter

**Unit IV:**

[12 Periods]

**Thermal physics**

Specific heat of solids and liquids – Dulong and Petit law – Newton’s law of cooling – **Thermal conductivity** – **Lee’s disc method** – Variation of specific heat with temperature – Vanderwaal’s equation of state – derivation of critical constants – Black body radiation – Stefan’s law – Laws of thermodynamics – Change of entropy in reversible and irreversible processes.

[12 Periods]

**Unit V:**

**Current Electricity and Electromagnetism**

Kirchhoff’s laws – Wheatstone’s network – Condition for balance – Carey –Foster’s bridge – measurement of resistance – Capacitor – Energy of charged capacitors – Loss of energy due to sharing of charges. Electromagnetic induction - Faraday’s laws – AC circuits – Mean – rms – Peak values – LCR in series and in parallel – Sharpness of resonance – Ballistic Galvanometer – Theory – Measurement of capacitance – Transformer and its applications.

**Text book**

1. R. Murugesan, “Properties of matter” S.Chand& Company, 2015. (unit 1&2)
2. Brijlal& N.Subramaniam, “Heat and thermodynamics” S.Chand& Company (2006).(unit 3)
3. Brijlal, M.N. Avadhanalu& N. Subramaniam, “A text book of Optics” S.Chand& Company (2015) (unit 4)
4. Brijlal&Subramaniam, “Electricity and magnetism”, S.Chand& Company publishers, New Delhi (2004). (unit 5)

**References Books**

1. D.S.Mathur, “Properties of Matter” Shyamlal Charitable Trust, New Delhi (2010).
2. Singhal, “Heat, Thermodynamics and Statistical mechanics” AgarwalPrakashPragatiPrakashan publisher Meerut (1992) .

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√		√			√		√
C02					√			√
C03	√				√		√	
C04	√	√			√			
C05	√			√	√			√

**Semester: III**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
-	<b>MATLAB</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>VAC</b>

**Introduction:** This paper aims to provide a first approach to the subject of Matlab, which is one of the important aspects of advanced mathematics.

**Course Outcome:**

CO1	:	To learn and apply basics concepts of MATLAB.
CO2	:	To learn and apply creating Data files.
CO3	:	To learn and apply Basics operations of Matrices and Vectors.
CO4	:	To Learn and apply about Script and Functions.
CO5	:	To learn and apply in plotting two or three dimensional.

**Unit I**

Introduction- Basics of MATLAB, Input – Output, File types – Platform dependence – General commands.

Interactive Computation: Matrices and Vectors – Matrix and Array operations

**Unit II**

Programming in MATLAB: Scripts and Functions – Script files – Functions files.

**Unit III**

Plotting: Two-dimensional plots - Three-dimensional plots

**Reference Books:**

1. William John Palm, “Introduction to Matlab 7 for Engineers” McGraw-Hill Professional, 2005.
2. Dolores M. Etter, David C. Kuncicky, “Introduction to MATLAB 7” Prentice Hall, 2004

**Semester III**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
	IDC -Quantitative Aptitude	#2	0	0	0	Theory

**Objective:** To enable the students to know the concepts of Quantitative Aptitude so as to improve the Mental ability in problem solving.

**Course Outcome:**

CO1	: To understand the basic concepts of Area, Average, Calendar, Chain Rule, Puzzle.
CO2	: To Understand the basic concepts of Partnership, Percentage, Pipes and Circumstances, Problems on age
CO3	: To acquire knowledge of Problems on boat and steam, Ratio, Simple Interest, Time and work
CO4	: To acquire knowledge of Mental Ability and logical reasoning.
CO5	: To acquire knowledge on Analytical Reasoning.

**Unit -I**

Area-Average-Calendar-Chain Rule-Puzzles

**Unit -II**

Partnership-Percentage-Pipes and Circumstances-Problems on age

**Unit -III**

Problems on boat and steam-Ratio- Simple Interest-Time and work

**Unit -IV**

Mental Ability and logical reasoning - Analogy Test-Series Test-Same Class (Odd) Test-Logical Venn Diagram- Syllogism.

**Unit -V**

Analytical Reasoning-Mirror Images-Water Image-(Number Letter Figure)-Completion of Incomplete Pattern-Grouping of Identical figures.

**Text Book**

1. R.S. Agarwal, "Mental Ability and Logical Reasoning", S. Chand and Company Ltd, New Delhi - 2014.

**Semester III**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
	<b>IDC - Decision Making</b>	#2	0	0	0	Theory

**Objective:** To teach students about role of quantitative techniques in managerial decision making and also about process of decision problem formulation.

CO1	: To understand the basic concepts of Decision Sciences.
CO2	: To Understand the basic concepts of Assignment Models
CO3	: To acquire knowledge of Transportation Models
CO4	: To acquire knowledge of CPM & PERT.
CO5	: To acquire knowledge on Probability.

**Unit -I**

Decision Sciences & Role of quantitative techniques, Linear Programming: Concept, Formulation & Graphical Solution

**Unit -II**

Assignment Models: Concept – Balanced and unbalanced problems of Assignment model - Flood’s Technique/ Hungarian Method.

**Unit -III**

Transportation Models: Concept, Formulation, Problem types: Balanced, Unbalanced, Minimization, Maximization Basic initial solution using North West Corner, VAM.

**Unit -IV**

CPM & PERT: Concept, Drawing network, Identifying critical path.

**Unit -V**

Probability: Concept, Addition, Conditional Probability theorem based decision making

**Text Book:**

- 1) J K Sharma , “Operations Research Theory & Applications” , MacMillan Publishers India Ltd., 4<sup>th</sup> Edition.



**Semester III**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
	<b>IDC - Big Data Analytics</b>	#2	0	0	0	Theory

**Objective:** To teach students about Big Data and its importance.

CO1	: To understand the Introduction to Data.
CO2	: To Understand the basic concepts of Big Data
CO3	: To acquire knowledge of Processing Big Data
CO4	: To acquire knowledge of Digital Data.
CO5	: To acquire knowledge on Machine Learning.

**Unit - I:**

Introduction to Data: Concept of Data, Source of Data, Methods of Collecting Data.

**Unit - II:**

Introduction to Big Data: Concept of Big Data – Section of Big Data: Volume, Variety, Velocity, and Veracity.

**Unit - III:**

Processing Big Data: Clustering – Redundancy – What is DFS – Process of DFS.

**Unit - IV:**

Digital Data: Types of Digital Data - Introduction to Big Data Analytics, History of Hadoop and process of Hadoop.

**Unit - V:**

Machine Learning : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering

**Text Book:**

- 1) Tom White, “ Hadoop: The Definitive Guide” , Third Edition, O’reily Media, 2012.
- 2) Seema Acharya, Subhasini Chellappan, "Big Data Analytics", Wiley 2015

**Semester III**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	<b>IDC - Statistical Modeling</b>	#2	0	0	0	Theory

**Objective:** To teach students about basic Statistics modeling.

CO1	: To understand the basic concepts of Statistical Methods.
CO2	: To Understand concepts of Presentation.
CO3	: To acquire knowledge of Measures of Central Tendency
CO4	: To acquire knowledge of Bivariate data.
CO5	: To acquire knowledge on Index Numbers.

**Unit - I**

Statistical Methods: Definition and scope of Statistics, concepts of statistical population and Sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio.

**Unit - II**

Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.

**Unit - III**

Measures of Central Tendency: Mean, Median and Mode.

**Unit - IV**

Bivariate data: Definition, scatter diagram, simple & rank correlation & Regression: Definition, Simple linear regression.

**Unit - V**

Index Numbers: Definition, construction of index numbers and problems thereof for weighted & unweighted index numbers.

**Text Books:**

1. Naveentham, "Business Mathematics & Statistics", Trichy.

**Semester: IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA43A	Core - VII – Dynamics	4	5	1	0	Theory

**Introduction:** This paper provides the knowledge about the field Kinematics, projectile, simple harmonic motion and impact of a particle on a surface.

**Course Outcome:**

CO1	:	To acquire the knowledge of kinematic, energy and momentum methods for particles and system of particles
CO2	:	To determine constant acceleration.
CO3	:	To calculate moment of inertia.
CO4	:	To predict the landing point of a projectile.
CO5	:	To acquire the knowledge of kinetic analyses, energy and momentum methods for rigid bodies.

**Unit I:** [12 Periods]

Kinematics: Velocity - Parallelogram law of velocity - Components of a velocity along two given directions - Triangle law of a velocities –Polygon law of velocities - Relative Velocity - Angular Velocity of a particle moving along a circle with uniform speed- Angular Velocity of a particle moving along any curve- Simple Problems.

[12 Periods]

**Unit II:**

Acceleration - Parallelogram law of Acceleration - Motion in a straight line under uniform acceleration - The equations of motion of a particle under constant acceleration - Acceleration of falling bodies - Vertical motion under gravity - Bodies freely falling down ward - Motion of a particle down a smooth include plane - The law of motion- Newton’s law of motion- Simple problems

[12 Periods]

**Unit III:**

Weight - difference between mass & weight – conservation linear momentum – force of friction – Motion of a particle on a rough horizontal plane under the action of a constant force – Pressure of a body resting on an moving horizontal plane – simple problems – Moment of Inertia – Uniform rod – Rectangular lamina – Uniform Rectangular Parallelopiped of edges 2a,2b,2c – Simple problems.

[12 Periods]

**Unit IV:**

Projectiles: Path of a projectile is a parabola- Characteristics of the motion of a projectile - Horizontal range of a projectile is maximum - velocity of the projectile in magnitude and direction at the end of time t - Simple problems.

[12 Periods]

### Unit V:

Impulsive force - Impact of two bodies - Loss of Kinetic energy in impact - motion of a shot & gun-  
Impact of water on surface - Simple problems

### Text book

1. M.K. Venkataraman, Dynamics, 14<sup>th</sup> Edition, Agasthiar Publications, Trichy, 2011.

### Contents:

Unit-I : Chapter 3: sections 3.3, 3.4, 3.6, 3.7,3.8, 3.10 – 3.13

Unit-II : Chapter 3: sections 3.17, 3.20, 3.22, 3.28, 3.29, 3.30, 3.31, 3.32

Chapter 4: sections 4.1 & 4.3

Unit-III : Chapter 4: sections 4.8, 4.10, 4.11, 4.13, 4.14, 4.16

Chapter 12: sections 12.1, 12.4

Unit-IV : Chapter 6: sections 6.2, 6.4, 6.5, 6.7 & 6.9

Unit-V : Chapter 7: sections 7.2 – 7.6

### References Books

1. A.V.Dharamapadam , Dynamics, S.Viswanathan Printers and Publishers Pvt., Ltd, Chennai, 1<sup>st</sup> edition, 2011.
2. K.ViswanathaNaik and M.S.Kasi, Dynamics, Emerald Publishers, 2004.
3. Naryanamurthi, Dynamics, National Publishers, New Delhi, 2008.

### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√		√			√	√
C02		√		√	√			√
C03		√		√	√	√		√
C04		√	√		√			
C05		√			√			√

**Semester: IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA43B	Core - VIII – Modern Algebra-I	4	5	1	0	Theory

**Introduction:** This course provides knowledge about sets, mappings, Different types of groups and rings.

**Course Outcome:**

CO1	: To acquire the concepts of advanced algebra such as groups, rings and their role in modern mathematics.
CO2	: To write abstract mathematical proofs in a logical manner.
CO3	: To analyze the cyclic subgroups of a group.
CO4	: To think critically by recognizing patterns and principle of algebra and relating them to the number system.
CO5	: To prove the basic results of ring theory.

**Unit I:** [12 Periods]  
Sets– Relations and binary relations – Equivalence classes- Mapping- The integers.

**Unit II:** [12 Periods]  
Definition of a group- some example of groups—Some preliminary lemmas.

**Unit III:** [12 Periods]  
Subgroups – Cyclic subgroup - Index of a group – Order of an element – Euler’s Theorem - Fermat theorem.

[12 Periods]  
**Unit IV:**  
A Counting Principle – Normal Subgroups and Quotient Groups – Homomorphisms.

[12 Periods]  
**Unit V:**  
Rings: Definitions and Examples-Some special classes of Rings- Homomorphisms- Ideals and Quotient Rings

**TEXT BOOK:**

1. I. N. Herstein, Topics in Algebra, second edition, John Wiley & Sons, New York, 2006.

**Contents:**

Unit-I : Chapter 1: section 1.1,1.2& 1.3

Unit-II :Chapter 2: sections 2.1,2.2,2.3

Unit-III :Chapter 2: sections 2..4

Unit-IV :Chapter 2: section 2.5 - 2.7

Unit-V :Chapter 3: sections 3.1 -3.4

**References Books**

1. Surjeet Singh and QaziZameeruddin, Modern Algebra, Vikas Publishing house, 1992.
2. A.R.Vasistha, Modern Algebra, Krishna PrakashanMandir, Meerut, 1994 - 95.
3. Arumugam.S, Isaac. A.T, Modern Algebra, Scitech Publications, 2017.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01		√	√		√		√	
C02		√	√		√			
C03		√	√		√			
C04	√		√		√			√
C05		√	√	√		√	√	

**Semester: IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA4ZD	Skill Enhancement Courses - II - Mathematica	4	5	1	0	Theory

**Introduction:** This course provides knowledge about numerical calculations, algebraic equations, math functions and various operations on functions and matrices.

**Course Outcome:**

CO1	:	To become proficient in Numerical calculations & Algebraic calculations.
CO2	:	To gain knowledge in Functions, programs and Graphics.
CO3	:	To acquire knowledge in Mathematical functions & equations.
CO4	:	To gain skills in series and Linear Algebra.
CO5	:	To become proficient in Numerical operations on data & functions.

**Unit I:** [12 Periods]  
Introduction To Mathematica: Running Mathematica - Numerical calculations – Building up calculations – Using the Mathematica system – Algebraic calculations – Symbolic mathematics - Numerical mathematics.

[12 Periods]

**Unit II:**  
Functions and programs – Lists – Graphics – Input and output in notebooks – The structure of graphics.

[12 Periods]

**Unit III:**  
Advanced Mathematics In Mathematica: Numbers - Mathematical functions – Algebraic manipulation – Manipulating equations.

[12 Periods]

**Unit IV:**  
Series, limits and residues - Linear algebra.

[12 Periods]

**Unit V:**  
Numerical operations on data and functions.

**Text Book:**

1. S. Wolfram, Mathematica, Fifth Edition, Cambridge University Press, Cambridge, 2003.

**Contents:**

Unit I	: Chapter 1: Sections 1.0-1.6
Unit II	: Chapter 1: Sections 1.7-1.10
Unit III	: Chapter 3: Sections 3.1-3.4
Unit IV	: Chapter 3: Sections 3.6-3.7
Unit V	: Chapter 3: Sections 3.8-3.9

**References Books:**

1. David McMahan, Daniel M.Topa, A Beginners guide to Mathematica, Taylor and Francis Publications,1<sup>st</sup> edition, 2002.
2. Paul Wellin, Programming with Mathematica-An Introduction, Cambridge University Press, 1<sup>st</sup> edition, 2013.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√			
C02	√	√		√			√	
C03		√	√		√	√		√
C04	√	√						
C05	√	√	√		√			√



**Semester: IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA4ZP	Skill Lab – II - Mathematica	4	0	0	3	Practical

**Introduction:** This paper focuses on the convergence and divergence of different types of series, also discusses the standard methods of solving both polynomial and transcendental type equations.

**Course Outcome:**

CO1	:	To learn algebraic and arithmetic expression
CO2	:	To Learn the concept of applying matrix and application of matrix.
CO3	:	To Learn and apply trigonometric functions.
CO4	:	To Learn and apply about plotting of different Curves with respect to their function.
CO5	:	To Learn and apply algebraic equation.

**List of Practical's**

1. Write program for Evaluation of arithmetic expression.
2. Write program for Exponential and logarithms.
3. Write program for Trigonometric functions.
4. Write program for Computation of complex numbers.
5. Write program for Plotting of curves (Algebraic function).
6. Write program for Plotting of curves (trigonometric function).
7. Write program for Plotting of curves (exponential function).
8. Write program for Operations in matrices.
9. Write program for Plotting of three 3D curves and shapes.
10. Write program for Solution of algebraic equation.

**Reference Book:**

1. Stephen Wolfram, "The Mathematica", Cambridge University Press.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√		√	√			√
C02	√			√		√	√	√
C03	√		√	√			√	√
C04	√			√			√	√
C05	√			√			√	

**Semester: IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
-	Latex	2	0	0	0	VAC

**Introduction:** This paper aims to provide a first approach to the subject of Latex & Mathematica, which is one of the basic subjects of modern mathematics, which provides system oriented knowledge.

**Course Outcome:**

CO1	:	To learn and apply basics concepts of LATEX.
CO2	:	To learn and apply creating Data files.
CO3	:	To learn and apply Basics Mathematics formulas in LATEX.
CO4	:	To Learn and apply about Script and Functions of LATEX.

**Unit -I**

Special Characters, Document layout and organization – Document class, Page style, Parts of the document, Centering and indenting, Lists, Theorem-like declarations, Boxes, Tables.

**Unit -II**

Footnotes and marginal notes, Mathematical formulas – Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine-tuning mathematics, Drawing pictures with LATEX.

**UNIT - III**

**List of Practical's**

1. Different Font Sizes in LATEX and Preparation of Title page in LATEX
2. Divide The Document With Sectioning Hierarchy of Book Environment in LATEX
3. Making Lists Using Itemize Environment in LATEX
4. Preparing Table in LATEX
5. Splitting The Equations in LATEX
6. Equation Using Left Cases in LATEX

**Treatment as in:**

1. H. Kopka and P.W. Daly, "A Guide to LATEX" Third Edition, Addison – Wesley, London, 1999.

**Semester: IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA4AB	Allied - IV Modern Physics, Electronics and Digital Electronics	4	5	1	0	Theory

**Introduction:** This paper provides the knowledge about up gradation in the field of quantum Mechanics, Atomic and Nuclear Physics and LASER

**Course Outcome:**

C01	: To acquire the knowledge of Light and applications through Quantum concepts.
C02	: To gain knowledge about nucleus, its properties and detection of particles.
C03	: To acquire knowledge about atom models.
C04	: To understand concept of LASER and its applications.
C05	: To gain knowledge about number systems and logic gates.

**Unit I:** [12 Periods]

**Quantum Physics**

Photoelectric effect - Laws of photoelectric effect – Millikan’s experiment – Photoconductive and photovoltaic cells – **Photomultiplier** – Applications of photo cells – Production and properties of X-rays – X – ray spectrum – Mosley’s law – Compton effect – Relation for change in wavelength – X- ray diffraction – Bragg’s law – Miller indices – Determination of h,k,l values of cubic crystals.

[12 Periods]

**Unit II:**

**Nuclear Physics**

Classification of nuclei – General properties of nuclei – Characteristics of nuclear forces – Nuclear structure – Liquid drop model – Shell model – Particle accelerators – Betatron – Electron synchrotron – Artificial Transmutations by  $\alpha$  -particles – Photon particles Nuclear fission and fusion (Quantitative) -Elementary particles – Mesons – Baryons – Leptons.

[12 Periods]

**Unit III:**

**Atomic Physics and Elements of Relativity**

Atom model – Sommerfeld – Vector atom models –Periodic table – Pauli’s exclusion principle – excitation and ionization potentials – Frank and Hertz method – Postulates of theory of relativity – Lorentz transformation equations – derivations – Length contraction – Time dilation – Mass- energy equivalence.

[12 Periods]

**Unit IV:**

**Laser Physics**

Purity of spectral lines – Coherence length and time – Spontaneous and induced emissions – population inversion – Meta stable state – Conditions for laser action – Ruby laser – He-Ne lasers – Applications of lasers – Raman effect – Raman shift – Stokes and antistokes lines – LASER Raman spectrometer.

[12 Periods]

**Unit V:**

**Electronics and Communication Physics**

V – I Characteristics of p-n junction diode – Zenar diode – Uses of Zenar diode – Characteristics of FET – UJT- **Principles of LED,LCD** - Number systems – Conversion of Binary into Decimal – Decimal into Binary – Binary addition – Subtraction – Basic logic gates – Boolean algebra – Demorgan’s theorem – Modulation – AM –FM – Basic principles of antenna and RADAR.

**Text book:**

1.R.Murugesan and KiruthigaSivaprasath , “Modern Physics”, S.Chand& Company (2008) (Unit I to V)

**Reference Books:**

1. Theraja.B.L, “Basic electronics” S.Chand& Company (2004).
2. V.K.Metha, “Principles of electronics” S.Chand& Company (2005).
3. Thiagarajan, “LASER physics” Mcmillan, New Delhi (1992).

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√				√		√	√
C02	√				√		√	
C03	√	√			√		√	
C04	√		√	√				√
C05	√		√			√		√

**Semester: IV**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
-	<b>Latex</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>VAC</b>

**Introduction:** This paper aims to provide a first approach to the subject of Latex & Mathematica, which is one of the basic subjects of modern mathematics, which provides system oriented knowledge.

**Course Outcome:**

CO1	:	To learn and apply basics concepts of LATEX.
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CO3	:	To learn and apply Basics Mathematics formulas in LATEX.
CO4	:	To Learn and apply about Script and Functions of LATEX.

**Unit -I**

Special Characters, Document layout and organization – Document class, Page style, Parts of the document, Centering and indenting, Lists, Theorem-like declarations, Boxes, Tables.

**Unit -II**

Footnotes and marginal notes, Mathematical formulas – Mathematical environments, Main elements of math mode, Mathematical symbols, Additional elements, Fine-tuning mathematics, Drawing pictures with LATEX.

**UNIT - III**

**List of Practical's**

1. Different Font Sizes in LATEX and Preparation of Title page in LATEX
2. Divide The Document With Sectioning Hierarchy of Book Environment in LATEX
3. Making Lists Using Itemize Environment in LATEX
4. Preparing Table in LATEX
5. Splitting The Equations in LATEX
6. Equation Using Left Cases in LATEX

**Treatment as in:**

1. H. Kopka and P.W. Daly, "A Guide to LATEX" Third Edition, Addison – Wesley, London, 1999.

**Semester IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDC - Actuarial Science	#2	0	0	0	Theory

**Objective:** To teach students about annuities, Premium calculation and Risk models.

CO1	: To Understand the basic concepts of Interest
CO2	: To Understand concepts of Sets.
CO3	: To acquire knowledge of Probability
CO4	: To acquire knowledge of Premium Calculation.
CO5	: To acquire knowledge on Models.

**Unit - I:** Interest - Rates of interest Simple and Compound interest rates, Profit and Loss Discounts.

**Unit - II:** Sets – Types of Set, Set operations – Venn diagram (Simple Problems).

**Unit - III:** Probability –Basic of Probability, Random Variable, and Addition and Multiplication theorems based simple problems.

**Unit - IV:** Premium Calculation – Net single premium, difference between integer and fractional ages at death.

**Unit - V:** Risk Models –Proportional Hazard Models, Excess Risk Models – Life table (Concept only)

**Text Book:**

1. Eric V. Slud, “Actuarial Mathematics & Life - Table statistics”, Mathematics department, University of Maryland, College park, Edition 2001.

**Reference Book:**

1. Jerry alan Beeh, lecture notes on “Actuarial Mathematics(E-notes)”, 2006.

**Semester IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDC - Astrology	#2	0	0	0	Theory

**Objective:** To teach students about Astrology.

CO1	: To Understand the basic concepts of Astronomy
CO2	: To Understand concepts of Calculation of Time.
CO3	: To acquire knowledge of Planets
CO4	: To acquire knowledge of Divisional Charts.
CO5	: To acquire knowledge on Panchang.

**Unit-I**

**Astronomy** : The solar system, Stars, Planets, Satellites, Earth, Equator, Latitude, Longitude, Zonal time Longitude, Ecliptic, Equatorial circle. The Solar and Lunar eclipses Declinations of Sun, changes of seasons, Distribution of Zodiac by signs and constellations, Rahu-Ketu, Point of Equinox.

**Unit-II**

**Astrological Mathematics I** : Calculation of Time (Standard, Local and Greenwich), Sidereal time, Sunrise and Sunset, Duration of day and night, Calculation of longitudes, 12 houses of horoscope (mid and starting points of houses).

**Unit-III**

**Astrological Mathematics II** : Longitudes of planets at moment, Planetary degrees, The Retrograde and Direct motions of planets, Rising and setting of planets, Casting of Horoscopes- Natal and chalit, calculation of Vimsottaridasha and antardasha.

**Unit-IV**

**Divisional Charts** : Calculation of Lagna, Hora, Dreshkan, Chaturthamsha, Saptamsha, Navamsha, Dashmamsha, Dwadashmsha, Sodshamsha, Vimshamsha, Chaturvimshamsha, Saptvimshamsha, Trishamsha, Khavedamsha, Akshvedamsha, Shastiamsha, Shodashvarga Horoscope analysis.

**Unit-V**

**Panchang** : Uses of Panchang to find out Tithi, Paksha & Month, to know panchang of a day, increases and decreases of Tithis, Kshaya and Adhikmaas Names of twelve months of Indian calendar, Nakshatra, Yog, Karan.



**Text Book:**

1. Kevin Heng Ser Guam , "The Mathematics of Astrology".
2. Aspects in Vedic Astrology.
3. Hindu predictive Astrology.

**Semester IV**

<b>Subject Code</b>	<b>Subject Title</b>	<b>Credit</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Type</b>
	<b>IDC - Statistical Quality Management</b>	#2	0	0	0	Theory

**Objective:** To teach students about statistical quality management to achieve quality in production and service organizations, through the use of adequate statistical techniques.

CO1	: To Understand the basic concepts of Statistical Quality Control
CO2	: To Understand concepts of Charts
CO3	: To acquire knowledge of Acceptance sampling plans
CO4	: To acquire knowledge of Quality system standards.
CO5	: To acquire knowledge on Reliability

**Unit - I**

Statistical Quality Control: Definition, Importance of SQC in industry. Causes of variation - chance and assignable causes, Process and Product control, Importance of Normal distribution,  $3\sigma$  control limits, specification limits and Natural tolerance limits.

**Unit - II**

Shewart control charts – Variable Control Charts - X BAR and R – chart its applications.

**Unit - III**

Acceptance sampling plans: Definition, Types of Accepting sampling plans, Merits and demerits of Acceptance sampling plans, applications, Concept of AOQ, AQL and LTPD, ASN, ATI, AOQL. Producers risk and consumer’s risk

**Unit - IV**

Quality system standards - ISO 9000 - Elements of ISO 9000 - Benefits of ISO 9000 - Elements of a quality system - Documentation ISO 9000 accreditation

**Unit - V**

Reliability: Meaning and concept of reliability, Reliability measures – Failure Density, Failure Rate or Hazard function, Probability of Failure, Mean Time to Failure (MITF), Mean Time between Failures (MTBF).

**Text Book:**

1. V.K.Kapoor and S.C.Gupta , “Fundamentals of Applied Statistics “, Sultan Chand
2. S.K.Sinha , “Reliability and life testing”, Wiley Eastern
3. R.C.Gupta , “Statistical Quality Control”.

**Semester IV**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	<b>IDC - Mathematics in India</b> (From Vedic Period to Modern Times)	#2	0	0	0	Theory

**Objective:** The Course would cover the development of mathematical ideas and techniques , starting from the Vedic period to modern times. While the treatment would be historical, we would be focusing mainly on the mathematical contents of various texts.

CO1	: To Understand the basic concepts of Mathematics in the Vedas and Sulva Sutras
CO2	: To know about the Indian Mathematicians.
CO3	: To acquire knowledge of Development of Combinatorics
CO4	: To acquire knowledge of Magic Squares, Calculus, Trigonometry
CO5	: To Understand knowledge on Mathematics in Modern India

**Unit -I**

Mathematics in the Vedas and Sulva Sutras-Panini-Pingala-Mathematics in the Jaina Texts-  
Development of Place Value System – Aryabhatiya of Aryabhata.

**Unit -II:**

Brahmasphutasiddhanta of Brahmagupta Bakshali Manuscript Ganitasarasangraha of Mahavira.

**Unit -III:**

Development of Combinatorics- Lilavati of Bhaskara- Bijaganita of Bhaskara-GanitaKaumudi of Narayana.

**Unit -IV:**

Magic Squares- Kerala School of Astronomy and Development of Calculus- Computation of Accurate Sine Tables - Trigonometry and Spherical Trigonometry.

**Unit -V:**

Proofs in Indian Mathematics- Mathematics in Modern India.

**Text Book:**

1.B.Datta and A.N.Singh , “ History of Hindu Mathematics”, 2 parts , Reprint , Bharatiya Kala Prakashan, New Delhi, 2004. Supplementary material revised by K.S.Shukla in issues of Indian Journal of History of Science, INSA, New Delhi, India spread over Vols. 15, 18, 19, 27 and 28,1980-1984.

2.C.N.SrinivasaIyengar, “History of Indian Mathematics”, World Press, Calcutta, 1967.

**Reference Book:**

1.T.A.SaraswatiAmm, “Geometry in Ancient and Medieval India”, MotilalBanarsidass, Varanasi, 1079.

2.A.K.Bag, “Mathematics in Ancient and Medieval India”, Choukhambha, Varanasi,

**SEMESTER - V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA53A	Core IX- Real Analysis – I	5	5	0	0	Theory

**Introduction:** This paper enables the students to learn about the basic concepts of Real Analysis and obtain a foundation for the further study in analysis.

**Course Outcome:**

CO1	: To learn basic concepts of Real and Complex number Systems.
CO2	: To acquire knowledge in Set theory, Relations and Functions.
CO3	: To gain knowledge about the concepts of intersection theorem and covering theorems.
CO4	: To learn about the concept of continuity, convergent sequences and metric space.
CO5	: To acquire knowledge about Limits and Continuity.

**UNIT -I:[12 Periods]**

The Real and Complex number Systems: Introduction - The field axioms - The order axioms- Geometric representation of real numbers-Intervals - Integers - The unique factorization theorem for integers - Rational numbers - Irrational numbers - 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- Absolute values and the triangle inequality - The Cauchy Schwarz inequality - Plus and minus infinity and the extended real number system  $R^*$ .

**UNIT-II:[12 Periods]**

Some Basic Notations of Set Theory: Ordered pairs - Cartesian product of two sets - Relations and functions - One to one functions and inverses - Composite functions - Sequences -Similar sets - Finite and infinite sets - Countable and uncountable sets – Uncountability of the real number system - Set algebra - Countable collections of countable sets.

**UNIT -III:[12 Periods]**

Elements of Point Set Topology: Euclidean space  $R^n$  - Open balls and open sets in  $R^n$  - The structure of open sets in  $R^1$  - Closed sets - Adherent points, Accumulation points - Closed sets and adherent points - The Bolzano-Weierstrass theorem - The Cantor intersection theorem – Lindelof covering theorem - The Heine-Borel covering theorem - Compactness in  $R^n$  .

### **UNIT -IV:[12 Periods]**

Elements of Point Set Topology: Metric spaces - Point set topology in metric spaces - Compact subsets of a metric space - Boundary of a set.

Limits and Continuity: Convergent sequences in a metric space - Cauchy sequences - Complete metric spaces - Limit of a function - Limits of vector valued functions.

### **UNIT -V:[12 Periods]**

Limits and Continuity: Continuous function - Continuity of composite functions - Continuity and inverse images of open or closed sets - Connectedness - Uniform continuity - Uniform continuity and compact sets - Discontinuities of real valued functions - Monotonic functions.

#### **Text Book:**

1. Tom M. Apostol, "Mathematical Analysis", Addison Wesley, Second Edition, 2002.

#### **Contents:**

Unit I - Chapter 1 Sections: 1.1 - 1.20 (Except 1.15-1.17).

Unit II - Chapter 2 Sections: 2.3 - 2.15 (Except 2.6).

Unit III - Chapter 3 Sections: 3.2- 3.12.

Unit IV - Chapter 3 Sections: 3.13 - 3.16,

Chapter 4 Sections : 4.2 -4.5, 4.7.

Unit V - Chapter 4 Sections: 4.8, 4.9, 4.12, 4.16, 4.19, 4.20, 4.22, 4.23.

#### **Reference Books :**

1. Ralph P. Boas, A primer of Real function, The mathematical Association of America, 1960.

2. Walter Rudin, Principles of Mathematical Analysis, Third Edition McGraw Hill International Editions, 1976.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√		√	
C02		√				√	√	
C03	√						√	√
C04		√	√		√			√
C05		√		√	√			



**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA53B	Core X -Complex Analysis-I	4	5	0	0	Theory

**Introduction:** This paper provides the knowledge about complex number system, complex functions and their properties.

**Course Outcome:**

CO1	: To understand the concept of complex number system and basic operations.
CO2	: To acquire knowledge about the geometric representation of complex numbers.
CO3	: To learn about analytic functions and rational functions.
CO4	: To obtain the knowledge about power series, convergence and related theorems.
CO5	: To learn about the exponential and trigonometric functions.

**UNIT- I: [12 Periods]**

The Algebra of Complex Numbers: Arithmetic operations - Square Roots – Justification - Conjugation, Absolute Value-Inequalities.

**UNIT -II: [12 Periods]**

The Geometric Representation of Complex Numbers: Geometric Addition and Multiplication - The Binomial Equation - Analytic Geometry - The Spherical Representation.

**UNIT- III:[12 Periods]**

Introduction to the Concept of Analytic Function: Limits and Continuity - Analytic functions - Polynomials -RationalFunctions.

**UNIT- IV:[12 Periods]**

Elementary Theory of Power Series: Sequences - Series - Uniform Convergence – Power Series - Abel’sLimitTheorem.

### UNIT -V:[12 Periods]

The Exponential and Trigonometric functions: The Exponential - The Trigonometric functions - The Periodicity -TheLogarithm.

#### Text book:

1. Lars V.Ahlfors, "Complex Analysis" , McGRAW HILL International Editions  
3<sup>rd</sup> Edition, 1979.

#### Contents:

- Unit I - Chapter 1: Sections 1.1 - 1.5.
- Unit II - Chapter 1: Sections 2.1 - 2.4.
- Unit III - Chapter 2: Sections 1.1 -1.4.
- Unit IV - Chapter 2: Sections 2.1 -2.5.
- Unit V - Chapter 2: Sections 3.1 - 3.4.

#### Reference books:

- 1.Ruel V. Churchill and others, "Complex Variables and Applications", Mc Graw Hill 3<sup>rd</sup>, edition, 1974.
2. E.G. Philips, "Functions of a Complex Variable", Longman Group Limited,1957.
3. R.P. Boas, "Invitation to Complex Analysis" , Random house, Newyork,1987.

#### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√		√				
C02		√				√		√
C03		√				√	√	√
C04	√		√	√	√			
C05		√		√	√	√		

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA53C	Core XI-Modern Algebra – II	5	5	0	0	Theory

**Introduction:** This paper provides the knowledge about Rings, Ideals, Matrices, vector spaces and linear transformations.

**Course Outcome:**

CO1	: To acquire knowledge about the ideals and quotient rings.
CO2	: To understand the concept of Matrices and characteristic vectors.
CO3	: To gain knowledge about the basic concepts of vector spaces.
CO4	: To learn about Algebra of linear transformations and its properties.
CO5	: To learn about the concept of canonical forms, triangular forms and related results.

**Unit -I:[12 Periods]**

Ideals and Quotient Rings – More Ideals and Quotient Rings – Maximal Ideal

**Unit-II:[12 Periods]**

Vector Spaces: Elementary basic concepts – Linear independence and basis – Dual spaces.

**Unit -III:[12 Periods]**

Vector Spaces: Inner product spaces.

Linear transformations: Algebra of Linear transformations – Characteristic Roots – Matrices

**Unit -IV:[12 Periods]**

Canonical forms: Triangular form – Nilpotent Transformations – Rational Canonical forms

**Unit -V:[12 Periods]**

Linear Transformations: Trace and transpose- Determinants – Hermitian, Unitary and Normal transformations.

**Text Book:**

1. I.N.Herstein, “Topics in Algebra”, John Wiley & Sons, 2<sup>nd</sup> edition, Reprint , 2007.

**Contents:**

UnitI: Chapter 3:Section 3.4, 3.5, 3.6.

UnitII: Chapter 4: Sections 4.1- 4.3.

Unit III: Chapter 4:Section 4.4.

Chapter 6:Sections 6.1- 6.3.

UnitIV: Chapter 6:Sections 6.4- 6.7.

Unit V: Chapter 6:Sections 6.8 – 6.10.

**Reference Books:**

1. Thomas W.Hungerford, “Algebra”, Springer international Edition, Reprint2005.
2. R.Balakrishnan, N.Ramabhadran, “A Text Book of Modern Algebra, Vikas Publishing House Pvt Ltd, 1985Edition.
3. Surjeet Singh, Qazi Zameeruddin, “Modern Algebra”, Vikas Publishing House Pvt. Ltd., Delhi.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	PO2	P03	P04	P05	P06	P07	P08
C01	√	√		√	√			
C02	√	√				√		√
C03	√				√	√		√
C04		√	√		√		√	
C05	√			√		√	√	

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5EA	Elective I-Linear Algebra	4	5	0	0	Theory

**Introduction:** This course enables the students to understand the concept of Vector spaces, linear equations and linear transformations.

**Course Outcome:**

CO1	: To learn the basic concepts of Vector spaces.
CO2	: To understand the concept of linear transformations and its characteristics.
CO3	: To acquire knowledge about Inner product space.
CO4	: To learn about the concept of determinants.
CO5	: To gain knowledge about the determinants and diagonalization.

**Unit -I:[12 Periods]**

Vector Spaces: Definitions and Examples- Vector Subspaces-Basics and dimension of a vector spaces- Quotient spaces

**Unit -II:[12 Periods]**

Linear Transformations: Linear Transformations-Representatives of a linear maps and matrices- Kernel and image transformations-Some special linear transformations

**Unit -III:[12 Periods]**

Inner product space: Orthogonality-Orthonormal basis-Orthogonal complements and projections- Orthogonal transformation.

**Unit -IV:[12 Periods]**

Determinants: 2 X 2 determinants as area of a parallelogram- Determinants and properties- Computation of determinants- Basics results on determinants.

**Unit -V:[12 Periods]**

Determinants: Orientations and vector product.

Diagonalization: Eigen values and Eigen Vectors- Diagonalization of symmetric matrices

**Text Book:**

1. S.Kumaresan, "Linear Algebra", Second Edition, PHI Learning Pvt. Ltd, New Delhi, 2017.

**Contents:**

Unit I : Chapter 2 and 3.

Unit II : Chapter 4.

Unit III: Chapter 5: Sections: 5.2,5.5,5.6,5.8.

Unit IV: Chapter 6: Sections:6.1,6.2,6.3,6.4.

Unit V: Chapter 6: Sections: 6.5, Chapter 7: 7.2, 7.3.

**Reference Books:**

1. B. S. Vatsa," Theory of matrices", Willey Eastern Limited,1995.
2. I.N. Herstein," Topics in algebra", John Wiley Son (ASIA) Pvt Ltd,Second Edition,2004.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√		√	√	√			
C02		√		√		√		√
C03	√		√			√	√	
C04	√	√			√			
C05	√			√			√	√

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5EB	Elective I-Discrete Mathematics	4	5	0	0	Theory

**Introduction :** This paper focuses on the mathematical logic, Relations& Functions, Formal languages and Automata, Lattices and Boolean Algebra and Combinatorics.

**Course Outcomes:**

CO1	:	To learn about the Mathematical logic, Inference theory and Predicate calculus.
CO2	:	To understand the basic concepts of set theory, Equivalence and compatibility Relations.
CO3	:	To learn about the different types of functions.
CO4	:	To gain knowledge about semigroups, monoids and its properties.
CO5	:	To learn about groups and related theorems.

**Unit -I:[12 Periods]**

Recurrence Relations and Generating functions: Recurrence - An introduction - Polynomials and their Evaluations - Recurrence Relations - Solution of Finite order Homogeneous (linear) Relations - Solution of Non-homogeneous relations - Generating Functions - Some common recurrence relations.

**Unit -II:[12 Periods]**

Logic: Introduction - TF-statements – Connectives - Atomic and Compound Statements - Well Formed (Statement) Formulae -The Truth table of a Formula - Tautology - Tautological Implications and Equivalence of Formulae - Replacement Process - Functionally Complete Sets of Connectives and Duality Law - Normal Forms - Principal NormalForms.

**Unit -III: [12 Periods]**

Lattices and Boolean Algebra: Lattices - Some properties of Lattices -New lattices - Modular and distributive lattices - Boolean Algebras

**Unit -IV: [12 Periods]**

Graph Theory: Introduction - Basic Terminology - Paths, Cycles and Connectivity- Subgraphs - Types of Graphs - Isomorphic Graphs - Homeomorphic Graphs – *Eulerian and Hamiltonian Graphs (Self study)*.

**Unit -V: [12 Periods]**

Approved in the BOS Meeting held on 11-04-2019

Language, Grammar and Automata: Introduction - Language - The Set Theory of Strings - Languages - Regular Expressions and Regular Languages - Grammar - Finite-State Machine- Finite State Automata.

### Text Book:

- 1.Sharma J. K," Discrete Mathematics", Macmillan Publishers India Ltd, 2011.
- 2.Venkataraman M. K, Sridharan N and Chandrasekaran N, "Discrete Mathematics", The National Publishing Company, 2000.

### Contents

- Unit I - Chapter 8 :Sections : 8.1 to 8.8. [Text Book 1]  
Unit II - Chapter 9 :Sections: 1 to 12. [Text Book 1]  
Unit III - Chapter 10 :Sections: 1 to 5. [Text Book 1]  
Unit IV - Chapter 9 :Sections: 9.1 to 9.7 and 9.9. [Text Book 2]  
Unit V - Chapter 15 :Sections: 15.1 to 15.7. [Text Book 2]

### Reference Books:

- 1.Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics – An applied introduction", Third Edition, Addison Wesley Publishing Company, 1994.
- 2.Tremblay J. P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, 2001.

### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√			√
C02		√		√	√			√
C03		√	√			√	√	
C04	√				√		√	
C05		√		√		√		



**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5EC	Elective I-Graph Theory	4	5	0	0	Theory

**Introduction:** This paper enables the students to gain knowledge about graphs, trees, blocks, connectivity, traversibility, planarity and their properties.

**Course Outcome:**

CO1	:	To learn the basic concepts of graph and its types.
CO2	:	To acquire knowledge about the operation on graphs and trees.
CO3	:	To understand the concept of Cut sets and Cut vertices.
CO4	:	To learn about the concept of Connectivity, Seperability, Planar and Dual Graphs.
CO5	:	To have a sound knowledge of matrix representation of graphs.

**UNIT-I:[12 Periods]**

Graph – Applications of graphs- Finite and Infinite graphs – Incidence and Degree – Isolated vertex, Pendant vertex and Null graphs.

Paths and Circuits: Isomorphism – Subgraphs – Walks, Paths and Circuits – Connected and disconnected graphs – Euler graphs.

**UNIT-II:[12 Periods]**

Operations on Graphs – More on Euler graphs – Hamiltonian Paths and Circuits – Travelling Salesman Problem.

Trees and Fundamental Circuits: Trees – Properties of Trees – Pendant vertices in a Tree – Distance and centers in a Tree.

**UNIT- III:[12 Periods]**

Spanning Trees – Fundamental Circuits – Finding all spanning trees of a graph – Spanning trees in a weighted graph .

Cut sets and Cut vertices: Cut sets –Properties of a cut set – All cut sets in a graph.

**UNIT- IV: [12 Periods]**

Fundamental circuits and cut sets – Connectivity and Seperability.

Planar and Dual Graphs: Planar graphs – Kuratowski’s two graphs – Representation of a planar graph.

### **UNIT- V: [12 Periods]**

Matrix Representation of Graphs: Incidence Matrix – Circuit Matrix – Fundamental Circuit Matrix and Rank of circuit matrix – Cut set matrix – Relationship among  $A_f$ ,  $B_f$  and  $C_f$  – Path matrix.

#### **Text Book:**

1. Narsingh Deo, “Graph theory with Application to Engineering and Computer Science”, Prentice Hall of India Pvt. Ltd. (2011).

#### **Contents:**

- Unit I: Chapter 1: Sections: 1.1- 1.5 C  
Chapter 2: Sections: 2.1,2.2, 2.4- 2.6.
- Unit II: Chapter 2: Sections: 2.7-2.10  
Chapter 3: Sections: 3.1-3.4.
- Unit III: Chapter 3: Sections: 3.7-3.10  
Chapter 4: Sections: 4.1 -4.3.
- Unit IV: Chapter 4:Sections: 4.4, 4.5.  
Chapter 5: Sections: 5.2-5.4.
- Unit V: Chapter 7: Sections: 7.1-7.4, 7.6-7.8.

#### **Reference books:**

1. R. Balakrishnan and K. Ranganathan, “A Text Book on Graph Theory”,Springer Verlog, New York,2000.
2. R.Gould, “Graph Theory”, The Benjamin/ Cummings Publishing Company,Inc., California,1988.
3. N. Hartsfield and G. Ringel, “Pearls in Graph Theory”, Academic Press,1990.
4. J.A. Bondy and U.S.R. Murty, “Graph Theory with Applications”, Macmillan Company, 1976.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√	√		
C02	√			√	√			√
C03	√		√				√	√
C04		√		√			√	
C05	√		√	√				√

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5ED	Elective II-Number Theory	4	5	0	0	Theory

**Introduction:**

This course enables the students to understand the concepts of fundamental theorems, Permutation and Combinations, Congruences, Primitive roots and their basic properties.

**Course Outcome:**

CO1	: To understand the concepts of divisibility and to solve linear Diophantine equations.
CO2	: To learn about the concept of permutations and combinations and its related theorems.
CO3	: To analyze congruences of various types and use the theory of congruences in applications.
CO4	: To apply the properties of multiplicative functions such as the Euler phi-function and quadratic residues.
CO5	: To evaluate the unsolved problems about primes.

**Unit -I:**

**[12 Periods]**

Basic Representation: Principles of Mathematical induction - The Basis Representation Theorem. The Fundamental Theorem of Arithmetic: Euclid's Division Lemma - Divisibility - The linear Diophantine Equation - The Fundamental Theorem of Arithmetic.

**Unit -II:**

**[12 Periods]**

Combinational and Computational Number Theory: Permutations and Combinations - Fermat's Little Theorem (Statement only) -Wilson's Theorem (Statement only ). Fundamentals of Congruences: Basic properties of Congruences- Residue systems.

**Unit -III:**

**[12 Periods]**

Solving Congruences: Linear congruences - the theorems of Fermat and Wilson Revisited - The Chinese Remainder theorem - Polynomial congruences .

**Unit -IV:[12 Periods]**

Approved in the BOS Meeting held on 11-04-2019

Arithmetic Functions: Combinatorial study of  $\phi(n)$  - Formulae for  $d(n)$  and  $\phi(n)$  -  
Multiplicative arithmetic functions - The Mobius Inversion Formula.

### Unit -V:[12 Periods]

Primitive Roots: Properties of Reduced Residue Systems - Primitive Roots Modulo P. Prime Numbers: Elementary properties of  $\phi(x)$  - Tchebyshev's theorem - Some unsolved problems about primes.

### Text Book:

1. George E. Andrews, "Number Theory", HPS (India), 1992.

### Contents:

Unit 1 - Chapter 1and2.

Unit II - Chapter 3: Sections: 3.1 - 3.3, Chapter 4 :Sections:4.1, 4.2.

Unit III - Chapter5.

Unit IV - Chapter6.

Unit V - Chapter 7and8.

### Reference Books:

1. David M. Burten, "Elementary Number Theory", McGraw- Hill,1997.
2. Kumaravelu et al., "Elements of Number Theory", Nagerkovil, SKV,2002.
3. Telang, "Number theory", Tata McGraw-Hill publishing Company Ltd,1984.

### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√	√		
C02	√			√	√			√
C03	√		√				√	√
C04		√		√			√	
C05	√		√	√				√

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5EE	Elective II-Fuzzy Set Theory	4	5	0	0	Theory

**Introduction:**

This paper provides the knowledge about fuzzy set theory, algebraic concepts and various properties of fuzzy invariance subspaces.

**Course Outcome:**

CO1	: To understand the basic concepts of fuzzy set and its properties.
CO2	: To learn about the concept of algebraic concept and Cartesian product of fuzzy subsets.
CO3	: To understand the concept of relations and logic connectives.
CO4	: To learn about the concept of fuzzy subgroup.
CO5	: To understand the concept of fuzzy invariant subspaces.

**Unit-I :[12 Periods]**

Introduction- Fuzzy subsets-Lattices and Boolean Algebras- L fuzzy sets-operations on fuzzy subsets –  $\alpha$  level sets – properties of fuzzy subsets of a set.

**Unit-II :**

**[12 Periods]**

Algebraic product and sum of two fuzzy subsets-properties satisfied by Addition and product-cartesian product of fuzzy subsets.

**Unit-III:**

**[12 Periods]**

Introduction- Algebra of fuzzy relations-logic-connectives.

**Unit-IV :**

**[12 Periods]**

Connectives- Introduction-fuzzy subgroup - homomorphic image and Pre-image of subgroupoid.

**Unit-V :**

**[12 Periods]**

Fuzzy invariant subgroups-fuzzy subrings.

**Text book:**

1. S.Nanda and N.R.Das “Fuzzy Mathematical concepts, Narosa Publishing House, New Delhi,2012.

**Contents:**

Unit I Chapter 1 Sections: 1.1,1.2, 1.4,1.5,1.7,1.9,1.10.

Unit II Chapter 1 Sections: 1.11-1.13.

Unit III Chapter 2 Sections: 2.1-2.4.

Unit IV Chapter 2 Sections: 2.5.

Chapter 3 Sections: 3.1-3.

Unit V Chapter 3 Sections: 3.4,3.5.

**Reference Books:**

1. George J. Klir and Tina A. Folger, Fuzzy sets, "Uncertainty and Information", Prentice –Hall of India Private Ltd-Fourth printing –June 1995.

2. H.J. Zimmermann, "Fuzzy Set Theory and its Applications", Allied Publishers Ltd, 1991.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√		√				√
C02	√			√		√		
C03		√	√		√		√	√
C04		√			√	√		
C05	√		√	√				√

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5EF	Elective II-Real time Applications of Mathematic:	4	5	0	0	Theory

**Introduction:**

This paper provides the knowledge about real time applications of mathematics.

**Course Outcome:**

CO1	: To understand the concept of Area, Volume, percentage and ratio.
CO2	: To learn about the concept of foreign business transactions.
CO3	: To understand about the concept of mathematics sport and games.
CO4	: To learn about the concept of Numerical reading and Government Budget.
CO5	: To understand about the concept of probability, time and work.

**Unit- I:[12 Periods]**

Mathematics for Living: Approximation, Estimation, the calculator and strategies of checking – Measurement – Linear –Area – Volume, Capacity and weight – Measuring Time – Fractions, Decimals, Percentages and Ratio – House and Home Mathematics – current Affairs.

**Unit -II: [12 Periods]**

Enterprise Mathematics: Wages and Salaries – Business Transactions – Keeping Records – Foreign Business Transactions – Planning for Business and Monitoring – Presentation and Analysis – Current Affairs.

**Unit-III:[12 Periods]**

Mathematics for Leisure and Civic Affairs:The mathematics of games and sport – Geometry and Sport – Leisure Time Mathematics –Holiday and Travel Mathematics – Elections – Current Affairs.

**Unit- IV:[12 Periods]**

Mathematics for Working Life:Wages and Salaries – Numerical Reading, Recording and Representation – Money Matters in the world of work – Government Budget – Examination preparation and Personal Reflection – Current Affairs.

**Unit -V: [12 Periods]**

Probability – Permutation and combination – Pipes and Cisterns –Problems on age- Time and Work.

**Text Book:**

1. “Mathematical Applications”, Government Publications, Postal trade section, Dublin.
2. Dr.R.S. Aggarwal, “Quantitative Aptitude”, S.Chand, Company Limited.



**Contents:**

Unit I- Module 1 Page No: 10-18 [Text Book 1].

Unit II- Module 2 Page No: 22-30 [Text Book 1].

Unit III- Module 3 Page No: 34-41[Text Book 1].

Unit IV- Module 4 Page No: 46-54[Text Book 1].

Unit V – Chapter 8,15,16,30,31 [Text Book 2].

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√				√		√
C02	√			√		√		
C03	√		√	√	√			√
C04	√		√			√		
C05		√	√		√			√

**SEMESTER V**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA5ZC	Skill Enhancement Courses –III Operations Research –I	4	5	0	0	Theory

**Introduction:** To enable the students to formulate a real world problem as a mathematical model.

**Course Outcome:**

CO1	:	To learn and understand the basic concepts of LPP.
CO2	:	To acquire knowledge about Big M Method and Dual simplex method.
CO3	:	To learn the concept of Transportation problem.
CO4	:	To learn the concept of Assignment Problem
CO5	:	To understand the concept of PERT and CPM.

**Unit -I:[12 Periods]**

Basics of O.R – Definition of O.R – Characteristics of O.R - Scientific methods in O.R – Necessary of O.R in Industry – O.R and Decision Making – Scope of O.R in Modern Management – Uses and limitations of O.R. Linear Programming Problem – Formulation of L.P.P – Graphical solutions of L.P.P – Simplex Method-Problems.

**Unit- II:[12 Periods]**

Charnes Penalty Method (or) Big – M Method - Duality in L.P.P – Concept of duality – Duality and Simplex Method – Problems

**Unit -III:[12 Periods]**

The Transportation Problems – Basic feasible solution by L.C.M – NWC- VAM optimum solutions – unbalanced Transportation problems.

**Unit- IV:[12 Periods]**

The Assignment Problems – Assignment algorithm – optimum solutions – Unbalanced Assignment Problems.

**Unit -V:[12 Periods]**

Network scheduling by PERT / CPM – Introduction – Network and basic components – Rules of Network construction – Time calculation in Networks – CPM. PERT – PERT calculations – Cost Analysis – Crashing the Network – Problems.

**Text Book**

1. Kandiswarup, P. K. Gupta, Man Mohan, “Operations Research”, S. Chand & Sons Education Publications, New Delhi, 12th Revised edition.

**Contents:**

- Unit I : Chapter 1:Sections:1.1,1.2,1.4,1.6,1.9  
Chapter 2:Sections:2.1,2.2.  
Chapter 3:Sections:3.2.  
Chapter 4: Sections:4.1-4.6.  
Unit II : Chapter 5: Sections:5.1-5.6.  
Unit III : Chapter10:Sections:10.1-10.8.  
Unit IV : Chapter 11:Sections:11.1-11.4.  
Unit V : Chapter 25:Sections:25.1-25.8.

**Reference Books**

1. Prem Kumar Gupta D. S. Hira, “Operations Research”, S. Chand & Company Ltd, Ram Nagar, New Delhi.
2. S. Dharani Venkata Krishnan, “Operations Research Principles and Problems”, Keerthi publishing house PVT Ltd.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01		√		√				√
C02	√	√				√		
C03	√		√	√				√
C04		√	√		√			
C05	√				√	√		√

**SEMESTER VI**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA63A	Core XII- Real Analysis – II	5	6	0	0	Theory

**Introduction:** This paper enables the students to learn about basic concepts of Real Analysis which is a foundation for further study in analysis.

**Course Outcome:**

CO1	: To understand the concept of derivatives.
CO2	: To acquire knowledge about bounded variation and rectifiable curves.
CO3	: To learn about the concept of Riemann Stieltjes Integral.
CO4	: To apply the bounded variation and step functions in Riemann Stieltjes Integral.
CO5	: To learn about the mean value theorems of Riemann Stieltjes Integral.

**UNIT -I:[12 Periods]**

Derivatives: Introduction - Definition of derivative – Derivatives and continuity - Algebra of Derivatives – The chain rule – One sided Derivatives and infinite derivatives -Functions with nonzero derivative – Zero derivatives and local extrema - Rolle’s theorem - The Mean Value Theorem for derivatives –Intermediate value theorem for derivatives - Taylor’s formula with remainder.

**UNIT -II:[12 Periods]**

Functions of Bounded Variations: Introduction - Properties of monotonic functions - Functions of bounded variations - Total variations - Additive property of total variation - Total variation on  $[a, x]$  as a function of  $x$  - Functions of bounded variation expressed as the difference of increasing functions - Continuous functions of boundedvariation

**UNIT -III:[12 Periods]**

The Riemann-Stieltjes Integral: Introduction - Notation - The definition of Riemann-Stieltjes Integral - Linear properties - Integration by parts - Change of variable in Riemann-Stieltjes integral - Reduction to a Riemann integral - Step functions as integrators - Reduction of a Riemann-Stieltjes integral to a finite sum - Euler’s summation formula.

**UNIT -IV:[12 Periods]**

The Riemann-Stieltjes Integral: Monotonically increasing integrators - Upper and lower integrals - Additive and linearity properties of upper and lower integrals - Riemann’s condition - Comparison theorems - Integrators of bounded variation - Sufficient conditions for existence of Riemann-Stieltjes integrals - Necessary conditions for existence of Riemann- Stieltjesintegrals.

### UNIT -V:[12 Periods]

The Riemann-Stieltjes Integral: Mean Value Theorems for Riemann-Stieltjes Integrals - The integral as a function of the interval - Second fundamental theorem of integral calculus - Change of variable in a Riemann integral - Second Mean-Value Theorem for Riemann integrals.

#### Text Book:

1. Tom M. Apostol, Mathematical Analysis, Addison Wesley, Second Edition 2002.

#### Contents:

Unit I - Chapter 5: Sections: 5.1 to 5.12.

Unit II - Chapter 6 : Sections: 6.1 to 6.8.

Unit III - Chapter 7 : Sections: 7.1 to 7.10

Unit IV - Chapter 7: Sections: 7.11 to 7.17.

Unit V - Chapter 7 Sections: 7.18 to 7.22.

#### Reference Books:

1. Goldberg R. R, "Methods of Real Analysis", Oxford and IBH Publishing Co., 1973.

2. Soma Sundaram D, Choudhary B, "A first course in Mathematical Analysis", Narosa Publishing House, 1996.

3. Walter Rudin, "Principles of Mathematical Analysis", McGraw Hill Inc, Third Edition, 1976.

#### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√				√		√	
C02		√		√			√	√
C03	√	√				√		√
C04	√		√		√			
C05	√	√				√	√	

**SEMESTER VI**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA63B	Core XIII- Complex Analysis -II	5	6	0	0	Theory

**Introduction:**

This paper enables the students to gain knowledge about linear transformations, fundamental theorems and various properties.

**Course Outcome:**

CO1	:	To learn about the concept of conformal mappings.
CO2	:	To acquire knowledge about linear transformations, cross ratio and family of circles.
CO3	:	To understand the concept of line integrals and Cauchy's theorem.
CO4	:	To gain knowledge about Cauchy's integral formula and higher derivatives.
CO5	:	To acquire knowledge about local properties of analytic functions and the maximum principle.

**UNIT- I :[12 Periods]**

Conformality: Arcs and closed curves - Analytic functions in Regions – Conformal mapping - Lengthandarea.

**UNIT- II :[12 Periods]**

Linear Transformations: The Linear group - The cross ratio - Symmetry – Oriented circles - Familiesofcircles.

**UNIT- III :[12 Periods]**

Fundamental Theorems: Line Integrals - Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle - Cauchy's Theorem inaDisk.

**UNIT- IV :**

**[12 Periods]**

Cauchy's Integral Formula: The Index of a point with respect to a closed curve – The Integral formula -HigherDerivatives.

**UNIT- V :[12 Periods]**

Local Properties of Analytic Functions: Removable singularities, Taylor's Theorem- Zeros and poles - The Local mapping - TheMaximumprinciple.

**Text Book:**

1. Lars V.Ahlfors, "Complex Analysis" , Mc GRAW HILL International Editions, 3<sup>rd</sup> Edition, 1979.

Approved in the BOS Meeting held on 11-04-2019

**Contents:**

Unit I : Chapter 3: Sections 2.1 -2.4.

Unit II : Chapter 3: Sections 3.1 -3.5

Unit III: Chapter 4: Sections 1.1, 1.3 - 1.5

Unit IV: Chapter 4: Sections 2.1- 2.3

Unit V : Chapter 4: Sections 3.1-3.4

**Reference Books:**

1. Ruel V. Churchill and others, "Complex Variables and applications", Mc Graw Hill, 3<sup>rd</sup> Edition, 1974.
2. E.G. Philips, "Functions of a Complex variable", Longman Group Limited, 1957.
3. R.P. Boas, "Invitation to complex Analysis", Random house, Newyork,1987.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√	√			√			
C02	√				√			√
C03		√				√	√	√
C04		√	√		√		√	
C05	√			√			√	

### Semester VI

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA6EA	Elective III-Astronomy	4	6	0	0	Theory

**Introduction:** This course enable the students to learn about the solar system, its components and interesting facts about the solar system.

**Course Outcome:**

C01	:	To learn and understand the concept of solar system.
C02	:	To acquire knowledge about the comets and meteors.
C03	:	To understand the concept of double and multiple stars.
C04	:	To acquire knowledge about the milky way.
C05	:	To acquire knowledge about the constellations.

**Unit -I:[12 Periods]**

The Solar System: Introduction - The Sun - Mercury - Venus - Mars - Asteroids - Jupiter - Saturn - Uranus - Neptune.

**Unit -II:**

**[12 Periods]**

The Solar System: Comets - Meteors - Zodiacal light.

**Unit -III:**

**[12 Periods]**

Double And Multiple Stars: Introduction - Variables stars - Eclipsing Variables Cepheid variables - Long period variables - Irregular variables - Novae - Star clusters Nebulae - Constellations - Zodiacal Constellations.

**Unit -IV:**

**[12 Periods]**

The Milky Way: Introduction - Seasonal changes in the night sky - The winter Constellations - The spring Constellations.

**Unit -V:**

**[12 Periods]**

Constellations: Introduction - The summer Constellations - The autumn Constellations.

**Text Book:**

1.Kumaravelu S and Susheela Kumaravelu," Astronomy for degree classes", 7th edition 1986.



**Contents:**

Unit I : Chapter 16 Sections: 316 - 326. Pg.No : 455-467

Unit II : Chapter 16 Sections: 327 - 329. Pg.No : 467-472

Unit III : Chapter 17 Sections: 339-345 Pg.No : 481-489

Unit IV : Chapter 17 Sections: 346-347. Pg.No : 489 -497

Unit V : Chapter 17 Sections:347. Pg.No : 497- 504

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01		√		√		√		√
C02	√	√				√		√
C03	√			√			√	
C04	√		√			√		
C05		√	√		√		√	

### Semester VI

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17MMA6EB	Elective III-Combinatorics	4	6	0	0	Theory

**Introduction:** This paper enables the students to understand the concept of permutations, combinations, error correcting codes, block designs and related problems.

#### Course Outcome:

CO1	:	To learn the basic concepts of permutations and the binomial theorem.
CO2	:	To acquire knowledge about the pairing problems and assignment problems.
CO3	:	To understand the concept of concurrence and generating functions.
CO4	:	To learn about the inclusion and exclusion principle and related problems.
CO5	:	To have a sound knowledge of block designs and its applications to error correcting codes.

#### Unit -I:[12 Periods]

Introduction to basic ideas - Selections and Binomial coefficients - Permutations - Ordered selections - Unordered selections - Further remarks on the binomial theorem - Miscellaneous.

#### Unit -II:[12 Periods]

Pairings problems: Pairings within a set - Pairings between sets - An optimal assignment problem and Gale's optimal assignment problem.

#### Unit -III:[12 Periods]

Concurrence: Some miscellaneous problems - Fibonacci type relations - Using Generating Functions - Miscellaneous methods and Counting simple electrical networks.

#### Unit -IV:[12 Periods]

The Inclusion-Exclusion Principle: The Principle - The Rook Polynomials- Steiner Systems and Sphere Packings - Introductory remarks - Steiner Systems  $S(5,8,24)$  - Leech's Lattice.

#### Unit -V:[12 Periods]

Block Designs and Error correcting codes: Block designs- Square block designs - Hadamard configurations - Error correcting codes.

#### Text Book:

1. Ian Anderson, "A first course in Combinatorial Mathematics", Oxford University press, 1974.

**Contents:**

Unit I : Chapter 1 and 2.

Unit II : Chapter 3.

Unit III : Chapter 4.

Unit IV: Chapter 5 and 7.

Unit V : Chapter 6.

**Reference Books:**

1. Balakrishnan V. K and Balakrishnan V, "Schaum's outline of Combinatorics", McGraw Hill Publishers, 1984.
2. Krishnamurthy V, "Combinatorics", Affiliated East West Press Pvt Ltd, New Delhi, 1986.

**Mapping of Course Outcomes with Program Outcomes:**

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√		√		√	√		
C02		√						√
C03	√	√			√		√	
C04		√		√		√		√
C05	√		√		√			

**SEMESTER VI**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA6EC	Elective II-Control Theory	4	6	0	0	Theory

**Introduction:** This course enables the students to understand about the design of control systems, including classical control theory in the time and frequency domain, Observability, Controllability, Stability, Optimal control.

**Course Outcome:**

CO1	:	To learn and understand the basic concepts of observability.
CO2	:	To acquire knowledge about the controllability of linear and non-linear systems.
CO3	:	To apply the concept of stability for linear and non-linear systems.
CO4	:	To use the stabilization concept for linear control.
CO5	:	To acquire knowledge about the optimal control of varying and non-varying systems.

**UNIT -I :[12 Periods]**

Observability: Linear Systems – Observability Grammian – Constant coefficient systems – Reconstruction kernel – Nonlinear Systems.

**UNIT -II:[12 Periods]**

Controllability: Linear systems – Controllability Grammian – Adjoint systems – Constant coefficient systems – steering function – Nonlinear systems.

**UNIT -III:[12 Periods]**

Stability: Stability – Uniform Stability – Asymptotic Stability of Linear Systems - Linear time varying systems – Perturbed linear systems – Nonlinear systems

**UNIT -IV:[12 Periods]**

Stabilizability: Stabilization via linear feedback control – Bass method – Controllable subspace – Stabilization with restricted feedback

### UNIT -V:[12 Periods]

Optimal control: Linear time varying systems with quadratic performance criteria – Matrix Riccati equation – Linear time invariant systems – Nonlinear Systems.

#### Text Book:

1. K.Balachandran and J.P.Dauer , “Elements of Control Theory”, Narosa, New Delhi, 1999.

#### Contents:

- Unit -I : Chapter 2.
- Unit -II : Chapter 3: Sections: (3.1 - 3.3)
- Unit - III: Chapter 4.
- Unit - IV: Chapter 5.
- Unit - V : Chapter 6.

#### Reference Books

1. R.Conti, “Linear Differential Equations and Control “, Academic Press, London, 1976.
2. R.F.Curtain and A.J.Pritchard, “Functional Analysis and Modern Applied Mathematics”, Academic Press, New York, 1977.
3. J.Klamka, “Controllability of Dynamical Systems “ , Kluwer Academic Publisher, Dordrecht, 1991.
4. D.L.Russell, “Mathematics of Finite Dimensional Control Systems “, Marcel Dekker, New York, 1979.
5. E.B. Lee and L. Markus, “Foundations of optimal Control Theory “, John Wiley, New York, 1967

#### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	PO2	P03	P04	P05	P06	P07	P08
C01	√	√		√				√
C02	√		√			√		
C03		√				√		√
C04	√			√				√
C05		√			√		√	√

**SEMESTER VI**

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
17BMA6ZD	Skill Enhancement Courses – IV Operations Research –II	4	6	0	0	Theory

**Introduction:** To enable the students to formulate a real world problem as a mathematical model.

**Course Outcome:**

CO1	: To learn and understand the concept of game theory and Domination property.
CO2	: To acquire knowledge about Big M Method and Dual simplex method.
CO3	: To learn the concept of transportation and assignment problem.
CO4	: To understand the concept of PERT and CPM.
CO5	: To acquire knowledge about Decision Analysis.

**Unit- I:[12 Periods]**

Game Theory – Two person zero sum game – The Maxmini – Minimax principle – problems Solution of 2 x 2 rectangular Games – Domination Property – (2 x n) and (m x 2) graphical method – Problems.

**Unit -II:[12 Periods]**

Queueing Theory – Introduction – Queueing system – Characteristics of Queueing system – symbols and Notation – Classifications of queues – Problems in (M/M/1) : ( $\infty$ /FIFO); (M/M/1) : (N/FIFO); (M/M/C) : ( $\infty$ /FIFO); (M/M/C) : (N/FIFO) Models.

**Unit- III:[12 Periods]**

Inventory control – Types of inventories – Inventory costs – EOQ Problem with no shortages – Production problem with no shortages – EOQ with shortages – Production problem with shortages – EOQ with price breaks.

**Unit- IV:[12 Periods]**

Simulation – Introduction – simulation models – Event – Types of simulation - Generation of Random Numbers – Mante-carlo simulation – simulation of queueing system.

### Unit -V:[12 Periods]

Decision Analysis – Decision Making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

#### Text Book

1. Kandiswarup, P. K. Gupta, Man Mohan, “Operations Research”, S. Chand & Sons Education Publications, New Delhi, 12th Revised edition.

#### Contents:

Unit I : Chapter 17: Sections: 17.1-17.11.

Unit II : Chapter 21: Sections:21.1-21.8.

Unit III :Chapter 19: Sections: 19.1,19.2-19.6,19.10,19.11,19.12.

Unit IV :Chapter 22: Sections: 22.1,22.4-22.7,22.9.

Unit V :Chapter 16: Sections: 16.1-16.7.

#### Reference Books:

1. Prem Kumar Gupta D. S. Hira, “Operations Research”, S. Chand & Company Ltd, Ram Nagar, New Delhi.

2. S. Dharani Venkata Krishnan, “Operations Research Principles and Problems”, Keerthi publishing house PVT Ltd.

#### Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes							
	P01	P02	P03	P04	P05	P06	P07	P08
C01	√			√		√		
C02		√	√		√			
C03	√							√
C04		√		√	√	√		√
C05	√					√		√