



**Bachelor of Mathematics Courses structure under CBCS**  
(For the candidates admitted from the academic year 2018-2019 onwards)

Semester	Part	Course	Course Code	Course Title	Hour/Week	Credit	Exam Hours	Marks		Total
								Int	Ext	
1	I	Language Course-I (LC) –Tamil	18UT1	Tamil-I (Ilakiyam-Kavithai, Sirukathai, Urainadai, IlakkiyaVaralaru)	6	3	3	25	75	100
	II	English Language Course-I (ELC)	18UE1	English-I (Prose for Effective Communication and Grammar)	6	3	3	25	75	100
	III	CC 1	18UMA1CC1	Calculus	5	4	3	25	75	100
		CC 2	18UMA1CC2	Algebra and Theory of Numbers	5	4	3	25	75	100
		First Allied Course I	18UPH1AC1	Physics I	4	3	3	25	75	100
		First Allied Course II(AP)	18UPH2AP1	Physics II Practical	2	-	***	-	-	-
IV	Value Education	18UVE		2	2	3	25	75	100	
<b>TOTAL</b>					<b>30</b>	<b>19</b>	<b>-</b>	<b>150</b>	<b>450</b>	<b>600</b>
2	I	Language Course-II (LC) –Tamil	18UT2	Tamil-II (IdaikkalaIlakkiyam,Nadagam, Puthinam, IlakkiyaVaralaru)	6	3	3	25	75	100
	II	English Language Course-II (ELC)	18UE2	English-II (Poetry for Effective Communication and Grammar)	6	3	3	25	75	100
	III	CC 3	18UMA2CC3	Differential Equations	5	4	3	25	75	100
		CC4	18UMA2CC4	Analytical Geometry - 3D and Trigonometry	5	4	3	25	75	100
		First Allied Course II	18UPH2AC2	Physics III	4	3	3	25	75	100
		First Allied Course II(AP)	18UPH2AP1	Physics II Practical	2	3	3	40	60	100
IV	Environmental Studies	18UES		2	2	3	25	75	100	
<b>TOTAL</b>					<b>30</b>	<b>22</b>	<b>-</b>	<b>190</b>	<b>510</b>	<b>700</b>
3	I	Language Course-III (LC) –Tamil	18UT3	Tamil-III (Kappiyallakkiyam ,Nadagam, IlakkiyaVaralaru)	6	3	3	25	75	100
	II	English Language Course-III (ELC)	18UE3	English-III(Short Story and Effective Communication Skill)	6	3	3	25	75	100
	III	CC 5	18UMA3CC5	Vector Calculus and Fourier Series	5	4	3	25	75	100
		CC6	18UMA3CC6	Sequence and Series	6	5	3	25	75	100
		Second Allied Course I	18UMA3AC3	Mathematical Statistics I	5	3	3	25	75	100
IV	Non Major Elective I	18UCA3NME1	Fundamentals of Computer	2	2	3	25	75	100	

<b>TOTAL</b>					<b>30</b>	<b>20</b>	<b>-</b>	<b>150</b>	<b>450</b>	<b>600</b>
4	I	Language Course–IV (LC) –Tamil	18UT4	Tamil-IV (PalanIlakkiyam, IlakiyaVaralaru, Podhukatturai)	6	3	3	25	75	100
	II	English Language Course- IV (ELC)	18UE4	English-IV(One Act Play and Effective Communication Skill)	6	3	3	25	75	100
	III	CC 7	18UMA4CC7	Laplace Transforms and Fourier Transforms	5	5	3	25	75	100
		Second Allied Course II	18UMA4AC4	Mathematical Statistics II	5	4	3	25	75	100
		Second Allied Course III	18UMA4AC5	Mathematical Statistics III	4	4	3	25	75	100
	IV	Non Major Elective II	18UCA4NME2	Internet and its Applications	2	2	3	25	75	100
		Skill Based Elective I	18UMA4SBE1	Mathematics for Competitive Examinations	2	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>23</b>	<b>-</b>	<b>175</b>	<b>525</b>	<b>700</b>
5	III	CC 8	18UMA5CC8	Algebra	5	5	3	25	75	100
		CC 9	18UMA5CC9	Real Analysis	5	5	3	25	75	100
		CC 10	18UMA5CC10	Numerical Methods	5	4	3	25	75	100
		CC 11	18UMA5CC11	Statics	5	4	3	25	75	100
	IV	Major Based Elective I	18UMA5MBE1:1 18UMA5MBE1:2	Discrete Mathematics / Mathematical Modeling	4	4	3	25	75	100
		Skill Based Elective II	18UMA5SBE2	Mathematical Statistics Lab	2	2	3	40	60	100
		Skill Based Elective III	18UMA5SBE3	MAT Lab	2	2	3	40	60	100
		Soft Skill	18USSD	Soft Skills Development	2	2	3	25	75	100
<b>TOTAL</b>					<b>30</b>	<b>28</b>	<b>-</b>	<b>230</b>	<b>570</b>	<b>800</b>
6	III	CC 12	18UMA6CC12	Linear Algebra	5	5	3	25	75	100
		CC 13	18UMA6CC13	Complex Analysis	5	5	3	25	75	100
		CC 14	18UMA6CC14	Dynamics	5	4	3	25	75	100
		CC 15	18UMA6CC15	Graph Theory	5	4	3	25	75	100
		Major Based Elective II	18UMA6MBE2:1 18UMA6MBE2:2	Operations Research/ Coding Theory	4	4	3	25	75	100
		Major Based Elective III	18UMA6MBE3:1 18UMA6MBE3:2	Number Theory / Astronomy	5	4	3	25	75	100
	IV	Extension Activities				1				
		Gender Studies	18UGS			1	1	3	25	75
<b>TOTAL</b>					<b>30</b>	<b>28</b>	<b>-</b>	<b>175</b>	<b>525</b>	<b>700</b>
<b>GRAND TOTAL</b>					<b>180</b>	<b>140</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4100</b>

**List of Allied Courses:**

First Allied Course I                      **Allied Physics**  
Second Allied Course II **Mathematical Statistics**

**List of Non Major Elective (For 2018 – 2019)**

Elective	Semester	Course Code	Title of the Course
NME-I	III	18UMA3NME1	Mathematics for Competitive Examinations – I
NME-II	IV	18UMA4NME2	Mathematics for Competitive Examinations – II

**List of Skill Based Elective (For 2018 – 2019)**

Elective	Semester	Course Code	Title of the Course
SBE-I	IV	18UMA4SBE1	Mathematics for Competitive Examinations
SBE-II	V	18UMA5SBE2	Mathematical Statistics Lab
SBE-III	V	18UMA5SBE3	MAT Lab

**List of Major Based Elective (For 2018 – 2019)**

Elective	Semester	Course Code	Title of the Course
Elective-I	V	18UMA5MBE 1:1	Discrete Mathematics
		18UMA5MBE 1:2	Mathematical Modeling
Elective-II	VI	18UMA6MBE 2:1	Operations Research
		18UMA6MBE 2:2	Coding Theory
Elective-III	VI	18UMA6MBE 3:1	Number Theory
		18UMA6MBE 3:2	Astronomy

**Paper Details:**

Tamil Part I	- 4
English Part II	- 4
Core Paper	- 15
Core Practical	- NIL
Allied Paper	- 5
Allied Practical	- 1
Non-Major Elective	- 2
Skill Based Elective	- 3
Major Based Elective	- 3
Environmental Studies	- 1
Value Education	- 1
Soft Skill Development	- 1
Gender Studies	- 1
Extension Activities	- 1 (Credit Only)

\* For those who studied Tamil up to 10th +2 (Regular Stream)

+ Syllabus for other Languages should be on par with Tamil at degree level

# those who studied Tamil up to 10th +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV

\*\* Extension Activities shall be outside instruction hours

Non Major Elective I & II – for those who studied Tamil under Part I

a) Basic Tamil I & II for other language students

b) Special Tamil I & II for those who studied Tamil up to 10th or +2 but opt for other languages in degree programme.

**Note:**

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

**FOR THEORY**

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for Semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

**FOR PRACTICAL**

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]

The passing minimum for Semester Examinations shall be 40% out of 60 marks [i.e. 24 marks]

**SEMESTER-I**  
**CORE COURSE - I - CALCULUS**

**Course Code: 18UMA1CC1**

**Hours: 5**

**Credit: 4**

**OBJECTIVES:**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

- To understand the knowledge about differentiation.
- To analyses the concepts of evolutes, envelopes and Integration.

**UNIT - I**

Successive Differentiation – Leibnit’z Theorem and its Applications– Maxima and Minima of two variables-Successive Partial Derivatives.

**UNIT - II**

Curvature– Radius of curvature in Cartesian and Polar Coordinates– Centre of Curvature – Evolutes and Involutives-Pedal Equation.

**UNIT - III**

Properties of Definite Integrals- Integration by parts – Reduction formulae for  $x^n e^{ax}$ ,  $\sin^n x$ ,  $\cos^n x$ ,  $\sin^m x \cos^n x$ ,  $\tan^n x$ ,  $\cot^n x$ .

**UNIT - IV**

**Multiple integrals:** Definition of the Double Integrals– Evaluation of the Double integral – Change the order of Integration - Double integral in Polar Coordinates – Triple Integrals.

**UNIT - V**

Beta and Gamma functions – Properties of Beta functions– Relationship between them – Evaluation of integrals.

**TEXT BOOK(S):**

1.S.Narayanan, T.K.Manicavachagom Pillai, “Differential Calculus”, Volume-I, S.V.Publications, 2010.

2.S.Narayanan, T.K.Manicavachagom Pillai, “Calculus”, VolumeII, S.V.Publications, 2011.

UNIT-I Chapters - 3 &8 Sections - 4 & 1.1, 1.2 of [1]

UNIT-II Chapter -10 Sections 2.1 to 2.7 of [1]

UNIT-III Chapter -1 Sections 11 to 13.7 of [2]

UNIT-IV Chapter -5 Sections 1 to 4 of [2]

UNIT-V Chapter -7 Sections 2 to 5 of [2]

**REFERENCE(S):**

1. S.Arumugam,A.Thangapandi Isaac “Calculus”, Volume-I, New Gamma Publications, 1991.

2. A. Singaravelu, “Differential Calculus and Trigonometry”, AR Publications, 2003.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	1	1	1	21	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global,

**SEMESTER-I**  
**CORE COURSE - II –ALGEBRA AND THEORY OF NUMBERS**

**Course Code: 18UMA1CC2**

**Total Marks: 100**

**Hours: 5**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To acquire the basic knowledge about Inequalities.
- To solve the equations in different methods.

**UNIT - I**

Inequalities - Triangle Inequalities- Arithmetic- Geometric and Harmonic means-Cauchy's Schwarz Inequality.

**UNIT - II**

Transformation of equations– Reciprocal roots - reciprocal equation and standard problems.

**UNIT - III**

Diminishing and increasing roots of a given equation– Formation of Quotient and Remainder – removal of terms – Formation of equations whose roots are any power of the roots of a given equation-Descartes rule of signs.

**UNIT - IV**

**Theory of numbers:** Prime Number -composite number– infinite sequence of primes – Decomposition of a composite number – Divisor of N– Euler's function  $\phi(N)$  – Integral part of a real number – Highest power of a prime p contained in n!.

**UNIT - V**

Divisibility of the product of r consecutive integers by r! – Congruences - Fermat and Wilson's theorem – Lagrange's theorem.

**TEXT BOOK(S):**

1. S. Arumugam and A. Thangapandi Isaac, Sequences and series, New Gamma Publishing House, 1991.
2. T.K. Manickavasagam Pillai, S. Natarajan and Ganapathy, "Algebra" Volume – I 2006.
3. T.K. Manickavasagam Pillai, S. Natarajan and Ganapathy, "Algebra" Volume –II 2013.

UNIT -I	Chapter-2	Sections 2.1 to 2.4 of [1]
UNIT -II	Chapter 6	Sections 15 & 16 of [2]
UNIT -III	Chapter 6	Sections 17 to 20& 24of [2]
UNIT -IV	Chapter 5	Sections 1 to 10 of [3]
UNIT -V	Chapter 5	Sections 11 to 12 & 16 to 18 of [3]

**REFERENCE(S):**

1. S. Arumugam, A. Thangapandi Isaac, Algebra (Theory of Equations, Inequalities and Theory of numbers), New Gamma Publishing House, 2006.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	1	1	1	25	Global

**Green - Local, Pink - Regional, Blue - National, Brown – Global**

## SEMESTER- II

### CORE COURSE - III - DIFFERENTIAL EQUATIONS

Course Code: 18UMA2CC3

Hours: 5

Credit: 4

Total Marks: 100

External Marks: 75

Internal Marks: 25

#### OBJECTIVES:

- To study the methods used to solve differential equations of first order and second order.
- To promote the knowledge in the field of partial differential equations of first order.

#### UNIT - I

Linear equations– Bernoulli's equation – Exact differential equations.

#### UNIT - II

Equations of the first order but of higher degree - Equations solvable for  $dy/dx$  -Equations solvable for  $y$  - Equations solvable for  $x$ – Clairaut's form– Equations that do not contain  $x$  explicitly - Equations that do not contain  $y$  explicitly .

#### UNIT - III

Linear Equations with constant coefficients- The operator  $D$ - Complementary function of a linear equation with constant coefficients – Particular integrals.

#### UNIT - IV

Linear equations with variable co-efficient – Equations reducible to the linear equations– Variation of parameters.

#### UNIT - V

Partial Differential Equations of the first order- Classification of integrals -Elimination of arbitrary constants and arbitrary functions- Lagrange's method of solving the linear equation - Special methods- Standard forms I, II, III and IV (Clairaut's form).

#### TEXT BOOK:

- S. Narayanan and T. K. Manicavachagom Pillai, Differential Equation and its Application, S. Viswanathan Publishers Pvt. Ltd., 2011.

UNIT -I	Chapter-2	Sections 4, 5, 6.1 to 6.4
UNIT -II	Chapter-4	Sections 1 to 4 (4.1Only)
UNIT -III	Chapter-5	Sections 1 to 4
UNIT -IV	Chapter-5	Sections 5, 6
	Chapter-8	Section 4
UNIT -V	Chapter-12	Sections 1 to 5

#### REFERENCE(S):

- M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Co. 2010.
- M.L. Khanna, Differential Equations, Jai Prakash Nath and Co. 2004.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
23	0	0	0	23	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER- II

### CORE COURSE - IV - ANALYTICAL GEOMETRY – 3D AND TRIGONOMETRY

Course Code: 18UMA2CC4

Hours: 5

Credit: 4

OBJECTIVES:

- To promote knowledge in the field of Analytical geometry.
- To acquire the knowledge of problem solving ability.

Total Marks: 100

External Marks: 75

Internal Marks: 2

#### UNIT - I

Direction cosines- Direction ratios - General equation of the plane- Intercept form - Normal Form- Angle between two planes.

#### UNIT - II

Length of the perpendicular- Equation of the planes bisecting the angle between two planes - Straight line as the intersection of two planes - Symmetrical form.

#### UNIT - III

Equation of a straight line passing through two given points - Condition for a line to be parallel to a plane- Coplanar lines - Shortest distance between two given lines – Simple problems.

#### UNIT – IV

**Expansions:** Expansions of  $\cos n\theta$ ,  $\sin n\theta$ ,  $\tan n\theta$ ,  $\tan (A + B + C + \dots)$ -Expansion of  $\cos^n\theta$ ,  $\sin^n\theta$ ,  $\sin^n\theta\cos^m\theta$  in a series of sines & cosines of multiples of  $\theta$  -Expansion of  $\sin\theta$ ,  $\cos\theta$  and  $\tan\theta$  in a series of ascending powers of  $\theta$ – Expansions of  $\sin \theta$  &  $\cos \theta$  to find the limits.

#### UNIT – V

**Hyperbolic Functions:** Euler's Formula - Hyperbolic Functions – Inverse Hyperbolic Functions.

#### TEXT BOOK:

- T.K. Manicavachagom Pillay, T. Natarajan, Analytical Geometry, Part II -Three Dimensions, S.Viswanathan Publishers Pvt. Ltd. 2009.
- S. Narayanan, T.K. Manichavasagam Pillai, "Trigonometry", S. Viswanathan (Printers & Publishers, Pvt Limited, 2011.

UNIT-I	Chapter-1	Sections 7, 8 of [1]
	Chapter -2	Sections 1 to 3, 5& 7 of [1]
UNIT-II	Chapter -2	Sections 10, 11 of [1]
	Chapter -3	Sections 1 to 3 of [1]
UNIT-III	Chapter -3	Sections 4 to 8 of [1]
UNIT – IV	Chapter- 3	Sections 1 to 5.1 of [2]
UNIT – V	Chapter-4	Sections 1 to 2.3 of [2]

#### REFERENCE(S):

- Shanti Narayanan, Analytical Solid Geometry, S. Chand & Company Ltd, New Delhi 2007.
- M.L. Khanna, Solid Geometry, Jai Prakash Nath & Co, Educational Publishers, 25<sup>th</sup> Edition, 2005.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
22	1	1	1	22	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

### SEMESTER- III

#### CORE COURSE - V - VECTOR CALCULUS AND FOURIER SERIES

Course Code: 18UMA3CC5

Total Marks: 100

Hours: 5

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To provide the basic knowledge of vector differentiation & vector integration.
- To acquire the knowledge of Fourier Transforms.

#### UNIT - I

**Vector Differentiation: Differential Operators:** Definition (Directional derivatives)- Differential Operator  $\nabla$  (del) – Operators  $a \cdot \nabla$  (a being unit vector)- The grad of a scalar point function – Properties of grad  $\phi$ - Equation of tangent plane & normal -Divergence and curl of a vector point function – Div f and Curl f are independent of the choice of axes- **Simple problems.**

#### UNIT - II

The Laplacian operator  $\nabla^2$ - Grad -Div & Curl of sums & Products – Div (grad  $\phi$ ) - curl (grad  $\phi$ ) - div (curl f) - curl (curl f) - grad (div f).

#### UNIT – III

**Vector Integration:** Line Integral–Normal surface Integral–Flux across a surface - Volume integral.

#### UNIT - IV

**Vector Integration (Continued):** Gauss divergence Theorem (without proof) - Stoke's Theorem (without proof) - Green's Theorem (without proof) - Stoke's Theorem in Space- Stoke's Theorem in cartesian form.

#### UNIT - V

**Fourier Series:** Definition of Fourier series- Finding Fourier expansion of a periodic function with period  $2\pi$ – Even and Odd functions and their properties – Half range Fourier series – Development in cosine and Sine Series.

#### TEXT BOOK(S):

- M.L. Khanna, Vector Calculus, Jai Prakash Nath and Co., 8th Edition, 1986.
- S.Narayanan and T.K Manicavachagom Pillay, Calculus Volume - III, S.Viswanathan Publishers Pvt., Ltd. 2011.

UNIT – I	Chapter-1	Section 1 to 8 of [1]
UNIT – II	Chapter-1	Sections 9 to 12 of [1]
UNIT – III	Chapter-3	Sections 1 to 4 of [1]
UNIT - IV	Chapter-3	Sections 5 to 8 of [1]
UNIT - V	Chapter-6	Sections 1 to 6 of [2]

#### REFERENCE(S):

- P.Duraipandiyan and Lakshmi Duraipandian, Vector Analysis, Emerald publishers, 1986.
- Dr. S.Arumugam and Prof. A.Thangapandi Issac, Fourier series, New Gamma publishing house, Nov 2012.
- A.R. Vasishtha, R.K. Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2002.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
31	1	1	1	31	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## CORE COURSE - VI - SEQUENCES AND SERIES

Course Code: 18UMA3CC6

Hours: 6

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

### OBJECTIVES:

- To understand the knowledge about the sequence and series.
- To acquire the knowledge of problem solving ability in summation of series and recurrence series.

### UNIT - I

**Sequence and their limits:** Limits theorem – Monotonic sequence – Subsequence and Bolzano weistrass theorem – The Cauchy criterion - Proper Divergent sequence.

**Convergency and Divergency of Series:** Rational numbers - Irrational numbers - Modulus of a real number-Sets, Sequences – Aggregate- Upper and lower bounds-Bounded sequences - Monotonic sequence.

### UNIT - II

**Convergency and Divergency of series (Continued):** Infinite Series- Definition of Convergence– Divergence & Oscillation – Geometric series– Some general theorems concerning infinite series– Series of positive terms– Comparison test – Convergence of  $\sum \frac{1}{n^p}$  and Geometric series Cauchy's condensation Test – D'Alembert's ratio test – **Simple problems based on above tests.**

### UNIT - III

**Convergency and Divergency of Series (Continued):** Cauchy's root test and Raabe's test and their **Simple problems**– Absolutely & Conditionally Convergent series– Alternative series with **Simple problems.**

### UNIT - IV

**Binomial Theorem:** Binomial Theorem for a rational index-Some important particular cases of the Binomial expansion-**Application** of the Binomial theorem to the summation of series– Approximate values.

**Exponential and Logarithmic Series:** Exponential limit-The Exponential theorem-Summation.

### UNIT - V

**Summation of Series:** General summation of series including Successive difference.

### TEXT BOOK(S):

1. Robert G. Bertle, Ronald R. Sherver, "Introduction to Real Analysis", Wiley India Third Edition, 2007.
2. T.K. Manicavachagam Pillai, T. Natarajan, K.S. Ganapathy, Algebra, Vol. I, S. Viswanathan Pvt. Limited, Chennai, 2004.

UNIT – I Chapter -3 Section 3.1 to 3.5(3.5.1 to 3.5.6) & 3.6 of [1]

Chapter-2 Sections 1 to 7 of [2]

UNIT – II Chapter-2 Sections 8 to 16 7 of [2]

UNIT – III Chapter-2 Sections 17 to 19, 21 to 24 7 of [2]

UNIT – IV Chapter-3 Sections 5, 6, 10 & 14 7 of [2]

UNIT – V Chapter-5 Sections 2 to 6 7 of [2]

### REFERENCE(S):

1. Dr.S.Arumugam, Sequences & Series, New Gamma Publishers, 1999.
2. M.K.Singal & Asha Rani Singal, "A First Course in Real Analysis, R.Chant & co, 1999
3. Shanti Narayan, Dr.M.D.Raisinghania, Elements of Real Analysis, Revised Edition S. Chand & Company Pvt.Ltd, New Delhi-55, 2014

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

34	4	4	4	34	Global
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Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER- III**  
**SECOND ALLIED COURSE - I**

**MATHEMATICAL STATISTICS - I**

**Course Code: 18UMA3AC3**

**Hours: 5**

**Credit: 3**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To develop the basic concepts of statistics.
- To apply the basic ideas of statistical data's.

**UNIT - I**

**Statistical data:** Formation of frequency distribution - Various measures of Central Tendency– Mean – Median – Mode -Geometric mean - Harmonic mean (SimpleProblems.only).

**UNIT - II**

**Measures of dispersion:** Range-quartile deviation- mean deviation - standard deviation – coefficient of dispersion– Skewness and kurtosis(SimpleProblems.only).

**UNIT - III**

**Probability:** Definition - axiomatic approach to Probability –Some theorems on probability (Two variables only)- Conditional probability(SimpleProblems.)– Multiplication Theorem – Independent events-Pair wise independent events.

**UNIT - IV**

**Random Variables:** Concept of random variables –Distribution function- Discrete and Continuous random variables-pmfandpdf(SimpleProblems.)

**UNIT - V**

**Mathematical Expectation:** Addition and Multiplication Theorems (two variables only) – Properties of variance– Co-variance(SimpleProblems.).

**TEXT BOOK:**

1. Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics – Sultan Chand & Sons, 2002.

UNIT – I Chapter - 2 Sections 2.3 to 2.9

UNIT – II Chapter - 2 Sections 2.13 & 2.14, 2.16 & 2.17

UNIT – III Chapter - 3 Sections 3.8 to 3.13 & 3.15

UNIT – IV Chapter - 5 Sections 5.1 to 5.4.1

UNIT – V Chapter - 6 Sections 6.1 to 6.6

**REFERENCE(S):**

1. S.P. Gupta, Statistical Methods, Revised Edition 2001.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
27	5	5	5	27	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

### SEMESTER - III

#### NON MAJOR ELECTIVE –I

#### MATHEMATICS FOR COMPETITIVE EXAMINATIONS – I

Course Code: 18UMA3NME1

Total Marks: 100

Hours: 2

External Marks: 75

Credit: 2

Internal Marks: 25

#### OBJECTIVE:

- To appear competitive Examinations confidently.
- To apply the skill of problem solving ability.

#### UNIT - I

**Numbers: Problems** on Addition – Subtraction – Multiplication and Division (Shortcut Methods) – Various tests for Divisibility – Prime and Composite numbers – Various types of numbers.

#### UNIT - II

**HCF and LCM of Numbers - Decimal fractions: Addition – Subtraction- Multiplication and Division of Decimal fractions - H.C.F and L.C.M of Decimals – Rule for converting Pure and Mixed Recurring Decimals into a Vulgar Fractions.**

#### UNIT - III

**Simplification: Square Root- Square Root by means of Factors – General Method – Square Root of Decimal Fractions - Square Root of Vulgar Fractions -Cube Root.**

#### UNIT - IV

**Percentage: Shortcut Method – Problems based on Population – Average - Ratio and Proportion.**

#### UNIT - V

**Partnership -Chain rule - Direct proportion– Indirect Proportion.**

#### TEXT BOOK:

- R.S. Aggarwal, Quantitative Aptitude, S. Chand & Company Ltd. 2007.

#### REFERENCE(S):

- R.S. Aggarwal, Arithmetic (Subjective and Objective) For Competitive Examinations, S. Chand and Company Ltd. 2004.
- R.S. Aggarwal, Objective Arithmetic, S. Chand & Company Ltd. 2004.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	4	3	15	14	National

**SEMESTER- IV**

**CORE COURSE - VII - LAPLACE TRANSFORMS AND FOURIER TRANSFORMS**

**Course Code: 18UMA4CC7**

**Hours: 5**

**Credit: 5**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVE:**

- To get the knowledge about Laplace Transforms and Fourier series.
- To acquire the knowledge of problem solving ability.

**UNIT - I**

**Laplace Transforms:** Sufficient condition for the existence of the Laplace Transforms – Properties of Laplace Transforms– Laplace Transform of periodic functions – Some general Theorems - Evaluation of Integrals.

**UNIT - II**

**Laplace Transforms (Continued):** Inverse Laplace Transforms- Inverse Transforms of functions- Related problems.

**UNIT - III**

**Laplace Transforms (Continued):** Application of Laplace Transforms- Solution of ODE with constant coefficients– Solution of Systems of Differential Equations- Solution of differential Equations with variable coefficients.

**UNIT - IV**

**Fourier Transforms:** Dirichlet's Conditions- Fourier Series– Fourier Integral formula – Fourier Transform with inversion Theorem- Fourier sine and cosine transform with inversion Formula.

**UNIT - V**

**Fourier Transforms (Continued) :** Properties of Fourier Transform - Theorems on Fourier Transform – Multiple Fourier Transforms – Convolution– Parseval's Identity.

**TEXT BOOK(S):**

1. S. Narayanan and T.K. Manicavachagom Pillay, Differential Equations and its Applications, S. Viswanathan (Printers and Publishers) Pvt., Ltd. 2011.
2. Vasishtha, Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2008.  
UNIT-I Chapter – 9 Sections 1 to 5 of [1]  
UNIT-II Chapter – 9 Sections 6 & 7 of [1]  
UNIT-III Chapter – 9 Sections 8 to 10 [1]  
UNIT-IV Chapter – 6 Sections 6.1 to 6.9 [2]  
UNIT-V Chapter – 6 Sections 6.1 to 6.11 [2]

**REFERENCE(S):**

1. Murray R. Spiegel, Schaum's Outline of Theory and Problems of Laplace Transforms, McGraw Hill, 1965.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, INC, 9<sup>th</sup> Edition, 2006.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
22	2	2	2	23	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER- IV**  
**SECOND ALLIED COURSE - II**  
**MATHEMATICAL STATISTICS - II**

Course Code: 18UMA4AC4  
Hours: 5  
Credit: 4

Total Marks: 100  
External Marks: 75  
Internal Marks: 25

**OBJECTIVES:**

- To assist the students to gain the proficiency in Mathematical statistics.
- To enrich the students' inferential skill with varying the degree of diagnostic attainment.

**UNIT –I**

**Binomial distributions:** Moments- Recurrence Relation for the moments –Factorial moments– Mean deviation about mean– Mode – MGF – Additive Property-Characteristic function– Cumulants – Recurrence relation for cumulants – PGF – Recurrence for the Probabilities of Binomial distribution.

**UNIT -II**

**Poisson distribution:** The Poisson process – Moments – Mode– Recurrence for moments – MGF – Characteristic functions – Cumulants – Additive or Reproductive Property – PDF -Recurrence for the Probabilities of Poisson distribution.

**UNIT -III**

**Normal distribution:** Normal distribution as a limiting form of Binomial distribution– Chief characteristics– Mode – Median – MGF – Cumulant generation functions– moments– Points of inflexion of normal curves– Mean deviation about mean- Area property-Fitting of normal distribution.

**UNIT -IV**

**Correlation:** Introduction– Meaning– Scatter Diagram– Karl Pearson's coefficient of correlation -Rank correlation.

**UNIT -V**

**Regression:** Introduction – Linear regression – curvilinear regression – regression curves.

**TEXT BOOKS:**

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2002, Sultan Chand & Sons publications, New Delhi.

UNIT-I Chapter –8 Sections – 8.4 [8.4.1 to 8.4.12]

UNIT-II Chapter – 8 Sections – 8.5 [8.5.1 to 8.5.10]

UNIT-III Chapter - 9 Sections – 9.1, 9.2 [9.2.1 to 9.2.7, 9.2.9 to 9.2.11, 9.2.14]

UNIT-IV Chapter - 10 Sections – 10.1 to 10.7

UNIT-V Chapter - 11 Sections – 11.1 to 11.4

**REFERENCES:**

1. S.P. Gupta, Statistical Methods, Revised Edition, 2001.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

42	0	0	0	42	Global
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Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER- IV**  
**SECOND ALLIED COURSE - III**  
**MATHEMATICAL STATISTICS - III**

**Course Code: 18UMA4AC5**

**Hours: 4**

**Credit: 4**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To understand the concept of Sampling and applications of Chi-square, t-test and F-test.

**UNIT – I**

**Theory of Attributes:** Class and Class frequencies– consistency of data –Independence of attributes– Association of attributes.

**UNIT -II**

**Theory of Estimation:** Definition of Point and Interval estimations –Cramer Rao inequality- Properties of best Estimators– Unbiasedness – Sufficiency - Efficiency and Consistency– SimpleProblems-Neymann Factorization theorem – Methods of moments and MLE (concept only).

**UNIT –III**

**Test of significance for Small samples:** Parameter and statistics – Statistical hypothesis- Students t- test and its properties– independent and paired ‘t’ tests– SimpleProblems– Snedcer’s F test and its properties– SimpleProblems.

**UNIT - IV**

**Test of significance for Large samples:** One tailed and Two tailed tests –Significance difference between one and two proportion based tests - Significance difference between one and two mean based tests– SimpleProblems.

**UNIT –V**

**Chi-Square distribution:** Properties – Uses – Goodness of fit– Conditions for the validity – Independence of attributes.

**TEXT BOOKS:**

- S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2002, Sultan Chand& Sons publications, New Delhi.
- T. Veerarajan, Probability, Statistics and Random processes, 3<sup>rd</sup> Edition: 2012, Tata McGraw Hill Education Private Limited, New Delhi.

UNIT-I	Chapter - 13	Sections 13.1 to 13.7[1]
UNIT-II	Chapter- 17	Sections 17.2, 17.3, 17.6 (Concept only) & 17.6.1. [1]
UNIT-III	Chapter - 8	Page no. 419 to 421, 447 to 463 [2]
UNIT-IV	Chapter - 8	Page no. 422 to 441[2]
UNIT-V	Chapter –8	Page no. 466 to 481 [2]

**REFERENCES:**

- S.P. Gupta, Statistical Methods, Revised Edition, 2001.
- R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

<b>Topics</b>					
<b>29</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>29</b>	<b>Global</b>

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

## SEMESTER - IV

### NON MAJOR ELECTIVE – II

#### MATHEMATICS FOR COMPETITIVE EXAMINATIONS – II

**Course Code: 18UMA4NME2**

**Total Marks: 100**

**Hours: 2**

**External Marks: 75**

**Credit: 2**

**Internal Marks: 25**

#### OBJECTIVES:

- To appear competitive examinations confidently.
- To apply the skills of problems solving ability.

#### UNIT - I

Time and work - Pipes and Cisterns.

#### UNIT - II

Time and Distance – Trains - Boats and Streams.

#### UNIT - III

Profit and Loss - Mixture.

#### UNIT - IV

Simple interest- Compound interest- Calendar.

#### UNIT - V

Volume and Area of Solid figures.

#### TEXT BOOK:

R.S. Aggarwal, Quantitative Aptitude, S. Chand & Company Ltd. 2007.

#### REFERENCE(S):

1. R.S. Aggarwal, Arithmetic (Subjective and Objective) For Competitive Examinations, S.Chand and Company Ltd. 2004.
2. R.S. Aggarwal, Objective Arithmetic, S. Chand & Company Ltd. 2004.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
<b>11</b>	<b>0</b>	<b>2</b>	<b>10</b>	<b>9</b>	<b>National</b>

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

**SEMESTER- IV**  
**SKILL BASED ELECTIVE - I**  
**MATHEMATICS FOR COMPETITIVE EXAMINATIONS**

**Course Code: 18UMA4SBE1**

**Total Marks: 100**

**Hours: 2**

**External Marks: 75**

**Credit: 2**

**Internal Marks: 25**

**OBJECTIVES:**

- To learn the problem solving techniques for aptitude problems.
- To enable the students prepare themselves for various competitive examinations.

**UNIT – I**

**H.C.F.andL.C.M. of Numbers-Percentage.**

**UNIT – II**

**Profit and Loss - Ratio and Proportion.**

**UNIT – III**

**Time and work -Pipes and Cisterns.**

**UNIT – IV**

**Time and Distance-Problems on Trains-Simpleinterest- Compoundinterest**

**UNIT – V**

**Area -Volume andSurface Areas.**

**TEXT BOOK:**

1. R.S.Aggarwal, Quantitative Aptitude.

<b>UNIT – I</b>	Chapter –2	Pages 25-36
	Chapter – 9	
	Chapter - 10	Pages 139-172
<b>UNIT – II</b>	Chapter - 11	Pages 173-204
	Chapter - 12	Pages 205-230
<b>UNIT – III</b>	Chapter - 15	Pages 257-275
	Chapter - 16	Pages 276-283
<b>UNIT – IV</b>	Chapter - 17	Pages 284-298
	Chapter - 18	Pages 299-313
	Chapter - 21	Pages 334-350
	Chapter - 22	Pages 351-356
<b>UNIT – V</b>	Chapter - 25	Pages 403-432

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
12	0	2	11	7	National

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

**SEMESTER- V**  
**CORE COURSE - VIII - ALGEBRA**

**Course Code: 18UMA5CC8**  
**Hours: 5**  
**Credit: 5**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To introduce the concepts of Group, Ring, Ideals, polynomial rings and their properties.
- To apply the techniques of unique factorization domain.

**UNIT - I**

**Groups:**Elementary Properties of Group-Equivalent definitions of a Group – Permutations - Subgroups.

**UNIT - II**

**Groups (Continued):** Cyclic Group- Order of an Element- Cosets- Lagrange’s Theorem- Normal Subgroups - Quotient Group.-Isomorphism - Homomorphism.

**UNIT - III**

**Rings:**Elementary properties of Rings - Isomorphism- Types of Rings – Characteristic of a Ring- Subrings.

**UNIT - IV**

**Rings (Continued):**Ideals- Quotient rings - Maximal and Prime Ideals - Homomorphism of Rings - Field of Quotients of an Integral Domain - Ordered Integral Domain.

**UNIT - V**

**Rings (Continued):**Unique Factorization Domain- EuclideanDomain– Principle Ideal Domain – Polynomial Rings - Polynomial Rings over U.F.D-Polynomial over  $\mathbb{Q}$ .

**TEXT BOOK:**

1. S. Arumugam and A. Thangapandi Isaac, Modern Algebra, Scitech Publications (India) Pvt. Ltd. 2003.

UNIT - I	Chapter -3	Sections 3.2 to 3.5
UNIT - II	Chapter -3	Sections 3.6 to 3.11
UNIT - III	Chapter -4	Sections 4.2 to 4.6
UNIT - IV	Chapter -4	Sections 4.7 to 4.12
UNIT - V	Chapter -4	Sections 4.13 to 4.18

**REFERENCE(S):**

1. M.L. Santiago, Modern Algebra, Arul Publications, 1993.
2. S.G. Venkatachalapathy, Modern Algebra, Maragham Publications, 2003.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

29	0	0	0	29	Global
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Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER- V**  
**CORE COURSE -IX - REAL ANALYSIS**

**Course Code: 18UMA5CC9**

**Hours: 5**

**Credit: 5**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To provide the basic knowledge of Continuity, Differentiability and Integrability of real functions.
- To acquire the knowledge of Riemann Integration.

**UNIT - I**

**Real Number System:**Field axioms–Order in  $\mathbb{R}$  -Absolute value of a real number and its properties–Supremum and Infimum of set– Order completeness property– countable and uncountable sets.

**UNIT - II**

**Continuous functions:**Limit of a Function – Algebra of Limits – Continuity of a function - Types of discontinuities– Algebra of Continuous Functions.

**UNIT - III**

**Differentiability of a function:** Derivability and Continuity–Algebra of derivatives – Inverse Function Theorem– Daurboux’s Theorem on derivatives.

**UNIT - IV**

**Differentiability of a function (Continued):** Rolle’s Theorem–Mean Value Theorems on derivatives- Taylor’s Theorem with remainder-Power series expansion.

**UNIT - V**

**Riemann Integration:** Definition– Daurboux’s theorem–conditions for integrability – Properties of Integrable functions - Continuity and derivability of integral functions –The First Mean Value Theorem -The Fundamental Theorem of Calculus.

**TEXT BOOK(S):**

1. M.K,Singhal&Asha Rani Singhal , A First Course in Real Analysis, R.Chand& Co., June 2008 Edition
2. 2.Shanthi Narayan, A Course of Mathematical Analysis, S. Chand & Co., 1995

UNIT – I	Chapter-1	Sections 2, 4 to 6, 10of [1]
UNIT – II	Chapter -5	Sections1, 1.1, 1.3, 2, 3 &4 of [1]
UNIT – III	Chapter - 6	Sections 1 to 5 of [1]
UNIT – IV	Chapter- 8	Sections 1, 2, 4 & 6of [1]
UNIT – V	Chapter - 6	Sections6.1 to 6.3, 6.5 to 6.8 & 6.9.1 of [2]

**REFERENCE:**

1. Gold Berge, Richar R, Methods of Real Analysis, Oxford & IBHP Publishing Co., New Delhi, 1970.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

### SEMESTER- V

#### CORE COURSE - X - NUMERICALMETHODS

Course Code: 18UMA5CC10

Total Marks: 100

Hours: 5

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To apply the numerical problem in efficiency with various methods.
- To acquire the knowledge of problem solving ability.

#### UNIT - I

**Algebraic & Transcendental Equations::** Finding a root of the given equation (Derivation of the formula not needed) using Bisection Method -Method of False Position - Newton Raphson Method - Iteration Method.

#### UNIT - II

**Finite Differences:** Forward - Backward and Central differences– Their symbolic relations– Newton’s forward - backward difference interpolation formulae– Interpolation with unevenly spaced intervals- Application of Lagrange’s interpolating Polynomial (Proof not needed)– Divided differences and their properties– Applications of Newton’s General Interpolating formula. (Proof not needed).

#### UNIT - III

**Numerical Integration:** Numerical Integration using Trapezoidal rule - Simpson’s first - second rules-Theory & problems

#### UNIT - IV

**Solutions to Linear Systems:** Gaussian Elimination Method– Jacobi - Gauss Siedal iterative methods– Theory & problems.

#### UNIT - V

**Numerical Solution of ODE:** Solution by Taylor Series Method- Picard’s method - Euler’s Method- Modified Euler’s Method– Runge-Kutta 2<sup>nd</sup> -4<sup>th</sup> order methods(Derivation of the formula not needed) - Theory & problems using Adam’s Predictor Corrector Method -Milne’s Predictor Corrector Methods

#### TEXT BOOK:

- S.S.Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India Pvt.Limited, 4<sup>th</sup> Edition, 2009.

UNIT – I	Chapter-2	Sections 2.1 to 2.5
UNIT – II	Chapter-3	Sections 3.1, 3.3, 3.6, 3.9, 3.9.1, 3.10, 3.10.1
UNIT – III	Chapter-5	Sections 5.2, 5.4 (5.4.1 to 5.4.3)
UNIT –IV	Chapter-6	Sections 6.3.2 & 6.4
UNIT – V	Chapter-7	Sections 7.1 to 7.6.2

#### REFERENCE(S):

- S. Narayanan & Others, Numerical Analysis, S. Viswanathan Publishers, 1994.
- A.Singaravelu, Numerical Methods, Meenachi Agency, June 2000.
- Dr.P.Kandasamy, Dr.K.Thilagavty, Dr.K.Gunavathi, Numerical Methods, S.Chand& co.,

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
29	5	5	5	29	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER- V**  
**CORE COURSE - XI - STATICS**

**Course Code: 18UMA5CC11**  
**Hours: 5**  
**Credit: 4**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

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

**UNIT - I**

**Forces acting at a point:** Resultant and Components– Parallelogram of forces –Analytical expression for the resultant of two forces acting at a point –Triangle of forces-Perpendicular and converse of triangle of force– Polygon of forces – Lami’s Theorem- An Extended form of the Parallelogram law of forces– Resolution of a force – components of a force along to given direction – Theorem on resolved parts –Resultant of any number of forces acting at a points graphically methods – Resultant of any number of forces acting at a points Analytical methods.

**UNIT - II**

**Parallel forces, Moments and Couples:** Resultant of two like - unlike and number of parallel forces acting on a rigid body–conditions of equilibrium of three coplanar parallel forces –center of two parallel forces – Moment of a force– Varignon’s theorem of moments– couples– equilibrium and Equivalence of two couples– couples in parallel planes– resultant of coplanar couples– Resultant of a of couple and a force.

**UNIT - III**

**Equilibrium of three forces acting on a rigid body and coplanar forces:** Rigid body subject to any three forces– three coplanar forces– conditions of equilibrium– two trigonometrical theorems - 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 – change of base point – equations to the line of action of the resultant.

**UNIT - IV**

**Friction:**Friction – Law’s of friction – coefficient –angle and cone of friction –equilibrium of a particle on a rough inclined plane- equilibrium of a particle on a rough inclined plane under a force parallel to the plane and under any force.

**UNIT - V**

**Equilibrium of strings:**Uniform string under the action of gravity– equation of the common catenary – tension at any point – important formulae– geometrical properties of the common catenary.

**TEXT BOOK:**

1. M.K.Venkataraman, Statics, Agasthiyar Publications, 14<sup>th</sup> Edition. 2011.  
UNIT – I                      Chapter - 2                      Sections 1 to 10  
UNIT – II                      Chapters- 3& 4                      Sections 1 to 12 &1 to 10  
UNIT – III                      Chapters- 5                      Sections 1 to 5  
UNIT – IV                      Chapter - 7                      Sections 1 to 12  
UNIT – V                      Chapter - 11                      Sections 1 to 6

**REFERENCE(S):**

1. A.V.Dharmapadham, Statics, S.Viswanathan Publishers Pvt.Ltd, 2006.
2. P. Durairandian, LaxmiDurairandian and MuthamizhJayapragasam, Mechanics S.Chand& Company PVT, LTD, 2014
3. S.L.Lony, Elements of Statics and Dynamics, Part-I, A.I.T.B.S.Publishers, 2007.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
44	0	0	0	44	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER- V

### MAJOR BASED ELECTIVE - I – DISCRETE MATHEMATICS

Course Code: 18UMA5MBE1:1

Hours: 4

Credit: 4

Total Marks: 100

External Marks: 75

Internal Marks: 25

#### OBJECTIVES:

- To enrich the knowledge in the field of functions.
- To study the concepts of Boolean algebra and the normal forms.

#### UNIT - I

**Statement and notation:** Connectives– Negative – Conjunctive – Disjunctive –Statement Formulae and Truth tables – Conditional and Bi-conditional statements – Well defined formulae – Tautologies– Other connectives.

#### UNIT - II

**Normal forms:**Disjunctive Normal forms – Conjunctive Normal forms – Principal Disjunctive and Conjunctive Normal forms- Ordering and uniqueness of Normal forms - Predicate Calculus.

#### UNIT - III

Inference theory of the predicate calculus –Relations and ordering.

#### UNIT - IV

**Lattice as partially ordered set:** Some properties of lattices– Lattices as algebraic systems – Sub lattice - Direct product and homomorphism– Some special lattices.

#### UNIT - V

**Boolean Algebra:** Definition and Example– Sub algebra - Direct Product and Homomorphism  
**Boolean functions:** Boolean forms and free Boolean algebras – Values of Boolean expressions and Boolean functions.

#### TEXT BOOK:

1. J.P. Tremblay and R. Manohar, Discrete mathematical Structures with Applications to Computer Science, Tata McGraw Hill, Thirty-ninth reprint, 2011.

UNIT - I Chapter- 1 Sections 1.1, 1.2 to 1.2.4, 1.2.6 to 1.2.8, 1.2.14

UNIT - II Chapter - 1 Sections 1.3.1 to 1.3.5 & 1.5

UNIT - III Chapter - 1 Sections 1.6 [1.6.4, 1.6.5]

Chapter - 2 Sections 2.3.1 to 2.3.5, 2.3.7 & 2.3.8

UNIT - IV Chapter - 4 Section 4.1

UNIT -V Chapter - 4 Sections 4.2 & 4.3

#### REFERENCE(S):

1. RakeshDube, AdeshPandey and Ritu Gupta, Discrete Structures and Automata Theory, Narosa Publishing House, 2000.
2. John E. Hopcroft, Jeffery D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publishing House, New Delhi, 1995.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	1	1	1	26	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER - V

### MAJOR BASED ELECTIVE – I - MATHEMATICAL MODELING

Course Code: 18UMA5MBE1:2

Hours: 4

Credit: 4

Total Marks: 100

External Marks: 75

Internal Marks: 25

#### OBJECTIVES:

- To study the mathematical models through ode and difference equations.
- To train the students to develop mathematical models in real life problems.

#### UNIT - I

##### Mathematical Modeling through Ordinary Differential Equations of First order:

Linear Growth and Decay Models – Non-Linear Growth and Decay Models – Compartment Models – Dynamic problems – Geometrical problems.

#### UNIT - II

##### Mathematical Modeling through Systems of Ordinary Differential Equations of First Order:

Population Dynamics – Epidemics– Compartment Models – Economics – Medicine - Arms Race - Battles and International Trade – Dynamics.

#### UNIT - III

##### Mathematical Modeling through Ordinary Differential Equations of Second Order:

Planetary Motions – Circular Motion and Motion of Satellites – Mathematical Modelling through Linear Differential Equations of Second Order – Miscellaneous Mathematical Models.

#### UNIT - IV

##### Mathematical Modeling through Difference Equations:

Simple Models– Basic Theory of Linear Difference Equations with Constant Coefficients – Economics and Finance – Population Dynamics and Genetics – Probability Theory.

#### UNIT - V

##### Mathematical Modeling through Graphs:

Solutions that can be Modeled Through Graphs – Mathematical Modeling in Terms of Directed Graphs - Signed Graphs -Weighted Digraphs and Unoriented Graphs.

#### TEXT BOOK:

1. J.N. Kapur, Mathematical Modeling, Wiley Eastern Limited, New Delhi, 1988.
  - UNIT - I Chapter – 2 Section 2.1 to 2.6
  - UNIT - II Chapter – 3 Section 3.1 to 3.6
  - UNIT - III Chapter – 4 Section 4.1 to 4.4
  - UNIT - IV Chapter – 5 Section 5.1 to 5.5
  - UNIT - V Chapter – 7 Section 7.1 to 7.5

#### REFERENCE:

1. J.N. Kapur, Mathematical Models in biology and Medicine, EWP, New Delhi, 1985.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER- V**  
**SKILL BASED ELECTIVE – II**

**MATHEMATICAL STATISTICS LAB**

**Course Code: 18UMA5SBE2**

**Total Marks: 100**

**Hours: 2**

**External Marks: 60**

**Credit: 2**

**Internal Marks: 40**

**OBJECTIVES:**

- To acquire the knowledge about statistical problem solving ability.
- To develop the skills of statistical lab.

**LIST OF PRACTICAL:**

1. Mean, Standard deviation, Variance.
2. Bar diagram, Line diagram, Pie chart and Histogram.
3. Co efficient of correlation.
4. Regression equation of X on Y.
5. Regression equation of Y on X.
6. Application of t-test for one sample problem.
7. Application of t-test for two sample problems.
8. Application of t-test for testing the significance of Correlation Coefficient.
9. One-tailed and Two-tailed tests.
10. Application of analysis of variance.

**TEXT BOOK:**

1. S. C. Gupta, V. K. Kapoor, Fundamentals of Mathematical Statistics, Edition:2002, Sultan Chand & Sons publications, New Delhi.
2. R.S.N. Pillai and Bagavathi, Practical statistics, Second Edition, 2013.

Total	Number of Topics	Category
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Number of Topics	Local	Regional	National	Global	Based on %
10	6	10	6	9	Regional

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER- V

### SKILL BASED ELECTIVE – III

#### MATLAB

Course Code: 18UMA5SBE3

Hours: 2

Credit: 2

Total Marks: 100

External Marks: 60

Internal Marks: 40

#### OBJECTIVES:

- To provide concepts used in routines in MATLAB on the following problems.
- To acquire the knowledge of MATLAB.

#### LIST OF PRACTICAL:

- Bisection Method.
- False-Position Method.
- Lagrange's Method.
- Newton's Interpolation Method.
- Trapezoidal Rule.
- Simpsons Rule.
- Gauss Jordan Method.
- Gauss Jacobi Iteration Method.
- Euler's Method.
- Runge-Kutta Fourth Order Method.

#### TEXT BOOK:

- Rizwan Butt, Introduction to Numerical Analysis Using MATLAB, Infinity Science Press LLC, Published by Firewall Media, New Delhi, 2008.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
10	0	0	0	10	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - VI**  
**CORE COURSE - XII - LINEAR ALGEBRA**

**Course Code: 18UMA6CC12**

**Total Marks: 100**

**Hours: 5**

**External Marks: 75**

**Credit: 5**

**Internal Marks: 25**

**OBJECTIVES:**

- To facilitate a better understanding of vector space.
- To acquire problems solving ability in linear algebra.

**UNIT- I**

**Vector Spaces:** Vector spaces– Definition and **Example**– Subspaces-linear transformation– Span of a set.

**UNIT - II**

**Basis and Dimension:** Linear Independence– Basis and Dimension –Rank and Nullity.

**UNIT- III**

**Matrix and Inner Product Space:**Matrix of a linear transformation-Inner product space– Definition and **Examples** –Orthogonality – Gram Schmidt Orthogonalisation process– Orthogonal Complement.

**UNIT- IV**

**Theory of Matrices:** Algebra of Matrices- Types of Matrices– The Inverse of a Matrix – Elementary Transformations – Rank of a matrix.

**UNIT- V**

**Characteristic Equation and Bilinear forms:** Characteristic equation -Cayley Hamilton theorem – Eigen values and Eigen vectors –Introduction- Bilinear forms – Quadratic Forms.

**TEXTBOOK:**

1. S. Arumugam and A.Thangapandi Isaac, Modern Algebra, SciTech Publications (India) Ltd., Chennai, Edition 2012.

UNIT - I	Chapter -5	Sections 5.1 to 5.4
UNIT - II	Chapter -5	Sections 5.5 to 5.7
UNIT - III	Chapter -5	Section 5.8
	Chapter -6	Sections 6.1 to 6.3
UNIT - IV	Chapter -7	Sections 7.1 to 7.6
UNIT - V	Chapters-7&8	Sections 7.7 & 7.8 and 8.1 & 8.2

**REFERENCE(S):**

1. I. N. Herstein, Topics in Algebra, Second Edition, John Wiley & Sons (Asia), 1975.
2. Dr. M.K.Venkataramany, the National Publishing Company.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	2	2	2	25	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER - VI

### CORE COURSE - XIII - COMPLEX ANALYSIS

Course Code: 18UMA6CC13

Total Marks: 100

Hours: 5

External Marks: 75

Credit: 5

Internal Marks: 25

#### OBJECTIVES:

- To understand the knowledge about the types of singularity of a complex function and contour integrals.
- To promote the knowledge of problem solving abilities in residues.

#### UNIT - I

**Functions of a Complex variable:**Limits-Theorems on Limits–Continuous functions – Differentiability – Cauchy-Riemann equations– Analytic functions –Harmonic functions.

#### UNIT - II

**Elementary Transformations:**Bilinear transformations– Cross ratio – fixed points of Bilinear Transformation – Some special bilinear Transformations.

#### UNIT - III

**Complex Integration:**Definite integral – Cauchy’s Theorem –Cauchy’s integral formula – Higher derivatives.

#### UNIT - IV

**Series Expansions:**Taylor’s series –Laurent’s Series– Zeroes of analytic functions - Singularities.

#### UNIT - V

**Calculus of Residues:**Residue- Cauchy’s Residue Theorem –Evaluation of definite Integrals

#### TEXT BOOK:

- S.Arumugam,A.Thangapandi Isaac &A.Somasundaram, “Complex Analysis”, New Scitech Publications (India) Pvt Ltd, 2002.

UNIT - I	Chapter - 2	Section 2.1 to 2.8
UNIT - II	Chapter - 3	Sections 3.1 to 3.5
UNIT - III	Chapter - 6	Sections 6.1 to 6.4
UNIT - IV	Chapter - 7	Sections 7.1 to 7.4
UNIT - V	Chapter - 8	Sections 8.1 to 8.3

#### REFERENCE(S):

- T.K.Manicavachagom Pillay, Complex Analysis, S.Viswanathan Publishers Pvt Ltd, 1994.
- Shanthi Narayan, P.K.Mittal, “Theory of Functions of Complex Variable” S.Chand&Company Ltd, Revised 8th edition 2005.

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

<b>Topics</b>					
<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>Global</b>

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

**SEMESTER - VI**  
**CORE COURSE - XIV –DYNAMICS**

**Course Code: 18UMA6CC14**

**Total Marks: 100**

**Hours: 5**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To provide a basic knowledge of the behavior of objects in motion.
- To develop a working knowledge to handle practical problems.

**UNIT - I**

**Kinematics:**Speed – Displacement – Velocity – Resolution of velocity – Triangle of Velocities – Polygon of velocity– Relative velocity – Angular velocity -Change of velocity-acceleration – Variable acceleration – Units of acceleration and Composition of accelerations.

**UNIT - II**

**Projectiles:** Introduction – Definitions– Two fundamental principles– Path of the projectile is a parabola – Characteristics of the motion of a projectile – Velocity of the projectile in magnitude and direction at the end of time t.

**UNIT - III**

**Collision of Elastic Bodies:**Introduction– Definitions – Fundamental Law’s of Impact- Impact of a smooth sphere on a fixed smooth plane– Direct impact of two smooth spheres– Loss of Kinetic Energy - Oblique impact of two smooth spheresand loss of Kinetic Energy– Dissipation of Energy due to Impact- **Simple**problems.

**UNIT - IV**

**Simple Harmonic Motion:**Introduction - Simple harmonic motion in a straight line– General solution - Geometrical Representation of a simple harmonic motion– Change ofOrigin- Composition of two simple harmonic motions of the same period and in the same straight line – Composition of simple harmonic motions of the same period in two perpendicular directions – **Simple**problems.

**UNIT - V**

**Motion under the Action of Central Forces:**Introduction - Velocity and acceleration in polar coordinates – Note on the Equiangular Spiral– Motion under a Central Force - Differential equation of central orbits– Perpendicular from the Pole on the Tangent formulae in Polar coordinates- Pedal equation of the central orbit.

**TEXT BOOK:**

1. Dr.M.K.Venkataraman, Dynamics, Agasthiyar Publications, 14<sup>th</sup> Edition, July 2011.

UNIT-I	Chapter-3	Sections 3.1 to 3.20
UNIT-II	Chapter-6	Sections 6.1 to 6.10
UNIT-III	Chapter-8	Sections 8.1 to 8.9
UNIT-IV	Chapter-10	Sections 10.1 to 10.7
UNIT-V	Chapter-11	Sections 11.1 to 11.8

**REFERENCE(S):**

1. P. Duraipandian, LaxmiDuraipandian and MuthamizhJayapragasam, Mechanics S.Chand&Company PVT, LTD, 2014.
2. A.V.Dharmapadham, Dynamics, S, Viswanathan Publishers Pvt.Ltd. 2006.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
43	2	2	2	43	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER - VI

### CORE COURSE - XV – GRAPH THEORY

Course Code: 18UMA6CC15

Total Marks: 100

Hours: 5

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To introduce the basic concepts of Graph theory.
- To apply the Graph Theory in other disciplines.

#### UNIT - I

**Graphs:** Introduction– Graphs - Finite and Null graphs–Degree of a Vertex – Isomorphism – Complete graphs – Subgraphs - Spanning and Induced Subgraphs – Degree Sequences and Partitions.

#### UNIT - II

**Paths and Cycles:** Introduction-Walks –Pathsand Cycles – Connected graphs - Disconnected graphs and Components – Bipartite graphs.

#### UNIT - III

**Trees:** Introduction- Cut Vertices - Bridges and Blocks– Block graphs and cut vertex graphs– Trees –Properties of trees– Distances - centre and centroids – Spanning trees – fundamental cycles.

#### UNIT - IV

**Cut Sets and Connectivity:** Introduction – Cutsets– Properties of cutsets – Fundamental cutsets–Connectivity –Separability.

#### UNIT - V

**Matrix Representation:** Introduction– Incidence Matrix –Adjacency Matrix–cycle Matrix– Rank of a Matrix – Cutset Matrix.

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#### TEXT BOOK:

1. V.R.Kulli, College Graph Theory, Vishwa International Publications, Gulbarga, 2012.

UNIT-I	Chapter- 1	Sections 1.1 to 1.7
UNIT-II	Chapter- 2	Sections2.1 to 2.5
UNIT -III	Chapter-4	Sections 4.1 to 4.6, 4.10 & 4.11
UNIT-IV	Chapter - 5	Sections 5.1 to 5.6
UNIT-V	Chapter- 7	Sections 7.1 to 7.6

**REFERENCE(S):**

1. Harary, "Graph Theory", Narosa Publishing House, 1989.
2. S.Arumugam "Invitation to Graph Theory", Scitech Publishers, 2001.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
37	0	0	0	37	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - VI****MAJOR BASED ELECTIVE - II - OPERATIONS RESEARCH**

Course Code: 18UM6MBE2:1

Total Marks: 100

Hours: 4

External Marks: 75

Credit: 4

Internal Marks: 25

**OBJECTIVE:**

- To introduce the techniques of Operations Research
- To acquire the knowledge of Network and Game theory.

**UNIT - I**

**Linear Programming of Problem:** Mathematical formulation of the problem – Graphical solution method – Simplex method for  $<$ ,  $=$ ,  $>$  constraints.

**UNIT - II**

**Application to Transportation problem:** Transportation algorithm – Degeneracy algorithm – Degeneracy in Transportation Problem - Unbalanced Transportation problem- Assignment algorithm – Unbalanced Assignment problem.

**UNIT - III**

**Sequencing Problem:** Processing of n Jobs through two machines – Processing of n Jobs through k machines – Processing of 2 Jobs through k machines.

**UNIT - IV**

**Game and Strategies:** Two-Person Zero-Sum games – some basic terms -the Maximin-Minimax principle – Games without saddle point – Mixed strategies -graphical solutions of  $2 \times n$  and  $m \times 2$  games – Dominance property.

**UNIT – V**

**Network Scheduling by PERT/CPM:** Introduction – Network - Basic Components – Logical Sequences – Rules of Network Construction – Critical path analysis – Probability Considerations in PERT – Distinction between PERT and CPM.

**TEXT BOOK:**

1. Kanti Swaroop, Gupta.P.K., & Manmohan, Operations Research, Sultan Chand & Co, 16<sup>th</sup> Revised Edition.

UNIT – I Chapters-2, 3 & 4

Sections 2.1 to 2.3, 3.1 to 3.5 & 4.3, 4.4

UNIT – II Chapters-10 & 11

Sections 10.1, 10.2, 10.5, 10.8, 10.9 to 10.13, 10.15 & 11.1 to 11.4

UNIT – III Chapter -12

Sections 12.1 to 12.8

UNIT – IV Chapter -17

Sections 17.1 to 17.7

UNIT – V Chapter -25

Sections 25.1 to 25.4, 25.6 to 25.8

**REFERENCE(S):**

- Hamdy A. Taha, Operations Research, 7<sup>th</sup> Edition, Prentice Hall of India, 2002.
- Richard Bronson, Theory and Problems of Operations Research, Tata McGraw Hill Publishing Company Ltd, New Delhi.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
28	0	0	0	28	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER - VI

### MAJOR BASED ELECTIVE – II –CODING THEORY

Course Code: 18UMA6MBE2:2

Total Marks: 100

Hours: 4

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To introduce the fundamental concepts of Coding Theory and to enlighten the students with applications of the subject.

#### UNIT I

**Error detection, correction and decoding:** Communication channels– Maximum Likelihood decoding.

#### UNIT II

Hamming distance – Nearest neighbour- minimum distance decoding – Distance of a code.

#### UNIT III

**Finite Fields:** Finite fields– Polynomial rings– Structure of finite fields - Minimal Polynomials.

#### UNIT IV

**Linear codes:** Vector spaces over finite fields- Linear Codes -Hamming weight – Bases for linear codes.

#### UNIT V

Generator matrix and parity - Check matrix– Equivalence of linear codes – Encoding with a linear code – Decoding of linear codes – Cosets –Nearest neighbour decoding for linear codes – Syndrome decoding.

#### Text Book:

San Ling and Chaoping Xing, Coding Theory: A first course, Cambridge University Press (2004).

UNIT I Chapter 1 &2 Sections 2.1 – 2.2

UNIT II Chapter 2 Sections 2.3 – 2.5

UNIT III Chapter 3

UNIT IV Chapter 4 Sections 4.1 – 4.4

UNIT V Chapter 4 Sections 4.5 – 4.8

#### REFERENCE:

- D.G. Hoffman et al, Coding Theory and Cryptography – The Essentials, Marcel Dekker INC., Second Edition, (2000).
- J.H. Van Lint, Introduction to Coding Theory, Springer, (1998).

Total Number of	Number of Topics				Category Based on %
	Local	Regional	National	Global	

<b>Topics</b>					
<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>Global</b>

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

## SEMESTER –VI

### MAJOR BASED ELECTIVE – III – NUMBER THEORY

**Course Code: 18UMA6MBE3:1**

**Total Marks: 100**

**Hours: 5**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

#### OBJECTIVES:

- To introduce the Diophantine equations, Congruences, Euler’s functions.
- To develop the problem solving skill in residue systems.

#### UNIT – I

**Divisibility:** Introduction– Divisibility – Primes- The Binomial theorem.

#### UNIT - II

**Congruences:** Congruences– Solution of Congruences–Congruences of Degree I – The Function  $\phi(n)$ - Congruences of Higher Degree.

#### UNIT - III

**Congruences(Continued):** Prime Power Moduli–Prime Modulus– Congruences of Degree Two - Prime Modulus- Power Residues.

#### UNIT - IV

**Quadratic Reciprocity:** Quadratic Residues – Quadratic Reciprocity –The Jacobi Symbol- Binary Quadratic forms – Equivalence and reduction of binary quadratic forms – sum of two squares – Positive definite binary quadratic forms.

#### UNIT -V

**Some Diophantine Equations:** Diophantine Equations– The Equation  $ax+by=c$  – positive solutions – Other Linear Equations - The Equation  $x^2+y^2=z^2$  – The equation  $x^4+y^4 = z^2$  - Ternary quadratic form – Rational points on curves.

#### TEXT BOOK:

1. Ivan Niven, Herbert S Zuckerman , “An Introduction to the Theory of Numbers”, Third Edition ,Wiley Eastern Ltd.1989.

UNIT- I	Chapter - 1	Sections 1.1 to 1.4
UNIT-II	Chapter - 2	Sections 2.1 to 2.5
UNIT-III	Chapter - 2	Sections 2.6 to 2.9
UNIT-IV	Chapters -3	Sections 3.1 to 3.7
UNIT-V	Chapter - 5	Sections 5.1 to 5.6

#### REFERENCE:

1. David M. Burton, Elementary Number Theory, Sixth Edition, Tata McGraw Hill (2010).
2. George E. Andrews, Number Theory, Dover publications, INC, New York (1994).

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
<b>29</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>29</b>	<b>Global</b>

## SEMESTER - VI

### MAJOR BASED ELECTIVE– III - ASTRONOMY

Course Code: 18UMA6MBE3:2

Hours: 5

Credit: 4

Total Marks: 100

External Marks: 75

Internal Marks: 25

#### OBJECTIVE:

- To provide knowledge about the universe, scientific thinking to problems in astronomy
- To study the observational foundations of astronomy's greatest discoveries and the nature of galaxy.

#### UNIT - I

Relevant properties of a sphere and relevant formulae for spherical trigonometry (All without Proof) –Celestial sphere– Diurnal motion.

#### UNIT - II

Earth – Dip of the horizon–Twilight – Astronomical refraction –Tangent - Cosine's Formula– Properties & Simple Problems Applying them.

#### UNIT - III

Geocentric Parallax–Kepler's Laws of Planetary motion (statement only)–Newton's deductions from them –Three anomalies of the Earth and relation between them.

#### UNIT - IV

Time- Equation of time – Seasons -Years and Calendar

**Heliocentric Parallax:** Annual Parallax –Aberration–Different Kinds of Aberration - Simple problems in the above.

#### UNIT - V

**Moon:**Introduction - Sidereal Month – Synodic Month – To find the relation between Sidereal and Synodic Months – Elongation – Conjunction – Opposition – Quadrature's – Daily motion of the moon – Age of moon - Phase of Moon – Successive Phase of Moon – The different phases of moon using formulae(except Moon's librations).

#### TEXT BOOK:

1. S. Kumaravelu and Prof. SusheelaKumaravelu, Astronomy, SKV Publications, 1995.

UNIT - I Chapters –1& 2

UNIT - II Chapter –3 [Pages 91 to 114, 123 to 157]

UNIT - III Chapter –5& 6 [Pages 158 to 197]

UNIT - IV Chapter – 7, 8 [Pages 198 to 222], [Pages 238 to 263]

UNIT - V Chapter - 12 [Pages 334 to 340]

**REFERENCE:**

1. V. Thiruvengkatacharya, A Text Book of Astronomy, S. Chand and Co., Pvt Ltd., 1972.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
35	2	2	2	35	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**B.Sc. Computer Science, B.Sc. Information Technology & Computer Application**

(For the candidates admitted from the academic year 2018-19 onwards)

**ALLIED MATHEMATICS**

**ALLIED COURSE - I - NUMERICAL METHODS AND STATISTICS**

**Code: 18UMA1AC1**

**Hours: 6**

**Credits: 4**

**Total Marks : 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To acquire the knowledge about the numerical problems.
- To analyse the statistical problems.

**UNIT - I**

**The Solution of Numerical Algebraic and Transcendental Equations:** Bisection Method - Iteration Method - Regula Falsi Method - Newton Raphson Method – **Simple Problems only**

**UNIT - II**

**Solutions of Simultaneous Linear Algebraic Equations:** Gauss Elimination Method – Gauss-Jordan Method – Gauss Jacobi - Gauss Seidel Method.

**UNIT - III**

**Numerical solution of ODE:** Taylor Series Method - Euler's Method - Runge Kutta Second and Fourth Order Method.

**Numerical Integration:** Trapezoidal Rule - Simpson's Rule (Proof not needed).

**UNIT - IV**

**Measures of Central Tendency:** Arithmetic Mean – Median – Mode – Geometric Mean – Harmonic Mean. **Measures of Dispersion:** Range – Quartile Deviation – Mean Deviation - Standard Deviation.

**UNIT - V**

**Correlation and Regression:** Introduction – Scatter Diagram - Karl Pearson Co-efficient of Correlation – Rank Correlation - Lines of Regression - **Simple Problems only**.

**TEXT BOOK(S):**

1. S.S.Sastry, "Introductory Methods of Numerical Analysis", PHI Learning Pvt.Ltd, New Delhi 2010.

2. ( Unit I, II, III )
3. Gupta.S.C&Kapoor, V.K, “Fundamentals of Mathematical Statistics”, Sultan Chand & sons, New Delhi 1994.( Unit IV ,V )

Unit – I	Chapter – 2	Sections 2.2 to 2.5
Unit – II	Chapter- 6 & 8	Sections 6.3.2 to 6.3.3 & 8.3.1 to 8.3.2
Unit – III	Chapter- 7 & 5	Sections 7.2, 7.4, 7.5 & 5.4.1 to 5.4.3
Unit – IV	Chapter- 2& 3	Sections 2.3 to 2.5.2, 2.6 to 2.9.1 & 3.3 – 3.5, 3.7
Unit – V	Chapter – 10	Sections 10.1 to10.3, 10.3.1,10.6 ,10.7 and 10.7.1

**REFERENCE(S):**

1. M.K. Jain, S.R.K. Iyengar and R.K. Jain, “Numerical Methods for Scientific and Engineering Computation”, New Age International Private Limited, 1999.
4. C.E. Froberg, “Introduction to Numerical Analysis”, II Edn., Addison Wesley, 1979.
5. P. Kandasamy, K.Thilagavathy, Calculus of Finite Differences and Numerical Analysis (Allied Mathematics), S.Chand&Co.Ltd, New Delhi.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
29	2	2	2	29	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global,

**B.Sc. Computer Science, B.Sc. Information Technology & Computer Application**

(For the candidates admitted from the academic year 2018-19 onwards)

**ALLIED MATHEMATICS**

**ALLIED COURSE - II – OPERATIONS RESEARCH**

**Code: 18UMA1AC2**

**Hours: 6**

**Credits: 4**

**Total Marks : 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To develop the problems solving ability in Assignment problems & Transportation problems.
- To analyse the network problems.

**UNIT - I**

**Linear Programming Problem:** Introduction - Graphical Solution Method – General Linear Programming Problem - Canonical forms of LPP - Standard forms of LPP.

**UNIT - II**

**Linear Programming Problem (Continued):** Introduction - Simplex Method for  $<$ ,  $=$ ,  $>$  constraints – Big-M Method - Duality - simple problems.

**UNIT - III**

**Transportation Problem:** Introduction – LP formulation of the Transportation Problem – Finding an Initial Basic Feasible Solution - Transportation Algorithm (Modi Method) – Unbalanced Transportation Problem.

**UNIT - IV**

**Assignment Algorithm:** Introduction - Mathematical Formulation of the Problem – Solution Methods of Assignment Problem – Special Cases in Assignment Problems – The Travelling Salesman Problem.

**UNIT - V**

**Networks:** Introduction – Network (Basic Components) – Logical Sequencing – Rules of Networking Construction – Concurrent Activities - CPM computation - PERT computation.

**TEXT BOOK:**

1. KantiSwarup, P.K.Gupta and Man Mohan, Operations Research, Sultan Chand &Co.Ltd.2012

Unit-I Chapter-3 Sections 3.1 to 3.5

Unit-II Chapter-4 Sections 4.1, 4.3 &4.4

Unit-III Chapter-10 Sections 10.1, 10.2, 10.9 to 10.13 &10.15

Unit-IV Chapter-11 Sections 11.1 to 11.4 & 11.7

Unit-V Chapter -25 Sections 25.1 to 25.7.

**REFERENCE(S):**

1. PremKumar,Gupta and D.S. Hira, “Operations Research”, An Introduction, S. Chand and Co., Ltd. New Delhi,
2. Hamdy.A.Taha, “Operations Research”, Seventh Edition, McMillan Publishing Company, New Delhi, 1982.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global,

## B.Sc., PHYSICS

(For the candidates admitted from the academic year 2018-19 onwards)

### ALLIED MATHEMATICS

#### ALLIED COURSE - I –ALGEBRA AND CALCULUS

**Code: 18UMA1AC1:1**

**Total Marks : 100**

**Hours: 6**

**External Marks: 75**

**Credits: 4**

**Internal Marks: 25**

#### OBJECTIVES:

- To understand the basic concepts of the Integration.
- To develop the knowledge of the problems in Theory of Equations

#### UNIT I

**Theory of Equations:**Relation between roots & coefficients–Transformations of Equations – Reciprocal Equations- Diminishing,Increasing & Multiplying the roots by a constant- Rolle’s Theorem- Descarte’s rule of Signs (statement only) –Simpleproblems.

#### UNIT II

**Matrices :**Singular matrices – Inverse of a non-singular matrix using adjoint method- Rank of a Matrix – Consistency – Characteristic equation,Eigen values,Eigen vectors – Cayley Hamilton’s Theorem (proof not needed)–Simpleapplications only

#### UNIT III

**Differentiation:**Maxima &Minima – Concavity,Convexity – Points of inflexion - Partial differentiation– Euler’s Theorem- Total differential coefficients (proof not needed) –Simple problemsonly.

#### UNIT IV

**Integration:**Evaluation of integrals of types 1.  $\int \frac{px+q}{ax^2+bx+c} dx$  - 2.  $\int \frac{px+q}{\sqrt{ax^2+bx+c}} dx$ - 3.  $\int \frac{dx}{a+bsinx}$   
4.  $\int \frac{dx}{a+b\cos x}$ - Evaluation using Integration by parts – Properties of definite integrals

#### UNIT V

**Differential Equations:** Variables Separables– Linear equations– Second order of types  $(a D^2 + bD + c) y = F(x)$  where a,b,c are constants and  $F(x)$  is one of the following types (i)  $e^{Kx}$  - (ii)  $\sin(kx)$  or  $\cos(kx)$  - (iii)  $x^n$ , n being an integer - (iv)  $e^{Kx} f(x)$

**TEXT BOOK(S):**

1. T.K. Manickavasagam Pillai & Others, Algebra, Vol II, S.V Publications, 1985 Revised Edition (Unit I)
2. T.K. Manickavasagam Pillai & Others, Algebra, Vol III, S.V Publications, Pvt.Ltd 2011. (Unit II)
3. S. Narayanan, T.K. Manicavachagam Pillai, Calculus, Vol I, II, III, S. Viswanathan Pvt Limited, 2003. (Units III, IV and V)

**REFERENCE:**

1. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.
2. S. Rethina Kumar, "Algebra and Calculus", Sai Publication – 2015.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
33	3	3	3	33	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global,

## B.Sc., PHYSICS

(For the candidates admitted from the academic year 2018-19 onwards)

### ALLIED MATHEMATICS

#### ALLIED COURSE - II - ANALYTICAL GEOMETRY (3D), TRIGONOMETRY AND FOURIER SERIES

Code: 18UMA2AC2:1

Total Marks : 100

Hours: 5

External Marks: 75

Credits: 3

Internal Marks: 25

#### OBJECTIVES:

- To understand the basic concepts of Analytical Geometry of 3D and Trigonometry.
- To develop the problem solving ability in Fourier Series.

#### UNIT – I

Equation of a straight line passing through two given points - Condition for a line to be parallel to a plane - Coplanar lines- Shortest distance between two given lines- Simple problems.

#### UNIT – II

Equation of a sphere- Finding centre and radius- Length of the tangent to a sphere- Plane section of a sphere

#### UNIT – III

Expansion of  $\sin n\theta$ ,  $\cos n\theta$ ,  $\tan n\theta$  (  $n$  being a positive integer )- Expansion of  $\sin^n\theta$ ,  $\cos^n\theta$ ,  $\sin^n\theta\cos^m\theta$  in a series of sines & cosines of multiples of  $\theta$  ( $\theta$  - given in radians )- Expansion of  $\sin\theta$ ,  $\cos\theta$  and  $\tan\theta$  in terms of powers of  $\theta$  (only problems in all the above).

#### UNIT – IV

Euler's formula for  $e^{i\theta}$  - Definition of Hyperbolic functions –Formulae involving Hyperbolic functions-Relation between Hyperbolic & circular functions– Expansion of  $\sin hx$ ,  $\cosh x$ ,  $\tan hx$  in powers of  $x$

#### UNIT – V

Definition of Fourier Series– Finding Fourier expansion of a periodic function with period  $2\pi$ - Use of Odd & Even functions in evaluating Fourier Coefficients

#### TEXT BOOK(S):

1. T.K.ManickavasagamPillai, T.Natarajan, “Analytical Geometry (3D)” Part-II, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011. ( Unit-I Chap-3 Sec 4,5,7 & 8) ( Unit-2 Chap-4 Sec 2-5)
2. S. Narayanan, T.K. ManichavasagamPillai, “ Trigonometry”, S. Viswanathan (Printers & Publishers, Pvt Limited, 2011. ( Unit-3 Chap-3 & Unit-4 Chap-4 Sec 1,2 (2.1, 2.2))
3. S. Narayanan, T.K. ManichavasagamPillai, “Calculus” Volume – III, S. Viswanathan(Printers & Publishers, Pvt Limited, 2011. ( Unit-5 Chap-6 Sec 1 to 5)

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	3	3	3	20	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global



## THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS), ELAMBALUR, PERAMBALUR

**Master of Mathematics Course Structure under CBCS**  
(For the candidates admitted from the academic year 2018-2019 onwards)



Semester	Course	Course Code	Course Title	Hours/Week	Credit	Exam Hours	Marks		Total
							Int	Ext	
1	Core Course I	18PMA1CC1	Linear Algebra	6	5	3	25	75	100
	Core Course II	18PMA1CC2	Real Analysis	6	5	3	25	75	100
	Core Course III	18PMA1CC3	Ordinary Differential Equations	6	5	3	25	75	100
	Core Course IV	18PMA1CC4	Classical Dynamics	6	5	3	25	75	100
	Core Course V	18PMA1CC5	Advanced Graph Theory	6	4	3	25	75	100
<b>TOTAL</b>				<b>30</b>	<b>24</b>		<b>125</b>	<b>375</b>	<b>500</b>
2	Core Course VI	18PMA2CC6	Algebra	6	5	3	25	75	100
	Core Course VII	18PMA2CC7	Complex Analysis	6	5	3	25	75	100
	Core Course VIII	18PMA2CC8	Partial Differential Equations	6	5	3	25	75	100
	CBE – 01	18PMA2EC1:1		6	4	3	25	75	100
	CBE – 02	18PMA2EC2:1		6	4	3	25	75	100
<b>TOTAL</b>				<b>30</b>	<b>23</b>		<b>125</b>	<b>375</b>	<b>500</b>
3	Core Course IX	18PMA3CC9	Topology	6	5	3	25	75	100
	Core Course X	18PMA3CC10	Calculus of Variations, Integral Equations and Transforms	6	5	3	25	75	100
	Core Course XI	18PMA3CC11	Measure Theory and Integration	6	4	3	25	75	100
	CBE – 03	18PMA3EC3:1		6	4	3	25	75	100
	CBE – 04	18PMA3EC4:1		6	4	3	25	75	100
<b>TOTAL</b>				<b>30</b>	<b>22</b>		<b>125</b>	<b>375</b>	<b>500</b>
4	Core Course XII	18PMA4CC12	Functional Analysis	6	5	3	25	75	100
	Core Course XIII	18PMA4CC13	Differential Geometry	6	4	3	25	75	100
	Core Course XIV	18PMA4CC14	Numerical Analysis	6	4	3	25	75	100
	CBE-05	18PMA4EC5:1		6	4	3	25	75	100
	Project Work	18PMA4PW		6	4	-	-	-	100
<b>TOTAL</b>				<b>30</b>	<b>21</b>				<b>500</b>
<b>GRAND TOTAL</b>				<b>120</b>	<b>90</b>				<b>2000</b>

**List of Elective Courses (For 2018 – 2019)**

Elective	Semester	Course Code	Title of the Course
Elective-I	II	18PMA2EC1:1	Fuzzy sets and Their Applications
		18PMA2EC1:2	Control Theory
Elective-II	II	18PMA2EC2:1	Probability Theory
		18PMA2EC2:2	Tensor Analysis and Special Theory of Relativity
Elective-III	III	18PMA3EC3:1	Advanced Operations Research
		18PMA3EC3:2	Methods of Mathematical Physics
Elective-IV	III	18PMA3EC4:1	Stochastic Processes
		18PMA3EC4:2	Combinatorics
Elective-V	IV	18PMA4EC5:1	Algebraic Number Theory
		18PMA4EC5:2	Financial Mathematics

**Note:**

Project : 100 Marks

Dissertation : 80Marks

Viva Voce : 20 Marks

Core Papers - 14

Core Based Elective Papers - 5

Project - 1

**Note:**

1. Theory Internal 25 marks External 75 marks
2. Practical Internal 40 marks External 60 marks
3. Separate passing minimum is prescribed for Internal and External
  - a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
  - b) The passing minimum for University Examinations shall be 40% out of 75 marks (i.e. 30 marks)
  - c) The passing minimum not less than 50% in the aggregate.

**SEMESTER – I**  
**CORE COURSE –I- LINEAR ALGEBRA**

**Course Code: 18PMA1CC1**

**Hours: 6**

**Credit: 5**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To understand the various aspects of Linear Algebra.
- To develop the knowledge in problem solving skills.

**UNIT - I**

**Linear Equations:** System of Linear Equations– Matrices and Elementary Row operations –Row Reduced Echelon Matrices– Matrix multiplication.

**UNIT - II**

**Vector Spaces:** Vector Spaces-Subspaces– Bases and Dimension.

**Linear Transformations:**The Algebra of Linear Transformations – Isomorphism – Representation of Transformations by Matrices.

**UNIT - III**

**Linear Transformations (Continued):**Linear Functional – The Double Dual- The Transpose of a Linear Transformation.

**Polynomials:**The Algebra of Polynomials– Polynomial Ideals-The Prime Factorization of a Polynomial.

**UNIT - IV**

**Determinants:** Commutative Rings – Determinant functions- Permutations and the Uniqueness of determinants.

**Elementary Canonical Forms:**Characteristic values– Annihilating polynomials - Invariant subspaces.

**UNIT - V**

**Elementary Canonical Forms (Continued):**Simultaneous Triangulation – Simultaneous Diagonalization– Direct Sums Decompositions -Invariant Direct Sums .

**TEXT BOOK:**

1. Kenneth Hoffman and Ray Kunze, Linear Algebra, Second Edition, Prentice – Hall of India Pvt.Ltd, New Delhi, 2004.

UNIT – I	Chapter - 1	Sections 1.2 to 1.5
UNIT – II	Chapters - 2 & 3	Sections 2.1 to 2.3 & 3.1 to 3.4
UNIT – III	Chapters - 3 & 4	Sections 3.5 to 3.7 & 4.1 to 4.4
UNIT – IV	Chapters - 5 & 6	Sections 5.1 to 5.3 & 6.2 to 6.4
UNIT – V	Chapter - 6	Sections 6.5 to 6.8

**REFERENCE(S):**

1. I.N.Herstein, Topics in Algebra, Wiley-Eastern Ltd., New Delhi, 1975.
2. David C.Lay, Linear Algebra and its Applications, Third Edition, Pearson Education, Pvt.Ltd, 2005.
3. S. Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, Ltd,2004.
4. A.R.Rao, P.Bhimanshankaram, Linear Algebra, Second Edition, Tata McGraw Hill, 2000.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
26	0	0	0	26	Global

**SEMESTER - I**  
**CORE COURSE –II- REAL ANALYSIS**

**Course Code: 18PMA1CC2**

**Hours: 6**

**Credit: 5**

**Total Marks : 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To understand a thorough knowledge of the various aspects of Real line and Metric Spaces which is imperative for any advanced Learning in Pure Mathematics.
- To analyse a complete Topological approach in all aspects of Analysis and make them to solve problems.

**UNIT - I**

**Basic Topology:** Finite Countable and Uncountable Sets – Metric spaces – Compact sets – Perfect sets – Connected sets.

**UNIT - II**

**Continuity:** Limits of functions – Continuous functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities – Monotonic functions – Infinite limits and limits at infinity.

**UNIT - III**

**Riemann – Stieltjes Integral:** Definition and Existence of the Integral – Properties of the Integral – Integration and Differentiation – Integration of vector valued functions – Rectifiable curves.

**UNIT - IV**

**Sequences and Series of Functions:** Uniform convergence - Uniform Convergence and Continuity – Integration and Differentiation - Equicontinuous families of functions – The Stone-Weierstrass Theorem.

**UNIT – V**

**Functions of Several Variables:** Linear Transformations - Differentiation – The Contraction Principle – The Inverse Function Theorem - The Implicit Function Theorem - Determinants – Derivatives of Higher order.

**TEXT BOOK:**

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, Mcgraw Hill, 1976.

UNIT – I	Chapter - 2
UNIT – II	Chapters - 4
UNIT – III	Chapter - 6
UNIT – IV	Chapter - 7
UNIT – V	Chapter - 9

**REFERENCE(S):**

1. Tom P. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. A.J. White, Real Analysis, An Introduction, Addison Wesley Publishing Co., Inc. 1968.
3. Serge Lang, Analysis I & II, Addison-Wesley Publishing Company, Inc. 1969.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
29	0	0	0	29	Global

**SEMESTER - I**

**CORE COURSE –III- ORDINARY DIFFERENTIAL EQUATIONS**

**Course Code: 18PMA1CC3**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 5**

**Internal Marks: 25**

**OBJECTIVES:**

- To give an in-depth knowledge of solving differential equations that we encounter frequently in various walks of life.
- To introduce existence and uniqueness theorem in differential equations.

**UNIT - I**

**Solution in Power Series:** Legendre Equation and Legendre Polynomials –Second Order Equation with Regular Singular Point - Properties of Bessel functions

**UNIT - II**

**Existence Theorems:** Existence and Uniqueness Theorem- Fundamental Matrix –GroanwallInequality - Successive Approximations - Picard’s Theorem – Some Examples.

**UNIT - III**

**Analysis and Methods of Nonlinear Differential Equations:** Introduction - ExistenceTheorem - Extremal Solutions - Upper and Lower Solutions.

**UNIT - IV**

**Boundary Value Problems:** Sturm-Liouville problem - Green’s Function - Sturm’s comparison Theorem.

**UNIT - V**

**Stability of Linear and Nonlinear Systems:**Introduction - Elementary Critical Points - System of Equations with Constant Coefficients - Linear Equation with Constant Coefficients.

**TEXTBOOK:**

1. S.G. Deo, Lakshmikanthan, V. Raghavendra, Textbook of Ordinary Differential Equations, Second Edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1997.

UNIT – I	Chapter - 3	Sections 3.3 to 3.5
UNIT – II	Chapters – 4& 5	Sections 4.4, 4.5 & 5.1 to 5.5
UNIT – III	Chapter - 6	Sections 6.1 to 6.4 & 6.7
UNIT – IV	Chapters - 7 & 8	Sections 7.2, 7.3 & 8.2
UNIT – V	Chapter - 9	Sections 9.1 to 9.5

**REFERENCE:**

1. George F. Simmmons, Differential Equations with Applications and Historical Notes, Tata McGraw-Hill Publishing Company Ltd., 1972.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
20	1	1	1	20	Global

**SEMESTER - I**  
**CORE COURSE –IV- CLASSICAL DYNAMICS**

**Course Code: 18PMA1CC4**  
**Hours: 6**  
**Credit: 5**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To give a detailed knowledge about the mechanical system of particles.
- To study the applications of Lagrange's equations and Hamilton's equations as well as theory of Hamilton-Jacobi Theory.

**UNIT - I**

**Introductory Concepts:**The mechanical system- Generalized Coordinates - Constraints - Virtual work - Energy and momentum.

**UNIT - II**

**Lagrange's Equation:** Derivation of Lagrange's Equations - **Examples** - Integrals of the Motion.

**UNIT - III**

**Special Applications of Lagrange's Equations:** Rayleigh's dissipation function - Impulsive motion - Gyroscopic systems- Velocity dependent potentials.

**UNIT - IV**

**Hamilton's Equations:** Hamilton's principle - Hamilton's equations - Other Variational principles-.- Phase space.

**UNIT – V**

**Hamilton – Jacobi Theory:** Hamilton's Principal Function – The Hamilton-Jacobi equation– Separability - Liouville's system - Stackel's theorem.

**TEXT BOOK:**

1. Donald T. Greenwood, Classical Dynamics, PHI Pvt. Ltd., New Delhi-1985.

UNIT – I	Chapter - 1	Sections 1.1 to 1.5
UNIT – II	Chapter - 2	Sections 2.1 to 2.3
UNIT – III	Chapter - 3	Sections 3.1 to 3.4
UNIT – IV	Chapter - 4	Sections 4.1 to 4.4
UNIT – V	Chapter - 5	Sections 5.1 to 5.3

**REFERENCE(S):**

1. H. Goldstein, Classical Mechanics, Second Edition, Narosa Publishing House, New Delhi.
2. Narayan Chandra Rana&PromodSharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	1	1	1	21	Global

**Green - Local, Pink - Regional, Blue - National, Brown – Global**

**SEMESTER - I**  
**CORE COURSE –V- ADVANCED GRAPH THEORY**

**Course Code: 18PMA1CC5**

**Hours: 6**

**Credit: 4**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To give a rigorous introduction to the basic concepts of Graph Theory.
- To give applications of Graph Theory in other disciplines.

**UNIT – I**

**Graphs and Subgraphs:** Graphs and simple graphs – Graph Isomorphism – The Incidence and Adjacency Matrices – Subgraphs – Vertex degrees – Paths and Connection – Cycles.

**UNIT – II**

**Trees and Connectivity:** Trees – Cut edges and Bonds – Cut vertices – Cayley’s Formula – Connectivity

**UNIT –III**

**Euler Tours and Hamilton Cycles, Matchings:** Euler Tours – Hamilton Cycles – Matchings and Coverings in Bipartite Graphs.

**UNIT – IV**

**Edge Coloring and Independent Set:** Edge Chromatic Number – Vizing’s Theorem –Independent Set – Ramsey’s Theorem

**UNIT - V**

**Vertex Coloring:** Chromatic Number – Brook’s Theorem – Hajo’s Conjecture – Chromatic Polynomials.

**TEXTBOOK:**

1. J.A. Bondy, U.S.R. Murty, Graph Theory with Applications, Mac Milan Press Ltd., 1976.

UNIT - I	Chapter - 1	Sections 1.1 to 1.7
UNIT - II	Chapters - 2 & 3	Sections 2.1 to 2.4 & 3.1, 3.2
UNIT - III	Chapters- 4 & 5	Sections 4.1, 4.2 & 5.1, 5.2
UNIT - IV	Chapters - 6 & 7	Sections 6.1, 6.2 & 7.1 to 7.3
UNIT - V	Chapter - 8	Sections 8.1 to 8.4

**REFERENCE(S):**

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

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
23	0	0	0	23	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - II**

**CORE COURSE –VI- ALGEBRA**

Course Code: 18PMA2CC6

Hours: 6

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

**OBJECTIVES:**

- To provide foundation in group.
- To enhance the power of ideas for solving the problems in Algebra.

**UNIT – I**

**Group Theory:** Definition of a group – Examples of groups– Preliminary Lemmas - subgroups- A Counting Principle – Normal Subgroups and Quotient Groups – Homomorphisms –Automorphisms - Cayley’s Theorem – Permutation Groups.

**UNIT – II**

**Group Theory:** Another Counting Principle - Sylow’s Theorem – Direct Products – Finite Abelian Groups.

**UNIT – III**

**Ring Theory:** Some Special Classes of Rings - Homomorphisms – Ideals and Quotient Rings –More Ideals and Quotient Rings – The Field of Quotients of an Integral Domain.

**UNIT – IV**

**Ring Theory:** Euclidean Rings- A Particular Euclidean Ring - Polynomials Rings - Polynomials over the Rational Field–Polynomial Rings over Commutative Rings -The Eisenstein criterion – Extension fields – Roots of polynomials – Splitting fields.

**UNIT – V**

**Linear Transformations:** Canonical Forms - Triangular Form – Hermitian transformation- Unitary and Normal Transformation.

**TEXT BOOK:**

1. I. N. Herstein, Topics in Algebra, Second Edition, John Wiley & sons (ASIA) Pvt Ltd., Singapore.

UNIT – I	Chapter - 2	Sections 2.1 to 2.10
UNIT – II	Chapter - 2	Sections 2.11 to 2.14
UNIT – III	Chapter - 3	Sections 3.2 to 3.6
UNIT – IV	Chapter - 3 & 5	Sections 3.7 to 3.11 & 5.1, 5.3
UNIT – V	Chapter - 6	Sections 6.4 & 6.10

**REFERENCE(S):**

1. Serge Lang, Algebra, Third Edition, Springer Graduate texts in Mathematics, New York, 2002.
2. N.S. Gopala Krishnan, University Algebra, Second Edition, John Wiley & sons (Asia) Pvt. Ltd., 1986.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
32	0	0	0	32	National

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - II**  
**CORE COURSE –VII- COMPLEX ANALYSIS**

**Course Code: 18PMA2CC7**

**Hours: 6**

**Credit: 5**

**Total Marks: 100**

**External Marks: 75**

**Internal Marks: 25**

**OBJECTIVES:**

- To learn the various intrinsic concepts and the theory of Complex Analysis.
- To study the concept of Analyticity, Complex Integration and Infinite Products in depth.

**UNIT - I**

**Fundamental Theorems:** Line Integrals - Rectifiable arcs - Line integrals as Functions of Arcs  
Cauchy's Theorem for Rectangle - Cauchy's Theorem in a Disk.

**UNIT – II**

**Cauchy's Integral Formula:** The index of a point with respect to a closed curve - The integral formula  
Higher Derivatives - Removable Singularities - Taylor's Theorem - Zeroes and Poles.

**UNIT – III**

**Cauchy's Integral Formula (Continued):** The Local mapping - The Maximum principle.

**Calculus of Residues:** The Residue theorem - The argument principle - Evaluation of Definite Integrals.

**UNIT – IV**

**Harmonic Functions:** Definitions and Basic properties - The Mean Value Property - Poisson's Formula  
- Schwarz's Theorem - The Reflection Principle.

**UNIT – V**

**Power Series Expansion:** Weierstrass's Theorem - The Taylor series - The Laurent series.

**Partial Fractions:** Partial Fractions - Infinite products-Canonical Products– Gamma function.

**Riemann mapping Theorem:** Statement and Proof – Boundary Behaviour – Use of the Reflection Principle.

**TEXTBOOK:**

1. Lars V. Ahlfors, Complex Analysis, Third Edition, McGraw-Hill Book Company, New York, 1979.

UNIT- I	Chapter - 4	Sections 1.1 to 1.5
UNIT – II	Chapter - 4	Sections 2.1 to 2.3 & 3.1 to 3.2
UNIT – III	Chapter - 4	Sections 3.3 to 3.4&5.1 to 5.3
UNIT – IV	Chapter - 4	Sections 6.1 to 6.5
UNIT – V	Chapter - 5	Sections 1.1 to 1.3& 2.1 to 2.4

**REFERENCE(S):**

1. John B. Conway, Functions of one Complex Variable, Second Edition, Springer Graduate Texts in Mathematics, New York, 1978.
2. S.Ponnusamy, Foundations of Complex Analysis, Second Edition, Narosa Publishing House, India, 2005.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
<b>30</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>30</b>	<b>Global</b>

**Green - Local, Pink - Regional, Blue - National, Brown – Global**

**SEMESTER - II**  
**CORE COURSE –VIII- PARTIAL DIFFERENTIAL EQUATIONS**

**Course Code: 18PMA2CC8**  
**Hours: 6**  
**Credit: 5**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To give an in-depth knowledge of solving partial differential equations and apply them in scientific and engineering problems.
- To study the other aspects of PDE

**UNIT - I**

Partial Differential Equations - origins of first order Partial differential equations- Cauchy's problem for first order equations- Linear equations of the first order- Integral surfaces Passing through a Given curve.

**UNIT –II**

Cauchy's method of characteristics- compatible systems of first order equations- Charpits method- Special types of first order equations- Solutions satisfying given conditions.

**UNIT - III**

**Partial Differential Equations of the Second Order:** The origin of second order equations –second order equations in Physics –Higher order equations in Physics - Linear partial differential equations with constant co-efficient.

**UNIT - IV**

Characteristics of equations in three variables - The solution of Linear Hyperbolic equations - Separation of variables - The method of Integral Transforms – Non Linear equations of the second order.

**UNIT - V**

**Laplace Equation:** Elementary solutions of Laplace's equations-Families of equipotential Surfaces- Boundary value problems-Separation of variables –Problems with Axial Symmetry -The Theory of Green's Function for Laplace Equation.

**TEXT BOOK:**

1. Ian N. Sneddon, Elements of Partial differential equations, Dover Publication –INC, New York, 2006.

UNIT I	Chapter - 2	Sections 1 to 5
UNIT II	Chapter - 2	Sections 8 to 12
UNIT III	Chapter - 3	Sections 1 to 5
UNIT IV	Chapter - 3	Sections 7 to 11
UNIT V	Chapter - 4	Sections 2 to 6 ,8

**REFERENCE(S):**

1. M.D.Raisinghania, Advanced Differential Equations, S.Chand and company Ltd., New Delhi, 2001.
2. E.T.Copson, Partial Differential Equations, Cambridge University Press.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

25	0	0	0	25	Global
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Green - Local, Pink - Regional, Blue - National, Brown – Global

## SEMESTER - II

### CBE - 01- FUZZY SETS AND THEIR APPLICATIONS

Course Code: 18PMA2EC1:1

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To introduce the concept of fuzzy theory and study its application in real problems.
- To study the uncertainty environment through the fuzzy sets that incorporates imprecision and subjectivity into the model formulation and solution process.

#### UNIT – I

**Fuzzy Sets:**Crisp Set -Basic types and Basic Concepts – Fuzzy sets versus Crisp sets – Additional properties of  $\alpha$  cuts – Representations of Fuzzy sets – Extension Principle for Fuzzy sets.

#### UNIT – II

**Operations on Fuzzy Sets:**Types of Operations – Fuzzy Complements – Fuzzy Intersection –t norms – Fuzzy union – t Conorms – Combinations of Operations.

#### UNIT – III

**Fuzzy Arithmetic:**Fuzzy Numbers –Linguistic variable - Arithmetic operations on Intervals - Arithmetic operations on Fuzzy Numbers – Lattice of Fuzzy Numbers-Fuzzy Equations.

#### UNIT – IV

**Fuzzy Relations:**Crisp and Fuzzy Relations – Projections and Cylindric Extensions – Binary Fuzzy Relations – Binary Relations on a single set – Fuzzy Equivalence Relations–FuzzyCompatibility Relations .

#### UNIT – V

**Fuzzy Logic:**Multivalued logics – Fuzzy propositions – Fuzzy Quantifiers – Linguistic Hedges – Inference from conditional Fuzzy propositions

#### TEXT BOOK:

- George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 2004.

UNIT – I	Chapters - 1 & 2	Sections 1.2 to 1.4 &2.1 to 2.3
UNIT – II	Chapter - 3	Sections 3.1 to 3.5
UNIT – III	Chapter - 4	Sections 4.1 to 4.6
UNIT – IV	Chapter - 5	Sections 5.1 to 5.8
UNIT – V	Chapter - 8	Sections 8.1 to 8.8

#### REFERENCE(S):

- H.J.Zimmermann, Fuzzy set Theory and its Applications, Allied Publishers Limited, New Delhi, 1991.
- George J.Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic, Prentice Hall of India, New Delhi, 1995.
- Timothy J.Ross, Fuzzy logic with Engineering Applications, McGraw Hill, Inc, New Delhi, 2000.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
30	0	0	0	30	Global

**SEMESTER - II**  
**CBE - 01 – CONTROL THEORY**

**Course Code: 18PMA2EC1:2**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To understand Observability, Controllability, Stability and Optimal control of linear systems.
- To acquire the knowledge of stability and stabilizability.

**UNIT-I**

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

**UNIT-II**

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

**UNIT-III**

**Stability:** Stability – Uniform stability – Asymptotic stability of linear systems - Linear time varying systems – Perturbed linear systems – Nonlinear systems.

**UNIT-IV**

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

**UNIT - V**

**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.

UNIT-I Chapter-2

UNIT-II Chapter-3 Sections 3.1 to 3.3

UNIT-III Chapter-4

UNIT-IV Chapter - 5

UNIT-V Chapter - 6

**REFERENCE(S):**

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.
1. J.Klamka, Controllability of Dynamical Systems, Kluwer Academic Publisher, Dordrecht, 1991.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	0	0	0	25	Global

**SEMESTER - II**  
**CBE-02- PROBABILITY THEORY**

**Course Code: 18PMA2EC2:1**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To understand about fields,  $\sigma$ -fields and random variables.
- To know about Expectations, Convergence in random variables and distribution functions.

**UNIT - I**

**Sets and Classes of Events:** Fields and  $\sigma$  Fields -Class of events.

**Random variables:** Functions and Inverse functions – Random variables – Limits of random variables.

**UNIT - II**

**Probability Space:** Definition of probability – Some simple properties – Discrete probability space – General probability space – Induced probability space.

**UNIT - III**

**Distribution functions:** Distribution functions of a random variable –Decomposition of distributive functions - Distributive functions of vector random variables – Correspondence theorem.

**UNIT - IV**

**Expectation and Moments:** Definition of Expectation –Properties of expectation – Moments, in Qualities.

**UNIT - V**

**Convergence of Random Variables:** Convergence in Probability –Convergence almost surely – Convergence in distribution – Convergence in the  $r^{\text{th}}$  mean -Convergence theorems for Expectations.

**TEXT BOOK:**

1. B.R. Bhat, Modern Probability Theory, Third edition, New Age International private ltd, New Delhi, 2007.
 

UNIT - I	Chapters - 1& 2	Sections 1.3, 1.4 & 2.1 to 2.3
UNIT - II	Chapter - 3	Sections 3.1 to 3.5
UNIT - III	Chapter - 4	Sections 4.1 to 4.4
UNIT - IV	Chapter - 5	Sections 5.1 to 5.3
UNIT - V	Chapter - 6	Sections 6.1 to 6.5

**REFERENCE(S):**

1. Chandra T.K and Chatterjee D, A first course in probability, Second Edition, Narosa Publishing House, New Delhi, 2003.
2. Kailai Chung and Farid Aitsahlia, Elementary Probability, Springer Verlag 2003, New York.
3. Marek Capinski and Thomas Zastawniak, Probability through problems, Springer Verlag, New York, 2003.
4. Sharma .T.K, A text book of probability and theoretical distribution, Discovery publishing house, New Delhi, 2005.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>Global</b>

**SEMESTER - II**

**CBE - 02 - TENSOR ANALYSIS AND SPECIAL THEORY OF RELATIVITY**

**Course Code: 18PMA2EC2:2**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To introduce the notion of Tensor and study its properties.
- To analyse the theory of relativity.

**UNIT - I**

Invariance - Transformations of coordinates and its properties - Transformation by invariance - Transformation by covariance and contra variance - Covariance and contra variance - Tensor and Tensor character of their laws - Algebras of tensors - Quotient tensors - Symmetric and skew symmetric tensors - Relative tensors.

**UNIT - II**

Metric Tensor - The fundamental and associated tensors - Christoffel's symbols - Transformations of Christoffel's symbols- Covariant Differentiation of Tensors - Formulas for covariant Differentiation- Ricci Theorem - Riemann Christoffel Tensor and their properties.

**UNIT - III**

Einstein Tensor- Riemannian and Euclidean Spaces (Existence Theorem)-The e-systems and the generalized Kronecker deltas - Application of the e-systems.

**UNIT - IV**

**Special Theory of Relativity:** Galilean Transformation - Maxwell's equations - The ether Theory - The Principle of Relativity Relativistic Kinematics - Lorentz Transformation equations - Events and simultaneity - Example Einstein Train - Time dilation - Longitudinal Contraction - Invariant Interval - Proper time and Proper distance - World line - Examples - twin paradox - addition of velocities - Relativistic Doppler effect.

**UNIT - V**

**Relativistic Dynamics :** Momentum - energy - Momentum energy four vector - Force - Conservation of Energy - Mass and energy - Examples - inelastic collision - Principle of equivalence - Lagrangian and Hamiltonian formulations.

**Accelerated Systems:** Rocket with constant acceleration - Examples - Rocket with constant thrust.

**TEXT BOOK(S):**

1. I.S. Sokolnikoff, Tensor Analysis, John Wiley and Sons, New York, 1964
2. D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 1985

UNIT-I	Chapter-2	Sections 18 to 28 of [1]
UNIT-II	Chapter-2	Sections 29 to 37 of [1]
UNIT-III	Chapter-2	Sections 38 to 41 of [1]
UNIT-IV	Chapter- 7	Sections 7.1 & 7.2 of [2]
UNIT-V	Chapter- 7	Sections 7.3 & 7.4 of [2]

**REFERENCE(S):**

1. J.L. Synge and A.Schild, Tensor Calculus, Toronto, 1949.
2. A.S. Eddington, The Mathematical Theory of Relativity, Cambridge University Press, 1930.
3. P.G. Bergman, An Introduction to Theory of Relativity, New York, 1942.
4. C.E. Weatherburn, Riemannian Geometry and Tensor Calculus, Cambridge, 1938.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	

51	4	4	4	51	Global
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Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - III**

**CORE COURSE –IX- TOPOLOGY**

Course Code: 18PMA3CC9

Hours: 6

Credit: 5

Total Marks: 100

External Marks: 75

Internal Marks: 25

**OBJECTIVES:**

- To develop the knowledge of Topological spaces and continuity.
- To analyse the concept of connectivity and compactness.

**UNIT - I**

**Topological Spaces:** Topological spaces - Basis for a Topology - The order Topology - The Product Topology on  $X \times Y$  - The subspace Topology - Closed sets and Limit points.

**UNIT - II**

**Continuous Functions:** Continuous functions - The Product Topology - The Metric Topology (Continued)

**UNIT - III**

**Connectedness:** Connected spaces- Connected subspaces of the Real line - Components and Local Connectedness.

**UNIT - IV**

**Compactness:** Compact spaces - Compact subspaces of the Real line - Limit Point Compactness – Local Compactness.

**UNIT - V**

**Countability and Separation Axioms:** The Countability Axioms - The separation Axioms - Normal spaces - The Urysohn Lemma - The Urysohn Metrization Theorem - The Tietz Extension Theorem.

**TEXT BOOK:**

1. James R. Munkres, Topology, Second Edition, Pearson Education Pvt. Ltd., New Delhi, 2003.

UNIT – I	Chapter - 2	Sections 12 to 17
UNIT – II	Chapter - 2	Sections 18 to 21
UNIT – III	Chapter - 3	Sections 23 to 25
UNIT – IV	Chapter - 3	Sections 26 to 29
UNIT – V	Chapter - 4	Sections 30 to 35

**REFERENCE(S):**

1. J. Dugundji, Topology, Prentice Hall of India, New Delhi, 1975.
2. George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Co., 1963
3. J.L. Kelly, General Topology, Van Nostrand, Reinhold Co., New York
4. L. Steen and J. Seebach, Counter examples in Topology, Holt, Rinehart and Winston, New York, 1970.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
22	0	0	0	22	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - III**  
**CORE COURSE - X –CALCULUS OF VARIATIONS, INTEGRAL EQUATIONS AND TRANSFORMS**

**Course Code: 18PMA3CC10**  
**Hours: 6**  
**Credit: 5**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To introduce various types of Integral Equations and Integral Transforms and to solve these equations.
- To understand the concept of Calculus of variation and its applications.

**UNIT - I**

**Calculus of Variations:** Maxima and Minima – The Simplest Case – Natural Boundary and Transition conditions - Variational notation –more general case – Constraints and Lagrange’s multipliers – Variable end points – SturmLiouville problems-Hamilton’s Principle – Lagrange’ Equations..

**UNIT – II**

**Linear Integral Equations:** Definition - Regularity conditions– Special kind of Kernels – Eigen values and Eigen functions – Convolution Integral – The inner and scalar product of two functions – Notation.

**Integral Equations with Separable Kernels:** Reduction to a system of Algebraic equations – **Examples**– Fredholm alternative- **Examples** –An approximate method.

**UNIT –III**

**Method of Successive Approximations:** Iterative scheme **Examples**– Volterra Integral equation – **Examples**– Some results about the Resolvent kernel.

**Classical Fredholm Theory:** The method of solution of Fredholm – Fredholm’s first Theorem – Second Theorem – Third Theorem.

**UNIT – IV**

**Z-Transforms:** Definitions of the Z Transforms and examples – Basic operational properties of Z Transforms – The inverse Z Transforms and examples – **Applications** of Z Transforms to finite difference equations – Summation of infinite series.

**UNIT - V**

**Hankel Transform:** Definition – Inverse formula – Some important results for Bessel function – Linearity property – Hankel Transform of the derivatives of the function – Hankel Transform of differential operators – Parseval’s Theorem.

**TEXT BOOK(S):**

1. F.B. Hildebrand, Methods of Applied Mathematics, Second Edition, PHI, ND 1972.
2. Ram.P.Kanwal – Linear Integral Equations Theory and Technique, Academic Press 1971.
3. Lokenath Debnath, Dambaru Bhatta, Integral transforms and their applications, Third Edition, CRC press, A chapman & Hall Book.
4. Vasishtha, Gupta, Integral Transforms, Krishna Prakashan Media Pvt Ltd, India, 2008.
  - UNIT – I Chapter - 2 Sections 2.1 to 2.11 of [1]
  - UNIT – II Chapters - 1 & 2 of [2]
  - UNIT – III Chapters -3 & 4 of [2]
  - UNIT – IV Chapter - 12 Sections 12.3 to 12.7 of [3]
  - UNIT – V Chapter - 9 of [4]

**REFERENCE(S):**

1. S.J. Mikhlin, Linear Integral Equations (translated from Russian), Hindustan Book Agency, 1960.
2. I.N. Snedden, Mixed Boundary Value Problems in Potential Theory, North Holland, 1966.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
43	5	5	5	43	Global

**SEMESTER - III**

**CORE COURSE - XI - MEASURE THEORY AND INTEGRATION**

**Course Code: 18PMA3CC11**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To understand Measure on a Real Line, Borel Measure, Lebesgue Measure, Measure on Measurable Space.
- To acquire the knowledge of  $L^p$  Space and Product Space.

**UNIT – I**

**Measure on the Real line:** Lebesgue outer measure - Measurable Sets - Regularity - Measurable function - Borel and Lebesgue measurability - Hausdorff measures on the real line.

**UNIT - II**

**Integration of Functions of a Real Variable:** Integration of non-negative functions - The General Integral - Integration of Series - Riemann and Lebesgue Integrals.

**UNIT – III**

**Abstract Measure spaces:** Measures and Outer Measures – Extension of a Measure – Uniqueness of the Extension - Completion of a Measure - Measure spaces.

**UNIT – IV**

**Convergence:** Convergence in Measure - Almost Uniform Convergence.

**Signed Measures and Their Derivatives:** Signed Measures and the Hahn Decomposition – The Jordan Decomposition – The Radon-Nikodym Theorem.

**UNIT – V**

**Lebesgue Stieltjes Integration:** Lebesgue Stieltjes Measure – Applications to Hausdorff Measures.

**Measure and Integration in a Product space:** Measurability in a Product space – The product Measure and Fubini's Theorem.

**TEXT BOOK:**

1. G. De Barra, Measure Theory and Integration, New age international Publishing Limited, 2011.

UNIT - I	Chapter - 2	Sections 2.1 to 2.6
UNIT - II	Chapter - 3	Sections 3.1 to 3.4
UNIT - III	Chapter - 5	Sections 5.1 to 5.5
UNIT - IV	Chapters - 7 & 8	Sections 7.1, 7.2 & 8.1 to 8.3
UNIT - V	Chapter – 9 & 10	Sections 9.1, 9.2 & 10.1, 10.2

**REFERENCE(S):**

1. M.E. Munroe, Measure and Integratio, Addison - Wesley Publishing Company, Second Edition, 1971.
2. P.K. Jain, V.P. Gupta, Lebesgue Measure and Integration, New Age International Pvt Limited Publishers, New Delhi, 1986. (Reprint 2000).
3. Richard L. Wheeden and Antoni Zygmund, Measure and Integral: An Introduction to Real Analysis, Marcel Dekker Inc. 1977.
4. Inder, K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, New Delhi, 1997.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
24	0	0	0	24	Global

**SEMESTER - III**

**CBE-03 – ADVANCED OPERATIONS RESEARCH**

**Course Code: 18PMA3EC3:1**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To enlighten the field of operations research.
- To apply OR techniques in business and management problems.

**UNIT - I**

**Advanced Linear Programming:**Duality–MatrixDefinition of the Dual Problem – Optimal dual solution - Parametric Linear Programming – Parametric Changes in c - Parametric Changes in b

**Goal Programming:** A goal programming formulation – Goal programming Algorithms.

**UNIT - II**

**Integer Linear Programming:**Integer Programming Algorithm – Traveling Salesperson Problem.

**UNIT –III**

**Deterministic Dynamic Programming:**Recursive Nature of Computations in DP – Forward and Backward Recursion – Selected DP Applications

**UNIT –IV**

**Deterministic Inventory Models:**General Inventory Model – Role of Demand in the Development of Inventory models – Static Economic OrderQuantity(EOQ) models.

**UNIT –V**

**Decision Analysis:**Decision Making under Certainly-Analytic Hierarchy Process (AHP). – Decision Making under Risk – Decision under Uncertainty-Game theory.

**TEXT BOOK:**

1. Hamdy A. Taha, Operations Research, Pearson Publishing Company, Eighth Edition.

UNIT - I	Chapter – 7&8	Sections 7.4, 7.5& 8.1, 8.2
UNIT - II	Chapter -9	Sections 9.2 & 9.3
UNIT - III	Chapter - 10	Sections 10.1 to 10.3
UNIT - IV	Chapter - 11	Sections 11.1 to 11.3
UNIT - V	Chapter - 13	Sections 13.1 to 13.4

**REFERENCE(S):**

- 1.S.D.Sharma, Operations Research, KedarNath Ram Nath&Co.Publishers, New Delhi, 2010.
- 2.Mokther S. Bazaraa and C.M. Shetty, Willy, Non Linear Programming, Theory and Algorithms, New York .
3. Prem Kumar Gupta and D.S. Hira, S, Operations Research-An Introduction,.,

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	1	1	1	21	Global

### SEMESTER - III

#### CBE - 03 - METHODS OF MATHEMATICAL PHYSICS

Course Code: 18PMA3EC3:2

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To understand the concept of Bessel functions, Hermitian polynomials.
- To acquire knowledge of non-homogeneous boundary value problems.

#### UNIT - I

Boundary value problems and series solution - Examples of boundary value problems - Eigen values - Eigen functions - The Sturm-Liouville problem.

#### UNIT - II

Bessel functions - Bessel functions of the second kind - Legendre polynomials - Associated Legendre polynomials and spherical harmonics.

#### UNIT - III

Hermite polynomials - Laguerre polynomials - The Gamma function - The Dirac Delta function.

#### UNIT - IV

Non-homogeneous boundary value problems and Green's function - Green's function for one-dimensional problems - Eigen function expansion of Green's function - Fourier transform method of constructing Green's function.

#### UNIT - V

Green's function in higher dimensions - Green's function for Poisson's equation and a formal solution of electrostatic boundary value problems - Wave equation with source - the quantum mechanical scattering problem.

#### TEXT BOOK:

1. P.K. Chattopadhyay, Mathematical Physics, Wiley Eastern Limited, 1990.

UNIT-I	Chapter-4	Sections 4.2 to 4.4
UNIT-II	Chapter-5	Sections 5.1, 5.2, 5.4 & 5.5
UNIT-III	Chapter-5	Sections 5.6 to 5.9
UNIT-IV	Chapter-6	Sections 6.1 to 6.4
UNIT-V	Chapter-6	Sections 6.5 to 6.8

#### REFERENCE(S):

1. B.D. Gupta, Mathematical Physics, Vikas Publishing House Pvt Ltd, New Delhi, 1993.
2. Goyal AK Ghatak, Mathematical Physics, Differential Equations and Transform Theory, McMillan India Ltd, 1995.
3. Kryzew, Higher Engineering Mathematics.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
21	0	0	0	21	Global

Green - Local, Pink - Regional, Blue - National, Brown - Global

**SEMESTER - III**  
**CBE - 04 – STOCHASTIC PROCESSES**

**Course Code: 18PMA3EC4:1**  
**Hours: 6**  
**Credit: 4**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To understand the stochastic models for many real life probabilistic situations.
- To learn the well-known models like birth-death and queuing to reorient their knowledge of stochastic analysis.

**UNIT - I**

**Stochastic Processes-Some notions:** Specification of Stochastic Processes – Stationary Processes – **Markov Chains:**Definitions and **Examples**– Higher Transition Probabilities .  
**Generalization of Independent Bernoulli Trails:** Sequence of Chain– Dependent Trails-Classification of states and chains.

**UNIT - II**

**Markov Chains (continued):** Classification of States and Chains – Determination of Higher Transition Probabilities – Stability of a Markov System –Markov Chainwith Denumerable- Number of States- Reducible Chains – Markov Chains with Continuous State Space.

**UNIT - III**

**Markov Processes with Discrete State Space:**Poisson Processes and its Extensions – Poisson Process- Poisson Process and Related Distributions – Generalizations of Poisson Process- Birth and Death Process – Markov Processes with Discrete State Space (Continuous time Markov Chains).

**UNIT - IV**

**Renewal Processes and Theory:**Renewal Process – Renewal Processes in Continuous Time –Renewal Equation– Stopping Time- Wald’s Equation – Renewal Theorems-Delayed & equilibrium renewal process.

**UNIT - V**

**Stochastic Processes in Queuing and Reliability:** Queuing Systems - General Concepts – The Queuing Model M/M/1- Steady State Behaviour – Transient Behaviour of M/M/1 Model – The Queuing Model M/M/1/K.

**TEXT BOOK:**

1. J. Medhi, Stochastic Processes, Second edition, New Age International Publications, 2002.  
UNIT-I            Chapters - 2 & 3            Sections 2.1 to 2.3 &3.1 to 3.4  
UNIT-II            Chapter - 3                    Sections 3.4 to 3.6, 3.8, 3.9 &3.11  
UNIT-III          Chapter - 4                    Sections 4.1 to 4.5  
UNIT-IV          Chapter - 6                    Sections 6.1 to 6.6  
UNIT-V            Chapter - 10                  Sections10.1 to 10.3

**REFERENCE(S):**

1. Samuel Korlin, Howard M. Taylor, A first course in Stochastic Processes, Second Edition.
2. Narayan Bhat , Elements of Applied Stochastic Processes,
3. Srinivasan and Metha, Stochastic Processes, N.V. Prabhu, Macmillan (NY), Stochastic Processes.

Total	Number of Topics	Category
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Number of Topics	Local	Regional	National	Global	Based on %
33	1	1	1	33	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - III**  
**CBE - 04- COMBINATORICS**

Course Code: 18PMA3EC4:2

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

**OBJECTIVES:**

- To introduce the notion of different types of distributions of objects and generating functions.
- To know the Polya's enumeration theorems.

**UNIT - I**

Permutations and Combinations - Distributions of distinct objects - Distributions of non distinct objects –Stirlings formula.

**UNIT - II**

Generating functions -Generating function for Combinations -Enumerators for Permutations - distributions of distinct objects into nondistinct cells - Partitions of integers – The Ferrer's graphs - Elementary relations.

**UNIT - III**

Recurrence Relation- Linear Recurrence Relations with Constant coefficients solutions by the technique of generating functions - a special class of nonlinear difference equations -Recurrence Relations with two indices.

**UNIT - IV**

The principle of inclusion and exclusion - General formula - Permutations with restriction on relative positions - derangements - the rook polynomials - permutations with forbidden positions.

**UNIT - V**

Polya's theory of counting - equivalence classes under a permutation group Burnside theorem - equivalence classes of functions - weights and inventories of functions - Polya' s fundamental theorem – generation of Polya's theorem.

**TEXT BOOK:**

1. C.L. Liu, Introduction of Combinatorial Mathematics, McGraw Hill,1968.  
 UNIT – I Chapter - 1  
 UNIT – II Chapter - 2  
 UNIT – III Chapter - 3  
 UNIT – IV Chapter - 4  
 UNIT – V Chapter - 5

**REFERENCE(S):**

1. Marshall Hall Jr, Combinatorial Theory,SecondEdition,John Wiley & Sons.
2. H.J. Rayser, Combinatorial Mathematics, Carus Mathematical Monograph, No.14.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
27	0	0	0	27	Global

**SEMESTER - IV**

**CORE COURSE - XII – FUNCTIONAL ANALYSIS**

Course Code: 18PMA4CC12

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 5

Internal Marks: 25

**OBJECTIVES:**

- To know the theorems of Functional Analysis viz., Hahn-Banach theorem.
- To analyse the open mapping theorem and Uniform boundedness principle.

**UNIT - I**

**Banach Space:** Definition and some Examples- Continuous linear transformations – Hahn-Banach Theorem.

**UNIT - II**

**Banach Space (Continued):** Natural imbedding of  $\mathbb{N}$  in  $\mathbb{N}^{**}$ - Open mapping theorem - Conjugate of an operator.

**UNIT - III**

**Hilbert Spaces:** Definition and some simple properties - Orthogonal complements - Orthonormal sets - Conjugate space  $H^*$ .

**UNIT - IV**

**Hilbert Spaces (Continued):** Adjoint of an operator–Self-Adjoint operators - Normal and unitary operators - Projections.

**UNIT – V**

**Finite Dimensional Spectral Theory:** Matrices - Determinants and the spectrum of an operator - Spectral Theorem-A Survey of the situation.

**TEXT BOOK:**

1. G.F Simmons, Introduction to Topology and Modern Analysis, McGraw Hill International Book Company, 2004.

UNIT-I	Chapter-9	Sections 46 to 48
UNIT-II	Chapter-9	Sections 49 to 51
UNIT-III	Chapter-10	Sections 52 to 55
UNIT-IV	Chapter-10	Sections 56 to 59
UNIT-V	Chapter-11	Sections 60 to 62

**REFERENCE(S):**

1. Walter Rudin, Functional Analysis, TMH Edition, 1974.
2. Balmohan V. Limaye, Functional Analysis, Second Print, Wiley Eastern Limited, Bombay, 2005.
3. M. Thamban Nair, Functional Analysis, A First Course, Prentice Hall of India, 2002.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
18	1	1	1	18	Global

**SEMESTER - IV**  
**CORE COURSE - XIII – DIFFERENTIAL GEOMETRY**

**Course Code: 18PMA4CC13**  
**Hours: 6**  
**Credit: 4**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To understand the curvature and torsion of a space curve.
- To know Geodesics and the Non-Intrinsic properties of a surface.

**UNIT - I**

**Space Curves:** Definition of a space curve - Arc length – tangent normal and binormal - curvature and torsion - contact between curves and surfaces- tangent surface-Involutes and Evolutes- Intrinsic equations - Fundamental Existence Theorem for space curves- Helices.

**UNIT - II**

**Intrinsic Properties of a Surface:** Definition of a surface - curves on a surface - Surface of revolution - Helicoids - Metric- Direction coefficients- Families of curves.

**UNIT - III**

**Intrinsic Properties of a Surface(Continued):** Isometric correspondence- Intrinsic properties - **Geodesics:** Geodesics - Canonical geodesic equations- Normal property of geodesics.

**UNIT - IV**

**Geodesics(Continued):** Existence Theorems - Geodesic parallels - Geodesics curvature- Gauss Bonnet Theorem - Gaussian curvature- surface of constant curvature.

**UNIT - V**

**Local Non Intrinsic Properties of a Surface:** The second fundamental form- Principal curvature - Lines of curvature - Developables – Developable associated with space curves and with curves on surfaces - Minimal surfaces- Ruled surfaces.

**TEXT BOOK:**

1. T.J.Willmore, An Introduction to Differential Geometry, Oxford University Press, (17<sup>th</sup> Impression) New Delhi, 2005. (Indian Print).
 

UNIT – I	Chapter-1	Sections 1 to 9
UNIT – II	Chapter-2	Sections 1 to 7
UNIT – III	Chapter-2	Sections 8 to 12
UNIT – IV	Chapter -2	Sections 13 to 18
UNIT – V	Chapter- 3	Sections 1 to 8

**REFERENCE(S):**

1. Struik, D.T. Lectures on Classical Differential Geometry, Addison - Wesley, Mass. 1950.
2. Kobayashi .S and Nomizu.K, Foundations of Differential Geometry, Interscience Publishers, 1963.
3. WihelmKlingenberg: A course in Differential Geometry, Graduate Texts in Mathematics, Springer Verlag, 1978.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
<b>35</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>35</b>	<b>Global</b>

**Green - Local, Pink - Regional, Blue - National, Brown – Global**

## SEMESTER - IV

### CORE COURSE - XIV – NUMERICAL ANALYSIS

Course Code: 18PMA4CC14

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To develop a sound knowledge and appreciation the ideas and concepts related to polynomials, Interpolation.
- To give a strong foundation to take up advanced level courses in analysis.

#### UNIT - I

**Iteration methods based on second degree equation:** Chebyshev Method - Multipoint Iteration Methods - Brige Vieta Method - Bairstow Method - Graeffe's Root Squaring Method.

#### UNIT - II

**Iteration Methods:** Jacobi Iteration Method- Gauss Siedel Iteration Method- Successive over Relaxation Method – Iterative Method to determine  $A^{-1}$ -Eigen values and Eigen Vectors- Jacobi Method for symmetric Matrices - Power Method.

#### UNIT - III

**Interpolation and Approximation:**Hermite Interpolation - Piecewise and Spline Interpolation - cubic spline interpolation – Bivariate interpolation – Lagrange and Newton's Bivariate interpolation – Least square approximation – Gram Schmidt orthogonalizing process.

#### UNIT - IV

**Differentiation and Integration:**Numerical Differentiation – Methods Based on Interpolation – Partial Differentiation –Optimum choice of step length-Numerical Integration – Methods Based on Interpolation – Methods Based on Undetermined Coefficients – Gauss Quadrature methods - Gauss Legendre and Gauss ChebyshevIntegration Methods –Romberg integration-Double Integration– Trapezoidal and Simpson's Method – Simple Problems.

#### UNIT - V

**Solution of Ordinary Differential Equations:**Euler method-Backward Euler's Method – Mid point method - Taylor series Method – Rungekutta Method – Implicit Runge Kutta methods- Predictor Corrector methods.

#### TEXT BOOK:

- M.K.Jain, S.R.K. Iyenger, R.K.Jain, Numerical Methods for Scientific and Engineering computation, Forth Edition, 2003.

UNIT - I	Chapter - 2	Sections 2.4, 2.9
UNIT - II	Chapter - 3	Sections 3.4 to 3.6
UNIT - III	Chapter - 4	Sections 4.5 to 4.7, 4.9
UNIT - IV	Chapter - 5	Sections 5.2, 5.5 to 5.8, 5.11
UNIT - V	Chapter - 6	Sections 6.3, 6.4, 6.7

#### REFERENCE(S):

- M.K.Jain, Numerical Solution of Differential Equations, Second Edition, New age international pvt Ltd., 1983.
- S.S. Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India, New Delhi, 1998.
- M.K.Jain, S.R.K. Iyenger, R.K.Jain, Numerical Methods (problems and Solutions) Wiely Eastern Limited. 1994.

Total Number of Topics	Number of Topics				Category Based on %
	Regional	National	Global	Local	
40	1	1	1	40	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - IV**  
**CBE - 05 – ALGEBRAIC NUMBER THEORY**

**Course Code: 18PMA4EC5:1**  
**Hours: 6**  
**Credit: 4**

**Total Marks: 100**  
**External Marks: 75**  
**Internal Marks: 25**

**OBJECTIVES:**

- To expose the charm, niceties and nuances in the world of numbers.
- To highlight some of the Applications of the Theory of Numbers.

**UNIT - I**

**Algebraic congruence and Primitive Roots:** Algebraic Congruence - Reduction of  $f(x) \equiv 0 \pmod{m}$  - Primitive Roots - Theory of Indices.

**UNIT - II**

**Arithmetic Functions:** Arithmetic Functions – Euler’s Function – Divisor Function – The Function of  $\sigma$  - The Function  $\sigma_k(n)$  - The Mobius Function  $\mu(n)$  - The Function  $P(n) = \prod_{d|n} d$

**UNIT - III**

Farey Sequence – Continued Fractions – Notion of Convergents and Infinite Continued Fractions- Applications to Equations

**UNIT - IV**

Quadratic Irrationals – Pell’s Equation – Fibonacci Numbers.

**UNIT - V**

Quadratic Residues - Legendre’s Symbol–Quadratic Reciprocity Law - Quadratic Residue for Composite Modules: Jacobi’s Symbol.

**TEXTBOOK:**

1. K.C. Chowdhury, A First Course in Theory of Numbers, Asian Books Pvt. Ltd., New Delhi, 2004.
 

UNIT- I	Chapter-3	Section 3.1 to 3.4
UNIT-II	Chapter-4	Section 4.1 to 4.5
UNIT-III	Chapter-5	Section 5.1 to 5.4
UNIT-IV	Chapter-5	Section 5.5 to 5.7
UNIT-V	Chapter-6	Section 6.1 to 6.4

**REFERENCE(S):**

2. S.B.Malik, Basic Number Theory, Second Edition, Vikas Publishing House Pvt. Ltd., Noida, 2009.
3. George E. Andrews, Number Theory, Courier Dover Publications, 1994.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
<b>22</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>Global</b>

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - IV**  
**CBE – 05 -FINANCIAL MATHEMATICS**

**Course Code: 18PMA4EC5:2**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**OBJECTIVES:**

- To know the financial mathematics through various models.
- To apply the various aspects of financial mathematics.

**UNIT - I**

**Single Period Models:** Definitions from Finance - Pricing a forward–Onestep Binary Model - a ternary Model - Characterization of no arbitrage – Risk Neutral Probability Measure.

**UNIT - II**

**Binomial Trees and Discrete Parameter Martingales:** Multi period Binary model - American Options - Discrete parameter martingales and Markov processes - Martingale Theorems - Binomial Representation Theorem - Overturn to Continuous models.

**UNIT - III**

**Brownian Motion:** Definition of the process - Levy's Construction of Brownian Motion - The Reflection Principle and Scaling- Martingales in Continuous time.

**UNIT - IV**

**Stochastic Calculus:** Non differentiability of Stock prices - Stochastic Integration - Ito's formula - Integration by parts and Stochastic Fubini Theorem - Girsanov Theorem - Brownian Martingale Representation Theorem – Geometric Brownian Motion - The Feynman Kac Representation.

**UNIT - V**

**Block-Scholes Model:** Basic Block Scholes Model–BlockScholes price and hedge for European Options - Foreign Exchange -Dividends - Bonds -Market price of risk.

**TEXT BOOK:**

1. Alison Etheridge, A Course in Financial Calculus, Cambridge University Press, Cambridge, 2002.

**REFERENCE(S):**

1. Martin Baxter and Andrew Rennie, Financial Calculus: An Introduction to Derivatives Pricing, Cambridge University Press, Cambridge, 1996.
2. Damien Lamberton and Bernard Lapeyre, (Translated by Nicolas Rabeau and FrancoisMantion), Introduction to Stochastic Calculus Applied to Finance, Chapman and Hall, 1996.
3. MarekMusielala and MarekRutkowski, Martingale Methods in Financial Modeling, Springer Verlag, New York, 1988.
4. Robert J.Elliott and P.Ekkehard Kopp, Mathematics of Financial Markets, Springer Verlag, New York, 2001 (3rd Printing).

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
30	0	0	0	30	Global

**Green - Local, Pink - Regional, Blue - National, Brown – Global**





THANTHAI HANS ROEVER COLLEGE(AUTONOMOUS), ELAMBALUR, PERAMBALUR

**M.Phil Computer Science (FT/PT) Programme**

(For the candidates admitted from the academic year 2018-2019 onwards)



Semester	Course	Course Code	Course Title	No. of Hours	Credit	CIA Marks	SE Marks	Total Marks
I	Core Course-I	18MPMA1CC1	Research Methodology	6	4	40	60	100
	Core Course-II	18MPMA1CC2	Analysis and Applied Mathematics	6	4	40	60	100
	Core Course-III	18MPMA1CC3	Teaching and Learning Skills	6	4	40	60	100
	Core Course-IV	18MPMA1CC4	Paper on Topic of Research (The syllabus will be prepared by the Guide and the examination will be conducted by the COE)	6	4	40	60	100
<b>Total</b>				<b>24</b>	<b>16</b>	<b>160</b>	<b>240</b>	<b>400</b>
II	Project Work	18MPMA2DW	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	-	8	-	-	200
<b>Total</b>				<b>-</b>	<b>8</b>	<b>-</b>	<b>-</b>	<b>200</b>
<b>Grand Total</b>				<b>24</b>	<b>24</b>	<b>160</b>	<b>240</b>	<b>600</b>

## SEMSTER - I

### CORE COURSE I - RESEARCH METHODOLOGY

Course Code: 18MPMA1CC1

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

#### OBJECTIVES:

- To enable the students to acquire research skills
- To provide a comprehensive and clear description of the course.

#### UNIT-I

**Research Methodology:** An introduction– Defining the research problem– Research design - Research Ethics.

#### UNIT –II

Noetherian modules – Primary decomposition– Artinian modules

#### UNIT -III

**Real Analysis:** Vector spaces– Integration as linear functional- Topological preliminaries – Regularity properties of Borel measures.

#### UNIT – IV

**Complex Measures:** Total variation – Absolute – Continuity - Consequences of the Random Nikodym theorem - Bounded linear functional of  $L^p$  - Riesz representation Theorem.

#### UNIT – V

Homotopy of paths – The Fundamental group – Covering spaces –The Fundamental Group of the circle – Retractions and fixes Points – the fundamental theorem of algebra- the Borsuk Ulam Theorem – Deformation Retracts and Homotopy Type.

#### TEXT BOOK(S):

1. C.R.Kothari, Research Methodology, New Age International Publishers, Second Revised Edition Reprint (2009).
2. N. S. Gopalakrishnan, Commutative Algebra, Oxonian Press Private Ltd, New Delhi, Second Edition(1988).
3. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Company Limited, Third Edition (2006).
4. James R. Munkres, Topology a First Course, Prentice Hall of India Learning Private Ltd. (2009).

UNIT - I Chapter - 1, 2 & 3 Page No. 1 to 54 [1]

UNIT - II Chapter - 3 Sections 3.1 to 3.3 [2]

UNIT - III Chapter - 2 Sections 2.1 to 2.13, 2.15 to 2.18 [3]

UNIT - IV Chapter - 6 Sections 6.1 to 6.19 [3]

**REFERENCE(S):**

1. David S. Dummit and Richard M. Foote, Abstract Algebra, Wiley-Student Edition, India, Second Edition (2009).
2. G. De. Barra, Measure Theory and Integration, New Age International (P) Ltd., New Delhi, Reprint(2009).
3. P. R. Halmos, Measure Theory, D. Van Nostrand Company Inc, Princeton N.J. (1950).
4. Serge Lang, Algebra, Addition- Wesley Publishing Company, Sydney, London, Second Edition (1970).
5. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, Second Edition(2002).

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	0	0	0	25	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

## SEMESTER - I

### CORE COURSE II – ANALYSIS AND APPLIED MATHEMATICS

**Course Code: 18MPMA1CC2**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

#### OBJECTIVES:

- To apply physical insight and mathematical techniques
- To the solution of problems in pure and applied mathematics.

#### UNIT – I

**Functional Analysis:** Operators on Hilbert Spaces - The adjoint of an operator – self adjoint operator – Normal and Unitary operators – Projections – The spectrum of bounded operator – Spectral theorem for normal and self adjoint operator – The structure of commutative Banach Algebra - The Gelfand mapping – Application of the formula  $r(x) = \lim \|x^n\|^{1/n}$  – Involution in Banach Algebra - The Gelfand Neumark theorem

#### UNIT – II

**Differential Equation (Linear and Non-Linear systems):** Uncoupled linear systems – Diagonalization – Exponential of operators – The fundamental theorem for linear systems – linear system in  $\mathbb{R}^2$  – Complex Eigen values- Multiple Eigen Values - Some preliminary concepts and definitions – The fundamental existence– Uniqueness theorem.

#### UNIT – III

**Graph Theory:** Directed Graphs – Independent Sets & Matching – Graph Coloring.

#### UNIT – IV

**Operations Research:** Nonlinear Programming Algorithms - Unconstrained Algorithms – Constrained Algorithms.

#### UNIT - V

**Fuzzy Graph:** Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees.

#### TEXTBOOK(S):

1. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill International
2. L.Perko, Differential Equations and Dynamical Systems, Third Edition, Springer International Edition, (2009).
3. R.Balakrishnan&K.Ranganathan, A text Book of Graph Theory, Second Edition, Springer Science + Business Media, New York 2012.
4. Hamdy A. Taha, Operations Research an Introduction, Eighth Edition, Prentice Hall, Delhi.

5. A. NagoorGani and V. T. Chandrasekaran, A first look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd. Chennai, First Edition (2010).

UNIT-I	Chapter -12	Sections 64 - 69
	Chapter -13	Sections 70 - 73
UNIT-II	Chapter - 1 & 2	Sections 1.1 - 1.7 & 2.1 - 2.2 [2]
UNIT-III	Chapter-2,5 & 7	Sections 2.1 to 2.3, 5.1 to 5.4 & 7.1 to 7.5 of [3]
UNIT-IV	Chapter-19	Section 19.1 to 19.2.2 [4]
UNIT-V	Chapter - 3	Sections 3.1 – 3.3 [5]

**REFERENCE(S):**

1. Balmohan V Limaye, Functional Analysis, New Age International(P)Ltd.NewDelhi, SecondEdition (2009).
2. M.Murugan, Topics in Graph Theory and Algorithms, Muthali Publishing House, Annanagar, Chennai, First Edition (2003).
3. KantiSwaroop, Gupta.P.K,&Manmohan, Operations Research, Sultan Chand & Co, 16<sup>th</sup>Revised Edition.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
31	1	1	1	31	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

## SEMESTER - I

### CORE COURSE-III – TEACHING LEARNING SKILLS

**Course Code: 18MPMA1CC3**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

#### Course Objectives :

- Acquaint different parts of computer system and their functions.
- Understand the operations and use of computers and common Accessories.
- Develop skills of ICT and apply them in teaching learning context and Research.
- Appreciate the role of ICT in teaching, learning and Research.
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject.
- Understand the communication process through the web.
- Acquire the knowledge of Instructional Technology and its Applications.
- Develop different teaching skills for putting the content across to targeted audience.

#### Unit I:

##### Computer Application Skills

Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning– ICT applications: Using word processors, spread sheets, Power point slides in the classroom. ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations  
ICT for Professional Development: Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

#### Unit II:

##### Communications Skills

Communication: Definitions - Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise

**Types of Communication:** Spoken and Written; Non-verbal communication– Intrapersonal, interpersonal, Group and Mass communication

**Barriers to communication:** Mechanical, Physical, Linguistic & Cultural

Skills of communication: Listening, Speaking, Reading and Writing– Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary– Classroom communication and dynamics.

### **Unit III:**

#### **Pedagogy**

**Instructional Technology:** Definition, Objectives and Types – Difference between Teaching and Instruction– Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation- Versatility of Lecture technique

**Demonstration:** Characteristics, Principles, planning Implementation and Evaluation –

**Teaching-learning Techniques:** Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

### **Unit IV:**

#### **E- Learning, Technology Integration and Academic Resources in India**

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching learning processes; frameworks guiding technology integration (likeTPACK; SAMR); Technology Integration Matrix- Academic Resources inIndia:MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-SodhSindhu; virtual labs;eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

### **Unit V:**

#### **Skills of Teaching and Technology based assessment**

Teaching skills:Definition, Meaning and Nature - Types of Teaching Skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills-

**Technology for Assessment:**Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; erubrics, etc.); online assessment (open-source software's; e-portfolio; quiz makers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

## REFERENCES

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Brandon Hall, E-learning, A research note by Namahn, found in: [www.namahn.com/resources/ .../note-e-learning.pdf](http://www.namahn.com/resources/.../note-e-learning.pdf), Retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
4. Information and Communication Technology in Education: A Curriculum for schools and programmed of Teacher Development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002.
5. Jereb, E., & Šmitek, B. (2006). Applying multimedia instruction in elearning. *Innovations in Education & Teaching International*, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, New Age International Publishers, New Delhi.
7. Learning Management system: [https://en.wikipedia.org/wiki/Learning\\_management\\_system](https://en.wikipedia.org/wiki/Learning_management_system) Retrieved on 05/01/2016
8. Mangal, S.K (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana.
9. Michael, D and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York.
10. Pandey, S.K (2005) Teaching communication, Commonwealth Publishers, New Delhi.
11. Ram Babu, Aabd Dandapani, S (2006), Microteaching (Vol.1 & 2), Neelkamal Publications, Hyderabad.
12. Singh, V.K and Sudarshan K.N. (1996), Computer Education, Discovery Publishing Company, New York.
13. Sharma, R.A., (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
14. Vanaja, M and Rajasekar, S (2006), Computer Education, Neelkamal Publications, Hyderabad.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
33	0	0	0	33	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global

## SEMESTER - I

### CORE COURSE IV: GRAPHTHEORY

Course Code: 18MPMA1CC4

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

Name of the Supervisor:

Name of the Scholar:

Title of the Course:

Register Number:

**Unit I:**TreesandFundamental Circuits

**Unit II:**Cut-sets and cut-vertices

**Unit III:**Planar and Dual Graphs

**Unit IV:**Colouring - Covering and Partitioning

**Unit V:** Directed Graphs

**Text Book:**

NarsinghDeo, Graph Theory with applications to Engineering and computer Science, PHI Learning, New Delhi, 2011.

Unit I : Chapter 3-Sections 3.1 to 3.10

Unit II : Chapter 4-Sections 4.1 to 4.8

Unit III : Chapter 5-Sections 5.1 to 5.9

Unit IV : Chapter 8-Sections 8.1 to 8.6

Unit V: Chapter 9-Sections 9.1 to 9.11

**Reference:**

1. Harary, Graph Theory, Narosa Publishing House, 1989.
2. J.A.Bondy, U.S.R.Murthy, Graph theory with Applications, Mac Milan press, 1976.

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
6	0	0	0	6	Global

Green - Local, Pink - Regional, Blue - National, Brown – Global

**SEMESTER - I**

**CORE COURSE IV: OPERATIONS RESEARCH**

**Course Code: 18MPMA1CC4**

**Total Marks: 100**

**Hours: 6**

**External Marks: 75**

**Credit: 4**

**Internal Marks: 25**

**Name of the Supervisor:**

**Name of the Scholar:**

**Title of the Course:**

**Register Number:**

**UNIT I:**

**Dynamic Programming**

Elements of the DP Model - The Capital Budgeting- More on the Definition of the state -  
Examples of DP models and computations- Problem of Dimensionality in Dynamic  
programming- Solution of Linear programs by Dynamic programming.

**UNIT II:**

**Decision Theory and Games**

Decisions under Risk- Decision Tree - Decisions Under Uncertainty - Game Theory.

**UNIT III:**

**Inventory Models**

The ABC Inventory System- Generalized Inventory Models– Deterministic Models – Just in  
Time (JIT) manufacturing system.

**UNIT IV:**

**Queuing Models**

Role of Poisson and Exponential Distribution- Processes Birth and Fousson and Death- Queues  
with Combined Arrival and Departures - Non-Poisson Queues - Queues with Priorities for  
Service - Random or Series Queues.

**UNIT V:**

**Nonlinear Programming**

Unconstrained Extremal Problems -Constrained Extremal Problems- Nonlinear Programming  
Algorithm- Unconstrained Nonlinear Algorithms - Constrained Nonlinear Algorithms.

**Text Book:**

1. Operations Research - An Introduction (Fifth Edition - 1996) H.A.Taha, Prentice Hall of India (P) Limited, New Delhi, 1996.

UNIT – I	Chapter – 10
UNIT – II	Chapter – 12
UNIT – III	Chapter – 14
UNIT – IV	Chapter – 15
UNIT – V	Chapter – 19 & 20

**Reference Books:**

1. D. Phillips, A. Ravindran, Solberg, Operations Research: Principals and Practice, JOHN WILEY & SONS (1976).
2. S.S.Rao, Engineering Optimization, (3rd Edition, 1996), New Age International (p) Ltd, New Delhi - 110 002

Total Number of Topics	Number of Topics				Category Based on %
	Local	Regional	National	Global	
25	3	3	3	25	Global

**Green** - Local, **Pink** - Regional, **Blue** - National, **Brown** – Global