

## **DEPARTMENT OF MATHEMATICS**

**With effect from the academic year 2017 - 18**

### **Aim**

The programme lays a strong foundation in various branches of Mathematics. It aims at imparting knowledge, developing problem solving skills, cultivating logical thinking and creating interest for further studies. It also envisages in acquiring problem solving skills for competitive examinations, numerical ability in core and interdisciplinary areas which would widen the scope of career prospects.

### **Objectives**

1. To enable the students to have keen exposure to the different branches of Mathematics so as to grasp a comprehensive knowledge of Mathematics.
2. To facilitate the students of B.Sc. Mathematics to join post graduate studies which in turn will offer them job opportunities and research pursuits.
3. To cultivate logical thinking and analytical skills which will sharpen their concentration and critical analysis.
4. To help the students of Mathematics to apply the skills and knowledge gained through the study of Mathematics to real life situations and face competitive examinations with confidence.

### **Eligibility Norms for Admission**

Those who seek admission to B.Sc. Mathematics must have passed the Higher Secondary Examinations conducted by the Board of Higher Secondary Examination, Tamil Nadu with Mathematics as one of the subjects or any other examination recognized and approved by the Syndicate of the Manonmaniam Sundaranar University, Tirunelveli.

**Duration of the Programme:** 3 Years

**Medium of Instruction:** English

### **Passing Minimum**

A minimum of 40% in the external examination and an aggregate of minimum 40% is required. There is no minimum pass mark for Continuous Internal Assessment.

### Courses Offered

Semester	Course	Subject code	Paper	Hours/week	Credit
<b>I</b>	<b>Part I</b>	TL1711	Language: Tamil	6	3
		FL1711	French		
	<b>Part II</b>	GE1711	General English: A Stream	6	3
		GE1712	B Stream		
	<b>Part III</b>	MC1711	Major Core I: Differential Calculus and Trigonometry	6	5
		MA1711	Allied I: Algebra and Calculus (for Physics and Chemistry)	6	5
	<b>Part IV</b>	AEC171	Ability Enhancement Compulsory Course (AECC): English Communication	2	2
		MNM171	Non Major Elective Course (NMEC): Mathematics for life - I	4	2
		VEC172	Foundation Course I : Values for Life	-	-
	<b>Part V</b>	SDP172	Skill Development Programme (SDP) - Certificate Course	-	-
STP174		Student Training Programme (STP) - Clubs & Committees / NSS	-	-	
	<b>Part I</b>	TL1721	Language Tamil	6	3
		FL1721	French		
	<b>Part II</b>	GE1721	General English A Stream	6	3

<b>II</b>		GE1722	B Stream			
	<b>Part III</b>	MC1721	Major Core II: Classical Algebra and Integral Calculus	6	5	
		MA1721	Allied II: Vector Calculus and Differential Equations (for Physics and Chemistry)	6	5	
	<b>Part IV</b>	AEC172	Ability Enhancement Compulsory Course (AECC): Environmental Studies	2	2	
		MNM172	Non Major Elective Course (NMEC): Mathematics for life – II	4	2	
		VEC172	Foundation Course I: Values for Life	-	1	
	<b>Part V</b>	SDP172	Skill Development Programme (SDP): Certificate Course	-	1	
		STP174	Student Training Programme (STP): Clubs & Committees / NSS	-	-	
	<b>III</b>	<b>Part I</b>	TL1721	Language: Tamil	6	3
			FL1721	French		
<b>Part II</b>		GE1721	General English: A Stream	6	3	
		GE1722	B Stream			
<b>Part III</b>		MC1731	Major Core III: Differential Equations and Vector Calculus	6	4	
		MC1732	Major Core IV: Sequences and series	5	4	

		MA1731	Allied III: Probability Theory and Distributions	5	5
	<b>Part IV</b>	SBC173/ SBC174	Skill Based Course (SBC): Meditation and Exercise / Computer Literacy	2	2
		VEC174	Foundation Course II: Personality Development	-	-
	<b>Part V</b>	STP174	Student Training Programme (STP): Clubs & Committees / NSS	-	-
		SLP173	Service Learning Programme (SLP): Extension Activity (RUN)	-	1
<b>IV</b>	<b>Part I</b>	TL1741/ FL1741	Language Tamil French	6	3
		<b>Part II</b>	GE1741	General English A Stream	6
	GE1742		B Stream		
	<b>Part III</b>	MC1741	Major Core V: Groups and Rings	6	5
		MC1742	Major Core VI: Analytical Geometry - 3 Dimensions	5	4
		MA1741	Allied IV: Applied Statistics	5	5
	<b>Part IV</b>	SBC173/ SBC174	Skill Based Course (SBC): Meditation and Exercise / Computer Literacy	2	2
		VEC174	Foundation Course II - Personality Development	-	1
			Student Training Programme (STP):	-	1

	<b>Part V</b>	STP174	Clubs & Committees / NSS		
<b>V</b>	<b>Part III</b>	MC1751	Major Core VII: Linear Algebra	6	5
		MC1752	Major Core VIII: Real Analysis	6	5
		MC1753	Major Core IX: Graph Theory	6	5
		MC1754	Major – Project	5	5
		MC1755 MC1756 MC1757	Elective I: (a) Numerical Methods (b) Fuzzy Mathematics (c) Object Oriented Programming with C++	5	4
	<b>Part IV</b>	MSK175	Skill Based Course (*SBC): Mathematics for Competitive Examination – I	2	2
		HRE175	Foundation Course III: Human Rights Education (HRE)	-	1
	<b>Part III</b>	MC1761	Major Core X: Complex Analysis	6	5
		MC1762	Major Core XI: Mechanics	6	5
		MC1763	Major Core XII: Number Theory	5	5
MC1764		Major Core XIII: Operations Research	5	5	
MC1765 MC1766 MC1767		Elective II: (a) <b>Astronomy</b> (b) Boolean Algebra (c) Web Designing with HTML	6	5	

<b>VI</b>	<b>Part IV</b>	MSK176	Skill Based Course(*SBC): Mathematics for Competitive Examination-II	2	2
		WSC176	Foundation Course IV : Women's Studies (WS)	-	1
			<b>TOTAL</b>	<b>180</b>	<b>140+3</b>

### **B.Sc. Programme Outcomes (PO)**

<b>PO</b>	<b>Upon completion of the B.Sc. Degree Programme, the graduates will be able to</b>
PO - 1	apply the acquired scientific knowledge to face day to day needs.
PO - 2	create innovative ideas through laboratory experiments.
PO - 3	carry out field works and projects independently and in collaboration with other institutions and industries.
PO - 4	reflect upon green initiatives and take responsible steps to build a sustainable environment.
PO - 5	face challenging competitive examinations that offer rewarding careers in science and education.
PO - 6	impart communicative skills and ethical values.
PO - 7	equip students with hands on training through various courses to enhance entrepreneurship skills.

### PROGRAMME SPECIFIC OUTCOMES (PSO)

<b>PSO</b>	<b>Upon completion of B.Sc. Mathematics, the graduates will be able to</b>	<b>PO Addressed</b>
PSO - 1	acquire a strong foundation in various branches of mathematics to formulate real life problems into mathematical models.	PO - 1
PSO - 2	develop problem solving skills, cultivating logical thinking, and face competitive examinations with confidence	PO - 5
PSO - 3	enhance numerical ability and address problems in interdisciplinary areas which would help in project and field works.	PO - 3
PSO - 4	apply the mathematical knowledge and skills to face competitive examination with confidence.	PO - 5
PSO - 5	pursue higher studies which in turn will offer them job opportunities in government and public sector undertakings, banks, central government institutes etc.	PO - 5
PSO - 6	develop entrepreneurial skills, become empowered and self-dependent in society.	PO - 7
PSO - 7	understand the professional, ethical, legal, security, social issues and responsibilities.	PO - 4
PSO - 8	apply knowledge of principles, concepts and results in specific subject area to analyse their local and global impact.	PO - 3
PSO - 9	communicate appropriately and effectively, in a scientific context using present technology and new findings.	PO - 6

**Semester** : III  
**Name of the course** : Probability Theory and Distributions (Allied)  
**Course Code** : MA1731

No. of hours	Credit	Total No. of hours	Marks
5	5	75	100

**Objectives:**

1. To impart knowledge on the basic concepts of Probability theory and Probability distributions
2. To apply the theory in real life situations

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the definition of probability and set functions	PSO – 1	R
CO - 2	differentiate between probability and conditional probability and compute according to the requirement	PSO – 4	An
CO - 3	understand the definition of random variables, their types and related concepts	PSO – 1	U
CO - 4	detect the different probability distributions which are widely used	PSO – 4	An
CO - 5	apply the techniques to prove the properties of probability and related distributions	PSO – 8	Ap
CO - 6	choose the suitable probability distribution corresponding to a given data	PSO – 5	E
CO - 7	test the validity of a given data	PSO - 9	E



## Unit I

Probability - Experiment - Sample space - Events - Conditional probability - Properties - independent events - Multiplication rule of probability - Baye's Theorem.

## Unit II

Random Variables - Discrete and continuous random variables - Probability density function - Distribution function - Mathematical expectations - Mean and variance.

## Unit III

Moment generating function - Properties - Cumulant generating function - Characteristic function - Poisson distribution - Recurrence formula for moments - Fitting of Poisson distribution.

## Unit IV

Binomial distribution - Moment generating function about origin and mean - Recurrence formula for moments - Mode of Binomial distribution - Fitting of Binomial distribution.

## Unit V

Normal Distribution - Properties of Normal curve - Moment generating function about origin and mean - Moments - Standard Normal distribution - Fitting of Normal distribution by area method and ordinate method.

### Text Book:

Arumugam, S., & others. (2006). Statistics. New Gamma Publishing House.  
Chapter 11: 11.1 - 11.2; Chapter 12: 12.1 - 12.6; Chapter 13: 13.1 - 13.3.

### Reference Books:

1. Kapur, J.N., & Saxena. (1986). Mathematical Statistics. (12<sup>th</sup> Edition). Chand & Company.
2. Pillai, R.S.N., & Bagavathi, V. (1989). Statistics. (12<sup>th</sup> Edition). Chand & Company.
3. Mangaladoss., & others. (1994). Statistics and its application. Suja Publishing House.
4. Sharma, J.N., & Goyal, J. K. (1987). Mathematical Statistics. (11<sup>th</sup> Edition). Krishna Bakashar Mandir.
5. Gupta, S.P. (2012). Statistical Methods. (42<sup>nd</sup> Edition). Sultan Chand and Sons.

**Semester** : IV  
**Name of the course** : Applied Statistics (Allied)  
**Course Code** : MA1741

No. of hours per week	Credit	Total No. of hours	Marks
5	5	75	100

**Objectives:**

1. To acquire the knowledge of correlation theory and testing hypothesis
2. To solve research and application oriented problems

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO – 1	identify and demonstrate appropriate sampling processes	PSO – 8	An
CO – 2	recall the methods of classifying and analyzing data relative to single variable	PSO – 1	R
CO - 3	describe the $\chi^2$ distribution in statistics	PSO – 7	U
CO - 4	distinguish between the practical purposes of a large and a small sample	PSO – 8	An
CO - 5	understand that correlation coefficient is independent of the change of origin and scale	PSO – 4	U

## Unit I

Correlation - Properties of correlation coefficient - Rank correlation - Regression - Equation of regression lines - Angle between regression lines.

## Unit II

Test of significance - Sampling - Sampling distribution - Testing of hypothesis - Procedure for testing of hypothesis for large samples - Test of significance for proportions and percentages.

## Unit III

Test of significance for means, difference of sample means, standard deviation and correlation coefficient.

## Unit IV

Test of significance for small samples - Test of significance based on t-distribution - Test of significance based on F-test - Test of significance of an observed sample correlation.

## Unit V

Test based on  $\chi^2$ -distribution -  $\chi^2$  test for population variance, goodness of fit and independence of attributes - Yate's Correction.

### Text Book:

Arumugam, S., & Thangapandi Isaac, A. (2006). Statistics. New Gamma Publishing House. Palayamkotai.

Chapters: 6, 14, 15, 16.

### Reference Books:

1. Kapur, J. N., & Saxena. (1986). Mathematical Statistics. (12<sup>th</sup> Edition). Chand & Company.
2. Pillai, R. S. N., & Bagavathi, V. (1989). Statistics. (12<sup>th</sup> Edition). Chand & Company.
3. Mangaladoss., & Others. (1994). Statistics and its Application. Suja Publishing House.
4. Sharma, J. N., & J. K. Goyal. (1987). Mathematical Statistics. (11<sup>th</sup> Edition). Krishna Bakashar Mandir.
5. Robert, V., Hogg., Joseph., Mckean, W., Allen., & Craig, T. (2013). Introduction to Mathematical Statistics. (6<sup>th</sup> Edition). Dorling Kindersley (India) Pvt. Ltd.

**Semester** : V  
**Name of the course** : Numerical Methods – Elective I (a)  
**Course Code** : MC1755

No. of hours per week	Credits	Total No. of hours	Marks
5	4	75	100

**Objectives:**

1. To study Numerical differentiation and Numerical integration using different formulae
2. To develop various methods for solving applied scientific problems

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	understand the basic definitions and meaning of interpolation	PSO - 1	U
CO - 2	select appropriate numerical methods and apply the same to various types of problems	PSO - 1	U
CO - 3	apply numerical methods to obtain approximate solutions to mathematical problems	PSO - 3	Ap
CO - 4	employ different methods of constructing a polynomial using various methods	PSO - 2	A
CO - 5	compare the rate of convergence of different numerical formula	PSO - 4	An
CO - 6	distinguish the advantages and disadvantages of various numerical methods	PSO - 4	An

## Unit I

Solutions of algebraic and transcendental equations. Iteration method - Newton Raphson method - Finite difference - Difference operators.

## Unit II

Newton's Interpolation formulae - Lagrange's Interpolation formula - Divided difference - Newton's divided difference formula.

## Unit III

Numerical differentiation - Derivatives using Newton's forward difference formula - Backward difference formula.

## Unit IV

Numerical integration - Newton cote's - quadrature formula - Trapezoidal rule - Simpson's  $(1/3)^{\text{rd}}$  rule - Simpson's  $(3/8)^{\text{th}}$  rule.

## Unit V

Numerical solution of differential equation - Taylor's series method - Picard's method.

## Text Book:

Arumugam, S., Thangapandi Issac, A., & Somasundaram, A. (2002). Numerical Methods. Scitech Publications Pvt. Ltd.

Chapter 3: Sections 3.0, 3.2 & 3.5 Chapter 6: Sections 6.1;

Chapter 7: Sections 7.1, 7.3 - 7.5;

Chapter 8: Sections 8.1, 8.2 & 8.5 (except Weddle's rule, Boole's rule & Romberg's method) & Chapter 10: Sections 10.1 & 10.2.

## Reference Books:

1. Sastry, S.S. (2003). Introduction methods of numerical analysis. ( $3^{\text{rd}}$  Edition). Prentice Hall of India.
2. Scar Borough, J.N. (1966). Numerical mathematical analysis. ( $6^{\text{th}}$  Edition). Oxford and IBH Publishing Co.
3. Gupta, P. P., G.S.Malik., & Sanjay Gupta. (1992). Calculus of finite differences and numerical analysis. ( $16^{\text{th}}$  Edition). KRISHNA Prakashan Mandir.
4. Devi Prasad. (2010). An Introduction to Numerical Anaysis. Narosa Publishing House.
5. Bhupendra Singh. (2012). Numerical Analysis. ( $2^{\text{nd}}$  Edition). Pragati Prakashan Educational Publishers.

**Semester** : VI  
**Name of the course** : Mechanics  
**Course Code** : MC1762

No. of hours per week	Credits	Total No. of hours	Marks
6	5	90	100

**Objectives:**

1. To study the application of Mathematics in Physical Sciences
2. To solve related problems

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	calculate the reactions necessary to ensure static equilibrium	PSO - 2	U
CO - 2	apply the principles of static equilibrium to particles and rigid bodies	PSO - 4	Ap
CO - 3	understand the ways of distributing loads	PSO - 7	U
CO - 4	identify internal forces and moments of a rigid body	PSO - 6	U
CO - 5	apply the basic principles of projectiles into real world problems	PSO - 2	Ap
CO - 6	classify the laws of friction	PSO - 4	An
CO - 7	describe energy methods for particles and systems of particles	PSO - 1	U
CO - 8	understand the general principles of dynamics	PSO - 7	U
CO - 9	differentiate the various frictional forces	PSO - 2	An

## Unit I

Lami's Theorem - Parallel Forces, like and unlike parallel forces - Equilibrium of three coplanar forces - Centre of two parallel forces - Moments - Varignon's theorem of moments - Generalised theorem of moments.

## Unit II

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

## Unit III

Friction - Statical, Dynamical and Limiting friction - Laws of friction - Coefficient of friction - Angle of friction - Cone of friction - Equilibrium of a body on a rough inclined plane - Problems on friction.

## Unit IV

Projectiles - Equation of path - Characteristics of the motion of the projectile - Maximum horizontal range - Two directions of projection for a given velocity - Velocity of the projectile.

## Unit V

Simple Harmonic Motion in a straight line - General solution of the SHM - Geometrical representation - Change of origin - Simple harmonic motion on a curve - Simple pendulum - Period of oscillation of a simple pendulum - Equivalent simple pendulum - Seconds pendulum.

### Text Books:

1. Venkataraman, M. K. (2012). Statics. (15<sup>th</sup> Edition). Agasthiar Publications. Chapter 2: Section 2.9; Chapter 3: Sections 3.1 to 3.13; Chapter 6: Sections 6.1 to 6.3 (Analytical proof only), 6.5, 6.7, 6.8, 6.13; Chapter 7: Sections 7.1 to 7.13 (up to example 15).
2. Venkataraman, M. K. (2012). Dynamics. (15<sup>th</sup> Edition). Agasthiar Publications. Chapter 6: Sections 6.1 to 6.10; Chapter 10: Sections 10.1 to 10.5, 10.11 to 10.15.

### Reference Books:

1. Durai Pandian, P., Lexmi Durai Pandian., & Muthamizh Jayapragasam. (2011). Mechanics. Chand S. & Company Ltd.
2. Rajeshwari, I. (2016). Mechanics. (1<sup>st</sup> Edition). Saras Publication.
3. Chaudhry, K. R., & Aggarwal, A. C. (1983). Elements of Mechanics. Chand, S.& Company Ltd.
4. Mathur, D. S. (1985). Mechanics. S.Chand & Company Ltd.
5. John., Synge, L., Byron., & Griffith, A. (1970). Principles of Mechanics. (International Student Edition). McGraw - Hill Kogakusha Ltd.

**Semester** : VI  
**Name of the course** : Operations Research  
**Course Code** : MC1764

No. of hours per week	Credits	Total No. of hours	Marks
5	5	75	100

**Objectives:**

1. To formulate real life problems into mathematical problems
2. To solve life oriented and decision making problems by optimizing the objective function

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	understand the origin and development of Operations Research	PSO - 1	U
CO - 2	explain what is an LPP	PSO - 1	U
CO - 3	define how to formulate an LPP with linear constraints	PSO - 1	R
CO - 4	maximize the profit, minimize the cost, minimize the time in transportation problem , Travelling salesman problem, Assignment problem	PSO - 3	Ap
CO - 5	identify a problem in your locality, formulate it as an LPP and solve	PSO - 4	C



## Unit I

Introduction - Origin and Development of Operations Research - Nature and features of Operations Research - Applications of Operations Research - Formulation of L.P.P - Mathematical Formulation of L.P.P - Solution of L.P.P - Graphical method.

## Unit II

Simplex method - Big-M Method - Algorithm for Big-M Method - Two phase method - Phase I: Solving auxiliary LPP using Simplex method - Phase II: finding optimal basic feasible solution.

## Unit III

Duality in L.P.P - Primal - Formation of dual L.P.P - Matrix form of primal and its dual - Fundamental theorem of duality - Dual simplex method - Dual Simplex Algorithm - Degeneracy and cycling in L.P.P.

## Unit IV

Transportation problems - Mathematical formulation of Transportation Problems - Dual of a Transportation Problem - solution of a Transportation Problem - North-West corner rule - Row minima method - Column minima method - Least cost method - Vogel approximation method.

## Unit V

Assignment Problems - Mathematical formulation - Solution to assignment problems - Hungarian Algorithm for solving Assignment Problem - Travelling Salesman Problem.

### Text book:

1. Kanti Swarup., Gupta, P. K., & Man Mohan. (2009). Operations Research. Sultan Chand & Sons.
2. Arumugam, S., & Thangapandi Issac, A. (2015). Operations Research (Linear Programming). (1<sup>st</sup> Edition). New Gamma Publishing house.  
Chapter 3: 3.1 - 3.7, 3.9, 3.10; Chapter 4: 4.1; Chapter 5: 5.1, 5.2

### Reference Books:

1. Gupta, P.K., & Hira, D.S. (1997). Operations Research. S.Chand and Co. Ltd.
2. Sankara Narayanan, T., & Joseph A. Mangaladoss. (2004). Operations Research. (5<sup>th</sup> Edition). Persi - Persi Publications.
3. Handy, A. Taha. (1989). Operations Research - An Introduction. (3<sup>rd</sup> Edition). Mac Millan Publishing Co. Inc.
4. Vittal, P. R., & Malini, V. (2013). Operations Research. Margham Publications.
5. Sharma, J. K. (2013). Operations Research – Theory and Applications. (5<sup>th</sup> Edition). Macmillan Publishers India Ltd.

**Semester** : VI  
**Name of the course** : Astronomy – Elective II (a)  
**Course Code** : MC1765

No. of hours per week	Credits	Total No. of hours	Marks
6	5	90	100

**Objectives:**

1. To introduce space science and to familiarize the important features of the planets, sun, moon and stellar universe
2. To predict lunar and solar eclipses and study the seasonal changes.

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	define the spherical trigonometry of the celestial sphere	PSO - 1	U
CO - 2	discuss the Kepler's laws	PSO - 1	U
CO - 3	calculate the maximum and minimum number of eclipses near a node in a year	PSO - 2	Ap
CO - 4	interpret latitude and longitude and apply this to find the latitude and longitude of a particular place	PSO - 4	E
CO - 5	distinguish between geometric parallax and horizontal parallax	PSO - 4	An

## Unit I

Spherical trigonometry (only the four formulae) Celestial sphere - Four systems of coordinates - Diurnal motion - Sidereal Time - Hour angle and Azimuth at rising - Morning and Evening stars - Circumpolar stars.

## Unit II

The Earth - Zones of the earth - Perpetual Day and Perpetual night - Terrestrial latitude and longitude - Dip of Horizon - Twilight, Duration of Twilight, Twilight throughout night, Shortest Twilight.

## Unit III

Refraction - Tangent formula, Constant of Refraction, Refraction on Horizontal and Vertical arcs, Refraction of any arc, Cassini's Formula, Horizontal Refraction. Geocentric parallax - Horizontal parallax - Effect of Geocentric parallax on Right Ascension and Declination - Angular diameter - Geocentric parallax and Refraction.

## Unit IV

Kepler's laws - Eccentricity of Earth's orbit - Newton's Law of Gravitation - Newton's deductions from Kepler's laws.

## Unit V

Eclipses - Lunar Eclipse - Solar Eclipse - Condition for a Lunar Eclipse - Synodic period of nodes Ecliptic limits - Maximum and minimum number of eclipses near a node in a year - Saros of Chaldeans - Duration of lunar and solar Eclipses.

### Text Book:

Kumaravelu, S., & Susheela Kumaravelu. (2012). Astronomy. (10<sup>th</sup> Edition).  
Chapter 2 up to article 83; Chapter 3: Art 93 & Art 106 to 116;  
Chapters 4, 5, 6 up to Art 154; Chapter 13

### Reference Books:

1. Subramanian, K., Subramanian, L. V. Venkataraman., & Brothers. (1965). A text book of Astronomy. (1<sup>st</sup> Edition). Educational Publishers.
2. Ramachandran, G. V. (1970). A text book of Astronomy. (7<sup>th</sup> Edition). Theni Printers.
3. Daniel Fleish., Julia Kregenow. (2013). Mathematics of Astronomy. (1<sup>st</sup> Edition). Cambridge University Press. NewYork.
4. Smart, W. M. (1949). Spherical Astronomy. (4<sup>th</sup> Edition). Cambridge university press.
5. Jean Meeus. (2002). More Mathematical Astronomy morsels. (1<sup>st</sup> Edition). Willmann Bell Publishing.

**Semester** : VI  
**Name of the course** : Web Designing with HTML – Elective II (c)  
**Course Code** : MC1767

No. of hours per week	Credits	Total No. of hours	Marks
6	5	90	100

**Objectives:**

1. To understand the importance of the web as a medium of communication
2. To create an effective web page with graphic design principles

**Course Outcome**

CO	Upon completion of this course the students will be able to:	PSO Addressed	CL
CO - 1	define modern protocols and systems used on the web(such as HTML,HTTP)	PSO - 1	U
CO - 2	employ fundamental knowledge on web designing with makeup language	PSO - 2	Ap
CO - 3	gain strong knowledge in HTML	PSO - 1	U
CO - 4	use critical thinking skills to design and implement an interactive websites with regard to issues of usability, accessibility and internationalism	PSO - 4	An
CO - 5	to pursue future courses in website development and design	PSO - 2	Ap

## **Unit I**

Introduction to HTML - Designing a Home Page - History of HTML - HTML Generations - HTML Documents - Anchor Tag - Hyper Links - Sample HTML Documents.

## **Unit II**

Head and Body Sections - Header Sections - Title - Prologue - Links - Colorful Web Page - Comment Lines - Some Sample HTML Documents.

## **Unit III**

Designing the Body Section - Heading Printing - Aligning the Headings - Horizontal Rule - Paragraph - Tab Setting - Images and Pictures - Embedding PNG Format Images.

## **Unit IV**

Ordered and Unordered Lists - Lists - Unordered Lists - Headings in a List - Ordered Lists - Nested Lists.

## **Unit V**

Table Handling - Tables -Table Creation in HTML - Width of the Table and Cells - Cells Spanning Multiple Row/Columns Coloring Cells - Column Specification - Some Sample Tables.

### **Text Book:**

Xavier, C. World Wide Web Design with HTML. Tata Mcgram Hill Publishing Company Limited.

Chapter 4: Sections 4.1 – 4.7; Chapter 5: 5.1 – 5.7;

Chapter 6: 6.1 - 6.7; Chapter 7: 7.1 – 7.5; Chapter 8: 8.1 – 8.7

### **Reference Books:**

1. Castro., Elizabeth., & Hyslop. (2013). HTML5, And CSS: Visual Quickstart Guide. (Eight Edition). Peachpit Press.
2. Devlin., & Ian. (2011). HTML5 Multimedia: Develop and Design. Peachpit Press.
3. Felke., & Morris. (2013). Basics of Web Design: HTML5 & CSS3. (2<sup>nd</sup> Edition). Addition -Wesley.
4. Felke & Morris. (2014). -Web Development & Design Foundations with HTML5. (7<sup>th</sup> Edition). Addition - Wesley.
5. John Duckett. (2011). HTML and CSS: Design and Build Website. (1<sup>st</sup> Edition). John wiley and sons.

### M.Sc. Programme Outcomes (PO)

<b>PO</b>	<b>Upon completion of M.Sc. Degree Programme, the graduates will be able to</b>
PO - 1	recognize the scientific facts behind natural phenomena.
PO - 2	relate the theory and practical knowledge to solve the problems of the society.
PO - 3	prepare successful professionals in industry, government, academia, research, entrepreneurial pursuits and consulting firms
PO - 4	face and succeed in high level competitive examinations like NET, GATE and TOFEL.
PO - 5	carry out internship programmes and research projects to develop scientific skills and innovative ideas.
PO - 6	utilize the obtained scientific knowledge to create eco-friendly environment.
PO - 7	prepare expressive, ethical and responsible citizens with proven expertise

### PROGRAMME SPECIFIC OUTCOMES (PSO)

<b>PSO</b>	<b>Upon completion of M.Sc. Mathematics, the graduates will be able to</b>	<b>PO Addressed</b>
PSO - 1	have a strong base in theoretical and applied mathematics.	PO – 2
PSO - 2	sharpen their analytical thinking, logical deductions and rigor in reasoning.	PO – 4
PSO - 3	understand the tools required to quantitatively analyze data and have the ability to access and communicate mathematical information.	PO – 7
PSO - 4	write proofs for simple mathematical results.	PO – 5
PSO - 5	acquire knowledge in recent developments in various branches of mathematics and participate in conferences / seminars / workshops and thus pursue research.	PO – 3
PSO - 6	utilize the knowledge gained for entrepreneurial pursuits	PO – 3
PSO - 7	understand the applications of mathematics in a global, economic, environmental, and societal context.	PO - 6
PSO - 8	use the techniques, skills and modern technology necessary to communicate effectively with professional and ethical responsibility.	PO - 7
PSO - 9	develop proficiency in analyzing, applying and solving scientific problems.	PO - 5

Semester : I

Major Core III

Name of the Course : Probability and Statistics

Course code : PM1713

No. of hours per week	Credit	Total No. of hours	Marks
6	4	90	100

**Objectives:**

1. To upgrade the knowledge in Probability theory
2. To solve NET / SET related Statistical problems

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the basic probability axioms, conditional probability, random variables and related concepts	PSO -1	R
CO - 2	compute marginal and conditional distributions and check the stochastic independence	PSO - 3	U, Ap
CO - 3	recall Binomial, Poisson and Normal distributions and learn new distributions such as multinomial, Chi square and Bivariate normal distributions.	PSO - 2	R,U
CO - 4	learn the transformation technique for finding the p.d.f of functions of random variables and use these techniques to solve related problems	PSO - 8	U, Ap
CO - 5	employ the relevant concepts of analysis to determine limiting distributions of random variables	PSO - 5	Ap
CO - 6	design probability models to deal with real world problems and solve problems involving probabilistic situations.	PSO - 7	C,Ap



## Unit I

Conditional probability - Marginal and conditional distributions, Correlation coefficient - Stochastic independence - Necessary and sufficient conditions for stochastic independence.

## Unit II

The Binomial, Trinomial and Multinomial distributions - Poisson distribution - Gamma, Chi-square, Normal and Bivariate Normal distributions.

## Unit III

Sampling theory - Transformations of variables of discrete and continuous type - Beta distribution, the  $t$  and  $F$  distributions.

## Unit IV

Extension of change of variable technique - Distributions of order statistics – Moment generating function technique - Distributions of  $\bar{x}$  and  $nS^2/\sigma^2$ - Expectations of functions of random variables.

## Unit V

Limiting distributions - Stochastic convergence - Limiting moment generating functions - Central limit theorem - Some theorems on limiting distributions.

### Text Book:

Robert V. Hogg., & Allen T. Craig. (2004). Introduction to Mathematical Statistics. (4<sup>th</sup> edition). New Delhi, Pearson Education.

Chapters 2 to 5.

### Reference Books:

1. Kapur, J.N., & Saxena, H.C. (2010). Mathematical Statistics. (12<sup>th</sup> Edition). S. Chand & Co.
2. Kadarkarai Thangam, K., & Subas Chandra Bose, A. (1995). Probability and Statistics. (1<sup>st</sup> Edition). Jeyalakshmi Publishers.
3. Morris H. DeGroot. (1975). Probability and Statistics. Addison Wesley Publishing Company.
4. Suddhendu Biswass., & Sriwastav, G.L. (2011). Mathematical Statistics. Narosa Publishing House.
5. Murthy, T.S.R. (1995). Probability and Statistics.(1<sup>st</sup> Edition). I.K. International Publishing House.

Semester : I

Elective I(a)

Name of the Course : Numerical Analysis

Course code : PM1715

No. of hours per week	Credit	Total No. of hours	Marks
6	4	90	100

**Objectives:**

1. To study the various behavior pattern of numbers
2. To study the various techniques of solving applied scientific problems

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the methods of finding the roots of the algebraic and transcendental equations.	PSO - 1	R
CO - 2	derive appropriate numerical methods to solve algebraic and transcendental equations.	PSO - 5	Ap
CO - 3	understand the significance of the finite, forward, backward and central differences and their properties.	PSO - 3	U
CO - 4	draw the graphical representation of each numerical method.	PSO - 5	Ap
CO - 5	solve the differential and integral problems by using numerical methods. (Eg. Trapezoidal rule, Simpson's rule etc.)	PSO - 5	Ap
CO - 6	solve the problems in ODE by using Taylor's series method, Euler's method etc.	PSO - 5	Ap
CO - 7	differentiate the solutions obtained by Numerical methods and exact solutions.	PSO - 3	C
CO - 8	compute the solutions of a system of equations by using appropriate numerical methods.	PSO - 9	Ap

## Unit I

Solution of Algebraic and Transcendental Equations - Bisection Method - Method of False Position - Iteration Method - Newton-Raphson Method - Secant Method - Muller's Method.

## Unit II

Finite Differences - Forward Differences - Backward Differences - Central Differences - Detection of Errors by use of difference tables - Differences of a polynomial - Newton's formulae for Interpolation - Central Difference Interpolation formulae - Gauss's central difference formulae - Stirling's formulae - Bessel's formulae - Everett's formulae.

## Unit III

Numerical Differentiation - Errors in Numerical Differentiation - Numerical Integration - Trapezoidal rule - Simpson's 1/3 rule - Simpson's 3/8 rule - Boole's and Weddle's rule.

## Unit IV

Solution of Linear systems - Direct Methods - Gauss elimination - Necessity for Pivoting - Gauss-Jordan method - Modification of the Gauss method to compute the inverse - LU Decomposition method - Solution of Linear systems - Iterative methods.

## Unit V

Solution by Taylor's series - Picard's method of successive approximations - Euler's method - Runge - Kutta methods - II order and III order.

### Text Book:

Sastry, S. S. (2000). Introductory Methods of Numerical analysis. (5<sup>th</sup> Edition). New Delhi, Prentice Hall of India Pvt Ltd.

Chapter 2: 2.1 to 2.5, 2.7, 2.8; Chapter 3: 3.3 (3.3.1 to 3.3.3), 3.4 to 3.6, 3.7 (3.7.1 to 3.7.4)

Chapter 6: 6.2 (6.2.1), 6.4 (6.4.1 to 6.4.4); Chapter 7: 7.5 (7.5.1 to 7.5.4, 7.5.6, 7.6).

Chapter 8: 8.2 to 8.5.

### Reference Books:

1. Balagurusamy, E. (2002). Numerical Methods. New Delhi: Tata McGraw Hill Publishing Company Ltd.
2. Rao, H. S. G. (2011). Numerical Methods. New Delhi: IK International publishing House PVT Ltd.
3. Goel Mittal. (2011). Numerical Analysis. (21<sup>st</sup> Edition). Pragati Prakashan Educational Publishers.
4. Vedamurthy, V. N., & N. ch. S. N. Iyengar. (2009). Numerical Methods. New Delhi, Vikas Publishing House PVT. LTD.
5. Devi Prasad. (2010). An Introduction to Numerical Analysis. Narosa Publishing House.

Semester : II

Elective II (a)

Name of the Course : Classical Dynamics

Course code : PM1725

No. of hours per week	Credit	Total No. of hours	Marks
6	4	90	100

**Objectives:**

1. To gain deep insight into concepts of Dynamics
2. To do significant contemporary research

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO - 1	recall the concepts of Newton's laws of motion, momentum, acceleration, motion of a particle.	PSO - 1	R
CO - 2	understanding the generalized co-ordinates of the Mechanical system.	PSO - 3	U
CO - 3	apply D'Alembert's Principle to solve the problems involving system of particles.	PSO - 5	Ap
CO - 4	solve the Newton's equations for simple configuration using various methods.	PSO - 4	C
CO - 5	transforming the Lagrangian equations to Hamiltonian equations.	PSO - 2	U
CO - 6	define the canonical transformations and Lagrange and Poisson brackets.	PSO - 1	R
CO - 7	evaluate the system of particles by deriving the Jacobi equation and Jacobi's theorem.	PSO - 7	E
CO - 8	understand the foundation of Hamilton's Principle and differential forms.	PSO - 2	U

## Unit I

The Mechanical System - Generalized coordinates - Constraints - Virtual work and D'Alembert's Principle - Energy and Momentum.

## Unit II

Derivation of Lagrange's equations - Problems using Lagrange's equation - Integrals of the motion.

## Unit III

Hamilton's Principle - Hamilton's Equations - Legendre transformation - Other Variational Principles - Modified Hamilton's Principle - Principle of least action - Examples.

## Unit IV

Hamilton's Principal function - The canonical integral - Pfaffian differential forms - The Hamilton - Jacobi equation - Jacobi's theorem - Conservative systems and ignorable coordinates - Examples.

## Unit V

Canonical Transformations - Differential forms and generating functions - Special transformations - Lagrange and Poisson brackets.

## Text Book:

Greenwood G. T. (1979). Classical Dynamics. Prentice Hall.

Chapter 1: 1.1 - 1.5; Chapter 2: 2.1 - 2.3; Chapter 4: 4.1 - 4.3

Chapter 5: 5.1, 5.2; Chapter 6: 6.1 - 6.3

## Reference Books:

1. Goldstein, H. (1994). Classical Mechanics. (2<sup>nd</sup> Edition). Narosa Publishing.
2. Synge, J. L., & Griffith, B. A. (1959). Principle of Mechanics. McGraw Hill.
3. Rutherford, D. E. (2000). Classical Mechanics. New York: Oliver Boyd.
4. Chorlton, F. (1969). Text book of Dynamics. Van Nostrand.
5. Javier E. Hasbun. (2009). Classical Mechanics. Jones and Bartlett Publishers.

Semester : III

Elective III (b)

Name of the Course : Stochastic Processes

Course code : PM1735

No. of Hours per Week	Credit	Total No. of Hours	Marks
6	4	90	100

**Objectives:**

1. To understand the stochastic models
2. To relate the models studied to real life probabilistic situations

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO – 1	recall the concept of the theory of probability	PSO - 1	R
CO – 2	understand the definitions and specification of stochastic processes	PSO - 2	U
CO – 3	differentiate between different states of Markov system	PSO - 3	U
CO - 4	categorize different stochastic processes such as Poisson processes, Yule- Fury processes, birth and death processes	PSO - 3	An
CO – 5	calculate residual and current life times using renewal processes	PSO - 2	An
CO – 6	select the suitable queuing model in real life situations	PSO - 7	E
CO – 7	apply the theory to create the correct stochastic model for a given problem	PSO - 8	Ap

## Unit I

Stochastic processes - Specification of Stochastic processes - Stationary processes - Markov chain - Transition probabilities - Random walk - Higher transition probabilities.

## Unit II

Classification of states and chains - Transient and recurrent states - Stability of a Markov system.

## Unit III

Markov process with discrete state space - Poisson process - Generalizations of Poisson process - Poisson Cluster process - Pure birth process - Yule-Furry process - Birth Immigration Process - Birth and death process.

## Unit IV

Renewal processes - Renewal process in Discrete time - Renewal process in continuous time - Renewal Equation - Renewal theorems - Residual and current life times.

## Unit V

Stochastic processes in queuing - Queuing processes - Steady state behaviour of M/M/1 queuing Model - Non-Markovian Queuing Models - Queues with Poisson input - M/G/1 and GI/M/1 queuing models.

### Text Book:

Medhi, J. (1994). Stochastic Processes. (Second Edition). New Age International Publishers. New Delhi.

Chapter 2: Sections 2.1, 2.2, 2.3; Chapter 3: Sections 3.1, 3.2, 3.4, 3.6.

Chapter 4: Sections 4.1, 4.3 (except 4.3.5 - 4.3.7), 4.4.

Chapter 6: Sections 6.1.1- 6.1.3, 6.2 (except example 2(b)), 6.3, 6.5 (except 6.5.2), 6.7.

Chapter 10: Sections 10.1 (except 10.1.4), 10.2 (except 10.2.3.1), 10.7 (except examples 7(a), 7(b) & sections 10.7.3, 10.7.4), 10.8 (except example 8(a)).

### Reference Books:

1. Narayan Bhat, U. (1972). Elements of Applied Stochastic Processes. (Second Edition). John Wiley & Sons. New York.
2. Prabhu, N.V. (1970). Stochastic Processes. Mac Millon. New York.
3. Bhat, B.R. (2010). Stochastic Models Analysis and Applications. New Age International (P) Limited Publishers.
4. Veerarajan, T. (2006). Probability, Statistics and Random Processes. Tata McGraw - Hill Publishing Company Limited.
5. Salil Kumar Chaudhri., & Ashis K. Chakraborty. (2009). Statistical Methods. Asian Books Private Ltd.

Semester : IV

Major Core XIV

Name of the Course : Operations Research

Course code : PM1743

No. of Hours per Week	Credit	Total No. of Hours	Marks
6	5	90	100

**Objectives:**

1. To learn optimizing objective functions
2. To solve life oriented decision making problems

**Course Outcome**

CO	Upon completion of this course the students will be able to	PSO Addressed	CL
CO – 1	explain the fundamental concept of DP model , Inventory model and Queuing model	PSO - 2	U
CO – 2	relate the concepts of Arrow (Network)diagram representations, in critical path calculations and construction of the Time chart	PSO - 3	U
CO – 3	distinguish deterministic model and single item	PSO - 3	U
CO – 4	interpret Poisson and Exponential distributions and apply these concepts in Queuing models	PSO - 6	R
CO – 5	solve life oriented decision making problems by optimizing the objective function	PSO - 7	C



## Unit I

Elements of the DP Model - The Capital Budgeting Example - More on the definition of the state - Examples of DP Models and computations - Solution of Linear Programming by Dynamic programming - Game theory.

## Unit II

Arrow (Network) Diagram Representations - Critical Path Calculations - Construction of the Time Chart and Resource Leveling - Probability and Cost Considerations in Project Scheduling.

## Unit III

A Generalised Inventory model - Types of Inventory Models - Deterministic Models - Single Item Static Model - Single Item Static - Model with Price Breaks - Multiple - Item static Model with Storage Limitations - Single - Item.

## Unit IV

Basic Elements of the Queueing Model - Roles of Poisson and Exponential Distributions - Queue with Combined Arrivals and Departure - Queueing Models of Type : (M/M/1): (GD/∞/∞) , (M/M/1): (GD/N/∞).

## Unit V

Queueing Models of Types: (M/G/1): (GD/∞/∞) - The Pollaczek - Khintchine Formula, (M/M/C) : (GD/∞/∞) - (M/M/∞) : (GD/∞/∞) Self service Model, (M/M/R) : (GD/K/K)  $R < K$  - Machine Service - Tandem or series queues.

### Text Book:

Handy.A. Taha. (1989). Operations Research - An Introduction. (3<sup>rd</sup> Edition). S. MacMillan Publishing Co. Inc.  
Chapter 9: Section 9.1 - 9.3, 9.5; Chapter 11: Section 11.4;  
Chapter 12: Section 12.1 - 12.4; Chapter 13: Section 13.1 - 13.3 (except 13.3.5);  
Chapter 15: Section 15.1, 15.2 (only 15.2.1, 15.2.2), 15.3 (15.3.1, 15.3.2, 15.3.3, 15.3.4, 15. 3.6, 15.3.7), 15.5 - (only 15.5.1).

### Reference Books:

1. Er. Prem Kumar Gupta., & Dr. Hira, D.S. (2014). Operations Research. (7<sup>th</sup> Edition). S. Chand and company private ltd.
2. Sharma, J.K. (2009). Operations Research: Theory and Applications. (4<sup>th</sup> Edition). Macmillian Publishers India ltd.
3. Panneerselvam, R. (2009). Operations Research. (2<sup>nd</sup> Edition). PHI Learning private ltd.
4. Prem Kumar Gupta., Dr. Hira, D. S., & AartiKamboj. (2012). Introduction to Operations Research. S. Chand and Company ltd.
5. Naidu, N. V. R., Rajendra, G., & Krishna Rao, T. (2011). Operations Research. (Kindle Edition). IK. International Publishing house private ltd.

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