Preamble

      Mathematics, the foundation of all sciences is a subject which offers limitless scope for diversification in higher education. The improvements and achievements in various fields are the gift of Mathematics. The world of education without mathematics would be non- existent. The fields of Information Technology, Social Research and Economic forecasts will not be successful but for the effective application of Mathematics. The demand for courses in Mathematics is bound to be consistent, continual and increasing.

Vision

      To promote and support a comprehensive, innovative and dynamic learning environment that meets the changing needs of a diverse global student population.

Mission

- To provide an exemplary mathematics programme that prepares students to be life-long learners and responsible, numerate citizens.
- To enhance the students logical, reasoning, analytical and problem solving skills.
- To provide meaningful support services, responds to the changing environment of mathematics education.
- To promote effective instructional strategies with students actively participating in the learning process.

Programme Outcome

PO.No	Upon completion of B.Sc Degree programme, the graduates will be able to
PO 1	apply the acquired knowledge of fundamental concepts in the field of science and to find solutions to various problems.
PO 2	inculcate innovative skills and team – work among students to meet societal expectations.
PO 3	perform analysis to assess, interpret, and create innovative ideas through practical experiments.
PO 4	facilitate to enter multidisciplinary path to solve day-to-day scientific problems.
PO 5	carry out fieldworks and projects, both independently and in collaboration with others, and to report in a constructive way.
PO 6	improve communication ability and knowledge transfer through ict aided learning integrated with library resources.
PO 7	transfer the knowledge to the other stakeholders through extensive community development programme.
PO 8	attain competency in job market / entrepreneurship.
PO 9	focus on developing domain specific language skills and knowledge of the students.

Programme Specific Outcome

PSO No.	Upon completion of the B.Sc. Mathematics program, students will be able to:	PO Mapped
PSO-1	understand the foundations of mathematics and perform basic computations in higher mathematics.	PO - 1
PSO-2	understand the power of abstraction and generalization and to carry out investigative and mathematical work with independent judgement.	PO - 3
PSO-3	communicate mathematical ideas, develop proficiency in the analysis of problems and use mathematical or other appropriate techniques to solve them.	PO – 6,7
PSO-4	apply mathematical ideas to model real-world problems.	PO - 4
PSO-5	apply rigorous, analytic, highly numerate approach to analyze, execute tasks and solve problems in daily life and at work.	PO - 2
PSO-6	appreciate the role of mathematical proof as a means of conveying mathematical knowledge.	PO - 1
PSO-7	carry out objective analysis and prediction of quantitative information with independent judgement.	PO - 5
PSO-8	create, use and analyze graphical representation of mathematical relationships	PO – 3
PSO-9	develop language communication skills.	PO – 9

Department of Mathematics

Course Structure (w.e.f. 2021)

Semester I

Part	Components	Sub. Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil French	21ULTA11 21ULFA11	,f;fhy ,yf;fpak; nra;As;> ,yf;fzk;> ,yf;fpa tuyhW> ciueil>rpWfij Introductory French Course	6	3	40	60	100
II	General English	21UGEN11	Poetry, Prose, Extensive Reading and Communicative English – I	6	3	40	60	100
III	Core I	21UMAC11	Classical Algebra	4	3	40	60	100
	Core II	21UMAC12	Calculus	4	3	40	60	100
	Allied I	21UPHA11	Allied Physics	4	3	40	60	100
	Allied Practical I	21UPHAR1	Allied Physics	2	--			
IV	Skill Enhancement Course – I	21UMAPE1	Professional English for Mathematics - I	2	2	20	30	50
	Ability Enhancement Course – I	21UAVE11	Value Education	2	2	20	30	50
	Total			**30**	**19**			

Semester II

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil	21ULTA21	rka ,yf;fpaq;fSk; ePjp ,yf;fpaq;fSk;> nra;As; ,yf;fzk>; ,yf;fpa tuyhW> ciueil> tho;f;if tuyhW	6	3	40	60	100
	French	21ULFA21	Intermediate French Course					
II	General English	21UGEN21	Poetry, Prose, Extensive Reading and Communicative English – II	6	3	40	60	100
III	Core III	21UMAC21	Analytical Geometry of Three Dimensions	4	3	40	60	100
	Core IV	21UMAC22	Differential Equations	4	3	40	60	100
	Allied II	21UPHA21	Allied Physics II	4	3	40	60	100
	Allied Practical I	21UPHAR1	Allied Physics Practical	2	2	40	60	100
IV	Skill Enhancement Course – I	21UMAPE2	Professional English for Mathematics - II	2	2	20	30	50
	Ability Enhancement Course – II	21UAEV21	Environmental Studies	2	2	20	30	50
Total				**30**	**21**			

Semester III

Part	Components	Course Code	Course Title	Hrs/Week	Credit	Max.Marks		
						CIA	ESE	Total
I	Tamil	21ULTA31	fhg;gpa ,yf;fpak;: nra;As;> ,yf;fzk;> ciueil> rpWfij> ,yf;fpa tuyhW	6	4	40	60	100
	French	21ULFA31	Advanced French Cou					
II	General English	21UGEN31	Poetry, Prose, Extensive Reading and Communicative English – III	6	4	40	60	100
III	Core V	21UMAC31	Sequences and Series, Trigonometry	6	5	40	60	100
	Allied III	21UMMA31	Statistics I	6	4	40	60	100
	Skill Based Elective	21UMAS31/ 21UMAS32	Introduction to Python Programming /Quantitative Aptitude - I	2	2	20	30	50
	NME I	21UMAN31	Mathematics for Competitive Examinations I	2	2	20	30	50
IV	Ability Enhancement Course – III	21UAWS31	Women's Synergy	2	2	20	30	50
	Self Study Course / /On-line Course/ Internship(Compulsory	21UMASS1/	Fundamentals of Mathematics		+2		50	50
Total				**30**	**23+2**			

Semester IV

Part	Components	Course Code	Course Title	HW/Wk	Credits	CIA	ESE	Total
						Max.Marks		
I	Tamil French	21ULTA41 21ULFA41	rq;f ,yf;fpak:; nra;As;> ,yf;fzk;> ciueil> tho;f;if tuyhW> ,yf;fpa tuyhW Language through Literature	6	4	40	60	100
II	General English	21UGEN41	Poetry, Prose, Extensive Reading and Communicative English- IV	6	4	40	60	100
III	Core VI	21UMAC41	Modern Algebra	6	5	40	60	100
	Allied IV	21UMMA41	Statistics II	6	4	40	60	100
	Skill Based Elective	21UMAS41/ 21UMAS42	Documentation using LaTeX / Quantitative Aptitude-II	2	2	20	30	50
	NME II	21UMAN41	Mathematics for Competitive Examinations II	2	2	20	30	50
IV	Ability Enhancement Course – IV	21UAYM41	Yoga & Meditation	2	2	20	30	50
	Self Study / On-line Course/ Internship (Optional)	21UMASS2/ 21UMAM41/ 21UMAI41	Industrial Mathematics		+2		50	50
V	NCC, NSS & Sports				1			
	Extension Activities CDP				+1			
	Total			30	**24+3**			

Semester V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
	Core VII (Common Core)	21UCMC51	Computer Oriented Numerical Methods	6	5	40	60	100
III	Core VIII	21UMAC51	Linear Algebra	5	4	40	60	100
	Core IX	21UMAC52	Graph Theory	5	4	40	60	100
	Core X	21UMAC53	Real Analysis	4	4	40	60	100
	Core XI	21UMAC54	Vector Calculus and Fourier Series	4	4	40	60	100
	Core Elective	21UMAE51/ 21UMAE52	Discrete Mathematics / Transforms	4	4	40	60	100
IV	Common Skill Based	21UCSB51	Computers for Digital Era and Soft Skills	2	2	20	30	50
	Self Study or On-line Course (Optional)	21UMASS3/ 21UMAM51	Astronomy	--	2		50	50
	Total			**30**	**29**			

Semester VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max. Marks		
						CIA	ESE	Total
III	Core XII	21UMAC61	Complex Analysis	6	5	40	60	100
	Core XIII	21UMAC62	Modern Analysis	6	5	40	60	100
	Core XIV	21UMAC63	Mechanics	6	5	40	60	100
	Core XV	21UMAC64	Operations Research	6	5	40	60	100
IV	Core XVI / Project	21UMAC65/ 21UMAP61	Coding Theory/ Project	6	4	40	60	100
	Total			**30**	**24**			
	Total			**180**				

Semester	Hours	Credits	Extra Credits
I	30	19	---
II	30	21	---
III	30	23	2
IV	30	24	3
V	30	29	--
VI	30	24	--
Total	**180**	**140**	**5**

Courses	Number of Courses	Hours / week	Credits	Extra Credits
Tamil	4	24	14	--
English	4	24	14	--
Core	15	76	63	--
Skill Based Elective	2	4	4	--
Core Elective	1	4	4	--
Group Project	1	6	4	--
Allied	4T+1P	20T+4P	14T+2P	--
NME	2	4	4	--
Skill Enhancement Course	2	4	4	--
Ability Enhancement Course	4	8	8	--
Common Skill Based	1	2	2	--
NCC, NSS & Sports		--	1	
Extension Activities		--		1
Self Study Papers (Optional)	1	--		2
Self Study Papers (Compulsory)	1	--	2	--
Field Project				2
Total		**180**	**140**	**5**

	SEMESTER – I		
	Core I - Classical Algebra		
Course Code:21UMAC11	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

Objectives:

   To provide a platform to students so that they can develop algebraic problem solving strategies.

   To Transform real life problems into equations and then solve them.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	solve polynomial equations and simultaneous linear equations.	3	An
CO-2	solve the equations using the relation between the roots and coefficients.	3	An
CO-3	form the equations from the given roots and identify and solve the reciprocal equations	8	Cr
CO-4	transform the equations by increasing, decreasing and multiplying the roots of the equations	3	Un
CO-5	solve the equations by removing the terms of the equations.	3	An
CO-6	locate real and imaginary roots of the equations	4	Un
CO-7	find the approximate values of the irrational roots of the equations.	3	Cr
CO-8	determine the roots of the equations by using various methods like Cardon's method, Ferrari's method.	3	Cr

Semester – I				
Part III Core I - Classical Algebra				
Course Code :21UMAC11	Hrs/week: 4		Hrs/Semester: 60	Credits: 3

Unit I

Fundamental theorem of algebra - In an equation with real coefficients, imaginary roots occur in pairs - In an equation with rational coefficients, irrational roots occur in pairs -Relations between the roots and coefficients of equations. Symmetric function of the roots

(Chapter 6, Sec 1 – 12, pages 282-307)

Unit II

Sum of the powers of the roots of an equation - Newton's theorem on the sum of the powers of the roots -Transformation of equation - Reciprocal equation - Standard form of reciprocal equations.

(Chapter 6, Sec 13-16, pages 308-327)

Unit III

To increase or decrease the roots of a given equation by a given quantity – Form of the quotient and remainder when a polynomial is divided by a binomial - Removal of terms – To form an equation whose roots are any power of the roots of a given equation - Transformation in General
.   **(Chapter 6, Sec 17-23, pages 327-351)**

Unit IV

Descarte's rule of signs - Rolle's theorem -Multiple roots -Strum's Theorem.

(Chapter 6, Sec 24 – 26, pages 351-362)

Unit V

Horner's method.- General solution of the cubic equations - Cardon's method – Trigonometrical method – Solution of biquadratic equation - Ferrari method.

(Chapter 6, Sec 30,34 , pages:376-382,390-398)

Text Book

1. Manicavachagom Pillay T.K., Natarajan T., Ganapathy K.S., *Algebra,* Volume-I, Ananda Book Depot, Chennai, Reprint 2017.

Books for Reference

1. Arumugam S. and A. Thangapandi Isaac, *Algebra*, New Gamma Publishing House, August 2006.

2. Kandasamy P. and Thilagavathi K., *Mathematics for B.Sc*., 2004, Volume I and Volume IV, S. Chand & Co., New Delhi.

SEMESTER – I			
Core II – Calculus			
Course Code :21UMAC12	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

Objectives:

- To train the students to take up the challenges and risks in their day to day life and to work collaboratively with others.
- To prepare students for success in Calculus and to develop an appreciation and proficiency with mathematical thinking.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	state the concept of curvature of a plane curve.	4	Re
CO-2	calculate the curvature of various curves in plane and space	4	Ev
CO-3	apply the fundamental concepts of Calculus to variety ofreal world problems.	3	Ap
CO-4	find surface area using a double integral.	7	Un
CO-5	evaluate triple integrals and use them to find volumes in rectangular, cylindrical and spherical coordinates.	3	Ev
CO-6	compute definite and indefinite integrals of algebraic and trigonometric functions using formulae and substitution	3	Cr
CO-7	know the relationship between the Gamma and Beta functions	5	An
CO-8	use Beta and Gamma function to solve different type of integrals and to understand Gamma function as a generalization of factorial function.	6	Ev

Semester – I
Part III   Core II - Calculus

Course Code :21UMAC12	Hrs/week :4	Hrs/ Semester :60	Credits :3

Unit I

Curvature and radius of curvature – Cartesian form-Centre of curvature

(Vol I, Chapter X, Sec 2.1 - 2.4, Pages : 291-309)

Unit II

Evolute and Involute-Pedal Equation -Asymptotes

(Vol I Chapter X, Sec 2.5 - 2.8, Pages: 309-317, Exercises 45: 1-11, Chapter XI, Pages: 324-341)

Unit III

Singular Points (Node, cusp, conjugate points) and Tracing of curves (Cartesian only)

(Vol I, Chapter XII, Chapter XIII, Pages: 342-372)

Unit IV

Double and Triple Integrals - Changing the order of integration. Jacobians and Change of variables

(Vol II , Chapter V, Pages : 203-213,219-223,Chapter VI, Pages : 251-269)

Unit V

Beta and Gamma functions – Application of Beta and Gamma Functions in evaluation of Double and Triple Integrals, Improper Integrals.

(Vol II, Chapter VII, Pages: 278-300)

Text Book
 1. S.Narayanan and T. K. Manicavachagom Pillay, *Calculus*, Vol I and Vol II**,** S.Viswanathan (Printers & Publishers) PVT. LTD. (Edition-2015).

Books for Reference
 1. Kandasamy P and K. Thilagavathi, *Mathematics for B.Sc.*, Volume II – 2004, S.Chand & Co., New Delhi.
 2. Apostol T.M., *Calculus*, Vol. I &II John Wiley and Sons, Inc., Newyork.

	SEMESTER-I			
	Skill Enhancement Course - I Professional English for Mathematics - I			
Course Code: 21UMAPE1	**Hrs/Week: 2**	**Hrs/Sem: 30**		**Credits: 2**

Objectives:

- To develop the language skills of students by offering adequate practice in professional contexts.
- To enhance the lexical, grammatical and socio-linguistic and communicative competence of first year physical sciences students

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PO addressed	CL
CO-1	Recognise their own ability to improve their own competence in using the language	3	Un
CO-2	Use language for speaking with confidence in an intelligible and acceptable manner	3	An
CO-3	Understand the importance of reading forlife	8	Cr
CO-4	Read independently any unfamiliar texts withcomprehension	3	Un
CO-5	Understand the importance of writing in academiclife	3	An
CO-6	Write simple sentences without committing error of spelling or grammar.	4	Un
CO-7	Develop critical thinking skills and get culturally aware of the target situation	3	Cr

SEMESTER-I
Skill Enhancement Course - I   Professional English for Mathematics - I

Course Code : 21UMAPE1	Hrs/Week: 2	Hrs/Sem: 30	Credits: 2

UNIT 1: COMMUNICATION
Listening and Speaking:

Listening to audio text and answering questions

　　　Listening toInstructions

　　　Pair work and small group work.

Reading and writing:

Comprehension passages –Differentiate between facts and opinion

Developing a story with pictures**.**

 Word Power/Vocabulary:

　　　Register specific - Incorporated into the LSRW tasks

Grammar in Context:

　　　Adverbs, Prepositions.

UNIT 2: DESCRIPTION
Listening: Listening to process description.-Drawing a flow chart.

Speaking: Role play (formal context)

Reading: Skimming/Scanning-Reading passages on products, equipment and gadgets.

Writing: Process Description –Compare and Contrast

　　　Paragraph-Sentence Definition and Extended definition- Free

　　Writing.

Vocabulary: Register specific -Incorporated into the LSRW tasks.

UNIT 3: NEGOTIATION STRATEGIES
 Listening: Listening to interviews of specialists / Inventors in fields   (Subject specific)

Speaking: Brainstorming.(Mind mapping). Small group discussions (Subject-Specific)

Reading: Longer Reading text.

Writing: Essay Writing (250 words)

Vocabulary: Register specific - Incorporated into the LSRW tasks

UNIT 4: PRESENTATION SKILLS
Listening: Listening to lectures.

Speaking: Short talks.

Reading: Reading Comprehension passages

Writing: Writing Recommendations

Interpreting Visuals inputs

Vocabulary: Register specific -Incorporated into the LSRW tasks

UNIT 5: CRITICAL THINKING SKILLS
Listening: Listening comprehension- Listening for information.
Speaking: Making presentations (with PPT- practice).
Reading: Comprehension passages –Note making.
   Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)
Writing: Problem and Solution essay– Creative writing –Summary writing
Vocabulary: Register specific - Incorporated into the LSRW tasks

Links for Reference

1. Britannica, T. E. (Ed.). (2020, April 16). Marie Curie. Retrieved June 18, 2020, from Encyclopedia
2. Britannica. Wikipedia, T. E. (Ed.). (16, June 2020). Marie Curie. Retrieved June 18, 2020, from
   Wikipedia.
3. https://www.myindiamyglory.com/2018/07/12/raman-effect-how-indian-scientist-cv-raman-discovered-why-sea-is-blue/
4. https://opensource.com/resources/internet-of-things
5. http://warofcurrents.newtfire.org/
6. https://www.youtube.com/watch?v=ubpsosv7mHM
7. https://www.englishclub.com/reading/health/cell-phone.htm
8. https://www.britannica.com/biography/Isaac-Asimov
9. https://www.softschools.com/
10. https://www.space.com/17056-kalpana-chawla-biography.html
11. https://labour.gov.in/childlabour/census-data-child-labour
12. https://www.bu.edu/csp/Conferences/Space_Exploration/Day1/Presentations/Kalam_Space%2
    0Exploration%20and%20Human%20Life.pdf
13. https://www.youtube.com/watch?v=WEKzNH09Vqs
14. https://www.bbc.com/news/world-europe-48616174
15. https://semiengineering.com/how-5g-differs-from-previous-network-technologies/
16. https://www.thehindubusinessline.com/info-tech/scientists-caution-government-to-go-slow-on-5g-roll-out/article28737197.ece
17. https://www.downtoearth.org.in/interviews/science-and-technology/-5g-is-unlikely-to-cause-health-concerns--63698

	SEMESTER – II			
	Core III Analytical Geometry of Three Dimensions			
Course Code : 21UMAC21		Hrs / Week : 4	Hrs / Semester: 60	Credits: 3

Objectives:

- To study the properties of cosmic structures and mathematical objects in three-dimensional surfaces.
- To explore the implementation and far-reaching consequences of systems of measurement and geometry.
- To help students visualize ideas, classify and identify different problem types in analytical geometry of three dimensions.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	understand the fundamental aspects of three-dimensional geometry.	1	Un
CO-2	represent simple three-dimensional figures using two-dimensional drawings.	3	Un
CO-3	demonstrate basic mathematical understanding and computational skills in three dimensions.	8	Un
CO-4	apply algebraic methods to the study of curves and surfaces that lie in three dimensions.	4	Un
CO-5	apply geometric properties and relationships to solve problems in three dimensions.	4	Un
CO-6	develop logical thinking, geometric thinking and three-dimensional spatial ability.	6	An
CO-7	solve many difficult problems with simple solutions.	5	Cr
CO-8	create opportunities to use spatial skills in problem-solving tasks.	4	Cr

SEMESTER – II			
Part III Core III - Analytical Geometry of Three Dimensions			
Course Code :21UMAC21	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

Unit I

Direction cosines -   direction ratios - angle between the lines – condition for perpendicularity and parallelism.

(Chapter 1, Sec 1 – 10,pages 1 – 23)

Unit II

Equation of planes - normal form - intercept form - angle between two planes

(**Chapter 2, Sec 1 – 11,pages 24-45**)

Unit III

Straight line- symmetrical form - plane and the straight line- angle between two planes - image of a point - image of line.

(Chapter 3, Sec 1 – 6,pages 46-61)

Unit IV

Skew lines - shortest distance between two lines -   coplanar lines - volume of tetrahedron.

(Chapter 3, Sec 7 - 11,pages 61 - 91)

Unit V

Sphere - plane section of sphere - tangent line - intersection of two spheres -   intersection of a plane with sphere.

(Chapter 4, Sec 1 – 8, pages 92 - 114)

Text Book

Manicavasagom Pillay T.K. and Natarajan T., Analytical Geometry of 3D, S.Viswanathan (Printers&Publishers) Pvt. Ltd, Reprint 2017.

Books for Reference

1. Arumugam S. and Thangapandi Isaac A., *Analytical Geometry of 3D and Vector Calculus*, New Gamma Publishing House, January 2006.

2. Arup Mukherjee and Naba Kumar Bej., *Analytical Geometry of Two and Three Dimensions***,** Books and Allied (P) Ltd., Kolkata, November 2010.

	SEMESTER – II		
	Part III Core IV - Differential Equations		
Course Code :21UMAC22	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

Objectives:

- To make the students to understand differential Equations as a powerful tool in solving problems in physical and social sciences.
- To furnish the students the tools necessary to solve ordinary differential equations.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	identify an ordinary differential equation and its order.	3	Un
CO-2	verify whether a given function is a solution of a given ordinary differentialequation (as well as verifying initial conditions when applicable).	8	An
CO-3	classify ordinary differential equations into linear and nonlinear equations.	4	Un
CO-4	solve first order linear differential equations.	3	An
CO-5	find the general solution of second order linear homogeneous equations with constant coefficients.	3	Cr
CO-6	compute the laplace transform of a functionuse shift theorems to compute the Laplace transform and inverse Laplacetransform	3	An
CO-7	use the laplace transform to compute solutions of second order, linearequations with constant coefficients	3	An
CO-8	identify essential characteristics of ordinary and partial differential equations.	3	Un

Semester – II
Part III   Core IV   -   Differential Equations

Course Code: 21UMAC22	Hrs/week :4	Hrs/Semester :60	Credits :3

Unit I

Equations of the first order, but of higher degree - Solvable for p, x & y - Clairaut's form – Equations that do not contain x explicitly- Equations that do not contain y explicitly- Equations homogeneous in x and y.   **(Chapter4, Sec 1- 4, pages 60 – 67)**

Unit II

Linear equation with constant coefficients: Complementary function of a linear equation with constant coefficients-Particular Integral-Special methods for finding Particular Integral

(Chapter 5, Sec 1-4, pages 68-88)

Unit III

Linear equations with variable coefficients- Special method of evaluating the P.I when X is of the form - Equations reducible to the linear equations-Linear equations of the second order - Complete solution given a known integral - Reduction to the normal form–Change of the independent variable– variation of parameters -Methods of operational factors.

(Chapter 5, Sec 5 and 6 pages 89-102 &Chapter8,Sec1-5, pages 145- 160)

Unit IV

Laplace transform - Definition-Sufficient conditions for the existence of Laplace transform-Laplace transform of periodic functions-Some general theorems- the Inverse transforms.

(Chapter9, Sec 1-6, pages 161-199)

Unit V

Partial differential equation of first order – Classification of integrals - Derivation of partial differential equations - Lagrange's method of solving the linear equation – Special methods, Standard forms – Charpit's method.

(Chapter 12, Sec1-4, Sec 5 (5.1-5.4) pages 219-238)

Text Book

S.Narayanan and T.K.Manickavachagam Pillay, *Differential Equations and its applications*. Published by: Divya Subramanian for Aanda Book Depot,Edition 2017.

Books for Reference

1. A.R.Vasishtha and Dr.S.K.Sharma, *Differential Equations*, Krishna Educational Publishers,Seventeenth Edition : 2015
2. Dr.S.Arumugam and A.Thangapandi Issac, *Differential Equations and Applications*, New Gamma Publishing House, Edition 2011

	SEMESTER-II		
Skill Enhancement Course - II Professional English for Mathematics - II			
Course Code :21UMAPE2	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

Objectives:

- To Increase the proficiency of students from all levels and abilities by refining their speaking, writing, reading, and listening skills.
- To provide a comprehensive and intensive course that assists students in achieving their professional, personal and educational objectives.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PO addressed	CL
CO-1	understand the basic objective of the course and obtain strong professional vocabulary for its application at different platforms	3	Un
CO-2	Apply the knowledge for writing purposes such as Presentation, drafting and project report etc.	2	Ap
CO-3	Evaluate the correct and error-free writing by being well-versed in rules of English grammar and cultivate relevant technical style of communication and presentation.	8	Ev
CO-4	Apply techniques for developing inter-personal communication and to respond questions at a formal interview	8	Ap
CO-5	Apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics	6	Ap
CO-6	Use critical thinking skills to face everyday life situations.	5	Cr
CO-7	Develop strategic competence that will help in efficient communication	6	Ap
CO-8	Apply the acquired knowledge and ideas in giving opinions during the meeting and making concluding remarks.	8	An

SEMESTER-II			
Skill Enhancement Course –II Professional English for Mathematics - II			
Course Code :21UMAPE2	**Hrs/Week: 2**	**Hrs/Sem: 30**	**Credits: 2**

UNIT 1: COMMUNICATIVE COMPETENCE

Listening and Speaking:

Listening and responding to complaints (formal situation)

Listening to problems and offering solutions (informal)

Reading and writing:

Reading aloud (brief motivational anecdotes)

Writing a paragraph on a proverbial expression/motivational idea.

Word Power/Vocabulary:

Synonyms & Antonyms

Grammar in Context:

Adverbs, Prepositions.

UNIT 2: PERSUASIVE COMMUNICATION

Listening and Speaking:

Listening to famous speeches and poems

Making short speeches- Formal: welcome speech and vote of thanks.

Informal occasions- Farewell party, graduation speech

Reading and Writing:

Writing opinion pieces (could be on travel, food, film / book reviews or on any

contemporary topic)

Reading poetry

Reading aloud: (Intonation and Voice Modulation)

Identifying and using figures of speech - simile, metaphor, personification etc.

Word Power/Vocabulary:

Idioms & Phrases

Grammar in Context

Conjunctions and Interjections.

UNIT 3: DIGITAL COMPETENCE

Listening and Speaking:

Listening to Ted talks

Making short presentations – Formal presentation with PPT, analytical presentation of graphs and reports of multiple kinds

Interactions during and after the presentations

Reading and writing:

Writing emails of complaint

Reading aloud famous speeches

Word Power/Vocabulary:

One Word Substitution

Grammar in Context:

Sentence Patterns

UNIT 4: CREATIVITY AND IMAGINATION

Listening and Speaking

Participating in a meeting: face to face and online

Listening with courtesy and adding ideas and giving opinions during the meeting and making concluding remarks.

Reading and Writing

Reading visual texts – advertisements

Writing a Brochure

Word Power/Vocabulary:

Denotation and Connotation

Grammar in Context:

Sentence Types.

UNIT 5: WORKPLACE COMMUNICATION & BASICS OF ACADEMIC WRITING

Listening and Speaking:

Informal interview for feature writing

Listening and responding to questions at a formal interview

Reading and Writing

       Writing letters of application

       Readers' Theatre (Script Reading)

       Dramatizing everyday situations/social issues through skits. (Writing scripts and performing)

Word Power/Vocabulary:

       Collocation

Grammar in Context:

       Working With Clauses.

Links for Reference

1. https://www.collinsdictionary.com/

2. https://youtu.be/moJjKqkn_Xs

3. https://www.collinsdictionary.com/

4. https://www.theguardian.com/commentisfree/2020/sep/08/robot-wrote-this-article-gpt-3

5. https://owl.purdue.edu/owl/general_writing/academic_writing/essay_writing/argumentative_essays

6. https://youtu.be/5ctbvkAMQO4

7. https://www.wareable.com/fitness-trackers/how-your-fitness-tracker-works-1449

8. https://www.hfe.co.uk/blog/a-study-of-fitness-trackers-and-wearables/

9. https://youtu.be/o_f7mp_tTqw

10. https://www.youtube.com/watch?v=IOluK9i1yiw&feature=youtu.be

11. https://www.sciencehistory.org/historical-profile/antoine-laurent-lavoisier

12. https://youtu.be/AE0kuHKoitE

13. https://science.howstuffworks.com/math-concepts/fibonacci-nature.html

14. https://youtu.be/nt2OlMAJj6o

15. https://www.everythingrf.com/community/what-is-electronic-warfare

16. https://w0ww.youtube.com/watch?v=Rsa1zsOx5Mw

17. http://www.bhopal.com/

18. https://www.youtube.com/watch?v=4WZTzKu3CsY

19. https://www.youtube.com/watch?v=khc2wUBsFU4

20. http://www.bhopal.com/

21. https://www.youtube.com/watch?v=32vJxDUr-nE

22. https://www.youtube.com/watch?v=BLhwNhtYU5E

23. https://www.bbc.com/news/science-environment-55365434

24. https://www.ted.com/talks/ray_kurzweil_get_ready_for_hybrid_thinking?referrer=playlist-talks_on_artificial_intelligen%23t-146994

25. https://celebratepicturebooks.com/tag/writing-resources-for-kids/

26. http://www.englishclub.com/writing/punctuation.htm

27. http://guidetogrammar.org/grammar/marks/marks.htm

28. http://www.grammarbook.com/english_rules.asp

	Semester – III		
	Part III Core V - Sequences and Series, Trigonometry		
Course Code :21UMAC31	**Hrs/week : 6**	**Hrs/Semester : 90**	**Credits : 5**

Objectives:

- To have a good foundation in Sequence of Bounded, Monotonic, Cauchy etc., and Summation of infinite series of positive terms and arbitrary terms.
- To develop the skill of computation with real sequences and series

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO s addressed	CL
CO-1	develop the analytical thinking to generalize the known concepts.	3	Cr
CO-2	know the important inequalities necessary to compare the real numbers.	3	Ev
CO-3	explain the difference between a sequence and a series in the mathematical context.	2	Un
CO-4	able to identify boundedness, monotonic, limit points etc. of a sequence.	8	Un
CO-5	able to apply various tests to verify the convergence or divergence of a given sequence and also the series.	4	Ap
CO-6	gain a basic knowledge about analysis which helps them in higher studies.	3	Re
CO-7	apply the real situation wherever usage of trigonometrical equations	4	Ap
CO-8	reconstruct the formulae which are accustomed in elementary levels	8	Ev

Semester – III
Part III Core V - Sequences and Series, Trigonometry

Course Code :21UMAC31	Hrs/week : 6	Hrs/Semester : 90	Credits : 5

Unit I

The Completeness Property of R – Suprema and Infima - The Completeness Property of R – Applications of the Supremum Property – Functions -The Archimedean Property – The Existence of $\sqrt{2}$ - Density of Rational Numbers in R.

(Text Book 1: Chapter 2 Sec 2.3 – 2.4, pages 36 – 46)

Unit II

Sequences - Bounded Sequences - Monotonic Sequences - Convergent Sequences - Divergent and oscillating sequences -   The algebra of limits- Behaviour of monotonic sequences

(Text Book 2: Chapter 3 Sec 3.1 – 3.7, pages 39 - 68)

Unit III

Some theorems on limits – Subsequences - Limit points - Cauchy sequences - Cauchy's general principle of convergence of sequences

(Text Book 2: Chapter 3 Sec 3.8 – 3.11, pages 69 - 103)

Unit IV

Series of Positive Terms - Infinite series - Comparison test - Kummer's test - D' Alembert's ratio test - Raabe's test - Gauss's test - Cauchy's Root test – Cauchy's condensation test(without proof)

(Text Book 2: Chapter 4 Sec 4.1 - 4.4, pages 112 - 150)

UNIT V

Hyperbolic functions - Logarithm of a complex number - Gregory's Series - Summation of trigonometric series using C+iSmethod(only)

(Chapter 7, pages: 7-01 – 7-17, Chapter 8, pages 8-01 – 8-05,Chapter 9, pages 9-15 – 9-33)

Text Book

1. Robert G. Bartle, Donald R. Sherbert, *Introduction to Real Analysis* (Fourth edition), Wiley Publication, 2017
2. Dr. Arumugam.S & Thangapandi Issac.A, *Sequences and Series and Trigonometry*, New Gamma Publishing House, Palayamkottai (June 2014).

Books for Reference

1. J.A. Green, *Sequences and Series*, Routledge& Kegan Paul Ltd, 1958

	Semester - III		
	Part III Allied - Statistics I		
Course Code : 21UMMA31	Hrs/week : 6	Hrs/Sem : 90	Credits : 4

Objectives:

- To help the students to understand the uses of statistics in various competitive fields.

- To apply the statistical tools in their day to day problems.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	understand the difference between the central moments and general moments	1	Un
CO-2	compute the central moments and general moments	3	Ev
CO-3	apply concepts and theorems in solving problems	8	Cr, Ap
CO-4	find correlation between two variables	3	Ap
CO-5	evaluate particular regression lines	3 and 7	Ap
CO-6	understand the difference between the discrete random variables and the continuous random variables and solve the problems	8	Un, Ap
CO-7	fit Binomial, Poisson and Normal distribution.	8	Ap
CO-8	compare moment generating function and cumulant generating function	2 and 7	Ev

Semester - III
Part III   Allied - Statistics I

Course Code : 21UMMA31	Hrs/week : 6	Hrs/Sem : 90	Credits : 4

Unit I

Moments - Skewness and kurtosis - Curve fitting - Method of least squares - fitting lines - parabolic, exponential & logarithmic curves   **(Text book 1 Chapter 4,5)**

Unit II

Correlation & regression - scatter diagram - Karl Pearson's coefficient of correlation - properties - lines of regression coefficient & properties - rank correlation

(Text book 1 Chapter 6 §sections 6.1,6.2 6.3)

Unit III

Random variables, distribution function, two dimensional random variables, moment generating function, cumulants and characteristic function

(Text book 2 chapter5&7 §sections 5.2 to 5.5 and 7.1 to 7.3)

Unit IV

Discrete probability distribution - Geometric, Binomial & Poisson distribution & their moment generating functions, characteristic function, properties & simple application.

(Text book 2§Chapter8§Section8.4,8.5,8.7 (Omitting Negative Binomials)

Unit V

Continuous probability distributions - Gamma distributions, Normal distributions - their properties - simple problems - importance of normal distribution

(Text book 2§ Chapter 9 §sec 9.2, 9.5,9.6 and 9.7)

Text Books

1. S.Arumugam and A.Issac, *Statistics*, New Gamma publishing House. Palayamkottai

2. Gupta S.C., Kapoor V.K., *Fundamentals of mathematical Statistics* Eleventh edition, Sultan Chand & Sons, Educational Publishers, New Delhi.

Reference books

1 H.C.Saxena, *Elementary Statistics*, S.Chand & Company Ltd., New Delhi

2. J.N.Kapurand Saxena, *Mathematical Statistics*, S.Chand & Company Ltd., New Delhi.

	SEMESTER – III		
	Part III Skill Based Elective – Introduction to Python Programming		
Course Code : 21UMAS31	**Hrs / Week: 2**	**Hrs / Semester: 30**	**Credits: 2**

Objectives:

- To acquire Programming skills and Object Oriented Skills in Python
- To develop the ability to write database applications in Python.

Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	apply decision and repetitions structures in programme design	5	Ap
CO-2	demonstrate the use of Python	5	Ap
CO-3	write python programs to solve problems	8	Cr
CO-4	distinguish various Python Objects	8	An
CO-5	use string function in Python	7	Ev
CO-6	understand the fundamental concepts to write a Python Program	1	Un
CO-7	demonstrate how to read and write files Programs in Python	4	Ap
CO-8	use compound data using Python lists and tuples	5	Ev

SEMESTER – III
Part III   Skill Based Elective – Introduction to Python Programming

Course Code : 21UMAS31	Hrs / Week: 2	Hrs / Semester: 30	Credits: 2

Unit I

Introduction to Python – Operators – Variables and Assignment – Numbers and Strings – Errors and Exceptions – Python Basics

(Chapter II Sec 2.1 - 2.16, Chapter III Sec 3.1 -3.6)

Unit II

Python Objects – Internal Types – Standard Type Operators – Standard Type Built-in Functions
(Chapter IV, Sec 4.1 – 4.5)

Unit III

Introduction to Numbers – Integers – Complex Numbers – Built-in and Factory Functions – Other Numeric Types

(Chapter V, Sec 5.1 – 5.7)

Unit IV

Strings – Strings and Operators – Built-in Functions – String Built-in Methods –Lists – List Type Built-in Methods – Tuples – Tuple Operators and Built-in Functions

(**Chapter VI, Sec 6.2 – 6.6, 6.11 -6.17**)

Unit V

Conditionals and Loops – if, else if – Conditional Expressions – while, for, break, pass Statements

(Chapter VIII, Sec 8.1 – 8.10)

Text Book

 Wesley J.Chun, *Core Python Programming*, Second Edition, Pearson Education, 2012.

Web Resources: 1**.** https://www.tutorialspoint.com/python/index.htm
                2. https://youtu.be/kqtD5dpn9C8
                3. https://youtu.be/_uQrJ0TkZlc

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python", Wiley, 2015
2. Jeeve Jose & P. SojanLal, " Introduction to Computing and Problem Solving with Python" Khanna Publishers, New Delhi, 2016.

	Semester – III		
Part III Skill Based Elective - Quantitative Aptitude I			
Course Code : 21UMAS32	**Hrs/week : 2**	**Hrs/ Semester : 30**	**Credits : 2**

Objectives:

- To bring out the mental ability and skill of the students

- To train the students for competitive and professional examinations

Course outcome:

Co No	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	solve the problems easily by using short-cut method with time management to face the competitive examinations	4	Ap
Co-2	develop their calculating and computing skills.	5	Ap
Co-3	acquires the ability to understand and analyze the problem	2	Un
Co-4	apply quantitative methods to solve a variety of business problems	5	Ap
Co-5	solve the questions with accuracy and approach the problems in different manner	3	Cr
Co-6	enhances logical skills, arithmetic skills and aptitude skills.	5	Ap
Co-7	simplify and evaluate algebraic expressions.	3	Ev
Co-8	use mathematical concepts in real world situations.	8	Ap

Semester – III
Part III Skill Based Elective - Quantitative Aptitude I

Code : 21UMAS32	Hrs/week : 2	Hrs/ Semester : 30	Credits : 2

Unit I

Numbers – Square roots & cube roots

(Chapters 1& 5, pages 1-24, 96-122)

Unit II

Time & Distance – Polygons

(Chapters 17 & 25, 343-360, pages 478-484)

Unit III

Problems on Numbers – Problems on Ages

(Chapters 7 & 8, pages 143-163)

Unit IV

True Discount – Banker's Discount – Calendar

(Chapters 26, 27 & 29, pages 485-493, 500-503)

Unit V

Simplification-Average

(Chapters 4 & 6, 68-95, pages 123-142)

Text Book

Agarwal R.S., *Arithmetic Subjective and Objective for Competitive Examinations* (Revised Edition 2011), S.Chand and Company Ltd. , Ram Nagar, New Delhi – 55.

	Semester – IV		
	Part III Core VI - Modern Algebra		
Course Code: 21UMAC41	**Hrs/week : 6**	**Hrs/Semester: 90**	**Credits : 5**

Objectives:

- To give an introductory knowledge of the basics abstract systems of mathematics.
- To train the students to generalize the known concepts and to develop analytical thinking.

Course Outcome:

Co. No	Upon completion of this course, students will	PSOs addressed	CL
Co-1	explain the theory behind relations and functions and how functions may relate dissimilar structures to each other.	3	Cr
Co-2	describe and generate the basic algebraic structures such as Groups, Rings, Fields, Integral Domain, Euclidean Domain, etc., and will identify examples of these specific constructs.	1	Ev
Co-3	have a working knowledge of important mathematical concepts such as order of Group, order of an element, generator of a cyclic group, index of a subgroup, characteristic of a Ring, Maximal and Prime Ideals etc.,	2	Un
Co-4	analyze relationship between abstract algebraic structures with familiar number system such as integers, complex and real numbers	2	An
Co-5	critically analyze and construct mathematical arguments that relate to the study of introductory linear algebra. (Proof and Reasoning).	8	An
Co-6	develop ability to form and evaluate conjectures.	1 and 5	Ap
Co-7	produce the group concepts in other science disciplinary	3	Ap
Co-8	illustrate the isomorphic structures	8	An

Semester – IV
Part III Core VI - Modern Algebra

Course Code: 21UMAC41	Hrs/week : 6	Hrs/Semester: 90	Credits : 5

Unit I

Relations and Mappings - Relations - Equivalence Relations - Functions – Binary Operations

(Chapter 2, Sec 2.1 - 2.5, pages 2.1 – 2.18)

Unit II

Permutation groups - Sub groups - Cyclic Groups - Order of an Element - Cosets and Lagrange's theorem - Euler's theorem - Fermat's theorem

(Chapter 3, Sec 3.4 -   3.8, pages 3.12 – 3.31)

Unit III

Normal Subgroups and Quotient Groups - Isomorphism - Cayley's theorem - Homomorphism - Automorphism - Fundamental theorems of Homomorphism

(Chapter 3, Sec 3.9 -   3.11, pages 3.31 – 3.50)

Unit IV

Rings - definition and examples – Elementary properties of rings- Isomorphism – Types of rings - Characteristic of a ring - Sub rings

(Chapter 4, Sec 4.1 - 4.6, pages 4.1 – 4.18)

Unit V

Ideals - Quotient Rings - Maximal and PrimeI – Homomorphism of rings - Unique factorization domain(U.F.D.) – Euclidean domain.

(Chapter 4, Sec 4.7 - 4.10, 4.13- 4.14, pages 4.18 – 4.26, 4.31-4.36)

Text Book

1. Arumugam S. and Thangapandi Isaac A - *Modern Algebra*, Scitech Publications (India) PVT Ltd. Chennai Edition, 2003

Books for Reference

 1. Bhattacharya P.B., Jain S.K., Nagpaul S.R., *Basic Abstract Algebra*, Second Edition, Cambridge University Press.

 2. Santiago M.L., *Modern Algebra*, Arul Publications, Madras, 1988.

Semester – IV			
Part III Allied - Statistics II			
Course Code : 21UMMA41	**Hrs/week : 6**	**Hrs/Sem : 90**	**Credits : 4**

Objectives:

- To cater needs of statistics in professional and academic courses

- To understand the application of statistics in various fields.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	understand the difference between the weighted index numbers and unweighted	1 and 2	Un
CO-2	compute the upper and lower control limits for different chart	3	Ev
CO-3	find approximate solutions to problems	4 and 8	Cr & Un
CO-4	apply concepts and theorems in solving problems.	4	Ap
CO-5	demonstrate problem solving skills	3	An
CO-6	know type I and type II error	1	Cr
CO-7	classify the different test static	5	Un & Ap
CO-8	apply the correct test static	4	Ap

Semester – IV
Part III   Allied - Statistics II

Course Code : 21UMMA41	Hrs/week : 6	Hrs/Sem : 90	Credits : 4

Unit I

Characteristics of index numbers, Laspeyers and Paasche's – Bowley's - Marshall and Erdgeworth's index numbers - Tests - Unit test - Commodity reversal test, Time reversal test, Circular test.   **§Text book 2 chapter 9**

Unit II

Statistical Quality Control - Definition, Advantages, Process control - Control chart, Mean chart, Range chart, p - chart, np – chart.

§Text book1 volume2 chapter 7 (page 1052 - 1074)

Unit III

Testing of hypothesis -   Null and Alternate Hypothesis. Type I and Type II errors - Critical region, level of significance - Test of significance for large samples - Testing a single proportion - Difference of proportions - testing a single mean - Difference of means.
§Text book1 volume2 chapter 3 (page 881 -908)

Unit IV

Tests based on t - distribution - Single mean - Difference of means - Tests based on F distribution - Variance ratio test - Test based on chi square distribution - Independence - Goodness of fit.

§Text book1 volume2 chapters 3&4 (page 910 -920, 939-990, 1006-1009)

Unit V

Analysis of Variance - One way and two way classified data - Basis of experimental design - simple problems.   **§Text book2 chapter17**

Text Books

1. Gupta S.P., *Statistical Method*, forty fourth editionSultan chand & sons publishers-New Delhi.
2. Arumugam S. and Issac A., *Statistics*, New Gamma publishing House. Palayamkottai.

Reference Book

1. Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics* , Eleventh edition, Sultan Chand & Sons, Educational Publishers, New Delhi.

	Semester - IV		
	Part III Skill Based Elective - Documentation using LaTeX		
Course Code :21UMAS41	**Hrs/week : 2**	**Hrs/ Semester: 30**	**Credits : 2**

Objectives:

- To give deep knowledge of the LaTeX for Mathematical documentation
- To train the students to use LaTeX skills in documenting and preparing for publications.

Course Outcome:

Co No	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	know the difference between MS Word and LaTeX	3	Un
Co-2	understand the uses of LaTeX	2	Un
Co-3	apply LaTeX in their typing work	1	Un
Co-4	handle math symbols and tables	3	An
Co-5	create documents and make small presentations.	3	Ap
Co-6	become proficient in the use of software applications as used in an office environment.	3 and 8	Ap
Co-7	manipulate with the real life needs in preparing documents	3	Ap
Co-8	prepare projects in updating with the new updates and versions	8	Cr

Semester - IV
Part III Skill Based Elective – Documentation using LaTeX

Course Code :21UMAS41	Hrs/week : 2	Hrs/ Semester: 30	Credits : 2

Unit I

Typing text : Words, sentences, and paragraphs - Symbols not on the keyboard - Comments and footnotes - Changing font characteristics - Lines, paragraphs, and pages – Spaces – Boxes.

(Chapter 5, Sec 5.1 - 5.9, pages: 61 - 115)

Unit II

Text environments: Some general rules for displayed text environments - List environments - Style and size environments -Proclamations (theorem-like structures) - Proof environments - Tabular environments - Tabbing environments - Miscellaneous displayed text environments

(Chapter 6, Sec 6.1 to 6.8, pages 117 - 149)

Unit III

Typing math: Math environments - Spacing rules - Equations - Basic constructs - Arithmetic operations - Delimiters - Operators - Math accents -Stretchable horizontal lines - Formula Gallery **(Chapter 7, Sec 7.1 to 7.9, pages 151 - 186)**

Unit IV

More math**:** Spacing of symbols Building new symbols - Math alphabets and symbols - Vertical spacing - Tagging and grouping - Generalized fractions - Boxed formulas

(Chapter 8, Sec 8.1 to 8.6, pages 187 - 206)

Unit V

LaTeX documents: The structure of a document - The preamble - Abstract - Sectioning - Cross-referencing - Bibliographies. **(Chapter 10, Sec 10.1 to 10.6, pages 245 - 270)**

Text Book:

George Gratzer, *More Math into LaTeX*, 4th Edition, Springer, 2007.

https://www.javatpoint.com/latex

https://www.overleaf.com/learn/latex/Tutorials

Books for Reference:

Helmut Kopka and Patrick W. Daly, A guide to LaTeX, Fourth Edition, Addison-Wesley.

David R. Wilkins, Getting started with LaTeX, Second Edition.

Practicals: Typing Text and Tables: Chapter 4.1 - Inserting Figures: Chapter 5.1 - Mathematical Equations: Chapter 6.3- Inserting References: Chapter 7.6 - Preparing an article for mathematical journal

	Semester – IV		
	Part III Skill Based Elective - Quantitative Aptitude II		
Course Code : 21UMAS42	**Hrs/week : 2**	**Hrs/ Semester : 30**	**Credits : 2**

Objectives:

- To bring out the mental ability and skill of the students
- To train the students for competitive and professional examinations

Course outcome:

Co No	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	acquires the ability to understand and analyze the problem	2	Un
Co-2	develop their calculating and computing skills.	5	Ap
Co-3	solve mathematical problems using shortcut methods.	4	Cr
Co-4	build confidence to face the competitive examinations.	5	Cr
Co-5	solve the questions with accuracy and within the given time limit.	3	Cr
Co-6	enhances logical skills, arithmetic skills and aptitude skills.	5	Ap
Co-7	simplify and evaluate algebraic expressions.	3	Ev
Co-8	use mathematical concepts in real world situations.	4 and 8	Ap

Semester – III
Part III Skill Based Elective - Quantitative Aptitude II

Course Code : 21UMAS42	Hrs/week : 2	Hrs/ Semester : 30	Credits : 2

Unit I

Percentage– Time and Work

(Chapters 10&15, pages 179-218, 309-330)

Unit II

Ratio and Proportion-Chain Rule

(Chapters 12& 14, Pages 248-276, 291-398)

Unit III

Problems on Trains – Boats and Streams

(Chapters 18 &19, Pages 361-381)

Unit IV

Profit and Loss-Alligation or Mixture

(Chapters 11 & 20 , Pages 219-247, 382-387)

Unit V

Line Graphs-Pie charts - Bar Diagrams

(Chapters 33,34 &35, Pages 525-549)

Text Book

  1. Aggarwal R.S., *Arithmetic Subjective and Objective for Competitive Examinations*,

     S.Chand and Company Ltd. , Ram Nagar, New Delhi - 55. Revised Edition 2014.

Books for Reference

  1. Aggarwal R.S., *Quantitative Aptitude*, S.Chand and Company Ltd. , Ram Nagar, New Delhi.

  2. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations*, Tata McGraw-Hill

      Publishing Company Ltd., New Delhi.

	Semester - V		
Part III Core VII (Common Core) - Computer Oriented Numerical Methods			
Course Code: 21UCMC51	**Hrs/Week: 6**	**Hrs/ Semester : 90**	**Credits : 5**

Objectives:

- To understand and apply different methods to find the value of definite integrals.
- To analyse and evaluate the accuracy of common numerical methods and implement numerical methods in MATLAB.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	find numerical solution of a problem in all aspects and apply these methods to practical implementation as reliable and efficient.	3	Re
CO-2	recognize and apply appropriate principles and concept relevant to numerical analysis.	5	Ap
CO-3	discover the most appropriate estimate for the missing data.	1	Cr
CO-4	analyze the errors obtained in the numerical solutions of problems.	6	An
CO-5	use appropriate numerical methods, determine the solutions to given problems.	3	Ap
CO-6	demonstrate the use of the interpolation method to find the solution for the data.	8	Un
CO-7	develop their calculation skills.	1	Cr
CO-8	differentiate gauss jacobi iteration and gauss seidal iteration method.	3	An

Semester - V
Part III Core VII (Common Core) - Computer Oriented Numerical Methods

Course Code: 21UCMC51	Hrs/Week: 6	Hrs/ Semester : 90	Credits : 5

Unit I
Difference operators-Other difference operators-Newton's interpolation formulae-Lagrange's interpolation formula-Divided difference-Divided difference formula-Inverse interpolation.
(Textbook: 1, Chapter 3, Sec 3.1, 3.2, Chapter 4, Sec 4.1,4.3,4.4,4.5,4.6, pages 3.1 – 3.45, 4.1- 4.16, 4.31- 4.54) (Problems only)

Unit II
Derivatives using Newton's forward difference formula-Derivatives using Newton's backward difference formula-Derivatives using Newton's central difference formula-Maxima and minima of the interpolating Polynomial-Numerical Integration-Newton – Cote's quadrature formula-Trapezoidal Rule-Simpson's one third rule-Simpson's three eighth rule-Weddley's rule.
(Textbook: 1, Chapter 5, Sec 5.1 - 5.4, Chapter 6, Sec 6.1 - 6.4, pages 5.1 – 5. 24, 6.1 – 6.26) (Problems only)

Unit III
Taylor series method-Picard's method- Runge-Kutta method.
(Textbook: 1, Chapter 7, Sec 7.1,7.2,7.4, pages 7.1-7.15, 7.25-7.40) (Problems only)

Unit IV
Introduction to MATLAB: MATLAB environment – Types of files _ platform – search path – Constants, variables and expressions – Vectors and Matrices – Polynomials – Input Output statements – MATLAB Graphics.
(Textbook: 2, Chapters:1,2,3,4,5,6)

Unit V
Control Structures- writing programs and functions – ordinary differential equation and symbolic mathematics.
(Textbook: 2, Chapters: 7,8,9)

Text Book
1. Arumugam S and Thangapandi Isaac A, *Numerical Analysis With Programming in C*, New Gamma Publishing House, Palayamkottai.
2. Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, *MATLAB and its Applications in Engineering*, Pearsons Publications.

Books for Reference
1. Stormy Attaway, *MATLAB- A Practical Introduction to Programming and Problem Solving*.
2. Stephen J. Chapman, *Essentials of MATLAB Programming*, Published November 1st 2007 by Thomson Learning.

Semester - V				
Part III Core VIII - Linear Algebra				
Course Code: 21UMAC51	Hrs/week : 5		Hrs/Semester : 75	Credits : 4

Objectives:

• To extend the knowledge in Abstract Algebra and develop analytical thinking.

• To equip the students with the ideas of Linear Algebra to pursue their higher studies.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSOs addressed	CL
Co-1	know all the definitions in Linear Algebra	1	Un
Co-2	analyze and construct mathematical arguments that relate to the study of linear algebra. (proof and reasoning).	3	An
Co-3	solve systems of linear equations.	3	Ap
Co-4	work within vector spaces and to distill vector space properties	3	An
Co-5	determine whether a system of equations is consistent or not and find its general solution.	6	An
Co-6	compute eigen values and eigenvectors of a matrix.	4	Ap
Co-7	develop analytical thinking in R-Programming	5	An
Co-8	understand the concept of Inner Product Spaces	1	Un

Semester - V			
Part III Core VIII - Linear Algebra			
Course Code: 21UMAC51	Hrs/week : 5	Hrs/Semester : 75	Credits : 4

Unit I

Vector spaces - Elementary properties - subspaces - Quotient spaces - Direct sum - Linear span of a set - Linear dependence and independence

(Text Book 1: Chapter 5, Sec 5.1, 5.2, 5.4, 5.5, Pages 5.1-5.10, 5.14-5.19)

Unit II

Basis - Dimension, Any two bases of a finite dimensional vector space have the same number of elements –Theorems on dimension.

(Text Book 1: Chapter 5, Sec 5.3, 5.6, Pages 5.10-5.13, 5.19-5.26)

Unit III

Linear   transformations - vector space of linear transformations - Rank and nullity

theorem – Matrix of linear   transformations – Algebra of matrices -Types of matrices – The

inverse of a matrix.

(Text Book 1: Chapter 5, Sec 5.7, 5.8, Chapter 7, Sec 7.1, 7.2, 7.3, Pages 5.26-5.30, 7.1-7.15)

Unit IV

Elementary transformations – Rank of a matrix -   Characteristic equation of a matrix - Eigen values and eigen vectors -   Cayley Hamilton theorem and problems – Solution of simultaneous equations using matrices.

(Text Book 1: Chapter 7, Sec 7.4, 7.5, 7.6, 7.7, 7.8, Pages 7.15-7.40)

Unit V

Inner product spaces – Norm – Schwartz inequality – Triangular inequality -   Gram Schmidt orthogonalisation process - orthogonal complement -   Vectors and Matrices in R programming

(Text Book 1: Chapter 6, Pages 6.1-6.9 & Text Book 2)

Text Book

1. Arumugam .S and Thangapandi Issac.A ,   Modern Algebra , Scitech Publications (India) Pvt. Ltd., Chennai, Reprint 2017.
2. Linear algebra in R Søren Højsgaard February 15, 2005

Books for Reference

1. Bhattacharya P.B., Jain S.K., Nagpaul S.R., *Basic Abstract Algebra*, Second Edition, Cambridge University Press.
2. Santiago M.L., *Modern Algebra*, Arul Publications, Madras, 1988.
3. Hrishikesh-D-Vinod, *Hands-on Matrix Algebra Using R: Active And Motivated Learning with Applications*, World Scientific Publications, 2011.
4. S.Kumaraesan, *Linear Algebra A geometric Approach*, PHI Learning Publishers

	Semester V			
	Part III Core IX- Graph Theory			
Course Code : 21UMAC52	**Hrs / Week : 5**		**Hrs / Semester: 75**	**Credits : 4**

Objectives:

- To learn basic concepts in graph theory.

- To translate situations to diagrammatic representations and to develop problem solving skills.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	interpret the basics of graphs.	1	Un
Co-2	identify induced subgraphs, paths,cycles ,independent sets and coverings in graphs	1	Re
Co-3	determine whether graphs are Hamiltonian and/or Eulerian and to solve problems involving vertex and edge connectivity, planarity and crossing numbers	5	An
Co-4	combine theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory.	8	Un
Co-5	inspect the applications of graph theory	7	An
Co-6	model and solve real-world problems using graphs both quantitatively and qualitatively.	4	Ap
Co-7	develop an appropriate level of mathematical literacy and competency.	6	Cr
Co-8	formulate problems in terms of graphs, solve graph theoretic problems and apply algorithms.	5	Cr

Semester V			
Part III Core IX - Graph Theory			
Course Code : 21UMAC52	Hrs / Week : 5	Hrs / Semester: 75	Credits : 4

Unit I

Graphs and sub graphs:

Introduction - Definition and examples - Degrees - Sub graphs –Isomorphism - independent
sets and coverings - intersection graphs - Line graphs - Matrices - Operation on graphs

(Chapter 2, Sec 2.1-2.4, 2.6-2.9, pages 5-17, 19-27).

Unit II

Degree Sequences: Introduction –Degree sequences - Graphic Sequence Connectedness -
introduction-walks - trails and paths - Connectedness and components - blocks - connectivity.

(Chapters 3 and 4 Sec 3.1-3.2, 4.1-4.4, pages 29-47).

Unit III

Eulerian and Hamiltonian graphs:

Introduction - Eulerian graphs - Hamiltonian graphs - Trees – introduction - Characterization of
trees - Centre of a tree .

(Chapters 5 and 6, Sec 5.1-5.2, 6.1-6.2, pages 48-65).

Unit IV

Planarity:

Definition and properties, Characterization of planar graphs – thickness,crossing and
outer planarity

(Chapter- 8, Sec 8.1-8.3, pages 73-84).

Unit V

Colourability:

Chromatic number and Chromatic index - the five colour theorem –Chromatic polynomials

(Chapter- 9, Sec 9.1-9.4, pages: 85-98).

Text Book

S. Arumugam , S. Ramachandran - *Invitation to Graph theory*, Scitech Publications
(India) Pvt. Ltd., (2001) Chennai - 17.

Books for Reference

1. Parthasarathy K.R., *Basic Graph Theory*, Tata McGraw Hill Publishing Company Limited,
   New Delhi
2. John Clark and Derek Allan Holton, *A First Look at Graph Theory*, World Scientific
   Publishing Co.Pte.Ltd, Singapore, Reprint 2013.

	SEMESTER – V		
	Part III Core X - Real Analysis		
Course Code : 21UMAC53	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 4**

Objectives:

- To inculcate knowledge on Real numbers and their properties & proofs.
- To develop the application of the concepts.

  Course Outcomes

Co No	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	interpret real number system and its properties.	1	Un
Co-2	define and recognize the continuity of real functions	1	Re
Co-3	define and recognize the real functions and its limits	1	Re
Co-4	interpret mathematical ideas via extended written presentation.	2	Un
Co-5	develop a broad understanding encompassing logical reasoning, generalization, abstraction, and formal proof.	5	An
Co-6	formulate proofs and structure mathematical arguments.	6	An
Co-5	determine the continuity, differentiability of functions defined on subsets of the real line	3	Ev
Co-7	apply the Mean Value Theorem and the intermediate value property to problems in the context of real analysis	5	Ap
Co-8	describe fundamental properties of the real numbers that lead to the formal development of real analysis.	3	An

SEMESTER – V
Part III Core X - Real Analysis

Course Code : 21UMAC53	Hrs / Week: 4	Hrs / Semester: 60	Credits: 4

Unit I

Continuous functions – Sequential Criterion for continuity – Discontinuity Criterion - Combinations of continuous functions – Composition of continuous functions - Continuous functions on intervals – The Maximum-Minimum theorem.

(**Chapter 5, Sec 5.1 - 5.3(upto 5.3.6), pages 124-137).**

Unit II

Bolzano's theorem- Uniform continuity – Nonuniform continuity Criteria – Lipschitz Functions - The continuous extension theorem - Step function - Extreme value theorem - Monotone functions.

(**Chapter 5, Sec 5.3 - 5.4, pages 138-148**).

Unit   III

Continuity and Gauges - Existence of δ-fine partitions - Monotone and inverse functions - The nth root function - Rational Powers.

(**Chapter 5, Sec 5.5 - 5.6, pages 149-159).**

Unit IV

Differentiation - The derivative- The chain rule - Inverse functions - The Mean value theorem - First Derivative Test for Extrema - Applications of Mean value theorem - Inequalities - The intermediate value property of derivatives.

(**Chapter 6, Sec 6.1-6.2, pages 161-179**)

Unit V

L'Hospital's rules - Indeterminate forms - Taylor's Theorem- Applications of Taylor's Theorem - Relative Extrema - Convex functions - Newton's Method.

(**Chapter 6, Sec 6.3 - 6.4, pages 180-196).**

Text Book

  Robert G. Bartle and Donald R. Sherbert, *Introduction to Real Analysis,* Fourth Edition, Wiley India Edition, Reprint 2017.

Books for Reference

1. Richard R. Goldberg, *Methods of Real Analysis*, Oxford & IBH Publishing Co., New Delhi. Reprint 1973.
2. Ajit Kumar and S. Kumaresan, *Real Analysis*, Crc Press, 2015.

	Semester –V		
	Part III Core XI - Vector Calculus and Fourier Series		
Course Code : 21UMAC54	**Hrs/week : 4**	**Hrs/Semester : 60**	**Credits : 4**

Objectives:

- To introduce physical application of derivatives of vectors.
- To study the line integral, surface integral and volume integral and their applications.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	differentiate and integrate vector-valued functions and apply calculus to motion problems in two and three dimensional space	2	An
Co-2	compute gradient, curl and divergence of vector fields.	1 and 3	C
Co-3	use the gradient to find directional derivatives.	3	Ap
Co-4	solve problems in multiple integration using rectangular, cylindrical, and spherical coordinate systems	8	A
Co-5	select and apply appropriate models and techniques to define and evaluate integrals	3	E
Co-6	apply greens theorem, stokes theorem and gauss divergence theorem to evaluate integrals.	3	A
Co-7	know that any periodic function can be expressed as a fourier series.	6	Cr
Co-8	expand an odd or even function as a half-range cosine or sine fourier series.	1	Un, An

Semester –V
Part III Core XI-Vector Calculus and Fourier Series

Course Code : 21UMAC54	Hrs/week : 4	Hrs/Semester : 60	Credits : 4

Unit I

Vector differentiation –Differentiation of vectors – Gradient

(Text Book 1: Chapter 5, Sec5.0,5.1,5.2,5.3, Pages 5-1 to 5-18)

Unit II

Divergence and Curl – Solenoidal, Irrotational

(Text Book 1: Chapter 5, Sec5.4, Pages 5-18 to 5-30)

Unit III

Vector integration - line integrals - surface integrals

(Text Book 1: Chapter 7,Sec 7.1, 7.2, Pages L&S INT 1 to 11)

Unit IV

Vector integration - Gauss, Stokes and Green's theorems (Without proof), problems only

(Text Book 1: Chapter 7, Sec 7.3, Pages L&S INT 11 to 32)

Unit V

Fourier series - Half - range, sine & cosine series

(Text Book 2: Part II Chapter 5, 459-478)

Text Books

1. Arumugam S. and Thangapandi Isaac A, *Analytical Geometry of Three DimensionsandVector Calculus*, New Gamma Publishing House, Edition 2014,

2. Arumugam S. and Thangapandi Isaac A, *Calculus*, New Gamma Publishing House, Edition 2014.

Books for Reference

1. DuraiPandian P and Laxmi Duraipandian, *Vector Analysis*, Emerald Publishers, Edition 1986.

2. Piskunov N, *Differential and Integral Calculus*, Vol II, CBS Publishers and Distributors.

	Semester –V		
Part III	**Core Elective – Discrete Mathematics**		
Course Code : 21UMAE51	**Hrs/week : 4**	**Hrs/ Semester: 60**	**Credits : 4**

Objectives:

- To provide students with the basic knowledge, both theoretical and empirical, necessary to understand, analyze and solve discrete mathematical problems arising throughout their higher education and professional future.
- To familiarize the students with the basic concepts, results, methods, vocabulary and notation associated with Discrete Mathematics.

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
Co-1	understand logic and mathematical reasoning to count or enumerate objects in a systematic way.	1	Un
Co-2	use truth tables for expressions involving the logical connectives .	8	Ap
Co-3	develop capacity in knowing what constitutes a valid argument, and in constructing valid arguments or proofs.	3	An
Co-4	apply standard rules of inference.	3	Ap
Co-5	grasp the notions of lattices.	1	Un
Co-6	understand Boolean algebra and truth tables.	1	Un
Co-7	evaluate and simplify expressions using the properties of Boolean Algebra.	5	Ev
Co-8	apply logical reasoning to solve a variety of problems.	4	Ap

Semester –V			
Part III	Core Elective – Discrete Mathematics		
Course Code : 21UMAE51	Hrs/week : 4	Hrs/ Semester: 60	Credits : 4

Unit I

Propositional logic - Propositional equivalences - Predicates and Quantifiers - Nested Quantifiers - Rules for inference - Introduction to proofs - Proof Methods and strategy

(**Text Book 1** :**Chapter 1- Sec 1.1, 1.2, 1.4-1.8**)

Unit II

Mathematical Induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and Combinations – Recurrence relations – Solving linear recurrence relations

(**Text Book 1 :Chapter 5 - Sec 5.1, 5.2, Chapter 6 - Sec 6.1,6.2 &6.3, Chapter 8 - Sec 8.1 & 8.2)**

Unit III

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths

(**Text Book 1 :Chapter 10 - Sec 10.1 – 10.5)**

Unit IV

Generating functions – Inclusion and Exclusion Principle and its applications – Relations and their properties – Representing relations – Closure of relations – Equivalence of relations – Partial orderings

(**Text Book 1** : **Chapter 8 - Sec 8.4, 8.5, 8.6, Chapter 9 - Sec 9.1, 9.3-9.6**)

Unit V

Partial ordering – Posets – Lattices as posets – Properties of Lattices – Lattices as algebraic systems – sub lattices – Direct product and homomorphism – some special lattices – Boolean algebra.

(**Text Book 2 , Chapter 4, 4-1, 4-2, pages 378 – 401)**

Text Books

1. Kenneth H. Rosen, *Discrete Mathematics and its Applications*, 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2012
2. Trembly J.P and Manohar R, *Discrete Mathematical Structures and Applications to computer Science,* Tata McGraw hill Pub. Co. Ltd, New Delhi 35th Reprint, 2008.

Book for Reference

1. Seymour Lipschutz, Marc Lars Lipson, *Discrete Mathematics*, Tata McGraw Hill, NewDelhi.
2. K.Chandrasehara Rao, *Discrete Mathematics,* NAROSA Publishing House Pvt. Ltd, 2012.

	Semester V		
	Part III Core Elective - Transforms		
Course Code: 21UMAE52	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Objectives:
- To enable the students to study the Laplace Transforms, properties of Laplace Transforms, inverse Laplace transforms and some applications to solve the differential equation and integral equations.
- To enable the students to study Fourier Transforms and its applications to solve some boundary value problems.

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	represent periodic functions using Fourier series.	1	Un, Ap
CO-2	Understand the relation between Fourier and Laplace transforms.	4	Ap
CO-3	learns complex numbers and their properties.	2,3	Un
CO-4	Evaluate complex integrals by various methods.	1	An
CO-5	understand Z - Transforms	1	Un
CO-6	solve ordinary differential equations using Laplace transform.	1,4	An
CO-7	understand the applications of Laplace transform and Fourier Transform	1,5	Un
CO-8	apply the Transforms to various differential equations.	2	Ap

Semester V			
Core Elective- Transforms			
Course Code: 21UMAE52	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

Unit I

Application of Laplace Transform to solve Integral Equations – Integral Equation – Abel's Integral Equation – Volterra Integral Equation – Fredholm Integral Equation – Integro-Differential Equation.

(Text Book 1: Chapter 10: Page No: 437-448)

Unit II

Fourier Transforms: Introduction – Fourier Integral Theorem – Fourier Transforms – Properties of Fourier Transforms – Convolution – Parseval's identity for Fourier Transforms

(Text Book 2: Chapter 22: Page No: 836 - 851)

Unit III

Relation between Fourier and Laplace Transforms - Fourier Transforms of the derivatives of a function – Inverse Laplace transforms by method of residues – Application of transforms to boundary value problems

(Text Book 2: Chapter 22: Page No: 851- 865)

Unit IV

Z-Transforms: Introduction –Definition – Some standard Z – Transform - Linear property – Damping rule – Some standard results – multiplication by n - Two basic theorems

(Text Book 2: Chapter 23: Page No: 866 - 874)

Unit V

Some useful inverse Z- Transforms – Convolution Theorem – Convergence of z-Transform – Evaluation of inverse Z – Transform – Applications to difference Equations

(Text Book 2: Chapter 23: Page No: 876 - 884)

Text book:

1. Rakesh Kumar and Nagendra Kumar, *Differential Equations and Integral Transforms*, BS Publishers & Distributers Pvt Ltd, New Delhi, First Edition 2016
2. Dr. B. S. Grewal, *Higher Engineering Mathematics*,Khanna Publishers, 40th Edition, October, 2007

Reference books:

T.Veerarajan, *Engineering Mathematics*, Tata McGraw-Hill Publishing Company Limited, New Delhi, Third Edition 2008.

	Semester –VI			
	Part III Core XII - Complex Analysis			
Course Code : 21UMAC61		**Hrs/week : 6**	**Hrs/Semester : 90**	**Credits : 5**

Objectives:

- To expose students to more complex theories of study.

- To sharpen analytical thinking and their problem solving capacity.

Course Outcome:

Co No	Upon successful completion of this course students will be able to:	PSO s addressed	CL
Co-1	compute sums, products, quotients, conjugate, modulus, and argument of complex numbers.	1	An
Co-2	understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.	2	Un
Co-3	evaluate integrals along a path in the complex plane and understand the statement of Cauchy's Theorem.	6	Ev
Co-4	know the condition(s) for a complex variable function to be analytic and/or harmonic.	3	Un
Co-5	compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues.	2	An
Co-6	use the Cauchy Residue theorem to evaluate integrals and sum series.	6	Ap
Co-7	demonstrate curve properties for image processing with transformation	6	Ap
Co-8	outline complex number system with intense perception	6	An

Semester –VI			
Part III Core XII - Complex Analysis			
Course Code :21UMAC61	**Hrs/week : 6**	**Hrs/Semester : 90**	**Credits : 5**

Unit I

Complex Numbers- Conjugation and modulus – Inequalities –Square Root – Geometrical Representation of Complex Numbers – nth Roots of Complex numbers - Circles and Straight lines – Regions in the Complex Plane - Extended Complex Plane - Continuous functions- Differentiability - The Cauchy - Riemann equations- Analytic Functions.

(Chapter 1 Sec 1.0 – 1.9, Chapter 2 Sec 2.4, 2.5, 2.6 & 2.7, pages 1- 21, 30 - 50)

Unit II

Harmonic functions - Conformal mapping – Elementary Transformations -Bilinear Transformations - Cross ratio –Fixed points of Bilinear Transformations – Some Special Bilinear Transformation.

(Chapter 2 Sec 2.8 - 2.9, Chapter 3, pages 50 - 100)

Unit III

Complex integration- Definite integral - Cauchy's theorem - Cauchy's integral formula - Higher derivatives

(Chapter 6, Sec 6.0 – 6.4, pages 132-172)

Unit IV

Series Expansions - Taylor's series - Laurent's series - Zeros of Analytic Functions – Singularities

(Chapter 7, Sec 7.0 – 7.4, pages 173 - 208)

Unit V

Calculus of Residues - Residues - Cauchy's Residue Theorem - Evaluation of Definite Integrals

(Chapter 8, Sec 8.0 – 8.3, pages 209 -255)

Text Book

Arumugam S., Thangapandi Issac A., SomasundaramA., *Complex Analysis*, SciTech publications(India) Pvt.Ltd, 2014.

Books for Reference

1. Narayanan,ManicavachagomPillai, *Complex Analysis*, S.Viswanathan printers & Publishers Pvt. Ltd.
2. P.Duraipandian, Laxmi Duraipandian & D.Muhilan, *Complex Analysis*, Emerald Publishers, Chennai.

	Semester – VI		
	Part III Core XIII - Modern Analysis		
Course Code : 21UMAC62	Hrs / Week: 6	Hrs / Semester: 90	Credits: 5

Objectives:

- To introduce the basic concepts in Analysis and to enable the students to understand fundamental ideas and theorems on Metric spaces
- To develop the application of the concepts.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	gain knowledge of concepts of modern analysis, such as open sets ,closed sets, completeness, connectedness and compactness in metric spaces	1	Un
Co-2	be able to write simple proofs on their own and study rigorous proofs	5	Ap
Co-3	develop a higher level of mathematical maturity combined with the ability to think analytically	2	Un
Co-4	develop a broad understanding encompassing logical reasoning, generalization, abstraction, and formal proof.	5	Ap
Co-5	formulate proofs and structure mathematical arguments.	6	Ap
Co-6	explain the basic theory of metric spaces and its application to function spaces.	3	Ev
Co-7	follow more advanced treatments of real analysis and study its applications	3	Ap
Co-8	apply the theory to solve mathematical problems including the construction of simple proofs.	2	An

Semester – VI
Part III Core XIII -   Modern Analysis

Course Code : 21UMAC62	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 5**

Unit I

Metric spaces - Bounded sets - open ball - open sets - diameter of a set - interior of set

(Chapter 2, Sec 2.1-2.6, pages 17-58).

Unit II

Closed sets - closure - limit point - dense sets

(Chapter 2, Sec 2.7-2.10, pages 59-79).

Unit III

Complete metric space - Cantor's intersection theorem - Baire's Category Theorem

(Chapter 3, Sec 3.1-3.2, pages 80-100).

Unit IV

Connectedness - equivalent conditions - connected subsets of R - connectedness and continuity - continuous image of a connected set is connected - Intermediate mean value theorem

(Chapter 5, Sec 5.1-5.3, pages 139-150).

Unit V

Compactness - definition of open cover - compact metric space – Heine Borel theorem - compactness and continuity - continuous image of a compact set is compact - uniform continuity – Continuous function on a compact metric space is uniformly continuous – equivalent characterizations of compactness–compactness and continuity.

(Chapter 6, Sec: 6.1-6.4, pages: 150-178).

 Text Book

     Arumugam S. and Issac, *Modern Analysis*, New Gamma Publishing House, Edition 2010.

Books for Reference

 1. Richard R Goldberg, *Methods of Real Analysis*, Oxford & IBH Publishing Co, New Delhi, Reprint 1973.
 2. Robert G.Bartle and Donald R.Sherbert, *Introduction to Real Analysis Fourth Edition* Wiley India Edition, Reprint 2017.

	Semester VI		
	Part III Core XIV - Mechanics		
Course Code :21UMAC63	Hrs/week :6	Hrs/Semester :90	Credits :5

Objectives

To provide basic knowledge of the behavior of objects in motion

To develop a working knowledge to handle practical problems

Course Outcomes

CO.No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	understand the equilibrium of forces	1	Un
CO-2	know the conditions for equilibrium	3	Ev
CO-3	distinguish between parallel and non parallel forces	8	Cr & Ap
CO-4	know the types of friction laws	1	Cr
CO-5	apply friction laws in problems	5	Un & Ap
CO-6	understand the two types of impact	1	Ap
CO-7	understand the simple harmonic motion	3 and 7	Ap
CO-8	determine the simple harmonic motion	4	Ap

Semester VI
Part III   Core XIV - Mechanics

Course Code :21UMAC63	Hrs/week :6	Hrs/Semester :90	Credits :5

Unit I

Lami's theorem, Parallel forces and moments - Resultant of Two like and unlike parallel forces, moment of a force - t Varignon's theorem - moment of force about an axis couples.

(Text Book 1: Chapter 3,4, pages 52-96)

Unit II

Equilibrium of three forces acting on rigid body subjected to any three forces - three coplanar forces theorem, Two Trigonometrical theorems, problems.

(Text Book 1: Chapter5, pages 98-142)

Unit III

Frictions - Laws of friction - angle of friction - cone of friction - Equilibrium of particle on a rough inclined plane under a Force.

(Text Book 1: Chapter7, pages 206-262)

Unit IV

Fundamental laws of impact -   impact of a smooth sphere on a fixed smooth plane - direct impact of smooth elastic spheres**.   (Text Book2: Chapter 8, pages 215-261)**

Unit V

Definition - Geometrical representation of S.H.M.'s –Composition of S.H.M.'s of the same period and in the same line -   Composition of S.H.M.'s of the same period and in two perpendicular directions.   **(Text Book2: Chapter 10, pages 309-355)**

Text Books

1. Venkatraman, M.K.*Statics*, Agasthiar Book House, Tiruchirapalli, Aug 2011

2.Venkatraman M.K*, Dynamics*, Agasthiar Book house, Tiruchirapalli, 16th Edition, Jan2014

Books for Reference

1**.** Duraipandian P., *Mechanics,* S.Chand and Company Ltd

2.Bali N.P., *Dynamics*, Laxmi Publication, Delhi

	Semester –VI		
	Part III Core XV - Operations Research		
Course Code :21UMAC64	**Hrs/week : 6**	**Hrs/Semester :90**	**Credits : 5**

Objectives:

- To introduce the various techniques of operations research
- To apply Mathematical theories to Commerce and Business and Management

Course Outcome:

Co No	Upon completion of this course, students will be able to	PSO s addressed	CL
Co-1	develop a fundamental understanding of linear programming models	1,3	Un
Co-2	express the dual of a linear programming problem and solve the resulting dual problem using the dual simplex method.	8	Cr, Ap
Co-3	solve a two – dimensional linear programming problem graphically.	8	Ap
Co-4	interpret the mathematical tools that are needed to solve optimization problems.	2	Ap
Co-5	apply the simplex method for solving linear programming problem	5	Ap
Co-6	comprehend the concept of a Transportation Model and develop the initial solution for the same	4	Un
Co-7	apply the Hungarian method for solving assignment problems	5	Ap
Co-8	examine the significant impact of job sequencing system on total elapsed time management	8	An

Semester – VI		
Part III Core XV - Operations Research			
Course Code :21UMAC64	Hrs/week : 6	Hrs/Semester :90	Credits : 5

Unit I

Introduction - Linear programming problem - Mathematical formulation of the problem - Introduction - Graphical Solution method - General linear programming problem - Canonical and standard forms of L.P.P. -Introduction - The Simplex algorithm

(Chapter 2, Sec 2.1 - 2.3, Chapter 3, Sec 3.1, 3.2, 3.4, 3.5, Chapter 4, Sec 4.1, 4.3, pages 39 - 40,   65 - 76, 79 - 84, 87 - 89, 99 - 106)

Unit II

Use of artificial variables - Two phase method - Big - M method (Method of penalties) - Introduction - General primal - dual pair -Formulating a dual problem - Primal - Dual pair in matrix form -Duality and Simplex method- Dual simplex method

(Chapter 4, Sec 4.4, Chapter 5, Sec5.1 – 5.4, 5.7, 5.9, pages 106 - 114, 129 - 134, 138 - 142, 148 - 150)

Unit III

Transportation problem: Introduction-LP formulation of the Transportationproblem-Solutions of a Transportation Problem - Finding an initial basic feasible solution - Test for optimality - Degeneracy in Transportation Problem - Transportation Algorithm (MODI Method).

(Chapter 10, Sec 10.1, 10.2, 10.8 – 10.13, pages 247, 248, 252 – 266, 269 - 273)

Unit IV

Assignment problem: Introduction - Mathematical formulation of the problem -Solution methods of assignment problem-Special cases in assignment problems.

(Chapter 11, Sec 11.1 - 11.4, pages 295 – 315)
Unit V

Sequencing problem:Introduction - Problems of sequencing - Basic terms used in sequencing - Processing n jobs through Two machines -Processing n jobs through k machines, Processing 2 jobs through k machines

(Chapter 12, Sections 12.1 - 12.6, pages 327 – 342)

Text Book
1.Kantiswarup, P.K. Gupta, and Manmohan: *Operations Research*, Sultan Chand & Sons, Educational Publishers, New Delhi, Reprint 2013.
Books for Reference
1.Prem Kumar Gupta and Hira D.S: *Operations Research*, Sultan Chand & Sons, Educational Publishers, New Delhi -2   .
2.Billy E Gillet: *Introduction to Operations Research*, Tata McGraw Hill publishing Company, New Delhi.

Semester VI			
Part IV Core XVI– Coding theory			
Course Code: 21UMAC65	**Hrs / Week: 6**	**Hrs / Semester: 90**	**Credits: 4**

Objectives:

- To obtain the concept of source coding and various coding techniques that are used for practical purposes.
- To generate mathematical ideas and methods that can be used to transmit information more reliably.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	understand the fundamental concepts of coding theory, types of error and control code technique.	1	Un
CO-2	perform with vectors, matrices and projective spaces over finite fields and polynomials.	4	Cr
CO-3	describe the concepts of extended golay code and decode the extended golay code.	3	Ev
CO-4	analyze the theoretical principles of source coding.	6	An
CO-5	analyze the notion of various decoding techniques.	3	An
CO-6	understand and analyze the concepts of error control coding.	2	Un, An
CO-7	prove general facts about different codes and block control coding.	6	Ev
CO-8	apply the knowledge of perfect codes, hamming codes, extended codes and golay codes for error detection and correction.	5	Ap

Semester VI			
Part IV Core XVI – Coding theory			
Code: 21UMAC65	Hrs / Week: 6	Hrs / Semester: 90	Credits: 4

Unit I

Basic assumptions – Correcting and detecting error patterns – Information rate – Effects of error correction and detection – Finding the most likely code word transmitted.

(Chapter 1, Sections: 1.1 - 1.6)

Unit II

Linear codes – Two important subspaces - Independence – Basis, Dimension – Matrices – Bases for C and C^+ – Generating matrices and Encoding.

(Chapter 2, Sections: 2.1 - 2.6)

Unit III

Parity check matrices – Equivalent codes – Distance of a linear code – Cosets – MLD for linear codes – Reliability of IMLD for linear codes.

(Chapter 2, Sections: 2.7 - 2. 12)

Unit IV

Some bounds for codes – Perfect codes – Hamming codes – Extended codes – The Extended Golay code – Decoding the extended Golay code – The Golay code.

(Chapter 3, Sections: 3.1 - 3.7)

Unit V

Polynomials and Words – Introduction to cyclic codes – Polynomial Encoding and Decoding – Finding cyclic codes – Dual cyclic codes.

(Chapter 4, Sections: 4.1 - 4.5)

Text Book

D.G. Hoffman, D.A Leonard, C.C. Linder, K.T. Phelps, C.A. Rodger and J.R. Wall, *Coding Theory - The Essentials*, Marcel Dekker, Inc., 1991, New York.

Books for Reference

1. Ron M. Roth, *Introduction to Coding Theory*, 2006, Cambridge University Press, Cambridge, UK.
2. Raymond Hill, *A first course in coding theory*, 2004, Clarendon Press, Oxford.