B.Sc. Mathematics with Computer Applications

Syllabus

AFFILIATED COLLEGES

Program Code: 26C

2021 – 2022 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A" Grade by NAAC,
Ranked 13th among Indian Universities by MHRD-NIRF,
World Ranking: Times -801-1000,Shanghai -901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The **B. Sc. Mathematics** program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Acquire knowledge in functional areas of Mathematics and apply in all the fields of learning.
PEO2	Recognise the need for lifelong learning and demonstrate the ability to explore some mathematical content independently.
PEO3	Employ mathematical ideas encompassing logical reasoning, analytical, numerical ability , theoretical skills to model real-world problems and solve them.
PEO4	Develop critical thinking, creative thinking, self confidence for eventual success in career.
PEO5	Analyze, interpret solutions and to enhance their Entrepreneurial skills, Managerial skills and leadership.
PEO6	To prepare the students to communicate mathematical ideas effectively and develop their ability to collaborate both intellectually and creatively in diverse contexts.
PEO7	Rewarding careers in Education, Industry, Banks, MNCs and pursue higher studies.

Program Specific Outcomes (PSOs)	
After the successful completion of **B. Sc. Mathematics (C.A)** program, the students are expected to	
PSO1	Maintain a core of mathematical and technical knowledge that is adaptable to changing technologies and provides a solid foundation for extended learning.
PSO2	Identify the applications of Mathematics in other disciplines and society.
PSO3	Develop anin-depth knowledge in Mathematics appreciating the connections between theory and its applications.
PSO4	Demonstrate their mathematical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
PSO5	Develop mathematical aptitude and the ability to think abstractly
PSO6	Learn independently and improve one's performance.
PSO7	Students are equipped to appear competitive examinations.

Program Outcomes (POs)	
On successful completion of the **B. Sc. Mathematics(C.A)**program	
PO1	Students are empowered with analytical and logical skills to formulate results and construct mathematical argument.
PO2	Ability to organize, analyze and interpret data accurately in both academic and non -academic context.
PO3	Demonstrate effective communication of mathematical ideas and creative thinking skills to facilitate solving real world problems as a team and independently.
PO4	Appreciate and identify the connections between mathematics and other disciplines.
PO5	Competency to obtain employment in education, public and private sectors.
PO6	Identify the area of interest for extended learning from the understanding gained from the domain and allied areas of Mathematics.
PO7	Develop mathematical aptitude, programming skills and make critical observations .
PO8	Garner innovative ideas to face global challenges.
PO9	Instill a sense of responsibility in tackling professional and social issues ethically.
P10	Trigger their passion for research in unexplored areas of Mathematics.

BHARATHIAR UNIVERSITY::COIMBATORE 641 046
B. Sc. Mathematics (C.A) Curriculum (Affiliated Colleges)
(CBCS PATTERN)
(*For the students admitted from the academic year **2021-2022** and onwards*)
Scheme of Examination

Part	Title of the Course	Hours/ Week	Examination				Credits
			Duration in Hours	Maximum Marks			
				CIA	CEE	Total	
	Semester I						
I	Language - I	6	3	50	50	100	4
II	English - I	6	3	50	50	100	4
III	Core Paper I - Classical Algebra	4	3	50	50	100	4
III	Core Paper II-Calculus	5	3	50	50	100	4
III	Allied A:Paper I Chosen by the College	7	3	50	50	100	4
IV	Environmental Studies*	2	3	-	50	50	2
	Total	**30**		**250**	**300**	**550**	**22**
	Semester II						
I	Language – II	6	3	50	50	100	4
II	English – II	6	3	50	50	100	4
III	Core Paper III - Analytical Geometry	4	3	50	50	100	4
III	Core paper-IV-Programming in C	3	3	30	45	75	3
III	Core paper-IV- Programming in C Practical	2	3	10	15	25	1
III	Allied A: Paper II Chosen by the College	7	3	50	50	100	4
IV	Value Education – Human Rights*	2	3		50	50	2
	Total	**30**		**240**	**310**	**550**	**22**
	Semester III						
III	Core Paper V- Trigonometry, Vector Calculus &Fourier Series	5	3	50	50	100	4
III	Core Paper VI-Statics	5	3	50	50	100	4
III	Core Paper VII - Programming in C++	5	3	50	50	100	4
III	Core Paper VII -Programming in C++ Practical	3	3	25	25	50	2
III	Allied B -Paper I Physics I/ Chemistry I	5	3	30	45	75	3
	Paper I - **Practical**	2	-	-	-	-	-
	(Or)-Accountancy-I	7	3	50	50	100	4
IV	Skill based Subject - Operations Research -I	3	3	30	45	75	3
IV	Tamil** / Advanced Tamil* (OR) Non-major elective - I (Yoga for Human Excellence)* / Women's Rights*	2	3		50	50	2
	Total	**30**		**235**	**315**	**550**	**22**

	Semester IV						
III	Core Paper VIII- Differential Equations and Laplace Transforms.	5	3	50	50	100	4
III	Core Paper IX- Dynamics	5	3	50	50	100	4
III	Core Paper X- RDBMS ORACLE	5	3	50	50	100	4
III	Core Paper X-RDBMS ORACLE Practical	3	3	25	25	50	2
III	Allied B - Paper II	5	3	30	45	75	3
	Physics II / Chemistry II Paper II- Practical	2	3	25	25	50	2
	(Or)-Accountancy-II	7	3	50	50	100	4
IV	Skill based Subject - Operations Research – Paper II	3	3	30	45	75	3
IV	Tamil**/Advanced Tamil* (OR) Non-major elective -II (General Awareness*)	2	3		50	50	2
	Total	**30**		**260**	**340**	**600**	**24**
	Semester V						
III	Core Paper XI- Real Analysis-I	5	3	50	50	100	4
III	Core Paper XII- Modern Algebra-I	5	3	50	50	100	4
III	Core Paper XIII- Complex Analysis	6	3	50	50	100	4
III	Core Paper XIV- Visual Basic	4	3	50	50	100	4
III	Core Paper XIV Visual Basic Practical	3	3	25	25	50	2
III	Elective I	4	3	30	45	75	3
IV	Skill based Subject - Operations Research Paper III	3	3	30	45	75	3
	Total	**30**		**285**	**315**	**600**	**24**
	Semester VI						
III	Core Paper XV - Real Analysis-II	5	3	50	50	100	4
III	Core Paper XVI - Modern Algebra-II	5	3	50	50	100	4
III	Core Paper XVII - Internet Java Programming	4	3	50	50	100	4
III	Core Paper XVII -Internet Java Programming Practical	4	3	25	25	50	2
III	Elective II	4	3	30	45	75	3
	Elective III	5	3	50	50	100	4
IV	Skill Based Subject - Operations Research Paper IV	3	3	30	45	75	3
V	Extension Activities ** / Swachh Bharath@			50	-	50	2
	Total	**30**		**335**	**315**	**650**	**26**
	Grand Total	**180**		**1605**	**1895**	**3500**	**140**

Note

* No Continuous Internal Assessment (CIA). Only University Examinations

** No University Examinations. Only Continuous Internal Assessment (CIA).

@Swachh Bharath Internship Scheme (SBIS) is to be added for 2 credits in the extension activities.

Allied Subjects(Colleges can choose any two subjects)		
1.Physics 2.Chemistry 3.Accountancy 4.Statistics.		
List of Elective papers		
(Colleges can choose any one of the paper as electives)		
Elective – I	A	Astronomy- I
	B	Numerical -Methods-I
	C	Graph Theory
Elective – II	A	Astronomy—II
	B	Numerical Methods-II
	C	Digital Electronics &Computer Fundamentals
Elective – III	A	Automata Theory & Formal Languages
	B	Fuzzy logic and Neural Networks
	C	Number Theory
	D	Discrete Mathematics
	E	Introduction to Industry 4.0 ***

***Syllabus added from 2020-2021

First Semester

Course code		CLASSICAL ALGEBRA	L	T	P	C
Core/Elective/Supportive		Core Paper – I	4	-	-	4
Pre-requisite		Knowledge Of Limits	Syllabus Version		2021 - 2022	

Course Objectives:

1. To enable the students to learn Binomial, Exponential, Logarithmic series and their application to summation of series.
2. To study intensively the convergence and divergence of different types of series.
3. To demonstrate the standard methods to solve both polynomial and transcendental type equations.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know about the concept of Binomial ,Exponential , Logarithmic series and their application to summation of series.	K1
2	Acquire a clear knowledge regarding methods to find an approximate roots of the equations.	K2
3	Apply the appropriate tests to find the convergenceor divergence of an infinite series.	K3
4	Apply Descartes's rule of signs to find the number of positive and negative roots if any in a polynomial equation .	K3
5	Analyzethe relation between roots and coefficients of the polynomial equations.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Summation Of Series Using Binomial And Exponential Theorem	12hours

Binomial, exponential theorems-their statements only- their immediate application to summation and approximation only.

Unit:2	Logarithmic Series, Convergence And Divergence Of Series	12 hours

Logarithmic series theorem-statement and proof-Immediate application to summation and approximation only. Convergency and divergency of series–definitions, elementary results-comparison tests-De -Alembert's and Cauchy's tests.

Unit:3	Absolute Convergence Of Series	12 hours

Absolute convergence-series of positive terms-Cauchy's condensation test-Raabe's test.

Unit:4	Theory Of Equations	12 hours

Roots of an equation- Relations connecting the roots and coefficients- transformations of equations-character and position of roots-Descarte's rule of signs-symmetric function of roots-Reciprocal equations.

Unit:5	Multiple Roots	12 hours

Multiple roots-Rolle's theorem - position of real roots of f(x) =0 – Newton's method of approximation to a root – Horner's method.

	Total Lecture hours	60 hours

Text Book(s)	
1	Algebra-T.K .Manicavachasam Pillai, T.Natarajan& K.S Ganapathy , (S. Viswanatham Printers & Publishers Private Ltd-2006)
Reference Books	
1	Mathematics for B.Sc. Branch I -Vol. I- P. Kandasamy and K.Thilagavathy (For B.Sc-I semester) (S. Chand and Company Ltd, New Delhi, 2004.)
2	Algebra - N.P.Bali (Publisher: Laxmi Publications-New Delhi Edition 2010) .
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.brainkart.com/article/Introduction-to-Binomial,-Exponential-and-Logarithmic-series_35107/
2	http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf
3	http://home.iitk.ac.in/~psraj/mth101/lecture_notes/Lecture11-13.pdf https://maths4uem.files.wordpress.com/2015/09/1028-infinite-series.pdf https://ocw.mit.edu/high-school/mathematics/exam-prep/concept-of-series/series-convergence-divergence/
Course Designed By:1. Dr. C.Janaki 2.Mrs .B.Thenmozhi	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	S	S	M	S	S
CO2	S	M	M	M	S	S	S	M	M	S
CO3	S	M	S	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		CALCULUS	L	T	P	C
Core/Elective/Supportive		Core Paper – II	5	-	-	4
Pre-requisite		Higher Secondary Level Mathematics.	Syllabus Version		2021 - 2022	

Course Objectives:

To orient the students to get an idea of curvatures, Integration of different types of functions, its geometrical applications, double, triple and improper integrals.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Identify areas in Mathematics and other fields where Calculus is useful.	K1
2	Understand the concepts of Evolutes and Envelopes, methods to find curvature and evolutes.	K2
3	Apply the concept of change of variables in double and triple integrals.	K3
4	Apply double, triple integral to find the area and volume respectively.	K3
5	Apply the Beta and gamma function to solve the multiple integrals .	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Curvature	15hours

Curvature-radius of curvature in Cartesian and polar forms-evolutes and envelopes- pedal equations- total differentiation- Euler's theorem on homogeneous functions. .

Unit:2	Integration	15 hours

Integration of $f'(x)/f(x)$, $f'(x)\,f(x)$, $[(px+q)/\sqrt{(ax^2+bx+c)}]$, $[\sqrt{(x-a)/(b-x)}]$, $[\sqrt{(x-a)(b-x)}]$, $1/[\sqrt{(x-a)(b-x)}]$, $1/(a\cos x+b\sin x+c)$, $1/(a\cos^2 x+b\sin^2 x+c)$, Integration by parts-Bernoulli's Formula.

Unit:3	Evaluation Of Double And Triple Integrals	15 hours

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

Unit:4	Change Of Variables In Double And Triple Integrals	15 hours

Change of order of integration in double integral- Jacobians.- Change of variables in double and triple integrals.

Unit:5	Beta And Gamma Functions	15 hours

Beta and Gamma integrals-their properties, relation between them- evaluation of multiple integrals using Beta and Gamma functions - Improper Integrals.

	Total Lecture hours	75 hours

Text Book(s)

1	Calculus Vol 1 - S. Narayanan and T.K.M. Pillai. ((Viswanathan Publishers 2008)
2	Calculus Vol 2- S. Narayanan and T.K.M. Pillai.((Viswanathan Publishers 2008)

Reference Books	
1	Mathematics for BSc – Vol I and. II - P. Kandasamy &K.Thilagarathy(S.Chand and Co-2004)
2	A Text book of calculus- Shanthi Narayanan &J.N.Kapoor(S.Chand& Co.2014)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://ocw.mit.edu/resources/res-18-006-calculus-revisited-single-variable-calculus-fall-2010/study-materials
2	https://www.khanacademy.org/math/calculus-home
3	https://www.sac.edu/FacultyStaff/HomePages/MajidKashi/PDF/MATH_150/Bus_Calculus.pdf
4	http://nptel.ac.in/courses/111104085/29
5	http://www.math.odu.edu/~jhh/Volume-1.PDF http://www.math.odu.edu/~jhh/Volume-2.PDF https://www.math.cmu.edu/~wn0g/2ch6a.pdf
6	https://nptel.ac.in/courses/111/105/111105122/ http://www.staff.ttu.ee/~lpallas/multipleintegrals.pdf
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	S	M	S	S
CO2	S	M	S	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

*S-Strong; M-Medium; L-Low

Second Semester

Course code		ANALYTICAL GEOMETRY	L	T	P	C
Core/Elective/Supportive		Core Paper – III	4	-	-	4
Pre-requisite		Knowledge In Trigonometry, Vector algebra	Syllabus Version	2021 - 2022		

Course Objectives:

Emphasis to enhance student knowledge in three dimensional analytical geometry and the geometrical aspects of three dimensional figs, viz, sphere, cone and cylinder.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Gainknowledge about the regular geometrical figures and their properties.	K1
2	Describe the geometric concepts.	K2
3	Find equation to tangent, normal at a point on a conic	K3
4	Analyzecondition of tangency and find the tangent plane to the central conicoid	K4
5	Analyze conics to explain natural phenomenon	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Straight Lines	12 hours

Analytical Geometry 3D -Straight lines-coplanarity of straight line-shortest distance (S.D) and equation of S.D between two lines-simple problems..

Unit:2	Sphere	12 hours

Sphere: standard equation of sphere-results based on the properties of a sphere-tangent plane to a sphere- equation of a circle.

Unit:3	System Of Spheres	12 hours

Tangency of spheres- coaxial system of spheres- radical planes- Orthogonal spheres.

Unit:4	Cone And Cylinder	12 hours

Cone whose vertex is at the origin- envelope cone of a sphere-right circular cone-equation f a cylinder-right circular cylinder.

Unit:5	Conicoid	12 hours

Nature of a conicoid- standard equation of central conicoid –enveloping cone- tangent plane-condition for tangency –director Sphere- director plane .

	Total Lecture hours	60 hours

Text Book(s)

1	Analytical Geometry - P. Durai Pandian & others (Emerald Publishers 1998).
2	Solid Geometry- N.P. Bali(Laxmi Publications (P) Ltd,2015)

Reference Books

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://www.brainkart.com/article/Three-Dimensional-Analytical-Geometry_6453/
2	http://egyankosh.ac.in/bitstream/123456789/11990/1/Unit-2.pdf

Course Designed By:: 1.Dr.C.Janaki
2. Mrs .B.Thenmozhi

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	M	S	S	M	S	S
CO2	S	M	S	S	S	S	S	S	S	S
CO3	S	M	S	M	M	M	S	S	S	S
CO4	S	M	S	S	M	S	M	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		PROGRAMMING IN C	L	T	P	C
Core/Elective/Supportive		Core Paper-IV	3	-	-	3
Pre-requisite		Higher Secondary level Mathematics	Syllabus Version		2021 - 2022	

Course Objectives:

To impart the importance of C language, its structure, Data types, Operators of C, Various control statements, Arrays, different types of functions and practical problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the importance of C language and data types.	K1
2	Understand the basic structure, operators and statements of C language.	K2
3	Understand decision control statements, loop control statements .	K2
4	Apply the concepts of data types, operators, expressions, control statements , arrays, character arrays and strings to write the C code for a given algorithm.	K3
5	Read, understand and trace the execution of programs written in C language	K4

K1 - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Constants,Variables&Data Types	9 hours

Introduction – Importance of C- Basic structure of C programme - Character set -Constants – Keywords and identifiers – Variables Data types – Declaration of variables – Assigning values to variables –Defining symbolic constants. .

Unit:2	Operators &Expressions	9 hours

Arithmetic operators - Relational operators - logical operators – assignment operators – increment and decrement operates –Conditional operators – Special operators – Arithmetic expressions –Evaluation of expressions –Precedence of arithmetic operators – Some computational problems –Type conversion in expressions – operator precedence and associating mathematical functions.

Unit:3	Managing Input -Output Operations , Decision Making And Branching	9 hours

Reading and Writing character – formatted input and output. Decision making with IF statement – Simple IF statement – The if ELSE statement - Nesting of IF ELSE statement – The ELSE IF ladder. The Switch statement –The ? Operator –The GOTO statement.

Unit:4	Decision Making & Looping	9 hours

The WHILE statement - the DO statement the FOR statement –Jumps in loops.

Unit:5	Arrays And Strings	9 hours

One, Two dimensional arrays – Initiating two dimensional arrays – Multidimensional arrays – Declaring and initializing string variables –reading strings from terminal – Writing strings on the screen – Arithmetic operations on characters

	Total Lecture hours	45 hours

Text Book(s)	
1	Programming in ANSI C (Fifth Edition)-E.Balagurusamy(Tata McGraw –Hill Publishing Company limited, New Delhi.)
Reference Books	
1	Programming with C (Schaum's outline series)- Byron Gottfried (TataMcGrawHill publishing company -1998.)
2	Programming with Ansi and Turbo C -Ashok N.Kamthane (Pearson Education publishers, 2002)
3	The spirit of C -HentryMullish and Herbert L cooper (Jaico publisher , 1996.)
4	The Ansi C, Second edition , October 1992-Brian W.Kernighan,DennisM.Ritchie (Published by Prentice- Hall of India Privated Limited, M-97,New Delhi- 110001.)
5	Ansi C: With Microsoft C 5.1 and Quick C 2.0 -C.Balasubramanian.(Tata McGraw-Hill Publishing company limited, New Delhi.)
6	Programming In C - Kris A.Jamsa-(Galgotia Publications Pvt.ltd. 1992)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/104/106104128/
2	https://nptel.ac.in/courses/106/105/106105171/
4	
Course Designed By: : 1.Dr.C.Janaki 2. Dr.K.Malar	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	M	M	S	S	S
CO2	S	S	M	M	S	M	M	S	M	S
CO3	S	M	M	M	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	M

*S-Strong; M-Medium; L-Low

Course code		PROGRAMMING IN C-(PRACTICAL)	L	T	P	C
Core/Elective/Supportive		Core Paper IV (Practical)	-	-	2	1
Pre-requisite		Knowledge in C	Syllabus Version		2021-2022	

Practical List

1. Write a C program to generate 'N' Fibonacci number.
2. Write a C program to print all possible roots for a given quadratic equation.
3. Write a C program to calculate the statistical values of mean, median.
4. Write a C program to calculate the statistical values of Standard Deviation and variance of the given data .
5. Write a C program to sort a set of numbers.
6. Write a C program to sort the given set of names.
7. Write a C program to find factorial value of a given number 'N' using recursive function call.
8. Write a C program to find the product of two given matrix.
9. Write a program to prepare pay list for a given data.

Third Semester

Course code		TRIGONOMETRY, VECTOR CALCULUS AND FOURIER SERIES	L	T	P	C
Core/Elective/Supportive		Core Paper – V	5	-	-	4
Pre-requisite		Knowledge In Vector Algebra,Differentiation,Integration	Syllabus Version	2021-2022		

Course Objectives:

To enable the students to learn about the expansion of trigonometric,hyperbolic functions, vector calculus and the expansions of Fourier series .

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the expansion of trigonometric functions and hyperbolic functions .	K1
2	Acquire the basic knowledge of vector differentiation and vector integration	K2
3	Determine and apply the important quantities associated with vector fields such as the divergence, curl and scalar potential.	K3
4	Understand and find Fourier series of a given periodic function.	K3
5	Examine line integral, surface integral ,volume integral and inter-relations among them .	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Expansion In Series	15 hours

Expansion in Series – Expansion of **cos ^{n} θ, sin ^{n} θ**in a series of cosines and sines of multiples of θ – Expansions of **cosnθ ,sinnθ and tannθ** in powers of sines , cosines and tangents – Expansion of sin θ, cos θ and tan θ in powers of θ – hyperbolic functions and inverse hyperbolic functions.

Unit:2	Logarithm Of Complex Quantities And Summation Of Series	15 hours

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

Unit:3	Vector Differentiation	15 hours

Scalar and vector fields –Differentiation of vectors – Gradient, Divergence and Curl-Solenoidal and irrotational vectors-Laplacian Operator.

Unit:4	Vector Integration	15 hours

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

Unit:5	Fourier Series	15 hours

Periodic functions – Fourier series of periodicity 2π – half range series.

	Total Lecture hours	75 hours

Text Book

1 Mathematics for B.Sc. Branch I, Volume I, II and IV - P.Kandasamy&K.Thilagavathi(S.Chand and Company Ltd, New Delhi, 2004.)

Reference Books	
1	Vector Analysis -P. Duraipandian, Laxmiduraipandian (Revised Edition-Reprint 2005 Emerald Publishers)
2	Trigonometry -T.K. Manichavasagam Pillai and S.Narayanan(Viswanathan Publishers and Printers Pvt. Ltd 2009.)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://www.math.odu.edu/~jhh/Volume-2.PDF http://www-math.mit.edu/~djk/18_01/chapter20/section03.html https://www.whitman.edu/mathematics/calculus_online/chapter16.html http://www.mecmath.net/calc3book.pdf
2	http://www.nptelvideos.in/2012/11/mathematics-iii.html
3	https://nptel.ac.in/courses/111107108/1
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	S	M	M	S	S
CO2	S	M	S	S	M	M	M	S	M	S
CO3	S	M	S	S	M	M	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		STATICS	L	T	P	C
Core/Elective/Supportive		Core Paper – VI	5	-		4
Pre-requisite		Basic Knowledge In Vector Algebra & Trigonometric Functions	Syllabus Version	2021 - 2022		

Course Objectives:

1.To enable the students to realize the nature of forces and resultant forces when more than one force acts on a particle.

2.To know about the conditions of equilibrium of couples and coplanar forces.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the various laws.	K1
2	Understand the concepts of forces and moments.	K2
3	Understand the concepts of equilibrium .	K2
4	Apply the concepts of forces and moments.	K3
5	Analyze the basics of coplanar forces , equilibrium of forces acting on a rigid body and solve the problems.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Law Of Forces	15 hours

Forces acting at a point – Parallelogram law-triangle law –Converse of Triangle law- Polygon Law of Forces- Lami's Theorem. .

Unit:2	Resolution And Components Of Forces	15hours

(□- □) theorem –Resolution of forces- Components of a force- Resultant of any number of Coplanar forces acting at a point- Conditions of equilibrium.

Unit:3	Parallel Forces,Moment And Couple	15 hours

Parallel Forces and Moments –Resultant of two parallel forces (Like and unlike)- Conditions of equilibrium of three coplanar forces- Moment of a force- Geometrical representation- Sign of the moment- Unit of moment – Varignon's Theorem on couples-Equilibrium of two couples- Equivalence of two couples

Unit:4	Forces Acting On A Rigid Body	15 hours

Moment of aforce about apoint-Varignon's Theorem - Coplanar forces acting on arigid body – Theorem on three coplanar forces in equilibrium .

Unit:5	General conditons of equilibrium of a System Of Coplanar Forces	15 hours

Reduction of a system of coplanar forces to a single force and a couple - necessary & sufficient conditions of equilibrium only – Equation to the line of action of the resultant.

	Total Lecture hours	75 hours

Text Book	
1	Statics -M.K.Venkataraman(Agasthiar Publications, Trichy, 1999)
Reference Books	
1	Statics -A.V.Dharmapadam.(S.Viswanathan Printers and Publishing Pvt., Ltd, 1993)
2	Mechanics -P.Duraipandian and Laxmi Duraipandian.(S.Chand and Company Ltd, Ram Nagar, New Delhi -55, 1985.)
3	Statics -Dr.P.P.Gupta(Kedal Nath Ram Nath, Meerut, 1983-84)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/112/105/112105164/
2	https://nptel.ac.in/courses/122/102/122102004/
3	https://www.khanacademy.org/science/ap-physics-1
Course Designed By: 1.Dr.C.Janaki 2.Dr. Renu Thomas	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	S	M	S	S	S
CO2	S	M	S	S	M	M	M	M	M	S
CO3	S	M	S	S	M	M	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		PROGRAMMING IN C++	L	T	P	C
Core/Elective/Supportive		Core Paper – VII	5	-	-	4
Pre-requisite		Knowledge in C Programming	Syllabus Version			2021-2022

Course Objectives:

To enable the students to learn about the class structure, operators, inheritance, polymorphism, file handling.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know about class structure, member functions & data members,inheritance, types and example problems.	K1
2	Understand how C++ improves C with object-oriented features.	K2
3	Develop programming skills.	K2
4	To make use of objects and classes for developing programs.	K3
5	Build C++ classes.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Tokens,Expressions And Control Structures	15 hours

Evolution of C++ - applications of C++ - structure of C++ program. Tokens – keywords – identifiers and constants – basic data types – user-defined data types – constant pointers and pointers to constants – symbolic constants –type compatibility – declaration of variables – dynamic initialization of variables – reference variables – operators in C++ - scope resolution operator – memory management operators – manipulators – type cast operator – expressions and their types – special assignment expressions – implicit conversions – operator precedence.

Unit:2	Functions In C++	15 hours

The main function – function prototyping – call by reference – return by reference – inline functions – default arguments – const arguments – function overloading. Managing Console I/O Operations: C++ streams – C++ stream classes – unformatted console I/O operations – formatted console I/O operations –managing output with manipulators.

Unit:3	Classes And Objects	15 hours

Specifying a class – defining member functions – making an outside function inline – nesting of member functions – private member functions – arrays within a class – memory allocation for objects –arrays of objects – objects as function arguments – friend functions – returning objects – const member functions. Constructors and Destructors: Introduction – constructors – parameterized constructors – multiple constructors in a class – constructors with default arguments – copy constructor.

Unit:4	Operator Overloading	15 hours

Introduction – defining operator overloading – overloading unary operators – overloading binary operators - overloading binary operators using friends – rules for overloading operators. Inheritance Introduction – defining derived classes – single inheritance – making a private member inheritable – multilevel inheritance – multiple inheritance – hierarchical inheritance – hybrid inheritance

Unit:5		**15 hours**
Working with files: Introduction—Classes for for File Stream Operations- Opening and closing of a file- Detecting end of file-More about Open( ): File Modes- File Pointers and their Manipulations- Sequencial Input and Output operations- Updating a File: Random Access.		
	Total Lecture hours	**75 hours**

Text Book(s)	
1	Object Oriented programming with C++- E.Balagurusamy(McGraw Hill 3rd Edition 2006.)
2	Object oriented programming in Turbo C++- Robert Lafore(Galgotia publications Pvt.Ltd, New Delhi- 110002,2002)
3	The C++ programming language- Bjarne Stroutstrup(II Edition, Addision Wesley, 1991.)

Reference Books	
1	Programming with C++ -D.Ravi Chandran (Tata McGraw-Hill publishing company limited, New Delhi 1996)
2	Object Oriented Programming with ANSI and Turbo C++- AshokN.Kamthane(Pearson Education publishers 2003)
3	Programming with C++ - John R.Hubbard(2nd Edition, TMH publishers2002).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105151/
2	https://nptel.ac.in/courses/106/101/106101208/
3	https://www.classcentral.com/course/swayam-programming-in-C-6704

Course Designed By: 1.Dr.C.Janaki
2.Dr. K.Malar

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	M	S	M	S	S
CO2	M	M	M	M	S	S	S	S	M	S
CO3	S	S	S	S	S	S	M	S	S	S
CO4	S	S	S	M	S	S	S	S	S	S
CO5	S	S	S	M	S	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		PROGRAMMING IN C++ (Practical)	L	T	P	C
Core/Elective/Supportive		Core Paper VII (Practical)	-	-	3	2
Pre-requisite		Knowledge in C++	Syllabus Version		2021-2022	

PRACTICAL LIST

1. Write a function 'power( )' to raise a number 'm' to a power 'n'. The function takes a 'double' value for 'm'and 'int' value for 'n', and returns the result correctly. Use a default vale of 2 for 'n' to make the function to calculate squares when this argument is omitted. Write a main( ) that gets the values of 'm' and 'n' from the user to test the function.

2. Write a program to compute compound interest of a given amount AMT for 'n' years. Use function overloading so that the program gets input of interest rate RATE in any of the data type 'float' or 'int'

3. Create a class which consist of employee detail ENO, ENAME, DEPT, BASIC SALARY. Write a member function to get and display them. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade and display the payslip in a neat format using console I/O

4. Define two classes POLAR and RECTANGLE to represent points in the polar and rectangle system. Write a program to convert from one system to another.

5. Create a class FLOAT that contains one float data member. Overload all the four arithmetic operators so that they operate on the objects of FLOAT.

Course code		Operations Research – Paper I	L	T	P	C
Core/Elective/Supportive		Skill Based Subject	3	-	-	3
Pre-requisite		Knowledge In Basic Mathematical Concepts	Syllabus Version	2021 - 2022		

Course Objectives:

To familiarize students with the basic concepts ,models and techniques for effective decision making ,model formulation and applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic concepts and application of operation researchin various fields.	K1
2	Know principles of construction of mathematical models of conflicting situations.	K2
3	Analyze the relationship between a linear program and its dual.	K3
4	Apply techniques constructively to make effective decisions in business and solve problems in industry.	K3
5	Build and solve transportation problems.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Basics Of Operations Research&Formulation Of L.P.P	9 hours

Basics of O.R – Definition of O.R – Characteristics of O.R - Scientific methods in O.R – Necessary of O.R in Industry – O.R and Decision Making – Scope of O.R in Modern Management–UsesandlimitationsofO.R.Linear Programming Problem – Formulation of L.P.P

Unit:2	Linear Programming Problem -Simplex method	9 hours

Graphical solutions of L.P.P – Problems. Simplex Method – Problems.

Unit:3	Big-M&Two Phase Method	9 hours

Charne'sPenality Method (or) Big – M Method - Two Phase Simplex method – Problems.

Unit:4	Duality In L.P.P	9 hours

Duality in L.P.P – Concept of duality – Duality and Simplex Method – Problems .

Unit:5	Transportation Model	9 hours

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

	Total Lecture hours	45 hours

Text Book

1	Operations Research – Kantiswarup, P. K. Gupta, Man Mohan(S. Chand & Sons Education Publications, New Delhi, 12th Revised edition -2003)

Reference Books	
1	Operations Research – Prem Kumar Gupta D. S. Hira(S. Chand & Company Ltd, Ram Nagar, New Delhi ,2014)
2	Operations Research Principles and Problems- S. Dharani Venkata Krishnan(Keerthi publishing house PVT Ltd.1994)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/102/111102012/
2	https://nptel.ac.in/courses/111/104/111104027/
3	
Course Designed By:1.Dr.C.Janaki 2. Dr. M.S. Annie Christi	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	M	M	M	S	S
CO2	S	M	S	S	S	S	S	S	M	S
CO3	S	S	S	S	M	M	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

*S-Strong; M-Medium; L-Low

Fourth Semester

Course code		DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS	L	T	P	C
Core/Elective/Supportive		Core Paper – VIII	5	-	-	4
Pre-requisite		Knowledge Of Ordinary And Partial Derivatives	Syllabus Version	2021 - 2022		

Course Objectives:

To impart knowledge on the method of solving ordinary differential Equations of First Order and Second Order, Partial Differential equations , Laplace Transforms, its inverse and Application of Laplace Transform to solve the first and second Order Differential Equations with constant coefficients.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Acquire knowledge to solve Differential and Partial Differential Equations.	K1
2	Solve higher order linear differential equations.	K2
3	Expose Differential Equation as a powerful tool in solving problems in Physical and Social sciences.	K3
4	Demonstrate competency to solve linear PDE by Lagrange's method	K3
5	Analyzethe concepts of Laplace transforms and inverse Laplace transforms to solve ODE with constant coefficients.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Differential Equation Of First Order And Higher Degree.	15hours

Ordinary Differential Equations: Equations of First Order and of Degree Higher than one – Solvable for p, x, y– Clairaut's Equation – Simultaneous Differential Equations with constant coefficients of the form

i) $f_1(D)x + g_1(D)y = \varphi_1(t)$

ii) $f_2(D)x + g_2(D)y \ \varphi_2(t)$ where f_1 , g_1 , f_2 and g_2 are rational functions $D=d/dt$ with constant coefficients and φ_1 , φ_2 explicit functions of tand explicit functions of t.

Unit:2	Higher Order Linear Differential Equation	15hours

Finding the solution of Second and Higher Order with constant coefficients with Right Hand Side is of the form $Ve^{ax}$where V is a function of x – Euler's Homogeneous Linear Differential Equations.

Unit:3	Partial Differential Equations	15 hours

Partial Differential Equations: Formation of equations by eliminating arbitrary constants and arbitrary functions – Solutions of P.D Equations – Solutions of Partial Differential Equations by direct integration – Methods to solve the first order P.D. Equations in the standard forms – Lagrange's Linear Equations.

Unit:4	Laplace Transforms	15 hours

Laplace Transforms: Definition – Laplace Transforms of standard functions – Linearity property – First Shifting Theorem – Transform of tf(t), , f (t)/t, $f'(t)$, $f''(t)$.

Unit:5	Inverse Laplace Transforms	15 hours
Inverse Laplace Transforms – Applications to solutions of First Order and Second Order Differential Equations with constant coefficients.		
	Total Lecture hours	**75 hours**

Text Book	
1	Mathematics for B.Sc – Branch – I Volume III-P.Kandasamy&K.Thilagavathi (S. Chand and Company Ltd, New Delhi, 2004.)
Reference Books	
1	Calculus Vol III- S. Narayanan and T.K. Manickavasagam Pillai, (S. Viswanathan Printers and Publishers Pvt. Ltd, Chennai 1991)
2	Differential Equations -N.P. Bali (Laxmi Publication Ltd, New Delhi, 2004)
3	Laplace and Fourier Transforms-Dr. J. K. Goyal and K.P. Gupta(PragatiPrakashan Publishers, Meerut, 2000)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://**nptel**.ac.in/courses/111105035/lectures 22-28
2	http://www.nptelvideos.in/2012/11/mathematics-iii.html
3	https://www.math.ust.hk/~machas/differential_equations.pdf. https://www.ijsr.net/archive/v2i1/ijsron2013331.pdf (LAPLACE TRANSFORMS) https://www.whitman.edu/mathematics/calculus_online/chapter17.html
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	M	S	M	S	S	S
CO2	S	M	S	S	S	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	S	S	S	S	M	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DYNAMICS	L	T	P	C
Core/Elective/Supportive		Core Paper-IX	5	-	-	4
Pre-requisite		Knowledge In Forces And Vector Algebra	Syllabus Version	2021 - 2022		

Course Objectives:

To impart knowledge about the projectile, Simple Harmonic Motion and understanding the notions of impact between two smooth spheres.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the basic kinematics and dynamic concepts.	K1
2	Describe the differential equation of Central Orbits .	K2
3	Apply the concepts of projectilesto solve problems relating to the motion of a projectile	K3
4	To understand apply the concepts of composition of simple harmonic motion in two directions	K3
5	Understand impulsive forces and analyze loss of K.E due to direct and oblique impact.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Projectiles	15hours

Path of a projectile-Greatest height-time of flight – Range -range on an inclined plane through the point of projection-Maximum range.

Unit:2	Central Orbits	15 hours

Radial and transverse components of velocity and acceleration – areal velocity of central orbits - Differential equation of central orbit in polar coordinates only.

Unit:3	Simple Harmonic Motion	15 hours

Amplitude, periodic time, phase-composition of two simple harmonic motions of the same period in a straight line and in two perpendicular lines.

Unit:4	Collision Of Elastic Bodies-Direct Impact Of Spheres	15hours

Impulsive force – Newton's experimental law- Principle of conservation of momentum- Direct Impact on a smooth fixed plane -Direct impact of two smooth spheres- loss of kinetic energy during direct impact.

Unit:5	Oblique Impact Of Spheres	15 hours

Oblique impact of a smooth sphere on fixed smooth plane – oblique impact of two smooth spheres - Loss of Kinetic energy during oblique impact.

	Total Lecture hours	75 hours

Text Book

1	Dynamics -M.K.Venkataraman(11th Ed. Agasthiar Publications, Trichy, 1994.)

Reference Books	
1	Dynamics -A.V.Dharamapadam(S.Viswanathan Printers and Publishers Pvt., Ltd, Chennai, 1998)
2	Dynamics -K.Viswanatha Naik and M.S.Kasi(Emerald Publishers, 1992)
3	Dynamics -Naryanamurthi(National Publishers, New Delhi, 1991)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/115/106/115106119/
2	https://www.askiitians.com/iit-jee-physics/mechanics/motion-of-projectile.aspx
Course Designed By: 1.Dr.C.Janaki 2.Dr. Renu Thomas	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	S	S	M	S	S
CO2	M	M	M	M	M	S	M	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	M	M	M	M	S	S	S	S	S	M
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		RDBMS AND ORACLE	L	T	P	C
Core/Elective/Supportive		Core Paper-X	5	-	-	4
Pre-requisite		Basic Knowledge In Database	Syllabus Version		2021-2022	

Course Objectives:

presents the basic concepts of DBMS, Keys, RDBMS, introduction to SQL, ORACLE data types, Queries in SQL, introduction to PL/SQL, its basic structure, triggers, basic concepts of forms, reports and practical problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the basic concepts of DBMS and RDBMSPL/SQL.	K1
2	Be familiar with the relational database theory, and be able to write relational algebra expressions for queries	K2
3	Master the basic concepts and appreciate the applications of database systems.	K3
4	design forms and generate reports using ORACLE Developer 2000.	K3
5	Master the basics of SQL and construct queries using SQL.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Basic Concepts Of DBMS	15 hours

Basic concepts of DBMS – Entities and their attribute Keys – Prime Keys, secondary keys, Super Keys, Candidate Keys, Alternative Keys - Examples, Relationship – Records and files, Data independence, Views – Types of Views, Components of a DBMS, DDL, DML, DQL. Advantages and disadvantages of DBMS, RDBMS –Relational Database – Relations and their schemes –Relation representation – Integrity rules..

Unit:2	Integrative SQL	15- hours

Integrative SQL –invoking SQL plus, data manipulation in DBMS ,The ORACLE data types, two dimention matrix creation, Intersectior of data into tables, data constrains, computation in expression lists used to select data, logical operation, Range searching, pattern matching, Orac‘e function, Grouping data from tables in SQL , Manipulating dates on SQL, joins, sub queries.

Unit:3	PL/SQL	15 hours

PL/SQL-Introduction, The PL/SQL execution environment, the PL/SQL syntax, Understanding the PL/SQL Block structure, database triggers.

Unit:4	Working With Forms	15 hours

Working with forms, Basic concepts, Application development in forms, Form module, Blocks items, Canvas view windows, Creating a form Generating and running a form, Using the Layout editor ,Master form, Triggers, Data Navigation Via an Oracle form ,Master detail form, Creating a master detail form, Master detail data entry screen.

Unit:5	Working With Reports	15 hours

Working with reports ,Defining a data model for report , specific the layout of a report, use the Oracle reports interface, Creating a default tabular report, Creating computed columns, Creating user parameter, Arranging the layout, Creating a Master / Detail report, Creating a matrix repor

	Total Lecture hours	**75 hours**
Text Book(s)		
1	Introduction to Database System–BipinDesai(Galgotia Publications 1991)(For unit 1 -chapter 1,sections 4.2 and 6.5.1 and 6.5.2)	
2	Commercial application Development using Oracle developer 2000 - IVAN BAYROSS(BPB Publications,1997)(For units 2, 3, 4, 5)	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105175/	
2	https://nptel.ac.in/courses/106/106/106106093/	
3	https://docs.oracle.com/cd/B19306_01/server.102/b14220.pdf	
Course Designed By:1.Dr.C.Janaki 2.Dr.K.Malar		

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	S	M	M	S	S
CO2	M	M	M	M	S	S	S	M	M	S
CO3	S	M	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		RDBMS AND ORACLE (PRACTICAL)	L	T	P	C
Core/Elective/Supportive		Core Paper-X (Practical)	-	-	3	2
Pre-requisite		Knowledge in RDBMS	Syllabus Version		2021-2022	

Practical List

1. Create a table _company‘ with the following fields and insert the values for 10 employees.

Field Name	Field Type	Field Size
Company Name	Character	15
Proprietor	Character	15
Address	Character	25
Supplier Name	Character	15
No of employees	Number	4
GP cent	Number	6 with 2 decimal places

Queries

a) Display all the records of the company which are in the ascending order of GP percent.

b) Display the detail of the company having the employee ranging from 300 to 1000.

2.Create a table named _employee‘ with the following field and insert the values.

Field Name Field Type Field Size

Employee Name Character 15

Employee code Character 6

Address Character 25

Designation Character 15

Grade Character 1

GP percent Number 6 with 2 decimal places Queries:

a) Display the name of the employees whose salary is greater than Rs.10, 000

b) Display the details of employees in ascending order according to employee code.

c) Display the total salary of the employees whose grade is —A‖.

3.Create a table named —student‖ with the following fields and insert the values:

Field Name Field Type Field Size

Student Name Character 15

Gender Character 6

Roll No Character 10

Department Name Character 15

Address Character 25

Percentage Number 4 with 2 decimal places

Queries:

a) Display the names of the students whose percentage is greater than 80.

b) Display the details of the student whose percentage is between 50 and 70.

c) Display the details of the students whose percentage is greater than the percentage of the Roll no =12CA01

4Create a table ―product‖ with the following fields and insert the values:

Field Name Field Type Field Size
Product No Number 6
Product Name Character 15
Unit of Measure Character 15
Quantity Number 6 with decimal places
Total Amount Number 8 with decimal places. Queries:
a) Using update statements calculate the total amount and then select the record.
b) Calculate the total amount by using sum operation.
c) Calculate the number of records whose unit price is greater than 50 with count Operation

5.Create the table PAYROLL with the following fields and insert the value:

Field Name	**Field Type**	**Field Size**
Employee No	Number	8
Employee Name	Character	8
Department	Character	10
Basic pay	Number	8 with 2 decimal
HRA	Number	6 with 2 decimal places.
DA	Number	6 with 2 decimal places.
PF	Number	6 with 2 decimal places.
Net Pay	Number	8 with 2 decimal places

Queries:
a) Update the record to calculate the net pay
b) Arrange the records of employees in ascending order of their net pay.
c) Select the details of employees whose HRA >= 1000 and DA <= 900.
d) Display the details of the employee whose department is sales.

6.Create a table publisher and book with the following fields:

Field Name	**Field Type**	**Field Size**
Publisher Code	Varchar	5
Publisher Name	Varchar	10
Publisher City	Varchar	12
Publisher State	Varchar	10
Title of book	Varchar	15
Book Code	Varchar	5
Book Price	Varchar	5

Queries:
a)Insert the records into the table publisher and book
b) Describe the structure of the tables
c) Show the details of the book with the title _DBMS‘.
d) Select the book code , book title , publisher city is _Delhi‘.
e) Find the name of the publisher starting with _s‘.

7.Create a table Deposit and loan with the following fields.

Field Name Field Type Field Size
Account Varchar 6
Branch Name Varchar 15
Customer Name Varchar 20
Balance Amount Varchar 10
Loan Number Varchar 7
Loan Amount Varchar6
Queries:
a) Insert the records into the table.
b) Describe the structure of the table
c) Display the records of Deposit and loan
d) Find the Maximum loan amount
e) Arrange the records in descending order of the loan amount

Course code		OPERATIONS RESEARCH – PAPER II	L	T	P	C
Core/Elective/Supportive		SKILL BASED SUBJECT	3	-	-	3
Pre-requisite		Knowledge In Basic Mathematical Concepts	Syllabus Version		2021 - 2022	

Course Objectives:

To impart knowledge in Assignment Problems, game theory, performance measures of queues and optimal use of Inventory.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Identify the importance of stocks, , the reasons for holding stockin an organization ,determine the optimal order quantity for models .	K1
2	Explain the various costs related to inventory system.	K2
3	Apply game theory concepts to articulate real-world situations by identifying, analyzing, and practicing strategic decisions .	K3
4	apply and extend queueing models to analyze real world systems.	K4
5	Build and solve assignment model.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Assignment Model	9 hours

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

Unit:2	Game Theory	9 hours

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

Unit:3	Queueing Model	9 hours

Queueing Theory – Introduction – Queueing system – Characteristics of Queueing system – symbols and Notation – Classifications of queues – Problems in (M/M/1) : (∞/FIFO)

Unit:4	Multi Channel Queueing Models	9 hours

Problems in (M/M/1):(N/FIFO); (M/M/C) : (∞/FIFO); (M/M/C) : (N/FIFO) Models.

Unit:5	Inventory Models	9 hours

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

	Total Lecture hours	45 hours

Text Book

1	Operations Research – Kantiswarup, P. K. Gupta, Man Mohan(S. Chand & Sons Education Publications, New Delhi, 12th Revised edition,2003)

Reference Books	
1	Operations Research – Prem Kumar Gupta D. S. Hira(S. Chand & Company Ltd, Ram Nagar, New Delhi,2014)
2	Operations Research Principles and Problems- S. Dharani Venkata krishnan(Keerthi publishing house PVT Ltd.1994)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/102/111102012/
2	https://youtu.be/zADj0k0waFY https://youtu.be/xvDdrswAj8M https://www.youtube.com/watch?v=xVPoWkkQTrQ https://www.youtube.com/watch?v=7kDtTAnvuww https://www.youtube.com/watch?v=IfLsPHKk51w
3	https://nptel.ac.in/courses/109/103/109103021/
4	https://nptel.ac.in/courses/110/105/110105082/ https://nptel.ac.in/courses/110/106/110106045/
Course Designed By:1.Dr.C.Janaki 2.Dr.M.S. Annie Christi	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	S	M	M	M	S	S
CO2	M	M	M	M	S	S	M	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	M
CO5	S	S	S	M	S	M	S	S	S	S

*S-Strong; M-Medium; L-Low

Fifth Semester

Course code		REAL ANALYSIS - I	L	T	P	C
Core/Elective/Supportive		Core Paper – XI	5	-	-	4
Pre-requisite		Knowledge in the basic properties of real numbers	Syllabus Version	2021 - 2022		

Course Objectives:

Aimed at exposing thereal number systems that underpin the development of real analysis and in understanding various physical phenomena .

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the basic topological properties of subsets of the real numbers .	K1
2	Understand the fundamental properties of the real numbers andanalyze the real number system.	K2
3	Learn the concept of limits, sequence,continuity,convergent sequence in metric spaces appreciating the abstract ideas and their applicability .	K2
4	Have the proficiency in the formulation and construction of proofs of basic results in real analysis.	K3
5	Demonstrate skills in communicating Mathematics and learn basic techniques and examples in analysis to be well prepared for extended learning .	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	The Real AndComplex Number Systems	15 hours

Introduction -the field axioms, the order axioms –integers –the unique Factorization theorem for integers –Rational numbers –Irrational numbers –Upper bounds, maximum Elements, least upper bound –the completeness axiom –some properties of the supremum –properties of the integers deduced from the completeness axiom- The Archimedian property of the real number system –Rational numbers with finite decimal representation of real numbers –absolute values and the triangle inequality –the Cauchy-Schwarz, inequality –plus and minus infinity and the extended real number system. .

Unit:2	Basic Notions Of A Set Theory.	15 hours

Notations –ordered pairs –Cartesian product of two sets – Relations and functions – further terminology concerning functions –one –one functions and inverse –composite functions –sequences –similar sets-finite and infinite sets –countable and uncountable sets – uncountability of the real number system –set algebra –countable collection of countable sets.

Unit:3	Elements Of Point Set Topology	15 hours

Elements of point set topology: Euclidean space R^n –open balls and open sets in R^n. The structure of open sets in R^n –closed sets and adherent points –The Bolzano –Weierstrass theorem –the Cantor intersection Theorem.

Unit:4	Covering &Compactness	15 hours

Covering –Lindelof covering theorem –the Heine Borel covering theorem –Compactness in $\mathbf{R^n}$ –Metric Spaces –point set topology in metric spaces –compact subsets of a metric space – Boundary of a set.

Unit:5	Limits And Continuity In Metric Spaces	15 hours
Convergent sequences in a metric space –Cauchy sequences –Completeness sequences – complete metric Spaces. Limit of a function –Continuous functions –continuity of composite functions. Continuous complex valued and vector valued functions.		
	Total Lecture hours	**75 hours**

Text Book

1 Mathematical Analysis-T.M.Apostol(2nd ed., Narosa Publishing Company, Chennai, 1990.)

Unit I Chapter 1 Sections 1.2, 1.3, 1.6 to 1.16, 1.18 to 1.20
Unit II Chapter 2 Sections 2.2 to 2.15
Unit III Chapter 3 Sections 3.2 to 3.9
Unit IV Chapter 3 Sections 3.10 to 3.16
Unit V Chapter 4 Sections 4.2 to 4.5, 4.8 to 4.10

Reference Books

1 Methods of Real Analysis -R.R.Goldberg.(NY, John Wiley, New York 1976.)

2 Introduction to Topology and Modern Analysis- G.F.Simmons.(McGraw – Hill, New York, 1963.)

3 G.Birkhoff and MacLane, A survey of Modern Algebra, 3rd Edition, Macmillian, New York, 1965.

4 J.N.Sharma and A.R.Vasistha, Real Analysis, Krishna Prakashan Media (P) Ltd, 1997

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1 https://nptel.ac.in/courses/111/105/111105069/#
2 https://nptel.ac.in/courses/111/101/111101134/
3 https://www.digimat.in/nptel/courses/video/111105098/
4 https://nptel.ac.in/courses/111/106/111106053/

Course Designed By: 1.Dr.C.Janaki
2. Dr. M.S. Annie Christi

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	M	S	S	S
CO2	S	S	M	M	M	S	S	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		MODERN ALGEBRA - I	L	T	P	C
Core/Elective/Supportive		Core Paper – XII	5	-	-	4
Pre-requisite		Higher Secondary level Mathematics	Syllabus Version	2021 - 2022		

Course Objectives:

Focuses on the concepts of algebraic structures which is one of a pillar of modern mathematics and emphasis on their properties and applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Recall the properties and extend group structure to finite permutation groups .	K1
2	Explain the concepts of homomorphism, isomorphism, automorphism	K2
3	Demonstrate abstract thinking capacity and ability to prove theorems.	K3
4	Compare features of different algebraic structures .	K4
5	Examine the properties of algebraic structures and their role in applied contexts.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Groups & its Basic Properties	15 hours

Sets – mappings – Relations and binary operations – Groups: Abelian group, Symmetric group Definitions and Examples – Basic properties.

Unit:2	Subgroups& Normal Subgroups	15 hours

Subgroups – Cyclic subgroup - Index of a group – Order of an element – Fermat theorem - A Counting Principle - Normal Subgroups and Quotient Groups.

Unit:3	Automorphisms	15 hours

Homomorphisms (Applications 1 and 2 are omitted) -Automorphisms – Inner automorphism – Cayley's theorem, permutation groups.

Unit:4	Rings	15 hours

Definition and Examples –Some Special Classes of Rings – Commutative ring – Field – Integral domain - Homomorphisms of Rings.

Unit:5	Ideals & Quotient Rings	15 hours

Ideals and Quotient Rings – More Ideals and Quotient Rings – Maximal ideal - The field of Quotients of an Integral Domain .

	Total Lecture hours	75hours

Text Book

1 Topics in Algebra -I.N. Herstein(John Wiley & Sons, New York, 2003.)

Unit I Chapter 1 Sections 1.1 to 1.3,
Chapter 2 Sections 2.1 to 2.3
Unit II Chapter 2 Sections 2.4 to 2.6
Unit III Chapter 2 Sections 2.7 to 2.10
Unit IV Chapter 3 Sections 3.1 to 3.3
Unit V Chapter 3 Sections 3.4 to 3.6.

Reference Books	
1	Modern Algebra -Surjeet Singh and Qazi Zameeruddin.(Vikas Publishing house, 1992.)
2	Modern Algebra- A.R.Vasishtha (Krishna Prakashan Mandir, Meerut, 1994 - 95.)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/104/106104149/
2	https://nptel.ac.in/courses/111/106/111106113/
3	https://www.classcentral.com/course/swayam-modern-algebra-14201
Course Designed By: : 1.Dr.C.Janaki 2. Dr. G.V. Chandrasekar	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	M	S	S	M	S	S
CO2	M	M	S	S	M	S	S	M	M	S
CO3	S	M	M	S	S	S	S	S	S	S
CO4	S	M	M	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

*S-Strong; M-Medium; L-Low

Course code		COMPLEX ANALYSIS	L	T	P	C
Core/Elective/Supportive		Core Paper – XIII	6	-	-	4
Pre-requisite		Knowledge in Calculus	Syllabus Version		2021 -2022	

Course Objectives:

To equip the students with the understanding of the fundamental concepts of complex functions,analyticity ,power series and complex integration.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Learn techniques of complex analysis effectively toestablish mathematical results.	K1
2	Recognize thesimple and multiple connected domains	K2
3	Investigate a function for its analyticity and find it series developement.	K3
4	Apply residue theorem to compute integrals	K4
5	Compute contour integrals directly and by the fundamental theorem.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Analytic Functions**	**18 hours**

Analytic function C-R equation – Sufficient condition – Harmonic functions.

Unit:2	**Biliner Transformation**	**18 hours**

Biliner transformation – Cross Ratio – Fixed Points – Transformation which map real axis to real axis – Unit circle to unit circle – real axis to unit circle.

Unit:3	**Complex Integration**	**18 hours**

Complex integration- Cauchy‘s Integral Theorem – Cauchy‘s Integral formula –Derivatives of analytic function – Moreras Theorem – Cauchy‘s inequality – Liouville‘s Theorem – Fundamental Theorem of Algebra.

Unit:4	**Taylor’s Series&Singularities**	**18 hours**

Taylor’s Theorem – Taylor’s Series – Laurent’s Series – Singular points – Types of singularities – Properties of singular – Properties of singularities – Indentification of singularities.

Unit:5	**Residues**	**18 hours**

Arguments Principle – Rouche’s Theorem – Calculus of residue – Evaluation of definite integrals..

	Total Lecture hours	**90 hours**

Text Book

1	Complex Analysis -P.Duraipandian and Laxmi Duraipandian.(Emerald Publishers, Chennai –2, 1986.)

Reference Books	
1	Complex Analysis – T.K.M.Pillai&S.Narayanan. (Viswanathan, S., Printers & Publishers Pvt Ltd 2009)
2	Functions of a complex variable-J.N.Sharma(Krishna Prakashan Media, 1991)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/103/111103070/
2	https://nptel.ac.in/courses/111/107/111107056/
3	https://nptel.ac.in/courses/122/103/122103012/
4	https://nptel.ac.in/courses/111/106/111106094/
5	https://nptel.ac.in/courses/122/103/122103012/
Course Designed By:1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	M	M	M	S	S
CO2	S	M	M	M	M	S	M	M	M	S
CO3	S	S	M	S	S	S	M	S	S	M
CO4	S	M	M	S	M	S	M	S	S	S
CO5	S	S	S	S	M	S	M	S	S	M

*S-Strong; M-Medium; L-Low

Course code		VISUAL BASIC	L	T	P	C
Core/Elective/Supportive		Core Paper –XIV	4	-	-	4
Pre-requisite		Basic Computer Skills And Familiarity With Microsoft Windows.	Syllabus Version			2021-2022

Course Objectives:

Provides the skills and knowledge required to use essential features and capabilities of Visual Basic , a programming system used to produce Graphical User Interfaces and applications in a Windows environment. It includes basic programming concepts, problem solving, programming logic, and the design of event-driven programming.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know about menus,dialog boxes	K1
2	Understand Visual Basic applications	K2
3	Apply the concept of data-driven program execution flow control in Visual Basic programming.	K3
4	Develop real time applications using VB .	K4
5	Apply and synthesize knowledge of user interface design	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Visual basic fundamentals	12 hours

Introduction to VB – Event avd Event Procedure – Object related concept- VB program development process- components- VB environment – saving and running –VB project- VB fundamentals- constants-variables- operators- library functions..

Unit:2	Branching And Looping	12 hours

Branching and looping- logical operators – If-then,If-then-Else,Select case- For Next, Do loop. While-Wend, Stop-VB control functions – Forms and controls.

Unit:3	Menus And Dialog Boxes	12 hours

Menus and dialog boxes: Building Drop down menus, Accessing menu-sub menus- Popup menus- dialog boxes. Executing and debugging a new project- Errors-Error handlers.

Unit:4	Procedures&Arrays	12 hours

Procedures: Modulus and procedures- sub procedures-Event procedures-Function procedures.
Arrays : Characteristics-Declarations- Dynamic Arrays- Control arrays.

Unit:5	Data Files	12 hours

Data Files: Characteristics-accessing and saving a file in VB –processing- Sequential Data file-Random access file-Binary files.

	Total Lecture hours	60 hours

Text Book

1 **VB** -Schaum's outlines -**Byron S Goutfield**(TMH Edition-2002)

Reference Books	
1	Programming with VB 6.0 - Mohammed Azam(Vikas Publications,2001)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.nptelvideos.com/visualbasic_net/?pn=1
Course Designed By: 1.Dr.C.Janaki 2.Dr.K.Malar	

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	S	M	M	S	S
CO2	M	M	S	M	S	S	S	M	M	S
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		VISUAL BASIC(PRACTICAL)	L	T	P	C
Core/Elective/Supportive		Core Paper XIV(Practical)	-	-	3	2
Pre-requisite		Knowledge in Visual Basictheory	Syllabus Version		2021-2022	

PRACTICAL LIST

1. In VB,create a project that displays the current data and time. Use VB variable Now and the Format Library function.
2. To enter and display text. Use text box and command button.
3. To convert temperature from Fahrenheit to centigrade or vice-versa
4. To select any one from a list. Use combo box to display choices.
5. To calculate factorial of a given number.
6. To illustrate the usage of Timer control .
7. To illustrate the usage of scroll bars.
8. To illustrate the usage of Drop down menus.
9. To illustrate the usage of menu enhancement.
10. To illustrate the usage of Pop-up menu.
11. To illustrate the usage of input boxes.
12. To find smallest of n numbers.
13. To find the sine of angle.
14. To sort list of numbers.
15. To determine deviations about an average.

Course code		OPERATIONS RESEARCH – PAPER III	L	T	P	C
Core/Elective/Supportive		Skill Based Subject	3	-	-	3
Pre-requisite		Knowledge In Basics of O.R	Syllabus Version	2021 - 2022		

Course Objectives:

Presents applications and method to solve Integer Programming Problems, Non-linear Programming Problems and Dynamic Programming problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the concept of simulation and Simulate a queueing system	K1
2	Understand the overall approach of dynamic programming.	K2
3	Solve nonlinear programming problems using Lagrange multiplier and using Kuhn-Tucker conditions.	K2
4	Apply concepts in optimal scheduling .	K3
5	To formulate a model for solving the intractable problems.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Simulation	9 hours

Introduction-simulation models-Event-Types of simulation- Generation of random numbers-Monte-Carlo simulation- simulation of queueing system.

Unit:2	Network Scheduling By PERT/CPM	9 hours

Introduction- Network and basic components- Rules of Network construction- Time calculation in Networks-CPM. Pert Calculations- Cost Analysis- crashing the network-Problems

Unit:3	Integer Programming Problem	9 hours

Integer Programming Problem – Gomory's fractional cut Method – Branch and Bound Method.

Unit:4	Non-linear Programming Problems	9 hours

General NLPP – Lagrange multiplier – Hessian bordered Matrix – Kuhn Tucker Condition – Problems

Unit:5	Dynamic Programming Problem	9 hours

Dynamic Programming Problem – Recursive equation approach – D.P.P Algorithm – Solution of L.P.P by D.P.P.

	Total Lecture hours	45 hours

Text Book

1	Operations Research – Kantiswarup, P. K. Gupta, Man Mohan(S. Chand & Sons Education Publications, New Delhi, 12th Revised edition.)

Reference Books	
1	Operations Research – Prem Kumar Gupta& D. S. Hira(S. Chand & Company Ltd, Ram Nagar, New Delhi)
2	Operations Research Principles and Problems- S. Dharani Venkata Krishnan(Keerthi publishing house PVT Ltd)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/107/111107104/
2	https://nptel.ac.in/courses/111/102/111102012/
3	https://nptel.ac.in/courses/111/104/111104027/
4	https://nptel.ac.in/courses/111/105/111105039/
Course Designed By: 1. Dr.C.Janaki 2. Dr.M.S. Annie Christi	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	S	S	S	M	S	S
CO2	S	M	M	M	M	S	S	M	S	S
CO3	S	M	M	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	M	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Sixth Semester

Course code		REAL ANALYSIS - II	L	T	P	C
Core/Elective/Supportive		Core Paper – XIII	5	-	-	4
Pre-requisite		Knowledge in Mappings&Properties of Real Numbers	Syllabus Version	2021 - 2022		

Course Objectives:

To present a deeper and rigorous understanding of fundamental concepts like continuity, connectivity, derivative, monotonic functions with properties and Riemann - Stieltjes integral.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate the understanding of continuity, uniform continuity ,compactness ,connectedness.	K1
2	Understand partitions and their refinement.	K2
3	Determine the Riemann integrability and the Riemann-Stieltjes integrability of a bounded function	K2
4	Examine the derivatives of function	K3
5	Acquire skills in writing and analyze the proofs that arise in the context of real analysis.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Topological Mappings	15hours

Examples of continuous functions –continuity and inverse images of open or closed sets – functions continuous on compact sets –Topological mappings –Bolzano's theorem. .

Unit:2	Monotonic Functions	15 hours

Connectedness –components of a metric space –
Uniform continuity - Uniform continuity and compact sets –fixed point theorem for contractions –monotonic functions.

Unit:3	Derivatives	15 hours

Definition of derivative –Derivative and continuity –Algebra of derivatives – the chain rule –one sided derivatives and infinite derivatives –functions with non-zero derivatives –zero derivatives and local extrema –Rolle's theorem –The mean value theorem for derivatives – Taylor's formula with remainder.

Unit:4	Functions OfBounded Variation	15 hours

Properties of monotonic functions –functions of bounded variation –total Variation – additive properties of total variation on (a, x) as a function of x – functions of bounded variation expressed as the difference of increasing functions –continuous functions of bounded variation.

Unit:5	The Riemann-Stieltjes Integral	15 hours

Introduction –Notation –The definition of Riemann –Stieltjes integral –linear properties – Integration by parts –change of variable in a Riemann –stieltjes integral –Reduction to a Riemann integral.

	Total Lecture hours	75 hours

Text Book	
1	Mathematical Analysis(2nd ed)-Tom. M. APOSTOL(Addison-Wisely. Narosa Publishing Company, Chennai, 1990.) Unit I :Chapter 4 Sections 4.11 to 4.15 Unit II :Chapter 4 Sections 4.16, 4.17, 4.19, 4.20, 4.21, 4.23 Unit III: Chapter 5 Sections 5.2 to 5.10 and 5.12 Unit IV :Chapter 6 Sections 6.2 to 6.8 Unit V :Chapter 7 Sections 7.1 to 7.7
Reference Books	
1	Methods of Real Analysis -R.R.Goldberg(NY, John Wiley, New York 1976.)
2	Introduction to Topology and Modern Analysis -G.F.Simmons(McGraw – Hill, New York, 1963.)
3	A survey of Modern Algebra -G.Birkhoff and MacLane(3rd Edition, Macmillian, NewYork, 1965.)
4	Real Analysis -J.N.Sharma and A.R.Vasistha.(Krishna Prakashan Media (P) Ltd, 1997.)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/106/111106053/
2	https://www.math.ucdavis.edu/~emsilvia/math127/chapter7.pdf https://www.whitman.edu/Documents/Academics/Mathematics/grady.pdf
3	https://nptel.ac.in/courses/122/101/122101003/
Course Designed By: 1. Dr.C.Janaki 2. Dr.M.S. Annie Christi	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	S	S	M	S	S
CO2	M	M	M	M	M	S	S	M	M	S
CO3	S	M	M	S	S	S	M	S	S	S
CO4	S	M	M	S	S	S	M	S	S	S
CO5	M	M	S	M	M	S	S	S	S	M

*S-Strong; M-Medium; L-Low

Course code		MODERN ALGEBRA - II	L	T	P	C
Core/Elective/Supportive		Core Paper – XV	5	-	-	4
Pre-requisite		Knowledge in Groups, Rings and Fields	Syllabus Version	2021 - 2022		

Course Objectives:

To develop understanding in the domain of matrix theory ,vector spaces, linear transformations as well as the principles underlying the subject.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Communicate and understand mathematicalideas and results with the correct use of mathematical definitions, terminology and symbols.	K1
2	Explain the concepts of base and dimension of Vector space.	K2
3	Apply the Gram-Schmidt process to construct an orthonormal set of vectors in an inner product space.	K3
4	Demonstrate competence with the basic ideas ofMatrix theory ,Vector spaces, Dual spaces, Linear transformation	K3
5	Have an insight to analyze a real life problem and solve it	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Matrices	10hours

Introduction – Addition and Scalar Multiplication of Matrices – Product of Matrices –Transpose of a Matrix – Matrix Inverse – Symmetric and Skew - Symmetric Matrices..

Unit:2	Special Matrices	10 hours

Hermitian and Skew-Hermitian Matrices – Orthogonal and Unitary Matrices – Rank of a Matrix –Characteristic Roots and Characteristic Vectors of a Square Matrix.

Unit:3	Vector Spaces	20hours

Elementary Basic Concepts – Subspace of a Vector space - Homomorphism – Isomorphism - Internal and External direct sums - Linear span - Linear Independence and Bases.

Unit:4	Dual Spaces	20 hours

Dual Spaces – Annihilator of a subspace - Inner Product Spaces – Norm of a Vector – Orthogonal Vectors - Orthogonal Complement of a subspace – Orthonormal set.

Unit:5	Linear Transformations	15 hours

Algebra of Linear Transformations – Regular, Singular Transformations – Range of T – Rank of T - Characteristic Roots – Characteristic Vectors – Matrices.

	Total Lecture hours	75 hours

Text Book(s)	
1	Modern Algebra -R.Balakrishnan and M. Ramabadran.(Vikas Publishing House Pvt. Ltd, New Delhi, Second Revised Edition 1994) (For Units I & II) . Unit I :Chapter 1 Sections 1.1 to 1.3, 1.5 to 1.7 Unit II :Chapter 1 Sections 1.8 and 1.9 Chapter 2 Section 2.9 Chapter 3 Section 3.9
2	Topics in Algebra -I.N. Herstein.(John Wiley & Sons, New York, 2003.) (For Units III, IV & V) Unit III: Chapter 4 Sections 4.1 and 4.2 Unit IV :Chapter 4 Sections 4.3 and 4.4 Unit V :Chapter 6 Sections 6.1 , 6.2 and 6.3
Reference Books	
1	Modern Algebra -Surjeet Singh and Qazi Zameeruddin(Vikas Publishing house, 1992.)
2	Modern Algebra -A.R.Vasishtha(Krishna Prakashan Mandir, Meerut, 1994 – 95.)
3	Linear Algebra -Seymour Lipschutz and Marc Lipson(3rd Edition, McGraw Hill, 2001.)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/106/111106135/
2	https://nptel.ac.in/courses/115/105/115105097/
3	https://nptel.ac.in/courses/111/101/111101115/
4	https://nptel.ac.in/courses/111/108/111108066/
Course Designed By: : 1.Dr.C.Janaki 2. Dr. G.V. Chandrasekar	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	S	S	M	S	S
CO2	M	M	S	S	M	S	M	M	M	S
CO3	S	M	S	S	M	S	M	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		INTERNET AND JAVA PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core Paper-XVII	4	-	-	4
Pre-requisite		Knowledge In C	Syllabus Version		2021-2022	

Course Objectives:

enable the students to study about internet,mail,web, HTML,Usenet, Gopher, veronica, Jug head, Archie and Java fundamentals, class, packages, exception handling,threads,applets and AWTS.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Familiarize with basics of the Internet Programming.	K1
2	Gain knowledge about Java fundamentals, operators and statements.	K2
3	Apply the concepts and demonstrate the capability to write program.	K3
4	To explore different web extensions and web services.	K4
5	Analyze the concept of threads, applets and AWTS.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Internet & HTML	12 hours

Introduction to Internet- Resources of Internet -hardware and software requirements of internet- Internet service providers (ISP)-Internet addressing- Mail Using mail from a shell account - Introduction to web- using the web.

Unit:2	Clients & Servers	12 hours

URLs, schemes host names and port numbers- Using the browser Hypertext and HTML- Using the web from a shell account Introduction to Usenet - Reading and posting Usenet articles- Using Usenet from a shell account- Gopher ,Veronica and Jug head- Using gopher from a shell account

Unit:3	Ftp & IRC	12 hours

Anonymous ftp- Using ftp from a shell account-archie-file type uses on the internet downloading software - mailing lists- telnet- Using telnet from a seller account talk fecilities- Using talks from a shell account – talk felicities – using talks from a shell account – IRC and muds

Unit:4	Java Evolution	12 hours

Features of java - java environment - comparing java with C++ - introduction to java language - types - operators - flow control - classes - packages and interfaces.

Unit:5	Java Classes & Applet	12 hours

Java classes - string handling- exception handling - threads and synchronization -utilities - input / output - networking - applets - abstract windows toolkit (AWT)-imaging.

	Total Lecture hours	12 hours

Text Book(s)

1 The internet Complete reference- Harley Hahn (second edition, Tata McGraw Hill, 1996.)

2 Java Hand Book-PatricNaughton(Tata McGraw Hill, 1996)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://freevideolectures.com/course/3140/internet-technologies
2	https://www.w3.org/MarkUp/html3/intro.html
3	https://beginnersbook.com/2013/05/java-introduction
	https://nptel.ac.in/courses/106/105/106105191/

Course Designed By:1.Dr.C.Janaki
2.Dr.K.Malar

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	S	S	M	S	S	S
CO2	M	M	M	M	S	S	S	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		INTERNET AND JAVA PROGRAMMING (PRACTICAL)	L	T	P	C
Core/Elective/Supportive		Core Paper-XVII(Practical)	-	-	4	4
Pre-requisite		Knowledge in Internet and Java Theory	Syllabus Version		2021-2022	

Practical List

1.Create web pages using HTML to display ordered and unordered list of a departmental store.
2.Program to display image and text using HTML tag for a advertisement of a company product.
3.Create web pages for a business organization using HTML frames.
4.Create a web site of your department with minimum links using HTML .
5.Create a document using formatting and alignment tags in HTML.
6.Write a Java program to print the triangle of numbers.
7.Write a program which creates and displays a message on the windows.
8.Write a program to draw several shapes in the created window.
9.Write a Java program to accept values and find the given no. is even or odd.
10. Write a Java program to calculate standard deviation.

Course code		OPERATIONS RESEARCH - PAPER -IV	L	T	P	C
Core/Elective/Supportive		Skill Based Subject	3		-	3
Pre-requisite		Knowledge in Basics of O.R	Syllabus Version		2021 - 2022	

Course Objectives:

Toenhance the students knowledge in decision analysis, sequencing of the jobs to be carried out based on cost optimization, replacement policiesand analyze the cases according to their categories.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the principles and applications of information theory	K1
2	Understand sequencing, replacement problems	K2
3	Demonstrate skills to achieve their objective using sequencing models	K3
4	Apply decision making under different business environments .	K4
5	Determine a solution to a rectangular game using simplex method	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	**Decision Analysis**	**9 hours**

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

Unit:2	**Sequencing Problems**	**9 hours**

Introduction-problem of sequencing - basic terms used in sequencing- processing n--jobs through 2 machines - processing n –jobs through k machines -- processing 2 jobs through k machines(Problems only).

Unit:3	**Replacement Problems**	**9 hours**

Introduction - Replacement of equipment / assets that deteriorates gradually - replacement of equipment that fails suddenly and problems.

Unit:4	**Information Theory**	**9 hours**

Introduction- A measure of Information-Axiomatic Approach to Information- Entropy-The expected information- Some properties of entropy function-Joint and conditional entropies

Unit:5	**Applications**	**9 hours**

General solution of (mxn) rectangular games using simplex method - Reliability and system failure rates using replacement problems.

	Total Lecture hours	**45 hours**

Text Book	
1	Operations Research -Kantiswarup, P. K. Gupta , Man Mohan (S.Chand&Sons education publications ; New Delhi.)
Reference Books	
1	Operations Research - P K Gupta & D S Hira (S. Chand and company ltd. Ram Nagar; New Delhi.).
2	Operations Research Principles Problems - S Dharani Venkatakrishnan(keerthi publishing house Pvt. Ltd.)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/104/117104129/
2	https://nptel.ac.in/courses/110/105/110105082/
3	https://nptel.ac.in/courses/110/106/110106045/ scheduling and sequencing
Course Designed By: 1.Dr.C.Janaki 2. Dr.M.S. Annie Christi	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	S	M	S	S
CO2	S	S	S	S	S	S	S	S	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	M	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Elective Courses

Course code		ASTRONOMY – I	L	T	P	C
Core/Elective/Supportive		ELECTIVE I – A	4	-	-	3
Pre-requisite		Knowledge In Physics and Mathematics	Syllabus Version		2021 - 2022	

Course Objectives:

To enable the students to understand the Astronomical aspects and about the laws governing the planet movements.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Defining properties of physical systems that comprise the known universe	K1
2	Understanding the Solar system, Celestial sphere, Dip-Twilight &Keplar's laws.	K2
3	Apply their physics and mathematical skills to problems in the areas of planetary science	K3
4	Demonstrate the skill to infer valid scientific conclusions and communicate those conclusions in a clear and articulate manner	K4
5	Analyze the astronomicalconcepts	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	**Solar system**	**12 hours**

General description of the Solar system. Comets and meteorites – Spherical trigonometry..

Unit:2	**Celestial sphere**	**12 hours**

Celestial sphere – Celestial co – ordinates – Diurnal motion – Variation in length of the day.

Unit:3	**Geocentric parallex**	**12 hours**

Dip – Twilight – Geocentric parallex.

Unit:4	**Refraction**	**12hours**

Refraction – Tangent formula – Cassinis formula.

Unit:5	**Kepler's law**	**12 hours**

Kepler's laws – Relation between true eccentric and mean anamolies.

	Total Lecture Hours	**60 hours**

Text Book(s)

1	Astronomy -S.Kumaravelu and SusheelaKumaravelu (TextPublisher: Sivakasi: Janki7th Edition 1986)

Course Designed By: 1.Dr.C.Janaki
2. Dr.A.Pushpalatha

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	S	S	S	S
CO2	M	M	M	S	S	S	S	S	M	S
CO3	M	M	M	M	M	S	M	S	S	S
CO4	S	S	M	S	S	S	S	S	S	S
CO5	S	M	M	S	S	S	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		NUMERICAL METHODS - I	L	T	P	C
Core/Elective/Supportive		ELECTIVE I – B	4	-	-	3
Pre-requisite		Knowledge In Higher Secondary Level Mathematics	Syllabus Version		2021 - 2022	

Course Objectives:

It exposes the students to study numerical techniques to find solutions of numerical, algebraic transcendental equations,solution of simultaneaous linear algebraic equations and interpolation.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Remember the concepts of errors and its effect on computation.	K1
2	Obtain numerical solutions of algebraic and transcendental equations.	K2
3	Apply the finite difference and interpolation concepts	K3
4	Develop skills in designing mathematical models for constructing polynomials to the given data and drawing inferences	K4
5	Analyze the efficiency of iteration methods	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	The Solution Of Numerical Algebraic And Transcendental Equations	12 hours

Bisection method – Iteration Method – Convergence condition – Regula Falsi Method – Newton – Raphson method - Convergence Criteria – Order of Convergence.

Unit:2	Solution Of Simultaneous Linear Algebraic Equations	12 hours

Gauss elimination method – Gauss Jordan method – Method of Triangularization – Gauss Jacobi method – Gauss Seidel method.

Unit:3	Finite Differences	12 hours

Differences – operators – forward and backward difference tables – Differences of a polynomial – Factorial polynomial – Error propagation in difference table.

Unit:4	Interpolation (for equal intervals)	12 hours

Newton's forward and backward formulae – equidistant terms with one or more missing values – Central differences and central difference table – Gauss forward and backward formulae – Stirling's formula.

Unit:5	Interpolation (for unequal intervals)	12 hours

Divided differences – Properties – Relations between divided differences and forward differences – Newton's divided differences formula – Lagrange's formula and inverse interpolation.

	Total Lecture hours	60 hours

Text Book	
1	Numerical methods -Kandasamy. P, Thilagavathi. K and Gunavathi. K (S. Chand and Company Ltd, New Delhi – Revised Edition 2007.)(Chapters: 3,4,5,6,7 and 8)
2.	Introductory Methods of Numerical Analysis-S.S. Sastry(Prentice Hall of India Pvt. Ltd.New Delhi-110001Fourth Edition,2006)
Reference Books	
1	Numerical Methods in Science and Engineering -Venkataraman M. K.(National Publishing company V Edition 1999.)
2	Numerical Methods for Scientists and Engineers -Sankara Rao K. (Prentice Hall India , 2nd Edition2004)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://www.simumath.com/library/book.html?code=Alg_Equations_Examples
2	http://jupiter.math.nctu.edu.tw/~smchang/9602/NA_lecture_note.pdf http://www.iosrjournals.org/iosr-jm/papers/Vol6-issue6/J0665862.pdf
3	https://nptel.ac.in/courses/122/102/122102009/ https://nptel.ac.in/courses/111/107/111107105/
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	M	M	S	S	S	S
CO2	S	S	S	M	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	M	S	S	M

*S-Strong; M-Medium; L-Low

Course code		GRAPH THEORY	L	T	P	C
Core/Elective/Supportive		ELECTIVE I - C	4	-	-	3
Pre-requisite		Knowledge In Basic Mathematics	Syllabus Version	2021 - 2022		

Course Objectives:

Enables the students to learn the basic concepts of Graphs, sub-graphs, Enteoriom graphs, Digraphs, tournaments ,connectivity, graphs, matrix representation of graphs, trees, planar graphs,.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Identify the properties of different types of graph and their application.	K1
2	Demonstrate knowledge of basic concepts in graph theory .	K2
3	Understand cut graphs ,cycle spaces	K2
4	Apply principles and concepts of graph theory in practical situations	K3
5	Analyse the concepts of Planar graphs.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Graphs	12 hours

Graphs –Sub graphs – Degree of a vertex walks, paths and cycles in a Graphs – connectedness cut vertex and cut edge.

Unit:2	Euler andHamiltonion Graphs	12 hours

Euler andHamiltonion Graphs – Algorithm for Euler circuits – Bipartite Graphs –Trees.

Unit:3	Cut set graphs	12 hours

Matrix representation of a graph – vector spaces, associated with a graph – cycle spaces and cut set graphs.

Unit:4	Planar graphs	12hours

Planar graphs – Euler's theorem on planar graphs – characterization of planar graphs (no proofs) of the difficult part of the characterization

Unit:5	Directed graphs	12 hours

Directed graphs – Connectivity – Eulerian Digraphs – Tournaments.

	Total Lecture hours	60 hours

Text Book

1. A First Course in Graph Theory - A.Choudum (Macmillan,2001) Chapters 1 to 7.

Reference Books

1. Graph theory with applications to Engineering and computer science-Narasingh Deo (Prentice Hall of India1979).
2. Graph Theory -Frank Harary (Narosa Publishing HACK 2001 **).**
3. Introduction to Graph Theory- Dr. M. Murugan.(Muthali Publishing House,2005)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/106/111106102/
2	https://www.digimat.in/nptel/courses/video/106104170/L19.html
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	S	M	S	S
CO2	M	M	M	S	S	S	M	S	S	S
CO3	M	M	M	S	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	M	S	M	S	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		ASTRONOMY II	L	T	P	C
Core/Elective/Supportive		ELECTIVE II – A	4	-		2
Pre-requisite		Knowledge In Physics& Mathematics	Syllabus Version		2021-2022	

Course Objectives:

To enable the students to learn about the interesting facts of Moon, Sun Planetary Motion .

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of precession and nutation	K1
2	Describe the eclipse of the moon	K2
3	Find equation of time .	K3
4	Demonstrate the ability to analyze observation and theory.	K4
5	Describe the properties of stellar system	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	**Time**	**12 hours**

Equation of time – Convertion of time – Seasons – Calendar.

Unit:2	**Abberation**	**12 hours**

Annual Parallax – Abberation.

Unit:3	**Precession**	**12 hours**

Precession – Nutation.

Unit:4	**Eclipses**	**12 hours**

The Moon – Eclipses.

Unit:5	**The Stellar System**	**12 hours**

Planetary Phenomenon – The Stellar system.

	Total Lecture hours	**60 hours**

Text Book(s)

1 **Astronomy -Mr.S.Kumaravelu and SusheelaKumaravelu.**

Course Designed By: 1.Dr.C.Janaki, 2. Dr.A.Pushpalatha

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	M	M	S	S
CO2	S	M	S	S	S	S	M	M	M	S
CO3	M	M	S	S	S	S	M	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		Numerical Methods II	L	T	P	C
Core/Elective/Supportive		ELECTIVE II-B	4	-	-	2
Pre-requisite		Knowledge In Higher Secondary Level Mathematics	Syllabus Version	2021 - 2022		

Course Objectives:

1. To equip the learners with the powerful tool for numerical differentiation, numerical integration ,difference equation, numerical solution to O.D.E.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Familiarizewith numerical integration and differentiation, numerical solution of ordinary differential equations.	K1
2	Distinguish methods of Taylor series, Euler's, Modified Euler's and Runge Kutta methods to find solutions of differential equations.	K2
3	Apply the techniques for enormous application in the field of Science and some fields of Engineering.	K3
4	Compute the integrals and derivatives by using the appropriate technique.	K4
5	Find the numerical solution of second order O.D.E by finite difference method.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	Numerical Differentiation	12 hours

Newton's forward and backward formulae to compute the derivatives – Derivative using Stirling's formulae – to find maxima and minima of the function given the tabular values.

Unit:2	Numerical Integration	12 hours

Newton – Cote's formula – Trapezoidal rule – Simpson's 1/3 rd and 3/8 th rules.

Unit:3	Difference Equation	12 hours

Order and degree of a difference equation – solving homogeneous and non – homogeneous linear difference equations.

Unit:4	Numerical Solution Of O.D.E-Single Step Methods	12hours

Taylor series method – Euler's method – improved and modified Euler method – Runge Kuttamethod(fourth order Runge Kutta method only)

Unit:5	Numerical Solution Of O.D.E-Multi Step Methods	12 hours

Numerical Solution of O.D.E **-**(for first order only)-Milne's predictor corrector formulae – Adam-Bashforth predictor corrector formulae – solution of ordinary differential equations by finite difference method (for second order O.D.E).

	Total Lecture hours	60 hours

Text Book(s)

1	Numerical methods -Kandasamy. P, Thilagavathi. K and Gunavathi. K (S. Chand and Company Ltd, New Delhi – Revised Edition 2007.)(Chapters: 9,10,11,Appendix and Appendix E)
2	Introductory Methods of Numerical Analysis-S.S. Sastry(Prentice Hall of India Pvt. Ltd.New Delhi-110001Fourth Edition,2006)

Reference Books	
1	Numerical Methods in Science and Engineering -Venkataraman M. K.(National Publishing company V Edition 1999.)
2	Numerical Methods for Scientists and Engineers -Sankara Rao K. (Prentice Hall India , 2nd Edition,2004)
3	Numerical Methods-M.K.Jain, S.R.K. Iyengar and P.KJain(New Age International(P) Ltd Publishers, New Delhi,2012 6th Edition)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://nptel.ac.in/courses/104101002/downloads/lecturenotes/module1/chapter6.pdf https://www.britannica.com/science/difference-equation
2	https://nptel.ac.in/courses/122/102/122102009/
3	https://nptel.ac.in/courses/111/107/111107063/
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	S	S	S	S	M	S	S
CO2	M	M	S	S	M	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	M	S	M	M	S	M	S	S	S
CO5	S	M	S	M	M	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DIGITAL ELECTRONICS AND COMPUTER FUNDAMENTALS	L	T	P	C
Core/Elective/Supportive		ELECTIVE II - C	4	-	-	2
Pre-requisite		Knowledge of Mathematics and Basic Electronics in secondary education.	Syllabus Version	2021 - 2022		

Course Objectives:

To study the numbers systems and codes, combinational ,sequential circuits , fundamentals of computer and peripherals

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Identify various number system and codes	K1
2	Describe basic organization of computer	K2
3	Familiarize logic circuits,registers,I /O devices,memories	K3
4	Apply Boolean laws and rules to simplify simple expressions	K4
5	Demonstrate the building up of Sequential and combinational logic from basic gates.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Number System And Codes	12 hours

Representation of information Number System and Codes – Binary to Decimal Conversion - Decimal to Binary Conversion – Octal Numbers – Hexadecimal Numbers – ASCII Code – Excess-3 Code – Gray Code.

Unit:2	Logic Circuits	12 hours

Logic circuits: Gates – AND, OR, NOT, NAND and NOR gates – Truth tables – Boolean Algebra – Karnaugh Maps – Product of sum and Sum of product methods – Don‘t care conditions – Multiplexers and Demultiplexers – Flip flops – RS, JK, D, T flip flops – Decoders.

Unit:3	Registers	12 hours

Shift Registers – Counters – Arithmetic circuits – Half adder – Full Adder – Half &fullSubtractor – Binary adder &Subtractor – Serial & Parallel Binary Adders – BCD Adder.

Unit:4	I/O Devices	12 hours

I/O devices: Punched tape – Tape readers – Alphanumeric codes – Character recognition – CRT – Output Device : Magnetic tape Output offline Operation – Error detecting and correcting codes – Printers: Dot Matrix, Laser, CRT, Keyboards – Terminals.

Unit:5	Semiconductor Memories	12 hours

Semiconductor Memories: ROM – RAM – Static RAM, Dynamic RAM – Magnetic disc memories – Magnetic tape – Digital recording techniques.

	Total Lecture hours	60 hours

Text Book(s)	
1	Digital Principles and Applications - Albert Malvino and Donald P Leach(Mc-Graw hill 1986)
2	Digital Computer fundamentals -T.C.Bartee(McGraw Hill; 5th edition 1981)
Reference Books	
1	Digital Circuits and Design - S. Salivaganan and S. Arivalagan(Oxford University Press,2018)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://pages.uoregon.edu/rayfrey/DigitalNotes.pdf
2	http://jnujprdistance.com/assets/lms/LMS%20JNU/B.Sc.(IT)/Sem%20I/Digital%20Computer%20Fundamentals/Version%201/Digital%20Computer%20Fundamentals.pdf
3	https://www.cl.cam.ac.uk/teaching/0708/DigElec/Digital_Electronics_pdf.pdf
Course Designed By: 1.Dr.C.Janaki 2.Dr.K.Malar	

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	M	M	S	S
CO2	M	M	M	M	M	S	M	S	M	S
CO3	M	M	S	M	S	S	M	S	S	S
CO4	M	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		AUTOMATA THEORY AND FORMAL LANGUAGES	L	T	P	C
Core/Elective/Supportive		ELECTIVE III - A	5	-	-	3
Pre-requisite		Knowledge in Mathematics	Syllabus Version	2021 - 2022		

Course Objectives:

To impart knowledge in Finite automata, regular languages, regular grammars,Context free grammars, languages, and pushdown automatawhich play a crucial role to Identify different formal language classes and their relationship.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Acquire a fundamental understanding of the core concepts in automata theory and formal languages.	K1
2	To design grammars and automata for different language classes	K2
3	Describe the types of grammar and derivation tree.	K2
4	To apply context-free languages, push-down automata.	K3
5	Design automata, regular expressions and context-free grammars accepting or generating a certain language.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Unit:1	**Phrase Structure Languages.**	**15 hours**

Introduction – phrase structure languages.

Unit:2	**Closure Operations**	**15 hours**

Closure operations.

Unit:3	**Context Free Languages.**	**15 hours**

Context free languages.

Unit:4	**Finite State Automata**	**15 hours**

Finite state automata.

Unit:5	**Push Down Automata.**	**15 hours**

Push down automata.

	Total Lecture hours	**75 hours**

Text Book

1	Formal Languages and Automata- Rani Siromoney. (Revised edition 1984)(Published by the Christian Literary Society, Madras-3)Chapters 1 to 6.

Reference Books	
1	Formal languages and their relation automata- J.E. Hopcroft and D.Ullman(Addision Wesley1969)
2	Automata theory:Machines and Languages -Richard .Y.Kain(McGraw Hill1972)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/103/106103070/
2	https://www.digimat.in/nptel/courses/video/111103016/L02.html
Course Designed By: 1.Dr.C.Janaki 2. Dr.A.Pushpalatha	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	M	M	S	S
CO2	S	M	S	S	S	S	M	M	S	S
CO3	M	M	S	S	S	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		FUZZY LOGIC AND NEURAL NETWORKS	L	T	P	C
Core/Elective/Supportive		ELECTIVE III - B	5	-	-	3
Pre-requisite		Knowledge in Higher Secondary level Mathematics	Syllabus Version		2021-2022	

Course Objectives:

Equip the learners with an understanding of the basic mathematical elements of the theory of fuzzy sets,differences and similarities between fuzzy sets and classical sets theories, concepts of neural networks, fuzzy logic.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Learn the concepts of fuzzy sets ,membership function ,fuzzy set operations.	K1
2	Understand principles of neural networks and fuzzy logic.	K2
3	Apply the soft computing methodologies in their fields of work.	K3
4	Apply basic fuzzy inference and approximate reasoning.	K4
5	Analyze and demonstrate ability to take research projects in these areas.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Fuzzy Set Theory	15 hours

Fuzzy set theory: Fuzzy versus crisp- Crisp sets: Operations on crisp sets – Properties of crisp sets – Partition and covering .Fuzzy sets: Membership function basic fuzzy set operations – Properties of fuzzy sets.Crisp relations: Cartesian product – Other crisp relations –Operations on fuzzy relations. Fuzzy relations: Fuzzy Cartesian product – Operations on fuzzy relations..

Unit:2	Fuzzy systems	15 hours

Fuzzy systems: Crisp Logic: Laws of prepositional Logic- Inference in prepositional Logic. Predicate Logic : Interpretations of Predicate Logic formula – Inference in predicate Logic . Fuzzy logic : Fuzzy Quantifiers – Fuzzy inference – Fuzzy rule based System – Defuzzification Methods – Applications.

Unit:3	Fuzzy Associative Memories	15 hours

Fuzzy Associative Memories : FAM an introduction – Single Association FAM: Graphical method of inference – Correlation Matrix Encoding . Fuzzy Hebb FAMS- FAM involving a rule base – FAM Rules with multiple Antecedents / Consequents: Decomposition rules. Applications.

Unit:4	Fundamentals Of Neural Network	15 hours

Fundamentals Of Neural Network: Basic Concepts of Neural Networks – Human Brain – Model of an Artificial Neuron – Neural Network Architectures: Single Layer FeedForward Network – Mutlilayer Feed forward Network – Recurrent Networks .Characteristic of neural Networks – Learning Methods – Taxonomy of neural Network Architectures – History of neural Network Research – Early neural Network Architectures – Rosenblatt‘s percetron – ADALINE network – MADALINE Network – Some Application Domains.

Unit:5	Back Propagation Networks	15 hours
Back Propagation Networks: Architecture of a Back Propagation Network: The perceptron Model – The solution – Single Layer Artificial Neural Network. Model for Multi Perceptron .Bankpropogation Learning : Input Layer computation – Hidden Layer Computation Output Layer Computation – Calculation of Error – Training of neural network – Method of steepest Descent – Effect of learning Rate □- Adding a Momentum Term – Back Propogation Algorithm.		
	Total Lecture hours	**75 hours**

Text Book(s)

1	Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications - S.Rajasekaran, G.A. Vijayalakshmi Pai(Prentice Hall of India Pvt. Ltd., New Delhi,2003.) Unit I : Chapter 6 Unit II: Chapter 7 Unit III : Chapter 14 Unit IV : Chapter 2 Unit V: Chapter 3(Sections 3.1,3.2)

Reference Books

1	Fuzzy Logic with Engineering Applications- Timothy J. Ross(McGrow Hill , 1997)
2	C++ Neural Networks And Fuzzy Logic-Dr.Valluru.B.Rao, Hayagriva,V.Rao(BPB Publications , Second Edition, 1996)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/127/105/127105006/

Course Designed By:1.Dr.C.Janaki
2.Dr.M.S,Annie Christi

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	M	S	S	S
CO2	M	M	S	S	S	S	M	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		NUMBER THEORY	L	T	P	C
Core/Elective/Supportive		ELECTIVE III – C	5	-	-	3
Pre-requisite		Knowledge in Algebra	Syllabus Version	2021-2022		

Course Objectives:

To impart knowledge in the basic concepts of number theory , fundamental definitions , theorems .

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of divisibility and primes.	K1
2	Solve congruence.	K2
3	Describe the fundamental theorem of Arithmetic.	K3
4	Understand the concepts and apply the theorems in areas of Mathematics.	K3
5	Compute powers of integers modulo prime numbers.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Early Number Theory	15 hours

Peano's Axiom - Mathematical Induction - The Binomial Theorem - Early Number Theory .

Unit:2	Divisibility Theory in Integers	15hours

Divisibility Theory in Integers - The Division Algorithm - The g.c.d. - Euclidean Algorithm - The Diophontine Equation ax + by = c

Unit:3	Primes and their Distributions	15 hours

Primes and their Distributions - The fundamental Theorem of Arithmetic - The seive of Eratosthenes - The Gull Conjecture.

Unit:4	The Theory of Congruence	15 hours

The Theory of Congruence - Basic Properties of Congruence - Special Divisibility test - Linear Congruence-Prime modulus- Power residues.

Unit:5	Fermat's Theorem	15 hours

Fermat's Theorem - Fermat's factorization method - The Little theorem - Wilson's theorem.

	Total Lecture hours	75 hours

Text Book

1	Elementary Number theory -David M. Burton (W.M.C. Br own Publishers, Dubuque, Lawa, 1989.)

Reference Books

1	An Introduction to theory of Numbers -Ivan Nivan and H. Zuckerman .
2	Elements of Number Theory - Prof. S.Kumaravelu and SusheelaKumaravelu(Raja Sankar offset Printers ,Sivakasi, 2002)
3	Beginning Number Theory -Neville Robinns(2nd Ed., Narosa Publishing House Pvt.Ltd.,Delhi, 2007)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/103/111103020/ https://nptel.ac.in/courses/111/101/111101137/

Course Designed By: 1.Dr.C.Janaki
2.Mr.R.Subramanian

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	M	M	M	M	M	S	S
CO2	S	S	S	M	S	S	S	M	S	S
CO3	M	M	M	M	M	S	M	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DISCRETE MATHEMATICS	L	T	P	C
Core/Elective/Supportive		ELECTIVE III – D	5	-	-	3
Pre-requisite		Higher Secondary level Mathematics	Syllabus Version	2021 - 2022		

Course Objectives:

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

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Assimilate various graph theoretic concepts and familiarize with their applications.	K1
2	Know and understand about partially ordered sets, Boolean algebra,lattices and their types.	K2
3	Apply Karnaugh map for simplifying the Boolean expression.	K3
4	Demonstrate the skill to construct simple mathematical proofs and to validate .	K4
5	To achieve greater accuracy , clarity of thought and language.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Mathematical logic	15 hours

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

Unit:2	Relations And Functions	15 hours

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

Unit:3	Formal Languages And Automata	15 hours

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

Unit:4	Lattices And Boolean Algebra	15 hours

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

Unit:5	Graph Theory	15 hours

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

	Total Lecture hours	75 hours

Text Book	
1	Discrete Mathematical Structures with applications to computer science- J.P Tremblay and R.P Manohar (Mc.Graw Hill, 1975.) Unit 1: Chapter 1. Sections - 1-2, 1-2.7. 1-2.9, 1-2.10, 1-2.11, 1-3, 1-5.1, 1-5.2, 1-5.4, 1-6.4 Unit 2: Chapter 2- Sections - 2-3.5, 2-3.7, 2-4.2, 2-4.3, 2-4.6, Chapter 3- Sections-3-2, 3-5, 3-5.3, Unit 3: Chapter 3- Sections 3-3.1, 3-3.2 Chapter 4- Section 4-6.2 Unit4: Chapter 4- Section 4-1.1, 4-2, 4-3, 4-4.2 Unit 5: Chapter 5- Section 5-1.1, 5-1.2, 5-1.3, 5-1.4
Reference Books	
1	Discrete Mathematics-Oscar Levin(3rd Edition)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/106/106106094/
2	https://nptel.ac.in/courses/111/107/111107058/
Course Designed By: 1.Dr.C.Janaki 2.Mr.R.Subramanian	

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	S	M	S	M	M	S	S
CO2	S	M	S	S	M	S	S	M	S	S
CO3	S	M	S	S	M	S	M	S	S	S
CO4	S	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		INTRODUCTION TO INDUSTRY 4.0	L	T	P	C
Core/Elective/Supportive		ELECTIVE III – E	5	-	-	3
Pre-requisite		Basic Knowledge Of Computer And Internet	Syllabus Version		2021-2022	

Course Objectives:

To impart knowledge on Industry 4.0, need for digital transformation and the following Industry 4.0 tools:

1. Artificial Intelligence
2. Big Data and Data Analytics
3. Internet of Things

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Know the reason for adopting Industry 4.0 and Artificial Intelligence.	K1
2	Understand the need for digital transformation.	K2
3	Apply the industry 4.0 tools.	K3
4	Analyze the applications of Big Data .	K4
5	Examine the applications and security of IoT Applications.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Industry 4.0	15 hours

Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality. .

Unit:2	Artificial Intelligence	15 hours

Artificial Intelligence : Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI -environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI .

Unit:3	Big Data And IoT	15 hours

Big Data : Evolution - Data Evolution - Data : Terminologies - Big Data Definitions - Essential of Big Data in Industry 4.0 - Big Data Merits and Advantages - Big Data Components : Big Data Characteristics - Big Data Processing Frameworks - Big Data Applications - Big Data Tools - Big Data Domain Stack : Big Data in Data Science - Big Data in IoT - Big Data in Machine Learning - Big Data in Databases - Big Data Use cases Big Data in Social Causes - Big Data for Industry - Big Data Roles and Skills -Big Data Roles - Learning Platforms; Internet of Things (IoT) : Introduction to IoT - Architecture of IoT - Technologies for IoT - Developing IoT Applications - Applications of IoT - Security in IoT .

Unit:4	Applications And Tools Of Industry 4.0	15 hours

Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.

Unit:5	Jobs 2030	15 hours
Industry 4.0 – Education 4.0 – Curriculum 4.0 – Faculty 4.0 – Skills required for Future - Tools for Education – Artificial Intelligence Jobs in 2030 – Jobs 2030 - Framework for aligning Education with Industry 4.0 .		
	Total Lecture hours	**75 hours**
Text Book		
1	Higher Education for Industry 4.0 and Transformation to Education 5.0(2021)-P.Kaliraj& T. Devi.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/106/105/106105195/	
Course Designed By:1.Dr.C.Janaki 2.Mr.R.Subramanian		

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	M	S	S	S	S	S	S	S
CO2	M	M	M	S	S	S	S	M	M	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	M	S	M	S	S	S	S	S	M

*S-Strong; M-Medium; L-Low