

DEPARTMENT OF CUMPUTER SCIENCE

Programme: B.Tech. and M.Tech. (Dual Degree)

Branch: Artificial Intelligence and Data Science

Master of Technology (Dual Degree) in
Artificial Intelligence and Data Science

PROGRAMME STRUCTURE (2024-29) ONWARDS

First Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130101T	Mathematics - I	3 (2-1-0)	25	75
B130102T	Physics - I	3 (2-0-2)	25	75
B130103T	Fundamentals of Programming	3 (2-0-2)	25	75
B130104T	Descriptive Statistics	3 (2-1-0)	25	75
B130105T	Introduction to Computer Science	3 (2-1-0)	25	75
ELECTIVE COURSES (ANY ONE)				
B130106T	Fundamentals of Electronics	3 (2-1-0)	25	75
B130107T	Engineering Graphics	3 (0-0-6)	25	75
GENERIC COURSE				
B130108T	Environmental Science	2 (2-0-0)	25	75

Second Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130201T	Mathematics -II	3 (2-1-0)	25	75
B130202T	Physics – II	3 (2-0-2)	25	75
B130203T	Data Structures	3 (2-1-0)	25	75
B130204T	Introduction to Probability Theory	3 (3-0-0)	25	75
B130205P	Advanced Excel	3 (0-0-6)	25	75
ELECTIVE COURSES (ANY ONE)				
B130206T	Digital Electronics	3 (2-0-2)	25	75
B130207T	Microprocessor	3 (2-0-2)	25	75
GENERIC COURSE				
B130208T	Indian Science and Society	2 (2-0-0)	25	75

DEPARTMENT OF CUMPUTER SCIENCE

Third Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130301T	Mathematics-III	3 (2-1-0)	25	75
B130302T	Design & Analysis of Algorithms	3 (2-0-2)	25	75
B130303T	Object Oriented Programming	3 (2-0-2)	25	75
B130304T	Probability Distributions	3 (2-1-0)	25	75
B130305T	Computer Architecture	3 (2-0-2)	25	75
ELECTIVE COURSES (ANY ONE)				
B130306T	Engineering Economics	3 (3-0-0)	25	75
B130307T	Numerical Methods	3 (3-0-0)	25	75
GENERIC COURSE				
B130308T	Communication Skills	2 (2-0-0)	25	75

Fourth Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130401T	Discrete Structures	3 (2-1-0)	25	75
B130402T	Python Programming	3 (2-0-2)	25	75
B130403T	Operating Systems	3 (2-1-0)	25	75
B130404T	Sampling Theory and Applications	3 (2-1-0)	25	75
B130405T	Database Management Systems	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130406T	Computer Graphics	3 (3-0-2)	25	75
B130407T	Digital Logic Design	3 (2-0-2)	25	75
GENERIC COURSE				
B130408T	Technical Communication	2 (2-0-0)	25	75

Fifth Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130501T	Software Engineering	3 (2-0-2)	25	75
B130502T	JAVA Programming	3 (2-0-2)	25	75
B130503T	Data Engineering	3 (2-1-0)	25	75
B130504T	Statistical Inference	3 (2-0-2)	25	75
B130505T	Automata Theory	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130506T	Econometrics	3 (2-0-2)	25	75
B130507T	Computer Networks	3 (2-0-2)	25	75
GENERIC COURSE				
B130508T	Web Technology	2 (2-0-0)	25	75

DEPARTMENT OF CUMPUTER SCIENCE

Sixth Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130601T	Data Mining and Data Warehousing	3 (2-0-2)	25	75
B130602T	R Programming	3 (2-0-2)	25	75
B130603T	NOSQL Databases	3 (2-0-2)	25	75
B130604T	Linear Algebra	3 (2-1-0)	25	75
B130605T	Design of Experiments	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130606T	Scientific Computing	3 (2-0-2)	25	75
B130607T	Soft Computing	3 (2-0-2)	25	75
ADVANCE COURSE				
B130608T	Data Security	2 (2-0-0)	25	75

Seventh Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130701T	Data Visualization	3 (2-0-2)	25	75
B130702T	Machine Learning	3 (2-0-2)	25	75
B130703T	Optimization Algorithms and Techniques	3 (2-1-0)	25	75
B130704T	Scala Programming	3 (2-0-2)	25	75
B130705T	Cryptography and Network Security	3 (3-0-0)	25	75
ELECTIVE COURSES-(Any One)				
B130706T	Stochastic Processes	3 (3-0-0)	25	75
B130707T	Multivariate Analysis	3 (3-0-0)	25	75
ADVANCE COURSE				
B130708T	Advanced JAVA	2 (2-0-0)	25	75

Eighth Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130801T	Deep Learning	3 (2-0-2)	25	75
B130802T	Forecasting Methods	3 (2-0-2)	25	75
B130803T	Hadoop and Spark	3 (2-1-0)	25	75
B130804T	Cloud Computing	3 (2-0-2)	25	75
B130805T	Dependable AI	3 (3-0-0)	25	75
ELECTIVE COURSES-(Any One)				
B130806T	Modelling and Simulation	3 (2-0-2)	25	75
B130807T	Decision Analysis	3 (3-0-0)	25	75
GENERIC COURSE				
B130808T	Ethics in AI	2 (2-0-0)	25	75

DEPARTMENT OF CUMPUTER SCIENCE

Ninth Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130901T	Blockchain Technology	3 (2-0-2)	25	75
B130902T	Natural Language Processing	3 (2-0-2)	25	75
B130903T	Computer Vision	3 (3-0-0)	25	75
B130904T	High Performance Computing	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130905T	Text and Image Analytics	3 (2-0-2)	25	75
B130906T	Social Network Analysis	3 (2-0-2)	25	75
Summer Training/ Internship				
B130907R	Internship	5 (0-0-10)	-	100

Tenth Semester:

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
DISSERTATION				
B131001R	M.Tech. Dissertation	20 (0-0-40)	-	100

Note: The above course contents can be modified as per requirement from time to time in accordance with University Guidelines.

DEPARTMENT OF COMPUTER SCIENCE
PROGRAMME: M.TECH. (DUAL DEGREE) – AI&DS
SESSION: 2024-29>>SEMESTER-I

DETAILED SYLLABUS

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130101T	Mathematics - I	3 (2-1-0)	25	75
B130102T	Physics - I	3 (2-0-2)	25	75
B130103T	Fundamentals of Programming	3 (2-0-2)	25	75
B130104T	Descriptive Statistics	3 (2-1-0)	25	75
B130105T	Introduction to Computer Science	3 (2-1-0)	25	75
ELECTIVE COURSES (ANY ONE)				
B130106T	Fundamentals of Electronics	3 (2-1-0)	25	75
B130107T	Engineering Graphics	3 (0-0-6)	25	75
GENERIC COURSE				
B130108T	Environmental Science	2 (2-0-0)	25	75

Course Code	B130101T	Course Title	Mathematics-I
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	To provide knowledge of series and sequence, single and multiple variable calculus, knowledge of vector calculus and their applications.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Infinite series: Tests for convergence of series (Comparison, Ratio, Root, Integral, Raabe's, logarithmic), Alternating series, Absolute convergence, Conditional convergence.	06
2.	Differential & Integral Calculus of Single Variable: Taylor's & MaClaurin's expansion, Radius of curvature, Tracing of some standard curves, Applications of definite integral to Area, Arc length, Surface area and volume (in cartesian, parametric and polar co-ordinates). Calculus of several variables: Partial differentiation, Euler's theorem, Total differential, Taylor's theorem, Maxima-Minima, Lagrange's method of multipliers, Application in estimation of error and approximation.	14
3.	Multiple Integrals: Double integral (Cartesian and polar co-ordinates), Change of order of integration, triple integrals (Cartesian, cylindrical and spherical co-ordinates), Beta and Gamma functions, Applications of multiple integration in area and volume.	08
4.	Vector Differential Calculus: Continuity and differentiability of vector functions, Scalar and Vector point function, Gradient, Directional Derivative, Divergence, Curl and their applications. Vector Integral Calculus: Line integral, Surface integral and Volume integral, Applications to work done by the force, Applications of Green's, Stoke's and Gauss divergence theorems.	15
TOTAL		43

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication / Reprint

1	Advanced engineering mathematics: Kreyszig; Wiley-India. 9 th Edition ISBN : 978-81-265-3135-6	2011
2	Advanced engineering mathematics: Jain/Iyenger; Narosa. 2 nd Edition. ISBN: 81-7319-541-2	2003
3	Advanced engineering mathematics: Taneja; I K international ISBN: 978-93-82332-64-0	2014
4	Advanced engineering mathematics: Alan Jeffery; Academic Press, ISBN: 978-93-80501-50-5	2010
5	Calculus and analytic geometry: Thomas/Finney; Narosa. ISBN : 978-81-85015-52-1	2013

Course Code	B130102T	Course Title	Physics-I
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To impart knowledge of basic concepts in applied physics and make the students familiar with topics like interference, diffraction, polarization, fiber optics, lasers, wave mechanics, etc. This course is also aimed at enhancing the analytical capability of the engineering students.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	RELATIVITY: Review of concepts of frames of reference and Galilean transformation equation, Michelson – Morley experiment and its implications, Einstein’s special theory of relativity, Lorentz transformation equations, Law of addition of velocities, Mass variation with velocity, Concept of energy and momentum, Mass energy relation.	8
2.	OSCILLATIONS AND WAVES: Damped and forced oscillations, Resonance (amplitude and power), Q – factor, Sharpness of resonance. Equations of longitudinal and transverse waves and their solutions, Impedance, Reflection and transmission of waves at a boundary, Impedance matching between two medium.	8
3.	PHYSICAL OPTICS: Interference by division of wave front and amplitude, Multiple beam interference and Fabry-Perot interferometer, Fresnel diffraction through a straight edge, Zone plate, Fraunhofer diffraction, single slit and N-slit / grating, Resolving power of telescope, prism and grating. Polarization by reflection and by transmission, Brewster’s law, Double refraction, elliptically and circularly polarized light, Nicol prism, Quarter and half wave plates.	8
4.	OPTICAL INSTRUMENTS: Cardinal points of co-axial lens systems, spherical and chromatic aberrations and their removal, Huygens and Ramsden’s eyepiece. Lasers: Coherence and coherent properties of laser beams, Brief working principle of lasers, Spontaneous and stimulated Emission, Einstein’s co-efficient, Ruby laser, He-Ne laser. Optical Fiber: Classification of optical fibers, Refractive index profile, Core-cladding refractive index difference, Numerical aperture of optical fiber, Pulse dispersion in optical fiber (ray theory).	16
TOTAL		40

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication / Reprint
1	Physics of Vibrations and Waves, by H.J. Pain.	2005/ John Wiley & Sons
2	Vibrations and Waves, by A.P. French.	1971/CRC Press
3	Perspective of Modern Physics, by Arthur Beiser	1981/ McGraw-Hill
4	Optics, by A. Ghatak.	2006/Tata McGraw-Hill
5	Berkley Physics Course Vol – 1.	2009/ Tata McGraw-Hill

Course Code	B130103T	Course Title	Fundamentals of Programming
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To introduce fundamentals of Programming using C and C++, concepts of program development and object oriented programming.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction: Concepts of algorithm, flow chart, Introduction to different Programming Languages like C, C++, Java etc. Elementary Programming in C: Data types, assignment statements, Arithmetic, unary, logical, bit-wise, assignment and conditional operators, conditional statements and input/output statements. Iterative programs using loops- While, do-while, for statements, nested loops, if else, switch, break, continue, and goto statements, comma operators. Concept of subprograms.	12
2.	Array representation, Operations on array elements, using arrays, multidimensional arrays. Structures & Unions: Declaration and usage of structures and Unions. Defining and operations on strings. Pointers: Pointer and address arithmetic, pointer operations and declarations, using pointers as function argument. File: Declaration of files, different types of files. File input/ output and usage-, File operation: creation, copy, delete, update, text file, binary file.	14
3.	Concept of macros and pre-processor commands in C, Storage types: Automatic, external, register and static variables. Sorting and searching algorithms: selection sort, bubble sort, insertion sort, merge sort, quick sort and binary search.	08
4.	Introduction to Object Oriented Programming: OOPS concepts: class, encapsulation, inheritance, polymorphism, overloading etc. C++ introduction, Concept of class, methods, constructors, destructors, inheritance.	08
TOTAL		42

PRACTICALS:

Unit	Contents	Contact Hours
1	Basics of Programming <ul style="list-style-type: none"> Write a C++ Program to Add Two Numbers. 	3

	<ul style="list-style-type: none"> • Write a C++ Program to Find Quotient and Remainder • Write a C++ Program to Swap Two Numbers with or without using the third variable. • Write a program to demonstrate the use of the Ternary operator. 	
2	<p>Loops and To understand the programming knowledge using Decision Statements (if, if-else, if-else-if ladder, switch, and GOTO)</p> <ul style="list-style-type: none"> • Write a C++ program to print the sum of digits of a given number. • Write a C++ Program to Find Largest Number Among Three Numbers • Write a program to print whether a given number is even or odd. • Write a program to find the Factorial of a number. • Write a program to give the Fibonacci Series • Write a program to check whether the given number is Armstrong or not • Write a program to check whether the given string is Palindrome or not. • Write a program to find whether a character is a consonant or vowel using a switch statement. • Pointer Programming. 	4
3	<p>Functions</p> <ul style="list-style-type: none"> • C++ program to Calculate Factorial of a Number Using Recursion • C++ program for Call by value • C++ program for the call by reference 	4
4	Simple programming for one-dimensional and two-dimensional arrays.	2
5	<p>Classes and Object</p> <ul style="list-style-type: none"> • Write a program to read the student name, roll no, marks, and display the same using class and object. • Write a program to find the area of a rectangle, circle, and square using class and object. 	4
6	<p>Friend Function and Inline Function</p> <ul style="list-style-type: none"> • Write a program to implement friend function and friend class • Write a program to implement inline function inside and outside of a class for <p>- Finding the area of a square - Finding the area of a cube.</p>	4
7	<p>Constructor and Destructor</p> <ul style="list-style-type: none"> • Write a program to implement constructor and destructor within a class. • Write a program to implement a default constructor in a class 	4

	<ul style="list-style-type: none"> • Write a program to implement parameterized constructor in a class. • Write a program to implement a copy constructor in a class 	
8	<p>Inheritance: Introduction, Types of Inheritance, Constructors and Destructors in Base and Derived Classes.</p> <ul style="list-style-type: none"> • Write a program to demonstrate Simple inheritance. • Write a program to demonstrate Hierarchical inheritances • Write a program to demonstrate multiple inheritances. • Write a program to demonstrate Multilevel inheritances • Write a program to demonstrate Hybrid inheritances 	4
9	<p>Write a program to demonstrate the constructor overloading.</p>	1
10	<p>Polymorphism and Virtual Member Functions, Abstract Base Classes, and Pure Virtual Functions.</p> <ul style="list-style-type: none"> • Write a program to demonstrate static polymorphism. • Write a program to demonstrate dynamic polymorphism. • Write a program to implement polymorphism using pure virtual functions. 	4
11	<p>Templates: Function Templates–Introduction, Function Templates with Multiple Type, Overloading with Function Templates, Class Templates – Introduction, Defining Objects of the Class, Template, Class Templates, and Inheritance</p> <ul style="list-style-type: none"> • Write a program to demonstrate the function templates • Write a program to demonstrate the function templates with multiple types. • Write a program to demonstrate the Class templates. 	4
12	<p>Exceptions: Introduction, Throwing an Exception, Handling an Exception, Object-Oriented Exception Handling with Classes, Multiple Exceptions, Extracting Data from the Exception Class, Re-throwing an Exception.</p> <ul style="list-style-type: none"> • Write a program to demonstrate exception handling using try and catch block. • Write a program to demonstrate multiple exception handling. • Write a program to demonstrate Re-throwing an exception handling using try and catch block. 	4
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	The C Programming Language, 2nd Edition, Brian W. Kernighan , Dennis M. Ritchie , PHI, (ISBN-978-8120305960)	1988
2.	Let Us C, 13 th Edition, Yashavant Kanetkar, BPB Publications, (ISBN: 978-8183331630)	2013
3.	Mastering C, Venugopal K R, Sudeep R Prasad, Edition 1, McGraw Hill Education. (ISBN- 9780070616677)	2006
4.	Programming in ANSI C , Sixth Edition, McGraw Hill Education (India) Private Limited E Balagurusamy (ISBN: 978-1259004612)	2012
5.	Object Oriented Programming with C++, Sixth edition , E. Balagurusamy, McGraw Hill Education (India) Private Limited (ISBN: 978-1259029936)	2013

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	The C Programming Language, 2nd Edition, Brian W. Kernighan, Dennis M. Ritchie, PHI, (ISBN-978-8120305960)	1988
2.	Let Us C, 13 th Edition, Yashavant Kanetkar, BPB Publications, (ISBN: 978-8183331630)	2013
3.	Mastering C, Venugopal K R, Sudeep R Prasad, Edition 1, McGraw Hill Education. (ISBN- 9780070616677)	2006
4.	Programming in ANSI C , Sixth Edition, McGraw Hill Education (India) Private Limited E Balagurusamy (ISBN: 978-1259004612)	2012
5.	Object Oriented Programming with C++, Sixth edition , E. Balagurusamy, McGraw Hill Education (India) Private Limited (ISBN: 978-1259029936)	2013

COURSE OUTCOMES:

No.	Outcome

Course Code	B130104T	Course Title	Descriptive Statistics
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	To provide fundamental knowledge of Statistics		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Statistical Methods: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement-nominal, ordinal, interval and ratio. Presentation: tabular and graphical, including histogram and ogives, consistency and independence of data with special reference to attributes.	12
2.	Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, absolute moments, factorial moments, skewness and kurtosis, Sheppard's corrections.	10
3.	Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.	12
4.	Index Numbers: Definition, construction of index numbers and problems thereof for weighted and unweighted index numbers including Laspeyre's, Paasche's, Edgeworth-Marshall and Fisher's. Chain index numbers, conversion of fixed based to chain based index numbers and vice-versa. Consumer price index numbers.	10
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication / Reprint
1	Fundamentals of Statistics, Vol. I & II/ Goon A.M., Gupta M.K. and Dasgupta B./ The World Press, Kolkata.	2002

2	John E. Freund's Mathematical Statistics with Applications/ Miller, Irwin and Miller, Marylees/ Pearson Education, Asia.	2006
3	Introduction to the Theory of Statistics/ Mood, A.M. Graybill, F.A. and Boes, D.C./ Tata McGraw-Hill Pub. Co. Ltd.	2007
4	An Introduction to the Theory of Statistics/ Yule G.U & Kendall M.G./C. Griffin	

Course Code	B130105T	Course Title	Introduction to Computer Science
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	To provide introductory knowledge of computer science, cloud computing, artificial intelligence, machine learning, etc.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>Introduction to Algorithms, Complexities and Flowchart, Introduction to Programming, Categories of Programming Languages, Program Design, Programming Paradigms, Characteristics or Concepts of OOP, Procedure Oriented Programming VS object oriented Programming.</p> <p>Introduction to C++: Character Set, Tokens, Precedence and Associativity, Program Structure, Data Types, Variables, Operators, Expressions, Statements and control structures, I/O operations, Array, Functions.</p>	12
2.	<p>Introduction of Operating System: Types of Operating Systems, functions of Operating Systems, need of Operating Systems. Process and threads.</p> <p>Data Base Management System: Introduction, File oriented approach and Database approach, Data Models, Architecture of Database System, Data independence, Data dictionary, DBA, Primary Key, Data definition language and Manipulation Languages.</p>	10
3.	<p>Cloud computing: definition, cloud infrastructure, cloud segments or service delivery models (IaaS, PaaS and SaaS), cloud deployment models/ types of cloud (public, private, community and hybrid clouds), Pros and Cons of cloud computing.</p>	8
4.	<p>Artificial Intelligence & Applications: The AI problems, what is an AI technique, Characteristics of AI applications. Problem Solving, Search and Control Strategies General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches, depth first and breadth first search. Heuristic Search Techniques: Hill climbing, branch and bound technique, best first search & A* algorithm, AND / OR graphs, problem reduction & AO* algorithm, constraint satisfaction problems.</p> <p>Introduction to Machine Learning and Deep Learning: Definition,</p>	12

	Applications, Classification of Machine Learning. Introduction to Deep Learning: Definition, Why is Deep Learning Important, Application of Deep Learning, Software and Frameworks.	
TOTAL		42

Course Code	B130106T	Course Title	Fundamentals of Electronics
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	This course provides the student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier It will build mathematical and numerical background for design of electronics circuit & component value. Students equipped with the knowledge and training provided in the course will be able to participate in design , development and operation in the different area of electronics system .		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Fundamentals of Semiconductor Material: Energy Band Diagram of conductor, semiconductor and insulator; Bhor Atomic Model for Atom, Crystal Structure of Semiconductor Materials, Intrinsic and Extrinsic Semiconductor Materials. Semiconductor Diodes : Symbol and Construction, Operating Characteristics in Forward and Reverse Bias,	06
2.	Special Purpose Diodes : Zener Diode; Optical Diodes like LED, Photo Diode, Laser Diode, Seven Segment Display; Other Diodes like Varactor Diode, Schottkey Diode, PIN Diode, Tunnel Diode , Step Recovery Diode.	09
3.	Bipolar Junction Transistor (BJT) : History of BJT invention; Types, Symbol and Construction of BJT; Basic Operation of BJT; BJT Configurations : Common Base, Common Emitter, Common Collector with Operation, Input/Output Characteristics; Applications of Transistors as Switch and Amplifier. BJT Biasing: DC Operating Point, Fixed (Base) Biasing, Emitter Biasing, Voltage Divider Bias, Emitter Feedback Bias, Collector Feedback Bias, Collector and Emitter Feedback Bias.	09

4.	Field Effect Transistor : Types, Symbol, Construction, Operation, Input/Output Characteristics and Applications of Junction Filed Effect Transistor (JFET), Metal Filed 6 Effect Transistor (MOSFET)	09
5.	Operational Amplifiers: Introduction to OpAmp, Differential and Common Mode Operation, OpAmp Basics, Practical OpAmp Circuits, OpAmp Applications as Summer, Integrator and Differentiator Basic of Organic Electronics : Introduction, Types of Organic Materials, Organic Electronic Devices, Applications.	09
TOTAL		42

S. No.	Name of Books/Authors/Publisher	Year of Publication / Reprint
1	'Electronic devices and circuit theory by Boylestad and Nashelsky, Pearson	1972
2	Electronic principle by Albert Malvino & Davis J Bates, TMH	2007
3	Solid state Electronics Devices' by Sreetman & Banerjee.	2005
4	Principles of electronics by V K Mehta and Rohit Mehta, Chand.	2014
5	'Electronics devices & Circuit' by Salivahanan. TMH	2008

COURSE OUTCOMES:

No.	Outcome

Course Code	B130107T	Course Title	Engineering Graphics
Credits	3 (0-0-6)	Pre-requisite	Nil
Objective	To familiarize the students with drafting and engineering drawing practices.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>General: Importance, Significance and scope of engineering drawing Lettering, Dimensioning, Scales, Sense of Proportioning, Different types of Projections, B.I.S. Specification, line symbols, rules of printing.</p> <p>Projections of Points and Lines: Introduction of planes of projection, Reference and auxiliary planes, projections of points and lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on auxiliary planes, shortest distance, intersecting and non-intersecting lines.</p>	8
2.	<p>Planes Other than the Reference Planes: Introduction of other planes (perpendicular and oblique), their traces, inclinations etc., projections of points lines in the planes, conversion of oblique plane into auxiliary plane and solution of related problems.</p> <p>Projections of Plane Figures: Different cases of plane figure (of different shapes) making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes). Obtaining true shape of the plane figure by projection.</p> <p>Projection of Solids: Simple cases when solid is placed in different positions, Axis, faces and lines lying in the faces of the solid making given angles.</p>	10
3.	<p>Isometric and Orthographic Views: First and Third angle of system of projection, sketching of Orthographic views from pictorial views and vice –versa, Sectional views. Principles of dimensioning.</p>	12
4.	Development of lateral surfaces of simple solids. Introduction to available drafting softwares like AutoCAD	15
TOTAL		45

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication / Reprint
1	Engineering Graphics, Narayana, K.L. and Kannaiah, P, Tata McGraw Hill	2005
2	Engineering Graphics, Naveen Kumar and S C Sharma	2013
3	Engineering Graphics, Chandra, A.M. and Chandra Satish, CRC Press	2003

Course Code	B130108T	Course Title	Environmental Science
Credits	2 (2-0-0)	Pre-requisite	Nil
Objective	To provide basic understanding of environment, natural resources, ecosystem, biodiversity, environmental pollution, etc.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Environment Definition, Scope, and importance of environmental studies; need for public awareness; Segments of environment- lithosphere, hydrosphere, atmosphere, and biosphere; Environmental degradation; Role of individual in environmental conservation; sustainable lifestyle.	06
2.	Natural Resources Forest Resources : Deforestation, mining, dams and their effects on forest and tribal people; Water resources: over-utilization, floods, drought, conflicts over water, dams-benefits and problems; Mineral resources: Use and exploitation, environmental effects; Food resources : World food problems, changes caused by modern agriculture, fertilizer-pesticide problems, water logging, salinity; Energy resources: Growing energy needs, renewable and non-renewable energy sources; Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.	09
3.	Ecosystems and Biodiversity Concept of an ecosystem, Structure and function, Energy flow, Ecological succession, ecological pyramids; Types, characteristic features, structure and function of the Forest, Grassland, Desert, and Aquatic ecosystems. Concept of Biodiversity, definition and types, Bio-geographical classification of India; Value of biodiversity; Biodiversity at global, national and local levels; India as a mega-diversity nation; Hot-spots of biodiversity; Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.	09
4.	Environmental Pollution Definition, Cause, effects and control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides.	09

5.	<p>Social Issues and Environment Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, Consumerism and waste products, Environment Laws and Acts, Issues involved in enforcement of environmental legislation, Public awareness. Population growth, variation among nations, Family Welfare Programme.</p>	09
TOTAL		42

DEPARTMENT OF COMPUTER SCIENCE
PROGRAMME: M.TECH. (DUAL DEGREE) – AI&DS

SESSION: 2024-29>>SEMESTER-II

DETAILED SYLLABUS

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130201T	Mathematics -II	3 (2-1-0)	25	75
B130202T	Physics – II	3 (2-0-2)	25	75
B130203T	Data Structures	3 (2-1-0)	25	75
B130204T	Introduction to Probability Theory	3 (3-0-0)	25	75
B130205P	Advanced Excel	3 (0-0-6)	25	75
ELECTIVE COURSES (ANY ONE)				
B130206T	Digital Electronics	3 (2-0-2)	25	75
B130207T	Microprocessor	3 (2-0-2)	25	75
GENERIC COURSE				
B130208T	Indian Science and Society	2 (2-0-0)	25	75

DETAILED SYLLABUS

Course Code	B130201T	Course Title	Mathematics-II
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	To impart knowledge of matrices and applications closed form and series solutions of differential equations, Laplace Transform, Fourier series, Fourier Transform and their applications.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Matrices: Rank of a matrix, Inverse of a matrix using elementary transformations, Consistency of linear system of equations, Eigen-values and Eigenvectors of a matrix, Cayley Hamilton theorem, Diagonalization of matrix.	07
2.	Ordinary differential equations: Second & higher order linear differential equations with constant coefficients, General solution of homogenous and non - homogenous equations, Method of variation of parameters, Euler-Cauchy equation, Simultaneous linear equations, Applications to simple harmonic motion. Special Functions: Power series method, Frobenius method, Legendre equation, Legendre polynomials, Bessel equation, Bessel functions of first kind, Orthogonal property.	15
3.	Laplace Transforms: Basic properties, Laplace transform of derivatives and integrals, Inverse Laplace transform, Differentiation and Integration of Laplace transform, Convolution theorem, Unit step function, Periodic function, Applications of Laplace transform to initial and boundary value problems.	08
4.	Fourier series: Fourier series, Fourier Series of functions of arbitrary period, Even and odd functions, half range series, Complex form of Fourier Series, Numerical Harmonic analysis. Fourier Transforms: Fourier Transforms, Transforms of derivatives and integrals, Applications to boundary value problem in ordinary differential equations (simple cases only).	12
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Advanced engineering mathematics: Kreyszig; Wiley. ISBN : 978-81-265-3135-6	2011
2.	Advanced engineering mathematics: Jain/Iyenger; Narosa. ISBN: 81-7319-541-2	2003
3.	Advanced engineering mathematics: Taneja; I K international ISBN: 978-93-82332-64-0	2014
4.	Advanced engineering mathematics: Alan Jeffery; Academic Press ISBN: 978-93-80501-50-5	2010
5.	Advanced engineering mathematics: Peter V. O'Neil Cengage Learning. ISBN : 978-81-315-0310-2	2007

COURSE OUTCOMES:

No.	Outcome

Course Code	B130202T	Course Title	Physics-II
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To provide basic understanding of quantum physics, classical and quantum statistics, nuclear physics, electrodynamics, and semiconductor physics.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Quantum Physics : Failure of classical physics ,Compton effect , Pair production, de-broglie relation, wave function, Probability density, Schrodinger wave equation, operators, expectation values and Eigen-value equation, particle in a box, simple harmonic oscillator problem, concept of degeneracy.	10
2.	Classical Statistics: Microscopic-macroscopic systems, concept of phase space, basic postulates of statistical mechanics, Maxwell—Boltzmann distribution law. Quantum Statistics: Fermi—Dirac and Bose—Einstein Distribution, Fermi- Dirac probability function, Fermi energy level.	10
3.	Nuclear Physics: Nuclear properties, constituent of the nucleus, binding energy, stable nuclei, radioactive decay law (alpha and beta spectrum), Q-value of nuclear reaction , nuclear models: liquid drop and shell model, nuclear fission and fusion, elementary ideas of nuclear reactors.	7
4.	Electrodynamics: Maxwell's equations, concept of displacement current, Derivation of wave equation for plane electromagnetic wave, Poynting vector. Poynting theorem, Energy density, wave equation in dielectric & conducting media. Semiconductor Physics: Concept of intrinsic and extrinsic semiconductors, Fermi level, characteristics of PN Junction, static and dynamic resistance, zenar diode and LED, diode as a rectifier, transistor (PNP and NPN) characteristics, current and voltage gain.	15
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Nuclear Physics, by Erwin Kaplan, Narosa	2002

2.	Concept of Nuclear Physics, by Bernard Cohen, McGraw-Hill	2001
3.	Perspective of Modern Physics, by Arthur Beiser, McGraw-Hill	1969
4.	Electrodynamics, by Griffith, PHI Learning	2012
5.	Electricity & magnetism, by Rangawala & Mahajan, McGraw-Hill	2012

COURSE OUTCOMES:

No.	Outcome

Course Code	B130203T	Course Title	Data Structures
Credits	3 (2-1-0)	Pre-requisite	Fundamentals of Programming
Objective	To study different kinds of data structures and their applications.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>Introduction: Introduction to Algorithmic, Complexity- Time-Space Trade off. Introduction to abstract data types, design, implementation and applications. Introduction to List data structure.</p> <p>Arrays and Strings: Representation of Arrays in Memory: one dimensional, Two dimensional and Multidimensional, Accessing of elements of array, performing operations like Insertion, Deletion and Searching. Sorting elements of arrays. Strings and String Operations.</p> <p>Stacks and Queues: Introduction to data structures like Stacks and Queues. Operations on Stacks and Queues, Array representation of Stacks , Applications of Stacks : recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues.</p>	12
2.	<p>Linked Lists: Singly linked lists, Representation of linked list, Operations of Linked list such as Traversing, Insertion and Deletion, Searching, Applications of Linked List. Concepts of Circular linked list and Doubly linked list and their Applications. Stacks and Queues as linked list.</p>	10
3.	<p>Trees: Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching , Insertion and Deletion , Applications of Binary search Trees, Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees.</p> <p>Searching and Sorting: Linear Search, Binary search, Interpolation Search, Insertion Sort, Quick sort, Merge sort, Heap sort, sorting on different keys, External sorting.</p>	12
4.	<p>Graphs: Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort and Critical Paths.</p> <p>File Structure: File Organization, Indexing & Hashing, Hash Functions, Collision Resolution Techniques.</p>	12
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Horowitz and Sahni, "Fundamentals of Data structures", Galgotia Publications.	1983
2.	Tannenbaum, "Data Structures", PHI.	2007
3.	An introduction to data structures and application by Jean Paul Tremblay & Pal G. Sorenson (McGraw Hill)	
4.	R.L. Kruse, B.P. Leary, C.L. Tondo, "Data Structure and Program Design in C", PHI.	2009

COURSE OUTCOMES:

No.	Outcome
After completing the course the students will be able to	
1.	Analyse time and space complexity of algorithms
2.	Explain, implement the following data structures: Lists (unordered and ordered), Stacks, Queues.
3.	Explain and use pointers, dynamic memory allocation, and linked structures for the above listed data structures.
4.	Explain, implement and apply the following hierarchical data structures: Binary search trees, Heaps, Graphs etc.
5.	Analyse sorting and searching algorithms, and explain their relationship to data structures.
6.	Choose and implement appropriate data structures to solve an application problem.

Course Code	B130204T	Course Title	Introduction to Probability Theory
Credits	3 (3-0-0)	Pre-requisite	Nil
Objective			

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, statistical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.	10
2.	Random variables: discrete and continuous random variables, p.m.f., p.d.f. and c.d.f., illustrations and properties of random variables, univariate transformations with illustrations. Two dimensional random variables: discrete and continuous type, joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables, bivariate transformations with illustrations.	14
3.	Mathematical Expectation and Generating Functions: Expectation of single and bivariate random variables and its properties. Uniqueness and inversion theorems (without proof) along with applications. Conditional expectations.	10
4.	Moments and Cumulants, moment generating function, cumulant generating function and characteristic function. Introduction of Discrete and Continuous Probability Distributions along with their characteristic properties and limiting/approximation cases.	10
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Hogg, R.V., Tanis, E.A. and Rao J.M.: Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi.	2009
2.	Miller, Irwin and Miller, Marylees: John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.	2006
3.	Myer, P.L.: Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi	1970

COURSE OUTCOMES:

No.	Outcome

Course Code	B130205P	Course Title	Advanced Excel
Credits	3 (0-0-6)	Pre-requisite	Nil
Objective	The main objective of this course is to learn analysis of data using MS Excel, resulting in less time and better understands what the data means.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Excel User Interface, Application, Workbook, Worksheets & its Components, Named Ranges; Formatting: Cell Color, Font Color, Indents, Alignments, Number Formats, Custom Formats, Editing commands; Data Sorting: Built-in Sort, Sorting Levels, Custom Sort; Data Filtering: Auto Filter – Filter By Color, Filter by Icono Advanced Filter, Remove Duplicates; Data Subtotal – Built-In Subtotal (Nested Subtotal).	10
2.	Data Validation: Based on cell values (text length, whole no Based on Formulas, List Dropdown, Circle Invalid Data, Input & Error Messages; Data Grouping: Grouping Rows, Grouping Columns. Data Tables: Conditional Formatting, Formatting based on Cell values, Formatting based on Formulas, Icon Sets (bars, scales, icons), Freezing Panes, Text-to-Columns, Delimited, Fixed Length; Data Consolidation (from multiple files), Getting External Data into Excel, From MS Access, From Text files, From Web, Other Data Sources.	12
3.	Formulas, TEXT Functions, IF, ERROR Functions, LOGICAL Functions, VLOOKUP, HLOOKUP, COUNTIF, SUMIF, SUMPRODUCT, DATE & TIME FUNCTIONS, FORMULA TEXT, Information Functions (ISNA, ISEVEN, ISERR...).	10
4.	Charts: Chart Types, Chart Components, Primary Vs Secondary Axis, Chart Formatting, Sparkline (2010 and above); Pivot Tables: Introduction & Creation, Slicer, TimeLine, Pivot Charts, Calculated Fields, Calculated Items, Grouping, Formatting – Number/Conditional, PowerPivot, PowerView.	08
TOTAL		40

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint

1.	John Walkenbac, "Excel 2016 Bible", John Wiley & sons.	2016
2.	Jordan Goldmeier , "Advanced Excel Essentials", Apress Publisher.	
3.	Conrad George Carlberg , "Business Analysis with Microsoft Excel", Que Publishers.	
4.	Bernd Held, "Microsoft Excel Functions & Formulas", Wordware publishing, Inc.	
5.	Steven Roman , "Writing Excel Macros with VBA" O'Reilly Media.	

COURSE OUTCOMES:

No.	Outcome
The student will be able to	
1.	perform basic operations in Excel.
2.	summarize data using Grouping and pivot table.
3.	write conditional statements and perform LOOKUP operations.
4.	create charts in excel.
5.	to create a dashboard in excel.

Course Code	B130206T	Course Title	Digital Electronics
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective			

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Foundation: Number system, Arithmetic operations using 1's,2's complement, various codes, Review of basic gates, universal gate application, Logic Families: - RTL, DTL, TTL & MOS, CMOS families for NOR/NAND gate, characteristics of Digital IC's- speed of operation, power dissipation, Fan-in, Fan-out, Noise margin, Current and Voltage parameters.	12
2.	Combinational Circuits: Boolean laws & algebra , Sum Of Product & Product Of Sum expression, K-Map and Tabular method of minimization, Combinational devices like Multiplexer, Demultiplexer, Decoders, Encoders, Tri -state Devices Combinational & Sequential Circuits: Combinational circuit design for Adder, Subtractor, Comparator, Multiplier , various Code converters Latches and Flip-Flop- SR, D, T, JK, Master-slave , Flip- Flop conversions.	14
3.	Counter and Registers: Synchronous counter, Asynchronous counter, Up-Down Counter, Shift Registers -serial in parallel out, serial in serial out, parallel in serial out, parallel in parallel out, Universal Shift Register	08
4.	Digital to Analog Conversion Technique as Binary Weighted DAC, R-2R Ladder, DAC808 IC Analog to Digital Conversions as Flash type, Counter type, Successive Approximations type A/D converter, Specifications of A/D converters, ADC 804 and 808 IC, Schmitt trigger, Monostable & Astable Multivibrator using IC555.	08
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint

1.	A. Anand Kumar, " Fundamentals of Digital Circuits", Fourth Edition, PHI Learning Private Limited	2016
2.	Mano M. Morris, " <i>Digital Design</i> ", 3rd edition, Pearson Education.	2006
3.	William H.Gothmann," <i>Digital Electronics: An Introduction to Theory and Practice</i> , Eastern Economy Edition, Prentice-Hall of India Private Limited, NewDelhi.	2001
4.	William I. Fletcher, " <i>An Engineering Approach to Digital Design</i> ", Pearson Education	2015

COURSE OUTCOMES:

No.	Outcome

Course Code	B130207T	Course Title	Microprocessors
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective			

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Microprocessors, Microcomputers & Programming Languages: Evolutions of Microprocessors, Microcomputer System: Processor as CPU and its main units. Internal Architecture of 8085 with bus architecture, Introduction to Computer Programming Languages.	12
2.	The 8085 Programming Model: Functions of internal general purpose registers, Flag Register, PSW, Program Counter and Stack Pointer. 8085 Assembly Language Programming: Assembly Language, Assembler. Instruction, Data Format, and Storage. T-State, Machine Cycle & Instruction cycle. Instruction Set: Over view and classification, Data Transfer, Arithmetic, Logical, Stack and Branch group of instructions, Addressing modes.	14
3.	Operations & Memory organization: initiated, Internal, and Peripheral initiated operations. Memory organization: Memory organization, Memory maps & addresses assigning to a memory chip. I/O Devices and Pinout diagram: I/O Ports, IN & OUT Instructions, Peripheral mapped & Memory mapped I/O techniques, Logic devices (Buffer, Decoder, Encoder, and D Latch), and Pinout diagram.	08
4.	Bus Timings & Control Signals: Timing diagrams, Control signal generation, Functional block diagram of 8085. Time delays, Subroutines and Interrupts: Counters and Time Delays, Stack and Subroutines, Code conversion and Interrupts. Interfacing: Interfacing of ICs: 8255, 8279, 8253, 8257 and 8259 with 8085. Interfacing with LCD, seven segment, temperature sensor, stepper motor. Introduction to 8086 architecture and programming concept.	08
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Microprocessor Architecture, Programming and Applications with 8085.: R. Gaonkar	

2.	Fundamentals of Microprocessors and Microcomputers : B. Ram 0000 to 8085	
3.	Sridhar and Ghosh, Microprocessor & Interfacing: Douglas Hall	

COURSE OUTCOMES:

No.	Outcome

Course Code	B130208T	Course Title	Indian Knowledge Systems
Credits	2 (2-0-0)	Pre-requisite	Nil
Objective	This course focuses on introduction to science and technology of Indian Knowledge System and Indian perspective of modern scientific view.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<u>Ancient philosophy of Knowledge:</u> Vedas, Vedangas, sutras – Gurukul parampara	10
2.	<u>Astronomy in India:</u> The Beginnings of Indian Astronomy - The Early Historical Period-The Siddhāntic Era - The Kerala School - Aryabhatta - Varahamihira- Bhaskara I – Brahamagupta- Bhaskara II – Brief notes on Astronomical instruments	10
3.	<u>Chemistry in India:</u> Early Chemical Techniques, Atomism in Vaiśeṣika - Rishi Kanad- Nagarjuna- Al-Bīrūnī, Vāgbhaṭa - Sushruta-Carak <u>Metallurgy in India</u> - Definition, Metallurgy in Harappan Civilization, Metallurgy of Gold- Copper- Zinc- Bronze - Iron and steel.	8
4.	<u>Developments in Mathematics:</u> Number systems- Geometry- works of Pingala- Baudhayana- Jaina Mahavira- Sridharacharya – Madhava <u>Siddanthas and Calender systems</u>	12
TOTAL		40

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication / Reprint
1	A Concise History of Science in India – Bose, Sen & Subbarayappa- INSA Publications	2009
2	Encyclopedia of Classical Indian Sciences- Roddam Narasimha, Universities Press	2007
3.	NCERT Modules of KPTI	

COURSE OUTCOMES:

No.	Outcome
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1.	It aimed to instil in students a rootedness and pride in India, and its “rich, diverse, ancient and modern culture and knowledge systems and traditions”.
2.	This course helps students, to understand the rich scientific and technological heritage of the country.
3.	This course highlights the emphasis and promotes the Indian concept of Multi-disciplinary Learning systems to integrate with modern science.
4.	The course will highlight the importance of Intellectual property to protect the Indian knowledge.

DEPARTMENT OF COMPUTER SCIENCE
PROGRAMME: M.TECH. (DUAL DEGREE) – AI&DS
SESSION: 2024-29>>SEMESTER-III

DETAILED SYLLABUS

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130301T	Mathematics-III	3 (2-1-0)	25	75
B130302T	Design & Analysis of Algorithms	3 (2-0-2)	25	75
B130303T	Object Oriented Programming	3 (2-0-2)	25	75
B130304T	Probability Distributions	3 (2-1-0)	25	75
B130305T	Computer Architecture	3 (2-0-2)	25	75
ELECTIVE COURSES (ANY ONE)				
B130306T	Engineering Economics	3 (3-0-0)	25	75
B130307T	Numerical Methods	3 (3-0-0)	25	75
GENERIC COURSE				
B130308T	Communication Skills	2 (2-0-0)	25	75

Course Code	B130301T	Course Title	Mathematics-III
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	To impart knowledge of Improper Integrals, function of complex variables, conformal mapping.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Improper real integrals of first and second kinds, test for convergence of improper integrals of the first kind, comparison tests, limit comparison test for improper integrals of second kind, absolute convergence of improper integrals, convergence of Beta and Gamma functions.	12
2.	Function of complex variables: differentiability for function of complex variable, Analytic function, Cauchy-Riemann equations, Harmonic functions, Linear rotational and Inverse transformation, Conformal mapping, Bilinear transformation, Schwarz- Christoffel transformations	12
3.	Complex integration: Line integral, Cauchy's integral theorem, Cauchy's integral formula, Cauchy's formula for derivative of analytic functions, Taylor's series, Laurent's series, Singularities, kinds of singularity, zeros, Residues, Cauchy's residue theorem, Evaluation of real integrals.	12
4.	Z-transformations, Inverse z-transforms, Convolution theorem, Introduction to difference equations, application of z-transform for solving difference equations.	10
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	E Kreyszig: Advanced Engineering Mathematics, John wiley.
2.	R.K. Jain & S K Iyenger: Advanced Engineerng Mathematics, 3rd edition, Narosa publishing House.
3.	Churchil & Brown: Complex Analysis, 8th edition, Mc Graw –Hill.
4.	Complex Analysis and Applications, Second Edition, Alan Jeffrey, CRC press

5.	Pal Srimant & Bhunia: Engineering mathematics, Oxford University Press.
6.	Complex Analysis by Schaum Series

Course Code	B130302T	Course Title	Design and Analysis of Algorithms
Credits	3 (2-0-2)	Pre-requisite	Data Structures and Algorithms
Objective	To introduce and implement various techniques for designing algorithms and advanced data structures. To learn space and time complexity analysis of algorithms.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Reasoning About Algorithms: P, NP, NP-completeness, Reductions, Complexity analysis. Graph Algorithms: Strongly-connected components, Kosaraju's Algorithm 1 and 2, Applications.	9
2.	Greedy Techniques: Local versus Global optimality, Interval Scheduling, Exchange arguments. Divide-and-Conquer: Optimality, Recursive algorithms, Divide-and-Conquer Recurrences, The Master Theorem and applications, Non-uniform Recurrences.	11
3.	Dynamic Programming: Reusing sub-computations (Sequence alignment, Bellman-Ford algorithm), Precomputing (Floyd-Warshall algorithm, Johnson's algorithm), Combinatorial problems. (Knapsack) Linear Programming: Canonical and standard forms, Feasibility and optimization, Simplex Algorithm.	11
4.	Approximation Algorithms: Relative Approximations, PAS and FPAS Scheduling. Randomized Algorithms: Random guess (Quick select), Random guess with high confidence (Karger's min-cut algorithm), Storing associative data (Hashing), Error bounds.	12
TOTAL		43

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	T. H. CORMEN, C. E. LEISERSON, R.L. RIVEST, C. STEIN, Introduction to Algorithms, MIT Press, 3rd Edition.
2.	J. KLEINBERG, E. TARDOS, Algorithm Design, Pearson Education

COURSE OUTCOMES:

No.	Outcome
After completing the course the students will be able to	
1.	Choose and implement appropriate algorithm design techniques for solving problems.
2.	Understand how the choice of data structures and algorithm design methods impact the performance of programs.
3.	Analyze the worst-case and average-case behaviour of algorithms in terms of time and memory requirements.

Course Code	B130303T	Course Title	Object Oriented Programming
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To provide knowledge of Object Oriented programming features.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>Object oriented paradigm & C++ at a glance: Evolution of programming paradigm, structured versus object-oriented development, elements of object-oriented programming, Objects, classes, methods, popular OOP languages, software reuse.</p> <p>Classes and objects: Introduction, Class revisited, constant objects and constructor, static data members with constructors and destructors, constructor overloading, nested classes, objects as arguments, returning objects , friend functions and friend classes, constant parameters and member functions, static data and member functions.</p>	10
2.	<p>Dynamic objects: Introduction, pointers to objects, array of objects, pointers to object members, this pointer, self-referential classes</p> <p>Operator overloading and Inheritance: overloading of new and delete operators, conversion between objects and basic types, conversion between objects of different classes, overloading with friend functions, abstract classes, inheritance types , virtual base classes, virtual functions, pointer to derived class objects, and base class objects, pure virtual functions, virtual destructors.</p> <p>Generic programming with templates: Introduction, function templates, overloaded function templates, class templates, inheritance of class template, class template containership, class template with overloaded operators.</p>	12
3.	<p>Introduction to byte code, security and portability, Data Types, variables, operators, arrays, type conversion and casting, type promotion, Control statements, standard input-output, Designing Classes, constructors, methods, access specifiers : public, private, protected, inheritance, packages and interfaces, Math, String, Vectors, and Array List classes, polymorphism: function and operator overloading, function overriding, abstract classes.</p> <p>Exception Handling: exception types, nested try-catch, throw, throws and finally statements, Multithread Programming: thread creation, synchronization and priorities.</p>	12
4.	<p>Input-output and file operations: Java.io, stream classes, Byte streams, character streams, serialization. Networking concepts: Client server and socket programming, TCP/IP client and server sockets.</p> <p>Applets and Java Swing: Applet design, AWT packages, Applet event handling, parameters to applets, AWT controls, layout manager,</p>	12

	Frames, container classes, Introduction to Java Beans, Swing and Servlets.	
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Mastering C++ K.R Venugopal Rajkumar, TMH.
2.	C++ Primer, "Lip man and Lajole", Addison Wesley.
3.	Maria litvin, Gary litvin, "Programming in C++", VPH.
4.	D Samantha, "Object oriented Programming in C++ and Java ", PHI.
5.	Patrick Naughton, Herbert Schildt: "The Complete Reference: Java 2", TMH. ISBN-13 9780070495432
6.	C Thomas Wu : "An Introduction to OO programming with Java", TMH, ISBN-10: 0073523305
7.	Balaguruswami, "Object oriented with C++", TMH. SBN 0070669074, 9780070669079, 2008
8.	Budd, "Object Oriented Programming", Addison Wesley

Course Code	B130304T	Course Title	Probability Distributions
Credits	3 (2-1-0)	Pre-requisite	Probability
Objective	To apply the concepts of various probability distributions to find out probabilities of the uncertainties. To apply the probability distributions in different fields.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Discrete Probability Distributions: Uniform, Binomial, Poisson, Geometric, Negative Binomial and Hyper-geometric distributions along with their characteristic properties and limiting/approximation cases.	10
2.	Continuous probability distributions: Normal, Exponential, Uniform, Beta, Gamma, Cauchy, lognormal and Laplace distributions along with their characteristic properties and limiting/approximation cases.	8
3.	Exact sampling distribution: Definition and derivation of p.d.f. of χ^2 with n degrees of freedom (d.f.) using m.g.f., nature of p.d.f. curve for different degrees of freedom, mean, variance, m.g.f., cumulant generating function, mode, additive property and limiting form of χ^2 distribution, tests of significance and confidence intervals based on χ^2 distribution.	12
4.	Exact sampling distributions: Student's and Fishers t-distribution, Derivation of its p.d.f., nature of probability curve with different degrees of freedom, mean, variance, moments and limiting form of t-distribution. Snedecore's F-distribution: Derivation of p.d.f., nature of p.d.f. curve with different degrees of freedom, mean, variance and mode. Test of significance and confidence Intervals based on t and F distributions.	12
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Goon, A.M., Gupta, M.K. and Dasgupta, B. (2003): An Outline of Statistical Theory, Vol. I, 4th Edn. World Press, Kolkata.
2.	Mood, A.M., Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn. (Reprint). Tata McGraw-Hill Pub. Co. Ltd.
3.	Myer, P.L. (1970): Introductory Probability and Statistical Applications, Oxford & IBH Publishing, New Delhi

4.	Johnson, R.A. and Bhattacharya, G.K. (2001): Statistics-Principles and Methods, 4th Edn. John Wiley and Sons.
5.	Hogg, R.V. and Tanis, E.A. (2009): A Brief Course in Mathematical Statistics. Pearson Education.
6.	Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn. (Reprint) John Wiley and Sons.

PRACTICALS:

1	Fitting of binomial distributions for n and $p=q=1/2$.
2	Fitting of binomial distributions for given n and p .
3	Fitting of binomial distributions after computing mean and variance.
4	Fitting of Poisson distributions for given value of λ .
5	Fitting of Poisson distributions after computing mean.
6	Fitting of negative binomial.
7	Fitting of suitable distribution.
8	Application problems based on binomial distribution.
9	Application problems based on Poisson distribution.
10	Application problems based on negative binomial distribution.
11	Problems based on area property of normal distribution.
12	To find the ordinate for a given area for normal distribution.
13	Application based problems using normal distribution.
14	Fitting of normal distribution when parameters are given.
15	Fitting of normal distribution when parameters are not given.
16	Exact Sample Tests based on Chi-Square Distribution.
17	Testing of goodness of fit.
18	Testing of independence of attributes.
19	Testing based on 2×2 contingency table without and with Yates' corrections.
20	Testing of significance and confidence intervals of an observed sample correlation coefficient.
21	Testing and confidence intervals of equality of two population variances

COURSE OUTCOMES:

No.	Outcome
By completing this course the students shall learn the following:	

1	Collecting the desired information about the universe in minimum time and high degree of reliability.
2	Understanding the concepts of a random variable and a probability distribution.
3	Understanding the difference between discrete and continuous random variables.
4	Computing probabilities using a binomial and Poisson probability distribution.
5	Understanding the difference between how probabilities are computed for discrete and continuous random variables.
6	How to compute probability values for a continuous uniform probability distribution and be able to compute the expected value and variance for such a distribution.
7	Be able to compute probabilities using a normal probability distribution. Understand the role of the standard normal distribution in this process.
8	Be able to compute probabilities using an exponential probability distribution.

Course Code	B130305T	Course Title	Computer Architecture
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To familiarize students with the architecture of a processor and machine level programming.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	CPU structure and functions, processor organization, ALU, data paths, internal registers, status flags; System bus structure: Data, address and control buses. Processor control, micro-operations, instruction fetch, hardwired control, microprogrammed control, microinstruction sequencing and execution.	12
2.	Instruction set principles, machine instructions, types of operations and operands, encoding an instruction set, assembly language programming, addressing modes and formats.	8
3.	Memory system, internal and external memory, memory hierarchy, cache memory and its working, virtual memory concept. I/O organization; I/O techniques: interrupts, polling, DMA; Synchronous vs. asynchronous I/O.	10
4.	8085 microprocessor architecture; Instruction set, instruction types and formats; Instruction execution, instruction cycles, different types of machine cycles and timing diagram. 16-bit microprocessors, 8086 architecture, registers, memory segmentation and addressing, 32-bit/64-bit microprocessor families.	14
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Mano, M.M., "Computer System Architecture" 3rd Ed., Prentice-Hall of India.
2.	Rajaraman, V. and Radhakrishnan, T., "Computer Organization and Architecture", Prentice-Hall of India
3.	Govindrajalu, B., "Computer Architecture and Organization", Tata McGraw-Hill.
4.	Stallings, W, "Computer Organization and Architecture", 5th Ed., Pearson Education.
5.	Hall, D.V., "Microprocessors and Interfacing", 2nd Ed., Tata McGraw-Hill.
6.	Brey, B.B., "The Intel Microprocessors", 6th Ed., Pearson Education

COURSE OUTCOMES:

No.	Outcome

Course Code	B130306T	Course Title	Engineering Economics
Credits	3 (3-0-0)	Pre-requisite	Nil
Objective	To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis. Profit/Volume (P/V) ratio, Elementary economic Analysis – Material selection for product, Design selection for a product, Process planning.	8
2.	Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor – Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.	10
3.	Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.	10
4.	Replacement and Maintenance Analysis: Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, Replacement of Existing Asset with a New Asset, Capital Recovery with Return, Concept of Challenger and Defender, Simple Probabilistic Model for Items Which Fail Completely. Depreciation: Methods of Depreciation-Straight Line Method of Depreciation, Declining Balance Method of Depreciation, Sum-of-the-Years-Digits Method of Depreciation, Sinking Fund Method of Depreciation, Service Output Method of Depreciation.	12
TOTAL		40

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Panneerselvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi.
2.	Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India.
3.	Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas.
4.	Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York.
5.	Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley.

COURSE OUTCOMES:

No.	Outcome
	Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

Course Code	B130307T	Course Title	Numerical Methods
Credits	3 (3-0-0)	Pre-requisite	Nil
Objective	This course provides coverage of key numerical methods to solve practical mathematical problems.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Floating point representation and computer arithmetic, Significant digits, Errors: Round-off error, Local truncation error, Global truncation error, Order of a method, Convergence and terminal conditions, Efficient computations.	8
2.	Bisection method, Secant method, Regula-Falsi method. Newton-Raphson method, Newton's method for solving nonlinear systems. Gauss elimination method (with row pivoting) and Gauss-Jordan method, Gauss Thomas method for tridiagonal systems. Iterative methods: Jacobi and Gauss-Seidel iterative methods.	10
3.	Interpolation: Lagrange's form and Newton's form. Finite difference operators, Gregory Newton forward and backward differences Interpolation. Piecewise polynomial interpolation: Linear interpolation, Cubic spline interpolation (only method), Numerical differentiation: First derivatives and second order derivatives, Richardson extrapolation.	12
4.	Numerical integration: Trapezoid rule, Simpson's rule (only method), Newton-Cotes open formulas. Extrapolation methods: Romberg integration, Gaussian quadrature, Ordinary differential equation: Euler's method. Modified Euler's methods: Heun method and Mid-point method, Runge-Kutta second methods: Heun method without iteration, Mid-point method and Ralston's method Classical 4th order Runge-Kutta method, Finite difference method for linear ODE.	12
TOTAL		42

List of Practicals (using any software)

1	Find the roots of the equation by bisection method.
2	Find the roots of the equation by secant/Regula-Falsi method.
3	Find the roots of the equation by Newton's method.
4	Find the solution of a system of nonlinear equation using Newton's method.
5	Find the solution of tridiagonal system using Gauss Thomas method.
6	Find the solution of system of equations using Jacobi/Gauss-Seidel method.
7	Find the cubic spline interpolating function.

8	Evaluate the approximate value of finite integrals using Gaussian/Romberg integration.
9	Solve the boundary value problem using finite difference method.

Note: Programming is to be done in any one of Computer Algebra Systems: MATLAB / MATHEMATICA / MAPLE.

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Brian Bradie, <i>A Friendly Introduction to Numerical Analysis</i> , Pearson Education, India.
2.	M.K. Jain, S.R.K. Iyengar and R.K. Jain, <i>Numerical Methods for Scientific and Engineering Computation</i> , 6th Ed., New age International Publisher, India.
3.	C.F. Gerald and P.O. Wheatley, <i>Applied Numerical Analysis</i> , Pearson Education, India.
4.	Uri M. Ascher and Chen Greif, <i>A First Course in Numerical Methods</i> , 7th Ed., PHI Learning Private Limited.
5.	John H. Mathews and Kurtis D. Fink, <i>Numerical Methods using Matlab</i> , 4th Ed., PHI Learning Private Limited.
6.	Laurence V. Fausett, <i>Applied Numerical Analysis, Using MATLAB</i> , Pearson, 2/e

COURSE OUTCOMES:

No.	Outcome

Course Code	B130308T	Course Title	Communication Skills
Credits	2 (2-0-0)	Pre-requisite	Nil
Objective	To develop communication skills among students that is most often quoted as lacking in engineers and IT professionals. This course will help students in becoming confident and effective communicators, who can project themselves positively to others.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Communication: Need for Effective Communication. The Process of Communication: Levels of communication; Flow of communication; Use of language in communication; Communication networks; Significance of technical communication. Barriers to Communication: Types of barriers; miscommunication; noise; overcoming measures.	
2.	Listening Skills: Listening as an active skill; Types of Listeners; Listening for general content; Listening to fill up information; Intensive Listening; Listening for specific information; Developing effective listening skills; Barriers to effective listening skills. Reading Skills: Previewing techniques; Skimming; Scanning; Understanding the gist of an argument; Identifying the topic sentence; Inferring lexical and contextual meaning; recognizing coherence and sequencing of sentences; Improving comprehension skills. Writing Skills: Sentence formation; Use of appropriate diction; Paragraph and Essay Writing; Coherence and Cohesion.	
3.	Letter Writing: Formal, informal and demi-official letters; business letters. Job Application: Cover letter, Differences between bio-data, CV and Resume. Report Writing: Basics of Report Writing; Structure of a report; Types of reports. Non-verbal Communication and Body Language: Forms of non-verbal communication; Interpreting body-language cues; Kinesics; Proxemics; Chronemics; Effective use of body language.	
4.	Interview Skills: Types of Interviews; Ensuring success in job interviews; Appropriate use of non-verbal communication. Group Discussion: Differences between group discussion and debate; Ensuring success in group discussions. Presentation Skills: Oral presentation and public speaking skills; business presentations. Technology-based Communication: Netiquettes: effective e-mail messages; power-point presentation; enhancing editing skills using computer software.	
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	<i>Improve your Writing</i> by V.N.Arora and Lakshmi Chandra OUP: Delhi ISBN 13: 978-0-19-809608-5	2013
2.	<i>Technical Communication: Principles and Practice</i> by Meenakshi Raman and Sangeeta Sharma OUP: Delhi. ISBN-13: 9780-19-806529-6	2014
3.	<i>English Phonetics and Phonology: A Practical Course.</i> By Peter Roach. Cambridge: Cambridge University Press. (Fourth Edition) ISBN: 978-0-521-14921-1	2014
4.	Sharma, Sangeeta & Binod Sharma. Communication Skills for Engineers & Scientists , PHI.	2012
5.	Swan, Michael, Catherine Walter. Oxford English Grammar Course. OUP: Delhi,	2011
6.	Kumar, E Suresh & P Sreehari A Handbook for English Language Laboratories , 2 nd Edition, Cambridge University Press, Foundation Books,	2014
7.	Dutt, P Kiranmai, Geetha Rajeevan & CLN Prakash A Course in Communication Skills. Cambridge University Press (Foundation Books).	2013
8.	Mitra, Barun K. Personality Development and Soft Skills. OUP: Delhi.	2011

COURSE OUTCOMES:

No.	Outcome
At the end of the course the students will be able-	
1.	To make communication with the parties concerned.
2.	To write memorandum, circulars, notices, business letters, and business reports
3.	To write resume and job application.
4.	To participate in group discussion and interviews.

DEPARTMENT OF COMPUTER SCIENCE
PROGRAMME: M.TECH. (DUAL DEGREE) – AI&DS
SESSION: 2024-29>>SEMESTER-IV

DETAILED SYLLABUS

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130401T	Discrete Structures	3 (2-1-0)	25	75
B130402T	Python Programming	3 (2-0-2)	25	75
B130403T	Operating Systems	3 (2-1-0)	25	75
B130404T	Sampling Theory and Applications	3 (2-1-0)	25	75
B130405T	Database Management Systems	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130406T	Computer Graphics	3 (2-0-2)	25	75
B130407T	Digital Logic Design	3 (2-0-2)	25	75
GENERIC COURSE				
B130408T	Technical Communication	2 (2-0-0)	25	75

DETAILED SYLLABUS

Course Code	B130401T	Course Title	Discrete Structures
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	To provide knowledge of set theory, relation, function, lattice, combinatorial problems, algebraic structures, proposition logic, and graph theory required for building mathematical foundation of computer science.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>Set theory: Basic concepts of set theory, operations on sets, Cartesian products, Venn Diagrams, proofs of some general identities on sets</p> <p>Relation: Definition, types of relation, composition of relations, Pictorial representation of relation, Equivalence relation, Partial ordering relation.</p> <p>Function: type of functions, one to one, into and onto function, Definition of sets, countable and uncountable sets, inverse function, recursive functions.</p>	12
2.	<p>Lattice: Introduction to lattice, properties of Lattices, bounded and complemented lattices, Hasse diagram, ordered set, isomorphic ordered set, well ordered set.</p> <p>Combinatorics: Introduction, fundamental counting principles, Permutation and combination, Binomial Theorem, Recurrence Relation: Linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions; Generating functions, pigeonhole principle, Mathematical Induction.</p>	10
3.	<p>Propositional and First-order logic: First order logic, truth tables, tautologies, Contradictions, Algebra of Proposition, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers. finite state machines.</p> <p>Algebraic Structures: Definition, Properties, Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Homomorphism and isomorphism of Groups, Rings and Fields.</p>	14
4.	<p>Graph Theory: Terminology, isomorphic graphs, Planer graphs, Multigraphs and weighted graphs, directed graphs, Euler's formula (Proof); Warshall's algorithms, Euler path & Hamiltonian circuits, Shortest path & minimal spanning trees, Depth-first Search and Breadth First</p>	10

	Search, Tree traversal algorithms. Graph coloring, chromatic number, five color theorem, Isomorphism and Homomorphism of graphs.	
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill, ISBN: 0070651426	1997
2.	C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill, (ISBN: 9780007043477	2000
3.	Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill ISBN: 9780070681880	2007
4.	Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", PHI, ISBN: 9788120301450.	2004

Course Code	B130402T	Course Title	Python Programming
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	The main objective is to help students to understand the fundamentals of python. Student will learn how to analysis data using Python.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Python: Python versus Java, Python Interpreter and it's Environment, Python installation, Python basics: variables, operators, Strings, Conditional and Control Statements, loops; Data structures: lists and dictionaries; functions: global functions, local functions, lambda functions and methods.	10
2.	Object Oriented Programming Concepts: Class, object, constructor, destructor and inheritance; Modules & Packages, File Input and Output, Catching exceptions to deal with bad data, Multithreading, Database Connectivity.	10
3.	Numpy: Creating Arrays, Arrays Operations, Multidimensional Arrays. Arrays transformation, Array Concatenation, Array Math Operations, Multidimensional Array and its Operations, Vector and Matrix. Visualization: Visualization with matplotlib, Figures and subplots, Labeling and arranging figures, Outputting graphics.	12
4.	Pandas: Manipulating data from CSV, Excel, HDF5, and SQL databases, Data analysis and modelling with Pandas, Time-series analysis with Pandas, Using Pandas, the Python data analysis library, Series and Data Frames, Grouping, aggregating and applying, Merging and joining.	12
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	McKinney Wes, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media	2012
2.	Hauck Trent, "Instant Data Intensive Apps with Pandas How-To", Packt Publishing Ltd.	2013
3.	Beazley David M., "Advanced Python Programming", Pearson Education	2009

4.	Chun Wesley , Core Python Programming, 3rd Edition,Prentice Hall Professional	2012
5.	Telles Matt "Python Power!: The Comprehensive Guide", Cengage Learning	2008
6.	McKinney Wes & PyData Development Team, "pandas: powerful Python data analysis toolkit", Release 0.13.1, Feb.2014	2014

1. <https://docs.python.org/3.4/tutorial/>
2. http://www.tutorialspoint.com/python/python_quick_guide.htm

COURSE OUTCOMES:

No.	Outcome
The students will	
1.	learn core data types of python
2.	learn conditional and looping operations in python.
3.	be able to work with Object-oriented concepts and Database connectivity in python.
4.	be able to analyze data using Pandas and Numpy
5.	be able to visualize the data using seaborn and matplotlib

Course Code	B130403T	Course Title	Operating Systems
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	<ul style="list-style-type: none"> • To explain main components of OS and their working • To familiarize the operations performed by OS as a resource Manager • To impart various scheduling policies of OS • To teach the different memory management techniques. 		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>OPERATING SYSTEMS OVERVIEW: Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems.</p> <p>OPERATING SYSTEMS STRUCTURES: Operating system services and systems calls, system programs, operating system structure, operating systems generations.</p>	10
2.	<p>PROCESS MANAGEMENT: Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows.</p> <p>CONCURRENCY AND SYNCHRONIZATION: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization Examples (Solaris), atomic transactions. Comparison of UNIX and windows.</p>	12
3.	<p>DEADLOCKS: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm.</p> <p>MEMORY MANAGEMENT: Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, virtual memory, demand paging, page-replacement algorithms, allocation of frames, thrashing, case study - UNIX.</p>	10
4.	<p>Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. File system implementation: file system structure, file system implementation, directory implementation, allocation methods, free-space management, efficiency and performance, comparison of UNIX and windows.</p>	12

	I/O SYSTEM: Mass storage structure - overview of mass storage structure, disk structure, disk attachment, disk scheduling algorithms, swap space management, stable storage implementation, tertiary storage structure.	
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7 th edition, Wiley India Private Limited, New Delhi.
2.	Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.
3.	Andrew S. Tanenbaum (2007), Modern Operating Systems, 2nd edition, Prentice Hall of India, India.
4.	Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India.

COURSE OUTCOMES:

No.	Outcome
At the end of the course students will be able to:	
1.	Outline various concepts and features of Operating systems.
2.	Compare various operating systems with respect to characteristics and features
3.	Implement algorithm of CPU Scheduling, Memory Scheduling and disk scheduling.

Course Code	B130404T	Course Title	Sampling Theory and Applications
Credits	3 (2-1-0)	Pre-requisite	Nil
Objective	The main objective of the sampling theory is to obtain optimum results, i.e., to construct maximum information about the characteristics of the population with the available sources at our disposal in terms of time, money and manpower by studying the sample values only.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Sample Survey: Concept of population and sample, need for sampling, steps in a sample survey, principles of sample survey, sampling and non-sampling errors, complete census v/s sample survey, Limitations of sampling.	8
2.	Simple Random Sampling: Definition of Simple random sampling, Simple random sampling with & without replacement. Unbiasedness of the sample mean, mean square error of the sample mean; merits, demerits and limitations of simple random sampling, simple random sampling for attributes. Stratified Random Sampling: Definition and advantages of stratified random sampling, proportional allocation, optimum allocation, cost function. Comparison of stratified random sampling with simple random sampling without stratification, proportional allocation versus simple random sampling, Neyman allocation Versus proportional allocation, Neyman allocation versus simple random sampling.	12
3.	Systematic Sampling: Definition, linear systematic sampling, circular systematic sampling, mean and variance of a systematic sample mean, comparison of systematic sampling to simple random sampling, systematic sampling versus stratified random sampling, stratified random sampling versus simple random sampling for a population with linear trend, merits and demerit of systematic sampling.	10
4.	Ratio Method of Estimation: Definition, bias of ratio estimate, expected value of ratio estimate for first order approximation under simple random sampling without replacement, variance of ratio estimate for first order approximation under simple random sampling without replacement. Regression Method of Estimation: Definition, simple regression estimate, determination of beta, expected value of regression estimate for first order approximation under simple random sampling without replacement, variance of regression for first order approximation under	12

	simple random sampling without replacement.	
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Sampling Techniques, Cochran W.G., Wiley Eastern. ISBN: 978-0-471-16240-7	1977
2.	Sampling Theories of Survey with Application, Sukhatme, P.V., Sukhatme, B.V. Sukhatme, S. Asok, C., IOWA State University Press and Indian Society of Agricultural Statistics	1984
4.	Sample Survey Theory, Des Raj and Chandhok P., Narosa Publishing House.	2013
5.	Fundamentals of Applied Statistics, Gupta, S.C. and Kapoor, V.K.: Sultan Chand and Co.	2019
6.	Theory and Methods of Survey Sampling, Mukhopadhyaya, P. PHI Learning. Print Book ISBN : 9788120336766 eBook ISBN : 9789354435430	2008
7.	Goon A.M., Gupta M.K. and Dasgupta B.: Fundamentals of Statistics (Vol.2), World Press.	2001

Course Code	B130405T	Course Title	Database Management Systems
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	The purpose of this course is to provide fundamental knowledge of database management system and understanding of how to use and design a DBMS.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	DBMS Concepts, Comparison between Database approach and Traditional file accessing approach, Advantages of database systems, Schemas and instances, Data Dependency, Data Dictionary, and Meta Data. Data models, Types of Data models (Object Oriented, Record Based and Physical data models), E-R diagram, Relational Data models: Domains, Tuples, Attributes, Keys, Relational database, Schemas, Integrity constraints, Relational algebra and relational calculus.	12
2.	Database Design: Introduction to normalization, Normal forms (1NF, 2NF, 3NF, BCNF), Functional dependency, Decomposition, Dependency preservation and lossless join, multi-valued dependencies. Structured Query Language: DDL, DML, DCL, TCL, SQL Functions, integrity constraints, various joins, sub-query, index, View, Sequence, and Clusters. PL/SQL: manipulating data using PL/SQL, Iteration, Exceptions, Cursors, Trigger.	12
3.	Transaction Processing and Concurrency Control: Transaction System, Serializability of schedules, conflict & view serializable schedule, Recovery from transaction failures, Log based recovery. Checkpoints dead lock handling, Concurrency Control, locking Techniques for concurrency control, time stamping protocols for concurrency control, validation based protocol, multiple granularity.	12
4.	Advance Concepts: Introduction to Distributed databases, data mining, data warehousing, Basic Concepts of Object Oriented Database System, Comparative study of OODBMS V/s RDBMS. Introduction to Image and Multimedia databases and data structures, Web and mobile database, Spatial and Geographic Database, Accessing Database from front-end Application. Case Study: Oracle, MySQL, DB2.	10
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts", Fifth Edition McGraw-Hill.
2.	Elmasri Ramez and Novathe Shamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3.	Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning.
4.	Ramakrishnan: Database Management System, McGraw-Hill
5.	Fred R.McFadden,Jeffrey A.Hoffer & Marry B.Prescott.?Modern Database Management, Fifth Edition,Pearson Education Asia,2001
6.	Gray Jim and Reuter Address, "Transaction Processing: Concepts and Techniques", Morgan Kauffman Publishers.

COURSE OUTCOMES:

S. No.	OUTCOME
1.	The student will learn the basics of database management.
2.	The student will be able to design database using ER diagram
3.	The student will able to optimize database using normalization.
4.	The student will able to work on database software MYSQL/Oracle.
5.	The student will learn how to write SQL queries.

Course Code	B130406T	Course Title	Computer Graphics
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	The main objective of course is to student able to understand the basics of Computer Graphics such as input/output devices, mathematical 2D transformations, 3D transformations, 2D displaying and 3D displaying.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Computer Graphics: Applications of computer graphics, Display devices, Random and Raster scan systems, Graphics input devices, Graphics software and standards. Line Drawing: simple DDA, Bresenham's Algorithm; Circle Drawing Algorithms: Midpoint Circle drawing, Bresenham's Algorithm; Polygon fill algorithm: Boundary-fill and Flood-fill algorithms.	12
2.	2D Transformations: Translation, Rotation, Scaling, Shearing, Reflection. Matrix representation, Homogenous Coordinates, composite transformations; Windowing: World Coordinate System, Screen Coordinate System, window-to-viewport transformation; Clipping: Point Clipping, Line Clipping and Polygon Clipping Algorithms.	12
3.	3D display methods, polygon surfaces, tables, equations, meshes, curved lies and surfaces, quadric surfaces, spline representation, cubic spline interpolation methods, Bazier curves and surfaces, B-spline curves and surfaces.	12
4.	3-D Transformations: Translation, Rotation and Scaling. Parallel & Perspective Projection: Types of Parallel & Perspective Projection; Basic Illumination Model: Diffuse reflection, Specular reflection; Shading: Phong and Gourad Shading, Ray Tracing; Color models like RGB, YIQ, CMY, HSV.	10
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	J.D.Foley, A.Van Dan, Feiner, Hughes Computer Graphics Principles & Practice 2nd edition Publication, Addison Wesley 1990.

2.	D.Hearn, Baker: Computer Graphics, Prentice Hall of India 2008.
3.	D.F.Rogers Procedural Elements for Computer Graphics, McGraw Hill 1997
4.	.D.F.Rogers, Adams Mathematical Elements for Computer Graphics, McGraw Hill 2nd edition 1989.
5.	Donald Hearn and M.P. Becker "Computer Graphics" Pearson Pub.
6.	Parekh "Principles of Multimedia" Tata McGraw Hill
7.	Sinha & Udai, "Computer Graphics", TMH
8.	Pakhira, " Computer Graphics ,Multimedia & Animation", PHI learning

COURSE OUTCOMES:

S. No.	OUTCOME
1.	
2.	
3.	
4.	
5.	

Course Code	B130407T	Course Title	Digital Logic Design
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To acquaint the students with the fundamental principles of Digital Logic Circuits and their design.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Number systems and Boolean algebra: Introduction to number system and Boolean algebra; Boolean identities, basic logic functions, standard forms of logic expressions, simplification of logic expressions. Logic families: Brief overview of Transistor as a switch; Logic gate characteristics – propagation delay, speed, noise margin, fan-out and power dissipation; Standard TTL and static CMOS gates.	10
2.	Combinational logic: Arithmetic circuits, decoders, encoders, multiplexers, de-multiplexers, and their use in logic synthesis; Hazards in combinational circuits. Introduction to VHDL: Behavioral – data flow, and algorithmic and structural description, lexical elements, data objects types, attributes, operators; VHDL coding examples, combinational circuit design examples in VHDL and simulation.	12
3.	Sequential logic circuits: Latches and Flip Flops (SR,D,J K,T); Timing in sequential circuits; Shift register; Counters–synchronous, asynchronous; Sequential circuit design examples in VHDL and simulation. Finite state machines: Basic concepts and design; Moore and Mealy machines examples; State minimization/reduction, state assignment; Finite state machine design case studies and FSM circuit design examples in VHDL and simulation.	13
4.	ROM and RAM, PLA, PAL and FPGA; RTL based design projects and their implementation in FPGA using VHDL. Astable and monostable multivibrator circuits using basic logic gates; Internal structure of 555 and its applications, clock circuits.	8
TOTAL		43

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Mano M.M., Ciletti M.D., "Digital Design", Pearson India, 4th Edition	2006
2.	Katz R.H., Borriello G., "Contemporary Logic Desing", Prentice Hall India, 2nd Edition.	2008
3.	Kohavi Z., Jha N.K., "Switching and Finite Automata Theory", Cambridge University Press, India, 2nd Edition	2011
4.	Wakerly J.F., "Digital Design: Principles and Practices," Pearson India, 4th Edition.	2008
5.	Harris D., Harris S., "Digital Design and Computer Architecture", Elsevier Publications, 2nd Edition.	2007
6.	Pedroni V.A., "Digital Circuit Design with VHDL", Prentice Hall India, 2nd Edition	2001

COURSE OUTCOMES:

No.	Outcome

Course Code	B130408T	Course Title	Technical Communication
Credits	2 (2-0-0)	Pre-requisite	Nil
Objective	This course is designed to help the students to develop skills that will enable them to produce clear and effective scientific and technical documents.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Technical writing: Definition, Similarities to other writings, Unique features, importance, technical writing as profession, qualifications for technical writing. Identifying audience. Problems involving content, words and phrases, punctuation, unity, coherence, logic, etc. Being concise.	10
2.	Techniques of Technical Communication. Analysing-Division, Classification, Partition. Defining-Formal, informal, expanded. Describing-subjective versus objective, spatial description, description of mechanism, process, selected details. Illustrating-Tables, graphs, charts, pictorials. Researching-Basic types of research, original research, searching the literature. Abstracting of your own reports, the works of others, precautions. Oral communication-one to one reporting, participation in conferences, speaking to large audiences, organising the speech.	12
3.	Basic forms of Technical Writings. The memorandum, The business letter, Formal report.	12
4.	Technical reports. Justification reports and proposals, the progress reports, periodic reports, status reports, trip reports. Laboratory reports, Feasibility reports, State-of-the-Art reports. Instructions and manuals.	8
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	James Sherlock: A Guide to Technical Communication	
2.		

COURSE OUTCOMES:

No.	Outcome
After completion of this course student will be able to-	
1.	Document the knowledge about products, services, technology, or concepts into well-crafted and organised information collateral.
2.	Write technical reports, memorandum, business letters, manuals, proposals, progress reports etc.
3.	Develop document involving spatial description, description of mechanism, process, illustrations, etc.

DEPARTMENT OF COMPUTER SCIENCE
PROGRAMME: M.TECH. (DUAL DEGREE) – AI&DS

SESSION: 2024-29>>SEMESTER-V

DETAILED SYLLABUS

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	CIE
CORE COURSES				
B130501T	Software Engineering	3 (2-0-2)	25	75
B130502T	JAVA Programming	3 (2-0-2)	25	75
B130503T	Data Engineering	3 (2-1-0)	25	75
B130504T	Statistical Inference	3 (2-0-2)	25	75
B130505T	Automata Theory	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130506T	Econometrics	3 (2-0-2)	25	75
B130507T	Computer Networks	3 (2-0-2)	25	75
GENERIC COURSE				
B130508T	Web Technology	2 (2-0-0)	25	75

DETAILED SYLLABUS

Course Code	B130501T	Course Title	Software Engineering
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	To introduce the concepts of software development, design and implementation.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to software and software engineering, various software process modules, capability, maturity, module and KPAs. Project planning, project introduction, team organization, scheduling and management, constructive cost model.	12
2.	Software measures, indicators and metrics, software risk analysis and management. Software requirement analysis and specifications, applicability to small, medium, and large-scale systems.	10
3.	Software design, technical design, objectives of design, design metrics, modularity, module coupling and cohesion, relation between cohesion and coupling; Design strategies: Bottom up design, top down design, hybrid design, functional oriented design, object oriented design; IEEE recommended practice for software design description	8
4.	Software testing, testability, testing process, structural testing, unit testing and integrated testing, debugging, testing tools, software maintenance, maintenance process, maintenance cost, reverse engineering and re-engineering. Configuration management, assessing and controlling software quality. CASE tools and workbenches.	12
TOTAL		42

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Pessman R., "Software Engineering", 7th Ed., McGraw-Hill	2002
2.	Sommerville, I., " Software Engineering", 6th Ed., Pearson Education	2007
3.	Dfleeger, S. L., "Software Engineering", Pearson Education	2000

COURSE OUTCOMES:

No.	Outcome

Course Code	B130502T	Course Title	JAVA Programming
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	The main objective of course is to student able to work with basics of Java language and advance concepts such as Servlets and JSP.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Java, Java Designing Goal, Role of Java Programmer, Features of Java Language, Java Virtual Machine. Java Bytecode. Variables and data types, Conditional and looping constructs. Arrays and Multi-Dimensional Array, Operations on Array; Strings: Operations, Mutable & Immutable String. Decision Control Structure: if, if-else, if else if, switch; Repetition Control Structure: while, do-while, for.	10
2.	Object-oriented programming: Java Classes and Objects, Constructors, Polymorphism: Overloading methods, Overriding methods, Polymorphism, Inheritance, Types of Inheritance in Java, final classes and final methods, Abstract classes and methods. Interfaces, Nested classes, Garbage Collection, Packages, Access modifier and Making JAR Files.	10
3.	Multi-Threaded Programming: Thread Life-Cycle, Thread priorities, Synchronizing Threads, Inter Process Communication, Deadlock; Input Output Streams; Exception handling: try, throw, catch, and finally block; Database Connectivity: Introduction to JDBC, JDBC Drivers & Architecture, CRUD operation Using JDBC, Connecting to NoSQL Databases.	12
4.	Advance Java Concepts: Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets. Java Server Pages(JSP), Advantages of JSP over Java Servlet Architecture and Life Cycle of a JSP Page, JSP Basic Tags, Implicit Objects and action Tags; JSTL, JavaBeans, MVC Architecture; Introducing Struts and Hibernate.	12
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Herbert Schildt, "Java The Complete Reference", 8th Edition, McGraw-Hill Osborne Media, 2011.

2.	Cay S. Horstmann and Gary Cornell, "Core Java™, Volume I – Fundamentals" 8 th Edition, Prentice Hall, 2007
3.	Cay S. Horstmann and Gary Cornell, "Core Java, Vol. 2: Advanced Features", 8 th Edition, Prentice Hall, 2008.
4.	K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.
5.	Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.
6.	C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.
7.	Black Book "Java server programming" J2EE, 1st ed., Dream Tech Publishers, 2008. Kathy walrath
8.	Complete Reference J2EE by James Keogh McGraw publication
9.	Professional Java Server Programming by Subrahmanyam Allamaraju, Cedric Buest, Wiley

COURSE OUTCOMES:

S. No.	OUTCOME
	After successfully completing the course the students will be able to-
1.	work with core java concepts
2.	update and retrieve the data from the databases using JDBC-ODBC.
3.	develop server side programs using Servlets.
4.	develop Java Server Pages applications using JSP Tags.

Course Code	B130503T	Course Title	Data Engineering
Credits	3 (2-1-0)	Pre-requisite	Python
Objective	This course introduces data engineering, process, tools, infrastructure platforms and explore real-life industry-based case studies.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction: Data Engineering, definition, ecosystem, evolution of data engineering. Types of data, types of file formats, Data repositories. RDBMS and NoSQL, CAP Theorem, Data Warehouses, Data Lakes, Lake house. Data Scientist Vs Data Engineer, Types of Data Engineers.	12
2.	ETL, ELT, and Data Pipelines; Data platforms, Data Integration Platform; Data Warehouse tools: Informatica, Snowflake, DBT, Google BigQuery, Amazon Redshift, Microsoft Data warehouse and Ab-initio; Cloud computing: why cloud computing, Cloud providers and services. Importance of data security, governance and compliance.	12
3.	Introduction to Big Data Technologies: Parallel computing, Distributed computing, Grid Computing, Cluster Computing; Introduction to Big Data platforms: Hadoop, Spark and Hadoop components such as Hive, HBase, Flume and Oozie. In-memory computation.	12
4.	Introduction to Streaming Platforms: Kafka, Amazon Kinesis, RabbitMQ, ActiveMQ; Introduction to Workflow Management platform: Airflow, Luigi, AWs step function; Data dashboarding tools: Power BI, AWS QuickSight, Looker, Tableau, Data Studio. Data Engineering Case Study.	10
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Andreas Kretz, "The Data Engineering Cookbook", https://github.com/andkret/Cookbook .
2.	Ralph Kimball, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modelling", Wiley; 3rd edition (1 July 2013).
3.	Martin Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly Publications.

4.	Big Data, Black Book: "Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R, and Data Visualization".
5.	Nathan Marz, "Big Data: Principles and best practices of scalable realtime data systems", Manning; 1st edition (2015)
6.	Bill Chambers, "Spark: The Definitive Guide: Big Data Processing Made Simple", O'Reilly Publications
7.	Paul Crickard III, "Data Engineering with Python: Work with massive datasets to design data models and automate data pipelines using Python", Packt Publishing (2020)

COURSE OUTCOMES:

S. No.	OUTCOME
1.	
2.	
3.	
4.	
5.	

Course Code	B130504T	Course Title	Statistical Inference
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective			

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Estimation: Concepts of estimation, unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Lehmann-Scheffe theorems and their applications. Cramer-Rao inequality and MVB estimators (statement and applications).	10
2.	Methods of Estimation: Method of moments, method of maximum likelihood estimation, method of minimum Chi-square, basic idea of Bayes estimators.	12
3.	Principles of test of significance: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test, uniformly most powerful test, Neyman Pearson Lemma (statement and applications to construct most powerful test). Likelihood ratio test, properties of likelihood ratio tests (without proof).	14
4.	Interval estimation - Confidence interval for the parameters of various distributions, Confidence interval for Binomial proportion, Confidence interval for population correlation coefficient for Bivariate Normal distribution, Pivotal quantity method of constructing confidence interval, Large sample confidence intervals.	11
TOTAL		47

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2 ndEdn. (Reprint) John Wiley and Sons
2.	Goon A.M., Gupta M.K.: Das Gupta.B. (2005), Fundamentals of Statistics, Vol. I, World Press, Calcutta
3.	Miller, I. and Miller, M. (2002) : John E. Freund's Mathematical Statistics (6th addition, low price edition), Prentice Hall of India

4.	Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
5.	Mood A.M, Graybill F.A. and Boes D.C.,: Introduction to the Theory of Statistics, McGraw Hill.
6.	Bhat B.R, Srivenkatramana T and Rao Madhava K.S. (1997) Statistics: A Beginner's Text, Vol. I, New Age International (P) Ltd

COURSE OUTCOMES:

S. No.	OUTCOME
After successfully completing the course the students will be able to-	
1.	understand the basic ideas and methods of probability and statistical inference.
2.	understand and compute confidence intervals.
3.	understand and apply tests of significance.
4.	understand and apply chi-square tests of goodness-of-fit and independence.
5.	understand and apply regression analysis and variance analysis

Practical:

1	Unbiased estimators (including unbiased but absurd estimators)
2	Consistent estimators, efficient estimators and relative efficiency of estimators.
3	Cramer-Rao inequality and MVB estimators
4	Sufficient Estimators – Factorization Theorem, Rao-Blackwell theorem, Complete Sufficient estimators
5	Lehman-Scheffe theorem and UMVUE
6	Maximum Likelihood Estimation
7	Asymptotic distribution of maximum likelihood estimators
8	Estimation by the method of moments, minimum Chi-square
9	Type I and Type II errors
10	Most powerful critical region (NP Lemma)
11	Uniformly most powerful critical region
12	Unbiased critical region
13	Power curves
14	Likelihood ratio tests for simple null hypothesis against simple alternative hypothesis
15	Likelihood ratio tests for simple null hypothesis against composite alternative hypothesis
16	Asymptotic properties of LR tests

Course Code	B130505T	Course Title	Automata Theory
Credits	3 (2-0-2)	Pre-requisite	Basic Mathematical Fundamentals: Sets, Logic, Relations, Functions.
Objective	This course aims to introduce an idea of Automata, Formal languages and computability.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Finite Automata: Basic Definition of an automaton, Description of a finite automata Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), transition systems, Acceptability of a string by a finite automaton, The equivalence of DFA and NFA, Construction of minimum automaton. Formal Languages: Basic definitions, Chomsky classification of languages, Languages and their relations, Operations on languages, Languages and automata.	10
2.	Regular Grammars: Identities and regular expressions, Finite automata and regular expressions, Conversion of non-deterministic systems to deterministic systems, Algebraic method using Arden's theorem, Construction of finite automata equivalent to regular expression, Pumping lemma for regular sets, Applications of pumping lemma.	8
3.	Context-free Grammer: Context-free grammars, Parse trees, Ambiguity in context-free grammars, Simplification of context-free grammars, Normal forms of context-free grammars, Pumping lemma, Decision algorithms. Pushdown Automata: Basic definitions, Acceptance by pushdown automata, Pushdown automata and context-free languages.	12
4.	Turing Machines and Linear Bounded Automata (LBA): Turing Machines Model, Representation of a Turing machine, Language acceptability by Turing machines, Design of Turing Machines, Universal Turing Machines and other modifications, Model of linear bounded Automaton, Turing machines and type- 0 Grammars, Linear bounded automata and languages, Halting problem of Turing machines, NP Completeness. Computability: Introduction and basic concepts, Primitive recursive functions, Recursive functions, Partial recursive functions and Turing machines.	14
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	J. E. Hopcroft, J. Motwani and J. D. Ull man, Introduction to Automata Theory, Languages and Computation, Pearson Education, Asia	2002
2.	J. H. Martin, Introduction of Languages and the Theory of Computation, McGraw-Hill International Edition, New York	1991
3.	Z. V. I. Kohavi, Switching and Finite Automata Theory, Tata McGraw-Hill, New Delhi.	1972
4.	H. R. Lewis and C. H. Papadimitrou, Elements of the Theory of Computation, Pearson Education.	1998

COURSE OUTCOMES:

No.	Outcome
The students will be able to	
1.	Understand, design, construct, analyze and interpret Regular languages, Expression and Grammars.
2.	Design different types of Finite Automata and Machines as Acceptor, Verifier and Translator.
3.	Understand, design, analyze and interpret Context Free languages, Expression and Grammars
4.	Design different types of Push down Automata as Simple Parser.
5.	Design different types of Turing Machines as Acceptor, Verifier, Translator and Basic computing machine.
6.	Compare, understand and analyze different languages, grammars, Automata and Machines and appreciate their power and convert Automata to Programs and Functions.

Course Code	B130506T	Course Title	Econometrics
Credits	3 (2-0-2)	Pre-requisite	Engineering Economics
Objective	The objective of the course is to teach students how to apply relevant econometric methods to analyse data and interpret the results from such analyses. The focus is on conceptual understanding and 'hands on' applications using economic data drawn from real-world examples, rather than on formal theoretical proofs. By the end of the paper, students should be able to appreciate and interpret the econometric and statistical analysis and be able to carry out and interpret their own econometric analysis.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Nature of Econometrics and Economic Data Definition of Econometrics – Steps in Empirical Economic Analysis - Econometric Model – The Role of Measurement in Economics – The Structure of Economic Data: Cross-Sectional data, Time Series data, Pooled Cross Section data, Panel Data.	10
2.	Simple Regression Model Two Variable Linear Regression Model: Assumptions, Estimation of Parameters, Tests of Significance and Properties of Estimators – Functional forms of Regression models – Loglinear models, Semi log- models and Reciprocal models – Choice of Functional Form.	8
3.	The General Linear Model Review of Assumptions, Estimation and Properties of Estimators: Un-biasness, BLUEs and Tests of significance of estimates – Analysis of Variance - Dummy variables - Nature of Dummy variables – Use of Dummy Variables – Errors in Variables and its consequences. Multicollinearity and Heteroscedasticity Multicollinearity: Source and Consequences, Tests for Multicollinearity and solutions for Multicollinearity. Heteroscedasticity: Sources and Consequences, Tests for Heteroscedasticity, Generalized Least Squares Method of Estimation.	12
4.	Auto-regressive and Distributed Lag Models Introduction – Types of Lag schemes - Koyck's lag model, Almon's Lag scheme, Partial Adjustment and Expectations models - Causality in Economics – The Granger Causality Test. Simultaneous Equation Models Specification – Simultaneous Bias – Inconsistency of OLS Estimators - The concept of Identification, Rank and Order conditions for Identification – Indirect Least Squares - Two stage Least Squares (without proof), Problems.	14

TOTAL	44
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BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	Johnston,J: Econometric Methods, McGraw-Hill Book Co., New York.	
2.	Maddala, G.S: Econometrics, McGraw-Hill Book Co., New York, 3rd Rd.	
3.	Gujarathi, D.N: Basic Econometrics, Fourth Edition, Tata McGraw-Hill, New Delhi.	
4.	Tintner,G: Econometrics, John Wiley & Sons, New York.	
5.	Wooldridge, Jeffery M: Econometrics, Cengage Learning India Pvt. Ltd, NewDelhi	

COURSE OUTCOMES:

No.	Outcome
The students will be able to	
1.	Use various advanced econometric models, estimation methods and related econometric theories.
2.	Application of appropriate econometric methods to test an economic theory including deriving and test a specific hypothesis relevant to a general economic or policy question.
3.	Interpretation and critical evaluation of the outcomes of empirical analysis.

Course Code	B130507T	Course Title	Computer Networks
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	<ul style="list-style-type: none"> • Build an understanding of the fundamental concepts of computer networking, protocols, architectures, and applications • Gain expertise in design, implement and analyze performance perspective of ISO-OSI layered Architecture • Be familiar with the components required to build different types of networks • To learn and understand the principles of routing and protocols of networking • Learn the flow control and congestion control algorithms • Take advanced courses in Networking 		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	<p>Introduction: Networking goals, Networking Topologies, Network Architecture - Interfaces and services, ISO-OSI Reference Model, TCP/IP Protocol suite. Comparison of OSI and TCP/IP.</p> <p>Signals: Analog Signals and Digital Signals, Characteristics of Analog Signals, Frequency Modulation (FM), Amplitude, Modulation (AM), Phase Modulation (PM), Quadrature Amplitude Modulation QAM.</p> <p>Encoding and Modulation: Digital to Digital signal conversion, Digital to Analog signal conversion, Analog to Analog signal conversion, Analog to Digital signal conversion</p>	10
2.	<p>Physical Layer: Transmission Media - Guided Transmission Media – Twisted pair, Coaxial Cable, Fiber Optics, and Unguided Media–Radio waves, Microwaves, Infrared. Packet and Circuit Switching</p> <p>Data Link Layer: Framing, Flow and Error Control, Error Detection and Correction - Types of Errors, Redundancy, LRC, CRC, Checksum. Flow and Error control Protocols: Stop and Wait, Stop and Wait ARQ, Go back-N ARQ, Selective repeat ARQ.</p>	10
3.	<p>Local Area Network: Ethernet: Multiple Access Links and Protocols – ALOHA, CSMA, CSMA/CD, CSMA/CA. 802.3 IEEE standard, Token Bus: 802.4 IEEE standard, Token Ring: 802.5 IEEE standard, Wireless LAN Protocols.</p> <p>Logical Addressing: IPv4 Addresses, Ipv6 Addresses.</p> <p>INTER Networking Devices: Layer 1 connections- Repeater, Hubs, Layer 2 connections- Bridges, Switches, Layer 3 connections- Routers,</p>	10

	Gateways. Unicast Routing Protocols: Distance Vector Routing, Link State Routing. Internet Protocols: Class A, B, C, D, E traffic, IPV4, IPV6. Address Mapping: ARP, RARP- ICMP- IGMP.	
4.	Transport Layer: Services, Multiplexing and De-multiplexing, Process to process delivery –User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control Techniques– Congestion Prevention Policies - Quality of services (QoS) – Techniques to improve QoS - Integrated Services. Principles of Networking Applications: Web, FTP, E-mail, DNS, Peer-to-Peer applications, Creating Networking Applications, Telnet, SNMP, Recent trends in Computer Networks.	14
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Larry L.Peterson, Bruce S.Davie, Computer Networks: A System Approach, Fifth Edition, 2012
2.	James F.Kurose and Keith W.Ross, Computer Networking: A Top-Down Approach, Sixth Edition, Pearson Education, 2013.
3.	Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition, McGraw-Hill, 2012.
4.	Behrouz A.Forouzan, TCP/IP Protocol Suite, 5th Edition, Tata McGraw-Hill, 2012
5.	W.Richard Stevens, TCP/IP Illustrated, The Protocols, 2nd Edition, Prentice Hall 2012
6.	Andrew S.Tenanbaum, Computer Networks, Fifth Edition, Prentice Hall, 2012

COURSE OUTCOMES:

No.	Outcome
At the end of the course students will be able to:	
1.	To understand the basic principles of Communication, Networks and Satellite Transponders.
2.	To understand bit rate and baud rate.
3.	To understand the concepts of CSMA/CD, ISDN.

4	To design sub-netting and enhance the performance of routing mechanisms.
5	To compare various congestion control mechanisms and identify suitable Transport layer protocol for real time applications.

Course Code	B130508T	Course Title	Web Technologies
Credits	2 (2-0-0)	Pre-requisite	Nil
Objective			

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Web Design: Introduction to hypertext markup language (HTML) document type definition, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, Divisions, Sections.	10
2.	Customized Features: Cascading style sheets, (CSS) for text formatting and other manipulations, Types, Introduction to DHTML	10
3.	JavaScript: Data types, operators, functions, control structures, events and event handling. JQuery: Introduction, Basics, Selectors, Attributes.	12
4.	Bootstrap: Introduction, Environment, a simple web page using bootstrap template, Designing tables, forms, buttons.	14
TOTAL		46

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Ivan Bayross, "Web Enabled Commercial Application Development Using Html, Dhtml, javascript", Perl CGI, BPB Publications, 2009
2.	BIG Java Cay Horstmann", Wiley Publication , 3rd Edition., 2009.
3.	David Flanagan, "jQuery, Pocket Reference", O'Reilly, 2011.Jake Spurlock, "Bootstrap", O'Reilly, 2013.JQuery Web Application Library, Tutorials Point (http://www.tutorialspoint.com/jquery/jquery_tutorial.pdf)

DEPARTMENT OF COMPUTER SCIENCE
PROGRAMME: M.TECH. (DUAL DEGREE) – AI&DS
SESSION: 2024-29>>SEMESTER-VI

DETAILED SYLLABUS

Code	Title	Credits (L T P)	MM – 100 Marks	
			CIE	ETE
CORE COURSES				
B130601T	Data Mining and Data Warehousing	3 (2-0-2)	25	75
B130602T	R Programming	3 (2-0-2)	25	75
B130603T	NOSQL Databases	3 (2-0-2)	25	75
B130604T	Linear Algebra	3 (2-1-0)	25	75
B130605T	Design of Experiments	3 (2-0-2)	25	75
ELECTIVE COURSES-(Any One)				
B130606T	Scientific Computing	3 (2-0-2)	25	75
B130607T	Soft Computing	3 (2-0-2)	25	75
ADVANCE COURSE				
B130608T	Data Security	2 (2-0-0)	25	75

DETAILED SYLLABUS

Course Code	B130601T	Course Title	Data Mining and Data Warehousing
Credits	3 (2-0-2)	Pre-requisite	-
Objective	The main objective of this course is to provide understanding of data warehouse fundamentals and data mining techniques for business applications.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Data Warehousing: Introduction data warehousing, Data Mart, Data Warehouse Architecture; Star, Snowflake and Galaxy Schemas for Multidimensional databases, Fact and dimension data, Partitioning Strategy-Horizontal and Vertical Partitioning. ETL Concepts. OLAP technology: Multidimensional data models and different OLAP Operations, OLAP Server: ROLAP, MOLAP, Data Warehouse implementation, Efficient Computation of Data Cubes, Processing of OLAP queries, indexing data.	
2.	Data Mining: Basics of data mining, Data mining techniques, KDP (Knowledge Discovery Process), Application and Challenges of Data Mining; Introduction to Web Mining, Text Mining. Data Processing: Data Cleaning, Data Integration and Transformation; Data Reduction: Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Data Discretization and Concept hierarchy generation for numerical and categorical data.	
3.	Mining Association Rules in Large Databases: Association Rule Mining, Single-Dimensional Boolean Association Rules, Multi-Level Association Rule, Apriori Algorithm, FP-Growth Algorithm, latest trends in association rules mining.	
4.	Classification methods: Decision tree, Bayesian Classification, Rule based; clustering methods: Partitioning methods (K-Means, K-Medoids) and Hierarchical Clustering (Agglomerative and Divisive Clustering, Multi-phase method) Prediction: Linear and non-linear regression.	
TOTAL		

BOOKS:

S. No.	Name of Books/Authors/Publisher	Year of Publication/ Reprint
1.	P.Ponnian, "Data Warehousing Fundamentals", John Wiley.	
2.	Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann.	
3.	P. N. Tan, M. Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education.	
4.	G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India.	
5.	Michael Berry and Gordon Linoff "Data Mining Techniques", Wiley Publications.	
6.	M.H.Dunham, "Data Mining Introductory & Advanced Topics", Pearson Education.	

COURSE OUTCOMES:

No.	Outcome
1.	The student will learn basics of Data Warehouse.
2.	The student will learn basics of Data Mining.
3.	The student will be able to Pre process the data.
4.	The student will be able to work with Classification Algorithms.
5.	The student will be able to cluster the data.

Course Code	B130602T	Course Title	R Programming
Credits	3 (2-0-2)	Pre-requisite	Basic Statistics
Objective	This course is an introduction to R, a powerful and flexible statistical language and environment that also provides more flexible graphics capabilities than other popular statistical packages.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to R programming language: Different platforms to Getting R, Managing R, Variables and identifiers, Data structure in R Different operators , Vector and Matrix Operations, Introduction Data frame, Big Data Structure, Exporting and Data cleaning, Missing Values Control Structures. Working with Objects and Data.	10-12
2.	Loop and basic programming in R Data Distribution and Statistical Testing: Types of Data distribution, Normal distribution, Poisson distribution, Random number generation, Chi-Square Testing, Student's t-test, F-test, Monte Carlo Simulation, interpretation of output.	6-8
3.	Advanced R: Statistical models in R, Correlation and regression analysis, Analysis of Variance (ANOVA), creating data for complex analysis, Data visualization Summarizing data, studies Graphical Analysis using R: Basic Plotting.	6-8
4.	Manipulating the plotting window, Box-Whisker Plots, Scatter Plots, Pair Plots, Pie Charts, Bar Charts. Special purpose chart using different libraries : ggplot , matplotlib etc.	8-10
TOTAL		

Practical:

1. Practical based on matrix operation and retrieving matrix elements
2. Adding and deleting columns/ rows from existing data-frame
3. Coding for simple functions and nested functions
4. Coding for structures (i.e. loops and controls)
5. Calculate probabilities for Binomial distribution
6. Calculate probabilities for Poisson distribution

7. Calculate probabilities for Normal distribution
8. Generate random numbers from uniform distribution
9. Monte-Carlo simulation
10. Chi-Square (Goodness of fit, independence and homogeneity) test for the given data
11. Testing of mean and variance for the given data (t-test and F- test)
12. Generating statistical plots for the given data
13. Fitting a linear model for the given data and interpretation of the results
14. Fitting a logistic regression model for the given data and interpretation of the results
15. Fitting a Poisson regression model for the given data and interpretation of the results
16. Comparing the mean of multiple groups using ANOVA.

BOOKS:

S. No.	Books' Details
1.	Mark Gardener: Beginning R: The Statistical Programming Language, Wiley publications.
2.	Norman Matloff: The Art of R Programming: A Tour of Statistical Software Design, OREILLY & Associates Inc.

COURSE OUTCOMES:

No.	Outcome
After completing the course the student will be able to	
1.	Manipulate Data- acquiring skills in flexible matrix manipulation
2.	Access online resources for R and import new function packages into the R workspace.
3.	Scripting in such a way that the script can be used with minimal effort for similar datasets and analyses and for especially large datasets
4.	Explore data-sets to create testable hypotheses and identify appropriate statistical tests
5.	Perform appropriate statistical tests using R
6.	Learn how to create high-quality figures, especially associated with more complex

Course Code	B130603T	Course Title	NoSQL Databases
Credits	3 (2-0-2)	Pre-requisite	Basic Knowledge about DBMS
Objective	<p>The objective of this course to enable the students to:</p> <ul style="list-style-type: none"> • Explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems. • Understand the architectures and common features of the main types of NoSQL databases (key-value stores, document databases, column-family stores, graph databases) • Discuss the criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases. 		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points.	8
2.	Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.	10
3.	NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.	12

4.	<p>Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.</p> <p>NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.</p>	16
TOTAL		46

BOOKS:

S. No.	Books' Details
1.	Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition, 2019.

WEB REFERENCES:

1. <https://www.ibm.com/cloud/learn/nosql-databases>
2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-databa>

COURSE OUTCOMES:

No.	Outcome
At the end of the Course the student will be able to	
1.	Explain and compare different types of NoSQL Databases

2.	Compare and contrast RDBMS with different NoSQL databases
3.	Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4.	Explain performance tune of Key-Value Pair NoSQL databases
5.	Apply Nosql development tools on different types of NoSQL Databases.

Course Code	B130604T	Course Title	Linear Algebra
Credits	3 (2-1-0)	Pre-requisite	Basic Set Theory
Objective			

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Vector space and subspaces, linear dependence and independence, basis and dimension of a vector space, finite dimensional vector spaces, completion theorem, examples of vector spaces over real and complex fields, linear equations. Vector spaces with an inner product, Gram-Schmidt Orthogonalization process, orthonormal basis and orthogonal projection of a vector.	10
2.	Linear transformations, algebra of matrices, row and column spaces of a matrix, elementary matrices, determinants, rank and inverse of a matrix, null space and nullity, partitioned matrices, Kronecker product. Hermite canonical form, generalized inverse, Moore-Penrose generalized inverse, idempotent matrices, solutions of matrix equations.	10
3.	Real quadratic forms, reduction and classification of quadratic forms, index and signature, triangular reduction of a positive definite matrix. Characteristic roots and vectors, Cayley-Hamilton theorem, minimal polynomial, similar matrices, algebraic and geometric multiplicity of a characteristic root, spectral decomposition of a real symmetric matrix, reduction of a pair of real symmetric matrices, Hermitian matrices.	12
4.	Singular values and singular value decomposition, Jordan decomposition, extreme of quadratic form, vector and matrix differentiation.	8
TOTAL		40

Practicals: Ranks, Finding Eigenvalues Eigenvectors, Quadratic forms, Linear transformations, Orthogonal transformation, Gram Schmidt Orthogonalisation, Finding G Inverse, Solving system of Linear Equations.

BOOKS:

S. No.	Books' Details
1.	Graybill, F.A.(1983), matrices with application and statistics, second edition, Wadsworth
2.	Rao, C.R.(1973), Linear Statistical Inference and its application, second edition. John Wiley and Sons.
3.	Scarle, S.R.(1982), Matrix Algebra useful for Statistics, John Wiley and Sons, Inc.
4.	Bellman, R. (1970) Introduction to Matrix Analysis, Second Edition. McGraw Hill
5.	Biswas, S.(1984), Topics in Algebra of Matrices. Academic Publications.
6.	Hoffman, K. and Kunze, R.(1971), Linear Algebra , Second Edition, Prentice Hall, Inc.
7.	Rao, A. R. and Bhimasankaram, R(1992) Linear Algebra, Tata Mcgraw Hill Publishing Company Limited.
8.	Rao, C. R. and Mitra, S.K.(1971) Generalized Inverse of Matrices and its Applications, John Wiley and Sons, Inc.

COURSE OUTCOMES:

No.	Outcome

Course Code	B130605T	Course Title	Design of Experiments
Credits	3 (2-0-2)	Pre-requisite	Statistical Methods
Objective	The course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. Both design and statistical analysis issues are discussed.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Analysis of Variance: one-way classification and two-way classification (for fixed, random and mixed effect models). Definition of different terms, Fundamental principles of design: Randomization, replication and local control. Layout and analysis of completely randomized design (CRD).	10
2.	Layout and analysis of randomized block design (RBD), Estimation and analysis of one missing observations in RBD, efficiency of RBD relative to CRD.	10
3.	Layout and analysis of Latin square design. Estimation and analysis of one missing observation in LSD. Efficiency of LSD relative to CRD and RBD.	10
4.	Factorial experiments, advantages of factorial experiments, 2^2 and 2^3 designs, main and interaction effects, contrast. Definition of confounding, complete and partial confounding.	10
TOTAL		40

BOOKS:

S. No.	Books' Details
1.	Montgomery D. C.: Design and Analysis of Experiments, John Wiley.
2.	Dey Alope (1986): Theory of Block Design - Wiley Estern.
3.	Angela Deal and Daniel Voss (1999): Design and Analysis of Experiments-

	Springer.
4.	Giri N. (1986): Analysis of Variance – Asia Publisher
5.	John P.W. (1971): Statistical Design and Analysis of Experiments – Mac Millon.
6.	Das M. N. and Giri, N.C. (1979) : Design & Analysis of Experiment – Wiley Estern.
7.	Gupta, S.C & Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Co.

COURSE OUTCOMES:

No.	Outcome

Course Code	B130606T	Course Title	Scientific Computing
Credits	3 (2-0-2)	Pre-requisite	-
Objective	The main objective is to train the students in computational methods for statistical analysis.		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Review of simulation techniques for various probability models, and resampling.	10
2.	Computational problems and techniques for <ul style="list-style-type: none"> • robust linear regression • nonlinear and generalized linear regression problem • tree-structured regression and classification • cluster analysis • smoothing and function estimation • robust multivariate analysis 	10
3.	Analysis of incomplete data: EM algorithm, single and multiple imputations. Markov Chain, Monte Carlo and annealing techniques.	10
4.	Neural Networks, Association Rules and learning algorithms.	10
TOTAL		40

BOOKS:

S. No.	Books' Details
1.	S. M. Ross, Simulation, Second edition.
2.	R. A. Thisted, Elements of Statistical Computing.
3.	P. McCullagh and J. A. Nelder, Generalized Linear Models.
4.	L. Breiman, Classification and Regression Trees.
5.	Brian Everitt, Cluster Analysis.
6.	R. J. A. Little, D. B. Rubin, Statistical Analysis with Missing Data.

7.	T. Hastie, R. Tibshirani and J. Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction.
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COURSE OUTCOMES:

No.	Outcome
Students will be able to	
1.	Implement statistical analysis techniques for solving practical problems.
2.	Perform statistical analysis on variety of data.
3.	Perform appropriate statistical tests and visualize the outcome.

Course Code	B130607T	Course Title	Soft Computing
Credits	3 (2-0-2)	Pre-requisite	Nil
Objective	<ul style="list-style-type: none"> • An understanding of the concept of different soft computing tools. • Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 		

COURSE DESCRIPTION:

Unit	Contents	Contact Hours
1.	Introduction to Neural Network: Concept of Neural Network, biological neural network, comparison of ANN with biological NN, evolution of artificial neural network, Basic models, Types of learning, Linear separability, McCulloch-Pitts neuron model, Hebb rule.	10
2.	Supervised and unsupervised learning: Perceptron, Backpropagation algorithm, Adalines and Madalines. Counter-propagation networks, Adaptive Resonance Theory, Kohonen's Self Organizing Maps, Neocognitron, Associative memory, Bidirectional Associative Memory.	12
3.	Fuzzy logic and fuzzy sets: fuzzy relations, fuzzy graphs, fuzzy arithmetic and fuzzy if-then rules, Process control using fuzzy logic, Decision-making fuzzy systems, Applications of fuzzy logic, Hybrid systems like neuro-fuzzy systems.	12
4.	Evolutionary Computation: Population-based Search, genetic algorithms and evolutionary computation, Swarm optimization, Ant colony optimization. Search techniques like Simulated Annealing, Tabu search etc.	10
TOTAL		44

BOOKS:

S. No.	Name of Books/Authors/Publisher
1.	Soft Computing and Intelligent Systems Design by F.O. Karray and C.DeSilva, Pearson Publication.
2.	Neural Networks, Fuzzy Logic and Genetic Algorithms by Rajsekaran and Pai, PHI Publication.
3.	S.N. Shivnandam, "Principle of soft computing", Wiley.

COURSE OUTCOMES:

S. No.	OUTCOME
1.	The student will be able to identify different neural network architectures, algorithms, applications and their limitations.
2.	The student will be able to analyze learning rules for each of the architectures and learn several neural network paradigms and its applications
3.	The student will be able to apply Neural Networks and Genetic Algorithms to different problem areas
4.	The student will be able to use the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
5.	The student will be able to evaluate and compare solutions by various soft computing approaches for a given problem.