

ARYAVART INTERNATIONAL UNIVERSITY  
Tilthai, Dharmanagar, North Tripura

ARYAVART INTERNATIONAL UNIVERSITY

Tilthai, Dharmanagar, North Tripura-799250

Syllabus for B Tech (CSE-AIML)

Semester 1

<b>Theory</b>									
Course Code	Topic	L	T	P	Credit	Theory Marks	Internal Marks	Practical Marks	Total Marks
24EG101	Engineering Physics	3	1	0	4	70	30	0	100
24EG102	Engineering Mathematics	3	1	0	4	70	30	0	100
24CS102	C Programming	3	1	0	4	70	30	0	100
24EN102	Business Communication	3	1	0	4	70	30	0	100
24CS101	Fundamentals of IT	4	0	0	4	70	30	0	100
<b>Practical</b>									
24EG191	Engineering Physics Lab	0	0	2	2	0	30	70	100
24CS192	C Programming Lab	0	0	2	2	0	30	70	100
<b>Total</b>					<b>24</b>	<b>350</b>	<b>210</b>	<b>140</b>	<b>700</b>

**Detailed Syllabus**

**ENGINEERING PHYSICS**

**Code: 24EG101**

Max Marks: 70

**Course Objectives:** This course is designed with some fundamental principle, laws and information to help the students to apply the basic concepts of physics to solve engineering problems. The study of basic principles and concepts of motion, light, electricity, and modern physics will help in understanding the technology courses where emphasis is on the applications of these principles in engineering and technology.

**UNIT I** **(08 Hrs)**

**Mechanics, waves and oscillations**

Newton Laws & Equations of Motion, Momentum, Energy, Angular Momentum, Rigid Body Motion, Periodic Motion & Superposition, Free and Forced Vibrations, Resonance and Coupled Oscillators.

**UNIT II** **(08 Hrs)**

**Concepts of Quantum Mechanics**

Particle properties of waves, Wave properties of particles, Atomic Structure, Schrödinger's Equation, Particle in a Box, Finite Potential Well, Quantum Harmonic Oscillator.

**UNIT III** **(08 Hrs)**

**Statistical Mechanics**

Statistical Distributions, Maxwell-Boltzmann Statistics, Molecular energies in an Ideal Gas Quantum Statistics, Applications of Statistical mechanics.

**UNIT IV** **(10 Hrs)**

**Optics**

**Wave Optics:** Electro Magnetic Radiation and Electro Magnetic Spectrum, Super Position of Waves, Refraction, Reflection, Interference, Diffraction and Polarisation.

**Lasers:** Characteristics of LASER, Spontaneous and Stimulated Emission of Radiation, Einstein's Coefficients and their significance. Meta-stable State, Pumping, Population Inversion. Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

**Fibre Optics:** Principle and construction of optical fibre, Acceptance Angle and Numerical Aperture, Classification of Optical Fibres, Attenuation in Optical Fibers (scattering, absorption and bending losses) Applications of Optical Fibres.

**UNIT V** **(06 Hrs)**

**Semiconductors and Semiconductor devices**

Semi-conductors Fermi Level in Intrinsic and Extrinsic Semi-conductors. Carrier concentration of Intrinsic Semi-conductor. Carrier concentration of Extrinsic Semi-conductor (qualitative).

Semiconductor devices - Formation of a PN Junction and working of a PN Junction diode, Energy band Diagram of open circuited PN Diode, I-V Characteristics of PN Junction diode. Applications: LED, Solar Cell and Photo diode.

**Text Book:**

1. B.K. Pandey & S. Chaturvedi, "Engineering Physics", Cengage Learning.
2. Avadhanulu M. N., Kshirsagar P. G, "A text book of Engineering Physics", S Chand publications Pvt. Ltd, 2014.
3. D.K. Bhattacharya and Poonam Tandon, "Engineering Physics", Oxford Higher Education press, 2015.

**Reference Books:**

1. P. K. Palanisamy, "Engineering Physics", Sitech Publications.
2. Charles Kittel, "Introduction to Solid State Physics", John Wiley Publisher.
3. A.S. Vasudeva, "Modern engineering Physics", S Chand.
4. Dekker, "Solid State Physics".

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**ENGINEERING MATHEMATICS**

**Code: 24EG102**

Max Marks: 70

**Course Objectives:** The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. The skills derived from the course will help the student from a necessary base to develop analytic and design concepts and also to understand the most basic numerical methods to solve simultaneous linear equations.

**UNIT I** **(08 Hrs)**

**Matrices:** Rank of a matrix by echelon form, system of homogeneous and non-homogeneous linear equations. Eigen values, Eigen vectors of Matrices, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by the Cayley-Hamilton theorem.

**UNIT II** **(08 Hrs)**

**Quadratic forms:** Symmetric matrix, Orthogonal matrices, Diagonalisation of a matrix by orthogonal process. Quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

**UNIT III** **(08 Hrs)**

**Mean value theorems:** Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof); Properties and Problems.

**UNIT IV** **(08 Hrs)**

**Multivariable calculus:** Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

**UNIT V** **(08 Hrs)**

**Multiple integrals:** Double integrals, change of order of integration, double integration in polar coordinates, areas enclosed by plane curves. Evaluation of triple integrals, change of variables between Cartesian and spherical polar coordinates.

**Textbook:**

1. E. Kreyszig, "Advanced engineering mathematics", John Wiley & Sons, new edition.
2. B. S. Grewal, "Higher engineering mathematics", Khanna Publishers, new edition.

**Reference Books:**

1. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, "Calculus", 13/e, Pearson Publishers, 2013.
3. Glyn James, "Advanced Modern Engineering Mathematics", 4/e, Pearson publishers, 2012.

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**C PROGRAMMING**

**Code: 24CS102**

Max Marks: 70

**Course Objectives:** The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

**UNIT I**

**(8 Hrs)**

Computer Programming: Basic Programming concepts, Modular programming and structured programming, Problem solving using Computers, Concept of flowcharts and algorithms.

Overview of C: Introduction, Importance of C, Sample C Programs, Basic structure of C programs, Programming style, executing a C Program.

Constants, Variables and Data types: C Tokens, keywords, and identifiers, constants, variables, datatypes, declaration of variables, assigning values to variables, defining symbolic constants.

Operators and Expressions: Arithmetic operators, Relational operators, Logical operators, Assignment operators, increment and decrement operators, conditional operator, bitwise operators, type conversion in expressions, operator precedence and associability.

Mathematical functions.

**UNIT II**

**(10 Hrs)**

Input and Output statements, reading a character, writing a character, formatted input, formatted output statements.

Decision-making, Branching and Looping: Decision making with IF statement, simple IF statement, The IF-ELSE statement, nesting of IF.. ELSE statements, The ELSE-IF ladder, The switch statement, The? operator, The GOTO statement, The WHILE statement, The DO statement, The FOR statement, jumps in loops.

**UNIT III**

**(10 Hrs)**

Arrays: one-dimensional array, Two-dimensional arrays, initializing arrays, Programs based on arrays such as sorting, Fibonacci sequence, matrix operations, etc.

Handling of Characters and Strings: Declaring and initializing string variables, reading string from terminal, writing string to screen, arithmetic operations on characters, putting strings together. Comparison of two strings, character and string handling functions.

**UNIT IV**

**(8 Hrs)**

User defined functions: Need for user-defined functions, a multi-functional program, the form of 'C' function, Return values and their types, calling a function, category of functions: No arguments and no return values, arguments but no return values, arguments with return values, nesting of functions, recursion, functions with arrays as parameters.

**UNIT V**

**(4 Hrs)**

Structure and Union: Structure definition, giving values to members, structure initialization; comparison of structure variables, array of structures, array within structure, union.

Pointers: Understanding pointers, accessing the address of variables, declaring and initializing pointers, accessing a variable through its pointer.

**Textbook:**

1. Kamthane, "Programming with ANSI and Turbo C"; Pearson Education 2003

**Reference Books:**

1. E. Balaguruswamy: "Programming in ANSI C", Tata McGraw-Hill (1998)
2. Yeshvant Kanetkar: "Let us C"
3. V. Rajaraman: "Programming in C", PHI (EEE) (2000)
4. Rajesh Hongal: "Computer Concepts & C language".
5. Brain Kernighan & Dennis M. Ritchie, "ANSI C Programming" (PHI).

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**BUSINESS COMMUNICATION**

**Code: 24EN102**

Max Marks: 70

**Course Objectives:** This course is designed to give students a comprehensive view of communication, its scope and importance in business and the role of communication in establishing a favourable outside the firm environment, as well as an effective internal communications program. The Business Communications course will prepare future entrepreneurs to create effective business communications, present business briefings, produce understandable business documents and examine the impact of the communications process on the business operation.

**UNIT I (10 Hrs)**

**Concepts and Fundamentals:** Introduction to Technical Communication, Need and importance of communication, channel, Distinction between general and technical communication, nature and features of technical communication, Seven Cs of communication, Types of Technical communication, style in technical communication, technical communication skills, Language as a tool of Communication, History of development of Technical Communication, Computer Aided Technical Communication

**UNIT II (10 Hrs)**

**Oral Communication:** Principles of effective oral communication, Introduction of Self and others, Greetings, Handling Telephone Calls Interviews: Meaning & Purpose, Art of interviewing, Types of interview, Interview styles, Essential, Techniques of interviewing, Guidelines for Interviewer, Guidelines for interviewee. Meetings: Definition, Kind of meetings, Agenda, Minutes of the Meeting, Advantages and disadvantages of meetings/committees, Planning and organization of meetings. Project Presentations: Advantages & Disadvantages, Executive Summary, Charts, Distribution of time (presentation, questions & answers, summing up), Visual presentation, Guidelines for using visual aids, Electronic media (PowerPoint presentation). The technique of conducting a Group Discussion and a JAM session.

**UNIT III (10 Hrs)**

**Written Communication:** Overview of Technical Writing: Definition and Nature of Technical Writing, Basic Principles of Technical Writing, Styles in Technical Writing.

Note-Making, Notice, E-mail Writing.

Writing Letters: Business letters, Persuasive letters- Sales letters and complaint letters Office memorandum, Good news and bad news letters.

Report Writing: Definition & importance; categories of reports, Elements of a formal report, style and formatting in report.

Special Technical Documents Writing: Project synopsis and report writing, Scientific Article and Research Paper writing, Dissertation writing: Features, Preparation and Elements.

Proposal Writing: Purpose, Types, characteristics and structure.

Job Application: Types of application, Form & Content of an application, drafting the application, Preparation of resume.

**UNIT IV (10 Hrs)**

**Soft Skills:** Business Etiquettes – Professional Personality, Workplace Protocols, Cubicle. Non-Verbal Communication: Kinesics and Proxemics, Paralanguage.

Inter-personal Skills.

**Language Skills:** Improving command in English, improving vocabulary, choice of words, Common problems with verbs, adjectives, adverbs, pronouns, tenses, conjunctions, punctuations, prefix, suffix, idiomatic use of prepositions. Sentences and paragraph construction, improve spellings, common errors and misappropriation, Building advanced Vocabulary (Synonyms, Antonyms), introduction to Business English.

**Text Book:**

1. Kavita Tyagi and Padma Misra , “Advanced Technical Communication”, PHI, 2011
2. P. D. Chaturvedi and Mukesh Chaturvedi, “Business Communication – Concepts, Cases and Applications”, Pearson, second edition.
3. Rayudu, “C.S- Communication”, Himalaya Publishing House, 1994.
4. Asha Kaul , “Business Communication”, PHI, second edition.

**Reference Books:**

1. Raymond Murphy, “Essential English Grammar- A self study reference and practice book for elementary students of English” , Cambridge University Press, second edition.

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2. Manalo, E. & Fermin, V. (2007). Technical and Report Writing. ECC Graphics. Quezon City.
3. Kavita Tyagi and Padma Misra, "Basic Technical Communication", PHI, 2011.
4. Herta A Murphy, Herbert W Hildebrandt and Jane P Thomas, "Effective Business Communication", McGraw Hill, seventh edition.

**FUNDAMENTALS OF IT**

**Code: 24CS101**

Max Marks: 70

**Course Objectives:** The main objective is to introduce IT in a simple language to all undergraduate students, regardless of their specialization. It will help them to pursue specialized programs leading to technical and professional careers and certifications in the IT industry. The focus of the subject is on introducing skills relating to IT basics, computer applications, programming, interactive Medias, Internet basics etc.

**UNIT I**

**(10 Hrs)**

**Fundamentals of Computers:** Definition and Characteristics of a Computer System. Computer Generations from First Generation to Fifth Generation. Classifications of Computers: Micro, Mini, Mainframe and super computers.

**Computer Hardware:** Major Components of a digital computer, Block Diagram of a computer, Input-output devices, Description of Computer Input Units, Output Units, CPU.

**Computer Memory:** Memory Hierarchy, Primary Memory – RAM and its types, ROM and its types, Secondary Memory, Cache memory. Secondary Storage Devices - Hard Disk, Compact Disk, DVD, Flash memory.

**UNIT II**

**(10 Hrs)**

**Interaction with Computers:** Computer Software: System software: Assemblers, Compilers, Interpreters, linkers, loaders.

**Application Software:** Introduction to MS Office (MS-Word, MS PowerPoint, MS-Excel). **Operating Systems:** Elementary Operating System concepts, Different types of Operating Systems. **DOS:** Booting sequence; Concepts of File and Directory, Types of DOS commands.

**Computer Languages:** Introduction to Low-Level Languages and High-Level Languages.

**UNIT III**

**(10 Hrs)**

**Computer Number System:** Positional and Non-positional number systems, Binary, Decimal, Octal and Hexadecimal Number Systems and their inter-conversion.

**Binary Arithmetic:** Addition, subtraction, multiplication and division. Use of complement method to represent negative binary numbers, 1's complement, 2's complement, subtraction using 1's complement and 2's complement. Introduction to Binary Coded Decimal (BCD), ASCII Codes, EBCDIC codes.

**UNIT IV**

**(10 Hrs)**

**Computer Network & Internet:** Basic elements of a communication system, Data transmission modes, Data Transmission speed, Data transmission media, Digital and Analogue Transmission, Network topologies, Network Types (LAN, WAN and MAN), Basics of Internet and Intranet.

**Internet:** Terminologies related to Internet: Protocol, Domain name, Internet Connections, IP address, URL, World Wide Web. Introduction to Client-Server Model, Search Engine, Voice over Internet Protocol (VOIP), Repeater, Bridge, Hub, Switch, Router, Gateway, Firewall, Bluetooth technology.

**Advanced Trends in IT Applications:** Brief Introduction to Cloud Computing, Internet of Things, Data Analytics, AI and Machine Learning.

**Text Book:**

1. P. K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 1992.
2. Anita Goel "Computer Fundamentals", Pearson.

**Reference Books:**

1. B. Ram, "Computer fundamentals: Architecture and Organization", New Age Intl.
2. Alex Leon & Mathews Leon, "Introduction to Computers", Vikas Publishing.
3. Norton Peter, "Introduction to computers", 4th Ed., TMH, 2001.
4. Vikas Gupta, "Comdex Computer Kit", Wiley Dreamtech, Delhi, 2004.

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**ENGINEERING PHYSICS LAB**

**Code: 24CS191**

Max Marks: 70

(BASED ON 24EG101) Engineering Physics:

**Concepts of Experimental Physics**

1. Error-Analysis and Drawing Graph.

**Mechanics - waves and Oscillations**

1. Compound Pendulum.
2. Estimation of the moment of inertia of a Fly wheel.
3. Estimation of the Young's modulus of a steel wire using a torsion pendulum.
4. Melde's Experiment.
5. Resonance in LCR Circuits.

**Optics**

1. Determine the thickness of the wire using wedge shape method.
2. Determination of the radius of curvature of the lens by Newton's ring method.
3. Determination of wavelength by plane diffraction grating method.
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. To determine the numerical aperture and acceptance angle of a given optical fibre.

**Semiconductor Physics**

1. Energy Gap of a semi-conductor.
2. I-V Characteristics (Resistor, Diode, Solar Cell, LDR).

**C PROGRAMMING LAB**

**Code: 24CS192**

Max Marks: 70

(BASED ON 24CS102) C Programming:

**Core Practical (Implement minimum 8 out of 10 practical)**

1. Write a program to convert temperature from Celsius to Fahrenheit by taking input from the user.
2. Write a program to find the greatest number among 3 numbers given by the user.
3. Write a program to check if a given number is a prime number or not.
4. Write a program to display the following pattern up to N rows, taking the value of N from the user:  
1  
2     3  
4     5     6  
7     8     9     10
5. Write a program to input marks of 50 students using an array and display the average marks of the class.
6. Write a program to search for a number entered by the user in a given array and display the array in ascending order.
7. Write a program to check if a string is palindrome or not.
8. Write a program to add, subtract, multiply and divide two numbers using pointers.
9. Write a program to create a structure for employees containing the following data members: Employee ID, Employee Name, Age, Address, Department and Salary. Input data for 10 employees and display the details of the employee from the employee ID given by the user.
10. Write a program to create two files with names Even File and Odd File. Input 20 numbers from the user and save even numbers in Even File and odd numbers in Odd File.

**Application Based Practical (Implement minimum 5 out of 10 practical)**

1. Write a menu driven program to construct a calculator for following arithmetic operations: addition, subtraction, multiplication, division, average and percentage.
2. Write a menu driven program to perform the following operations:
  - (i) Print Armstrong numbers up to N,
  - (ii) Display prime numbers between 1 to N,
  - (iii) Reverse of an integer

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3. Write a program to convert a hexadecimal number into a binary number.
4. Write a program to calculate factorial of a number and display fib on acci series up to N terms using recursive functions.
5. Write a program to perform
  - (i) Matrix addition,
  - (ii) matrix multiplication, and
  - (iii) Matrix transpose on 2D arrays.
6. Write a program to make use of arrays with structures in the following ways:
  - (i) Use array as a structure data member
  - (ii) Create array of structure variables
7. Write a program to compare the contents of two files by taking names of the files through command line arguments.
8. WAP to perform I/O and make use of file positioning functions on Binary files. (using fseek, ftell, rewind functions).
9. Write a menu driven program to implement the following string operations:
  - (i) Calculate length of a string
  - (ii) Concatenate at the end of a given
  - (iii) Copy one string to another
  - (iv) Compare contents of two strings
  - (v) Copy nth character string to another
10. Write a program to read time in string format and extract hours, minutes and second also check time validity.

**Note:**

1. **In total 15 practical to be implemented. 2 additional practical may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add program as per the requirement of the course.**

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**Theory Paper**

Total: 100 Marks

External: 70 Marks Internal:30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each (1x10 = 10)

Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)

Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)

Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks

External: 70 Marks Internal:30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks

**Algorithm & Flowchart:** 5 + 5 Marks

**Program Execution:** 15 + 15 Marks

**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks

**Record:** 5 Marks

**Attendance:** 5 Marks

**Program Writing:** 15 Marks

**Program Execution:** 15 Marks

**Viva:** 10 Marks

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Syllabus for B Tech (CSE-AIML)

Semester 2

Theory									
Course Code	Topic	L	T	P	Credit	Theory Marks	Internal Marks	Practical Marks	Total Marks
24CS302	Computer Organization and Architecture	3	1	0	4	70	30	0	100
24CS301	Object Oriented Programming with C++	4	0	0	4	70	30	0	100
24CS201	Data Structure and Algorithm Using 'C'	3	1	0	4	70	30	0	100
24CS321	Basics of Python Programming	4	0	0	4	70	30	0	100
24GN401	Indian Constitution	2	0	0	2	70	30	0	100
Practical									
24CS391	C++ Lab	0	0	2	2	0	30	70	100
24CS392	Python Programming Lab	0	0	2	2	0	30	70	100
<b>Total</b>					<b>22</b>	<b>350</b>	<b>210</b>	<b>140</b>	<b>700</b>

**Detailed Syllabus**

**COMPUTER ORGANIZATION AND ARCHITECTURE**

**Code: 24CS302**

Max Marks: 70

**Course Objectives:** The course objectives of *Computer Organization and Architecture* are to discuss and make student familiar with the Principles and the Implementation of Computer Arithmetic, Operations of CPU including RTL, ALU. It also focuses on Instruction Cycle and Busses, Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design, Memory System and I/O Organization and Principles of Multiprocessor Systems.

**UNIT I**

**(10 Hrs)**

**Boolean Algebra and Logic:** Basics Laws of Boolean Algebra, Logic Gates, Simplifications of Boolean equations using K-maps SOP and POS, Don't Care condition.

**Arithmetic Circuits:** Adder, Subtractor, Parallel binary adder/Subtractor.

**UNIT II**

**(10 Hrs)**

**Combinational Circuits:** Multiplexers, De-Multiplexers, Decoders, Encoders.

**Flip-flops:** S-R, D, J-K, T, Clocked Flip-flop, Race around condition, Master slave Flip-Flop, Realisation of one flip-flop using other flip-flop, Applications of flip flop: Latch, Registers, Counters (elementary treatment to be given).

**UNIT III**

**(10 Hrs)**

**Data Transfer Operations:** Register Transfer, Bus and Memory Transfer, Registers and micro-operations.

**Basic Computer Organizations and Design:** Instruction Codes, Computer Registers, Instruction Cycle, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

**UNIT IV**

**(10 Hrs)**

**Input-Output Organization:** Peripheral Devices, Input-Output Interfaces, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).

**Memory Organization:** Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

**Text Book:**

1. Morris Mano, Computer System Architecture, 3rd Edition, Prentice-Hall of India Private Limited, 1999.
2. Moris Mano, "Digital Logic and Computer Design", PHI Publications, 2002

**Reference Books:**

1. R. P. Jain, "Modern Digital Electronics", TMH, 3rd Edition, 2003.
2. William Stallings, "Computer Organization and Architecture", 4th Edition, Prentice Hall of India Private Limited, 2001
3. Subrata Ghosal, "Computer Architecture and Organization", Pearson 2011.
4. Malvino, "Digital Computer Electronics: An Introduction to Microcomputers", McGraw Hill.

**OBJECT ORIENTED PROGRAMMING WITH C++**

**Code: 24CS301**

Max Marks: 70

**Course Objectives:** The objectives of the course are to have students identify and practice the object-oriented programming concepts and techniques, practice the use of C++ classes and class libraries, arrays, vectors, inheritance and file I/O stream concepts.

**UNIT I**

**(10 Hrs)**

**Object Oriented Paradigm:** Procedural vs. object-oriented development, Basic concepts of object-oriented programming, Applications and benefits of OOP, Comparison between C and C++.

**Beginning with C++:** Stream based I/O, Literals- constant qualifiers, Operators in C++, Reference variable, Functions, Default arguments, Parameter passing by value, Reference and pointer, Inline functions, Type conversion, Basic C++ programs, New, Delete operators- basic use and dynamic memory allocation for arrays.

**UNIT II**

**(10 Hrs)**

**Classes and Objects:** C++ class declaration, Access specifiers, Member functions, Arrays within a class, Array of objects, Memory allocation of objects, Passing objects as arguments, Returning objects from functions, Function overloading, Static data and member functions, Friend function and friend class, This pointer.

**Constructors & Destructors:** Introduction to constructor and destructor, Parameterized constructor, Constructor with default arguments, Multiple constructors in a class, Copy constructor.

**UNIT III**

**(10 Hrs)**

**Inheritance:** Types of inheritance, Derivation – public, private & protected, Ambiguity resolution (function overriding), Aggregation, Composition v/s Classification, Virtual base class, Constructor and destructor in derived classes.

**Polymorphism:** Types of polymorphism, early v/s late binding, Virtual Functions: Need for virtual functions, Pointer to derived class objects, Pure virtual functions, Abstract classes.

**Operator Overloading:** Overloading unary operators, Nameless objects, Overloading binary operators, Overloading with friend functions, Conversion between basic types and user-defined types.

**UNIT IV**

**(10 Hrs)**

**Parametric polymorphism:** Generic Programming with Templates, Introduction, Function templates/generic functions, Characteristics, Overloading of template functions, Class templates, Template arguments.

**Exception Handling:** Exception-handling model, Types of exception, Catching and Handling exceptions, Generic catch, Rethrowing an exception, Specifying exceptions for a function.

**Streams & Files:** C++ Streams, Basic stream classes, C++ predefined streams, I/O operations, Unformatted console I/O operations, Manipulators, Opening and closing a file- different modes and methods, Error handling during file operations, File pointers and their manipulations, Sequential access to file, Random input and output operations, Persistent objects, Command line arguments.

**Text Book:**

1. K.R. Venugopal, Rajkumar, T. Ravishanker, "Mastering C++", TMH
2. E. Balagurusamy, "Object Oriented Programming with C++", McGraw-Hill Education

**Reference Books:**

1. Ashok N. Kamthane, "Object-Oriented Programming with ANSI And Turbo C++", Pearson Education.
2. Schildt Herbert, "C++: The Complete Reference", Tata McGraw Hill.
3. R. Lafore, "Object Oriented Programming using C++", Galgotia Publications.

**DATA STRUCTURE AND ALGORITHM USING C**

**Code: 24CS201**

Max Marks: 70

**Course Objectives:** The course is designed to develop skills to design and analyse simple linear and non-linear data structures. It strengthens the ability to the students to identify and apply the suitable data structure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

**UNIT I**

**(10 Hrs)**

**Linear Data Structures- Static:** Introduction to Algorithms- Attributes, Design Techniques, Time Space Trade Off, Data Structures, Classification and Operations of Data Structures.

**Arrays:** Single Dimension, Two-Dimension and Introduction to Multi-Dimensional, Memory Representation, Address Calculation, Sparse Matrices- Types, Representation.

**Searching and Sorting:** Linear and Binary Search, Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Elementary Comparison of Searching and Sorting Algorithms.

**Hashing:** Hash Table, Hash Functions, and Collision Resolution.

**UNIT II**

**(10 Hrs)**

**Linear Data Structures- Dynamic**

**Introduction:** Dynamic Memory Allocation, Dynamic Memory versus Static Memory Allocation. **Linked List**

**Types:** Singly Linked List, Doubly Linked List, Header Linked List, Circular Linked List. **Operations:** Creation, Insertion, Deletion, Modification, Searching, Sorting, Reversing, and Merging.

**UNIT III**

**(10 Hrs)**

**Abstract Data Types:**

**Stacks:** Introduction, Static and Dynamic Implementation, Operations, Applications- Evaluation and Conversion between Polish and Reverse Polish Notations.

**Queues:** Introduction, Static and Dynamic Implementation, Operations, Types- Linear Queue, Circular Queue, Doubly Ended Queue, Priority Queue.

**UNIT IV**

**(10 Hrs)**

**Non-Linear Data Structures:**

**Introduction to Graphs:** Notations & Terminologies, Representation of Graphs- Adjacency Matrix, Incidence Matrix and Linked Representation.

**Trees:** Notations & Terminologies, Memory Representation, Binary Trees Types- Complete, Full, Strict, Expression Binary Tree, Tree Traversals (Recursive), Binary Search Tree and Basic Operations

**Introduction and Creation (Excluding Implementation):** AVL Tree, Heap Tree, M- Way Tree, and B Tree.

**Textbook:**

1. Schaum's Outline Series, "Data Structures", TMH, Special Indian Ed., Seventeenth Reprint, 2014.
2. Y. Langsam, M. J. Augenstein, and A.M. Tanenebaum, "Data Structures using C and C++", Pearson Education India, Second Edition, 2015.
3. D. Samanta, "Classic Data Structures", PHI, Second Edition, 2009.

**Reference Books:**

1. Ashok N Kamthane, "Introduction to Data Structures in C", Pearson, Third Edition, 2009.
2. E. Horowitz and S. Sahni, "Fundamentals of Data Structures in C". Universities Press, Second edition, 2008.
3. D. Malhotra and N. Malhotra, "Data Structures and Program Design using C", Laxmi Publications, Indian adapted edition from Mercury Learning and Information-USA, First edition, 2018.
4. Y. Kanetkar "Data Structures through C", BPB Publication, Third Edition, 2019.
5. R.F Gilberg, and B A Frouzan- "Data Structures: A Pseudocode Approach with C", Thomson Learning, Second Edition, 2004.

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6. A. K. Rath, and A.K. Jagadev, “Data Structures and Program Design Using C”, Scitech Publications, Second Edition, 2011.

**BASICS OF PYTHON PROGRAMMING**

**Code: 24CS321**

Max Marks: 70

**Course Objectives:** This course is designed to introduce programming concepts using Python to students. The course aims to develop structured as well as object-oriented programming skills using Python. The course also aims to achieve competence amongst its students to develop correct and efficient Python programs to solve problems spanning multiple disciplines.

**UNIT I**

**(8 Hrs)**

**Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

**UNIT II**

**(8 Hrs)**

**Types, Operators and Expressions:** Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow- if, if-elif-else, for, while, break, continue, pass.

**UNIT III**

**(8 Hrs)**

**Data Structures:** Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions, strings and basic operations of strings.

**UNIT IV**

**(8 Hrs)**

**Functions:** Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

**UNIT V**

**(8 Hrs)**

**Object Oriented Programming OOP in Python:** Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding,

**Error and Exceptions:** Difference between an error and an exception, Handling Exception, try except block, Raising Exceptions, User-Defined Exceptions.

**Text Book:**

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
2. Learning Python, Mark Lutz, Orielly.

**Reference Books:**

1. Think Python, Allen Downey, Green Tea Press.
2. Core Python Programming, W. Chun, Pearson.
3. Introduction to Python, Kenneth A. Lambert, Cengage.

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**INDIAN CONSTITUTION**

**Code: 24GN401**

Max Marks: 70

**Course Objectives:** The objective of the *Indian Constitution* course is to provide the students with a foundational understanding of the principles, structure, and functioning of the Indian Constitution. The course emphasizes the rights and duties of citizens, governance frameworks, and the role of the Constitution in shaping the democratic and legal structure of India.

**UNIT I**

**(5 Hrs)**

**Introduction to Constitution:** Meaning and importance of the Constitution, salient features of Indian Constitution. Preamble of the Constitution. Fundamental rights- meaning and limitations. Directive principles of state policy and Fundamental duties -their enforcement and their relevance.

**UNIT II**

**(5 Hrs)**

**Union Government:** Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions.

**UNIT III**

**(5 Hrs)**

**State and Local Governments:** State Executive- Governor, Chief Minister, Council of Ministers. State Legislature- State Legislative Assembly and State Legislative Council. State Judiciary-High court. Local Government-Panchayat raj system with special reference to 73rd and Urban Local Self Govt. with special reference to 74th Amendment.

**UNIT IV**

**(5 Hrs)**

**Election provisions, Emergency provisions, Amendment of the constitution:** Election Commission of India- composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.

**Text Book:**

1. M.V.Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication, 2005.
2. Durga Das Basu (DD Basu), "Introduction to the constitution of India", (Student Edition), 19th edition, Prentice-Hall EEE, 2008

**Reference Books:**

1. Merunandan, "Multiple Choice Questions on Constitution of India", 2nd Edition, Meraga publication, 2007

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**C++ LAB**

**Code: 24CS391**

Max Marks: 70

**(BASED ON 24CS301) Object Oriented Programming with C++ Core Practical (Implement a minimum of 8 out of 10 practical)**

1. WAP to implement 'Inline function'.
2. WAP to implement call by reference and return by reference using a class. [Hint. Assume necessary functions].
3. WAP to implement the friend function by taking some real-life examples.
4. WAP to implement 'Function Overloading'.
5. WAP to implement Parameterized Constructor, Copy Constructor and Destructor.
6. WAP to show the usage of the constructor in base and derived classes, in multiple inheritance.
7. WAP to show the implementation of 'containership'.
8. WAP to show swapping using template function (Generic).
9. WAP to implement 'Exception Handling'.
10. WAP to read and write values through an object using file handling.

**Application-Based Practical (Implement a minimum 5 out of 10 practicals)**

11. Create a class **Employee** which has name, age, and address of the employee. Include functions `getdata()` and `showdata()`, `getdata()` takes the input from the user, `showdata()` displays the data in the following format:

*Name:*

*Age:*

*Address:*

12. Write a class called **C Account** which contains two private data elements, an integer **Account Number** and a floating-point **account Balance** and three-member functions:

- A constructor that allows the user to set initial values for **Account Number** and **Account Balance** and a default constructor that prompts for the input of the values for the above data numbers.
- A function called **Input Transaction**, which reads a character value for **Transaction Type** ('D' for deposit and 'W' for withdrawal) and a floating-point value for **Transaction Amount**, which updates **Account Balance**.
- A function called **Print Balance**, which prints on the screen the **Account Number** and **Account Balance**.

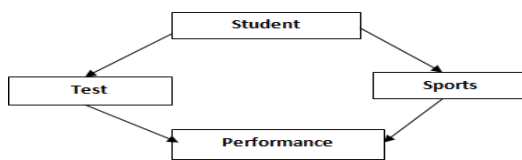
13. Define a class *Counter* which contains an int variable *count* defined as static and a static function `Display ()` to display the value of *count*. Whenever an object of this class is created *count* is incremented by 1. Use this class in the main to create multiple objects of this class and display the value of count each time.

14. WAP to add and subtract two complex numbers using classes.

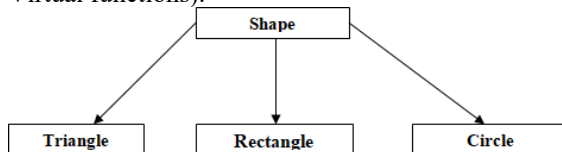
15. Write a program to overload Binary + to add two similar types of objects. (Both with and without using friend functions)

16. WAP to implement += and = operators

17. Implement the following class hierarchy, considering appropriate data members and member functions:



18. Implement the following hierarchy considering appropriate data members and member functions (use Virtual functions).



19. WAP to convert meter to centimeter and vice versa, using data conversions and operator overloading

20. WAP to count digits, alphabets and spaces, stored in a text file, using streams.

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**Note:**

1. In total 10 practicals to be implemented. 2 additional practicals may be given by the course instructor.
2. This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.

**PYTHON PROGRAMMING LAB**

**Code: 24CS391**

Max Marks: 70

(BASED ON CS201) Basics of Python Programming:

**1. Basics & operations**

- a) Running instructions in Interactive interpreter and a Python Script.
- b) Write a program to purposefully raise Indentation Error and correct it.
- c) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem).
- d) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

**2. Control Flow**

- a) Write a Program for checking whether the given number is a even number or not.
- b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10.
- c) Write a program using a for loop that loops over a sequence. What is sequence?
- d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

**3. Control Flow - Continued**

- a) Find the sum of all the primes below 200.  
Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:  
1, 2, 3, 5, 8, 13, 21, 34, 55, 89,...
- b) By considering the terms in the Fibonacci sequence whose values do not exceed 400, find the sum of the even-valued terms.

**4. DS**

- a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure
- b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.
- c) Write a program combining lists that combines these lists into a dictionary.
- d) Write a program to count the frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

**5. Files**

- a) Write a program to print each line of a file in reverse order.
- b) Write a program to compute the number of characters, words and lines in a file.

**6. Functions**

- a) Write a function ball collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.  
Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius  
If (distance between two balls centers) <= (sum of their radii) then (they are colliding)
- b) Find mean, median, mode for the given set of numbers in a list.

**7. Functions - Continued**

- a) Write a function nearly equal to test whether two strings are nearly equal. Two strings a and b are nearly equal when a can be generated by a single mutation on b.
- b) Write a function dups to find all duplicates in the list.
- c) Write a function unique to find all the unique elements of a list.

**8. Functions - Problem Solving**

- a) Write a function cumulative product to compute cumulative product of a list of numbers.
- b) Write a function reverse to reverse a list. Without using the reverse function.
- c) Write a function to compute gcd,lcm of two numbers. Each function shouldn't exceed one line.

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**9. Multi-D Lists**

- a) Write a program that defines a matrix and prints.
- b) Write a program to perform addition of two square matrices.
- c) Write a program to perform multiplication of two square matrices.

**10 - Modules**

- a) Install packages requests, flask and explore them using (pip).
- b) Write a script that imports requests and fetches content from the page Eg. (Wiki).
- c) Write a simple script that serves a simple HTTP Response and a simple HTML Page.

**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each ( $1 \times 10 = 10$ )  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each ( $2 \times 6 = 12$ )  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each ( $3 \times 6 = 18$ )  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each ( $5 \times 6 = 30$ )

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks

**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks

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**Syllabus for B Tech (CSE-AIML)**

**Semester 3**

<b>Theory</b>									
<b>Course Code</b>	<b>Topic</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	<b>Theory Marks</b>	<b>Internal Marks</b>	<b>Practical Marks</b>	<b>Total Marks</b>
24MT101	Discrete Mathematical Structure	4	0	0	4	70	30	0	100
24CS401	Java Programming	4	0	0	4	70	30	0	100
24CS305	Digital Logic Design	4	0	0	4	70	30	0	100
<b>Discipline Specific Elective (DSE-1) (Choose any one)</b>									
24MT203	Linear Algebra	4	0	0	4	70	30	0	100
24CS318	Analog and Digital Electronics	4	0	0	4	70	30	0	100
<b>General Elective (GE-1) (Choose any one)</b>									
24CM111	Economics for Engineers	2	0	0	2	70	30	0	100
24PS101	Introduction to Political Science	2	0	0	2	70	30	0	100
<b>Practical</b>									
24CS491	Java Lab	0	0	2	2	0	30	70	100
24CS395	Digital Logic Design Lab	0	0	2	2	0	30	70	100
<b>Total</b>					<b>22</b>	<b>350</b>	<b>210</b>	<b>140</b>	<b>700</b>

**Detailed Syllabus**

**DISCRETE MATHEMATICAL STRUCTURE**

**Code: 24MT101**

Max Marks: 70

**Course Objectives:** The objective of the course is to develop the mathematical foundations essential for computer science, including logic, set theory, relations, functions, graphs, and combinatorics.

**UNIT I**

**(10 Hrs)**

**SETS:** Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Operations on Sets: Union, Intersection difference and Complements of Sets, Algebra of sets, Cartesian product, Simple applications.

**RELATION AND FUNCTIONS:** Properties of Relations, Equivalence Relation, Partial Order Relation, Composition of relations, and Representation of relations using digraph and Matrix, Function: Domain and Range, onto, into and One to One Functions, Composite and Inverse Functions, Hashing functions, Recursive function.

**PROPOSITIONAL LOGIC:** Introduction, Proposition, First order logic, Basic logical operations, truth tables, tautologies, contradictions, Algebra of Propositions, logical implications, logical equivalence, predicates, Universal and existential quantifiers.

**UNIT II**

**(10 Hrs)**

**PARTIAL ORDER RELATIONS AND LATTICES:** Partial Order Sets, Totally ordered set, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal elements, Greatest lower bound, least upper bound, Lattices and Algebraic Structure, Principle of Duality, Elementary Properties of Lattices, Atoms. Sub lattices, Bounded lattice, Distributed & Complemented Lattices, Isomorphic lattices. Boolean lattice.

**UNIT III**

**(10 Hrs)**

**COMBINATORICS:** Introduction, Basic Counting Principles, Permutations, Permutations of things not all different, Circular Permutations, Combinations, Restricted Permutations and Combinations, Derangement, Pascal's Triangle, Binomial Theorem (only for natural Numbers).

**RECURRENCE RELATIONS:** Introduction, Order of Recurrence Relations, Degree of Recurrence Relations, Linear Homogeneous Recurrence Relations, Homogeneous Recurrence Relations, Solution of linear homogeneous and nonhomogeneous recurrence relations.

**UNIT IV**

**(10 Hrs)**

**GRAPHS:** Introduction, Degree of a vertex of a graph, Handshaking Theorem, types of Graphs, sub graph, Matrix representation of a graph: adjacent and incidence matrices, Isomorphic graphs, path and circuit (Floyd's and Warshall algorithms), Connected graph, Hamiltonian graph, Euler graph, Graph colouring (Vertex, Edges and Map).

**Textbook:**

1. Rosen, K. H., Discrete Mathematics and its Applications, McGraw Hill Education, 8th edition 2021.
2. Kolman, Busby and Ross, "Discrete Mathematical Structures", Pearson, 10th edition 2015.
3. Babu Ram, "Discrete Mathematics", Pearson Education, 1st edition 2010.

**Reference Books:**

1. D. S. Malik, M. K. Sen, "Discrete Mathematics" Cengage Learning, 2012.
2. S. K. Sarkar "A Text Book of Discrete Mathematics" S. Chand Publications, 9th edition 2019.
3. Singh J. P. "Discrete Mathematics for Undergraduates" ANE Books, 1st edition, 2013.
4. Tremblay J. P. and Manohar, R., "Discrete Mathematical Structures with Applications to Computer Science" Tata McGraw Hill.

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**JAVA PROGRAMMING**

**Code: 24CS401**

Max Marks: 70

**Course Objectives:** The objective of the course is to learn object-oriented programming using Java, covering core concepts such as classes, inheritance, interfaces, exception handling, and GUI development.

**UNIT I**

**(10 Hrs)**

**Java Basics:** Java as an Object-oriented Programming Language, History of Java, Features of Java, Difference between Java and C++, Java Architecture (JDK, JVM, JRE), Java Tokens: Data types, Literals, Variables, Scope and lifetime of variables, Operators. Control Structures, Arrays.

**Introducing Classes:** Creating a Class: properties, methods and constructors. Object Access modifiers, Method Overloading, Garbage collection, this keyword, Static (variable, method, block), final keyword, Wrapper Classes, String class and methods.

**UNIT II**

**(10 Hrs)**

**Inheritance:** Types, Super keyword, method overriding, covariant return type, abstract class.

**Interfaces and Packages:** Creation and implementation an interface, the difference between abstract class and interface, Packages, and importing a package.

**Exception Handling:** Exception Class, built-in checked and unchecked exceptions, user-defined exceptions, use of try, catch, throw, throws, finally.

**UNIT III**

**(10 Hrs)**

**Using I/O:** Elementary concepts of Input/Output, using the byte streams, reading and writing using byte streams, automatically closing a file, using the character-based streams, File I/O using character streams (using a File Writer and using a File Reader).

**Multi-threaded programming:** Multithreading fundamentals, Thread class, and Runnable interface, the life cycle of a thread, creation of single and multiple threads, implementation of Thread methods, Synchronization (using Synchronized methods, synchronized statement).

**UNIT IV**

**(10 Hrs)**

**Swings Fundamentals:** Components (JLabel and ImageIcon, using swing Buttons (JButton, JToggleButton, JCheckBox, JRadioButton), JTextField, JScrollPane, JList, JComboBox) and Containers, Layout managers, event delegation Model, event handling (event sources, event listeners, event classes and interfaces, adapter classes).

**JDBC:** JDBC Architecture, JDBC Drivers, Connection, Statement, Prepared Statement, Result set, Connecting to the Database using JDBC.

**Textbook:**

1. Herbert Schildt, "Java 2 -The Complete Reference" – Tata McGraw-Hill Education Private Limited, 2010.
2. Trilochan Tarai, "Java Core Concepts and Applications", I.K. International Publishing House Pvt. Ltd., 2015.

**Reference Books:**

1. E. Balaguruswamy, "Programming with Java: A Primer", McGraw-Hill Education Private Limited, 5<sup>th</sup> edition.
2. Herbert Schildt, Dale Skrien, "Java Fundamentals: A Comprehensive Introduction" – Tata McGraw-Hill Education Private Limited, 2013.
3. Cay S. Horstmann, "Core Java Volume 1 – Fundamentals", 10th edition, Pearson, 2017.
4. Ken Arnold, Davis Holmes, James Gosling, Prakash Goteti, "The Java Programming Language", 3rd edition, Pearson, 2008.

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**DIGITAL LOGIC DESIGN**

**Code: 24CS305**

Max Marks: 70

**Course Objectives:** The objective of the course is to understand the principles of digital electronics and logic circuits, including number systems, Boolean algebra, combinational and sequential circuit design.

**UNIT I** **(8 Hrs)**

Number Systems and Codes: Decimal, Binary, Octal, and Hexa-decimal number systems and their conversions, ASCII code, Excess-3 code, Gray code, Complement representation of negative numbers: Signed Magnitude, One's complement method, Two's complement method, Binary Arithmetic.

**UNIT II** **(8 Hrs)**

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion

**UNIT III** **(8 Hrs)**

Combinational Logic Design: Analysis of combinational circuits, Design Procedure – Binary Adder, Subtractor, BCD Adder, multiplier, comparator, decoders, encoders, multiplexers, demultiplexers, Code Converters.

**UNIT IV** **(8 Hrs)**

Sequential Circuits: Latches: RS latch and JK latch, Flip-flops: RS, JK, D, T flip flops, Master-slave flip flops, Edge-triggered flip-flops. Shift registers, Universal Shift register, ripple counters, synchronous counters, Ring counter, Johnson counter, Up-Down counter.

**UNIT V** **(8 Hrs)**

VLSI Design flow: Design entry, Schematic, HDL, different modelling styles in VHDL, Data types and objects, Dataflow, Behavioural and Structural Modelling, Synthesis and Simulation, VHDL constructs and codes for combinational and sequential circuits.

**Textbook:**

1. M. Morris Mano and Michael D. Ciletti, Digital Design, 4th Edition, Pearson Education, 2013.
2. D.V. Hall, "Digital Circuits and Systems", Tata McGraw-Hill, 1989

**Reference Books:**

1. Anand Kumar, Switching Theory and Logic Design, 2nd Edition, PHI, 2014.
2. Charles Roth, "Digital System Design using VHDL", Tata McGraw-Hill, 2nd edition, 2012.
3. R.P. Jain, "Modern Digital Electronics", Tata McGraw-Hill, 4th edition, 2009

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**LINEAR ALGEBRA**

**Code: 24MT203**

**Max Marks: 70**

**Course Objectives:** The Linear Algebra course equips students to solve systems of linear equations using Gaussian elimination and matrix methods, perform vector operations in Euclidean spaces including dot products, norms, and orthogonality, compute eigenvalues, eigenvectors, and diagonalize applicable matrices, apply linear transformations such as rotations, projections, and reflections, understand core concepts of vector spaces, bases, dimension, and linear independence, and utilize determinants to analyze matrix invertibility and geometric properties.

**UNIT I**

**(10 Hrs)**

Real Matrices, Complex Matrices, Hermitian and skew Hermitian Matrices, Unitary Matrices, Elementary row and column operation, Echelon Matrix.

System of linear equation: LU Decomposition Method

**UNIT II**

**(10 Hrs)**

Matrix of a Linear mapping, Null Space, Range Space, Injectivity and Subjectivity, composition of linear Mapping, Invertible linear maps and Linear operators, Invertible operators.

**UNIT III**

**(10 Hrs)**

Inner product space: Definition and properties of inner product space, orthogonality, Cauchy-Schwarz inequality, Norm and Orthogonal Basis and Gramm-Schmidt orthonormalization.

**UNIT IV**

**(10 Hrs)**

Schur's Theorem, Linear functional, Riesz representation Theorem, Orthogonal complement or dual subspace  
Singular value and singular vectors singular value decomposition.

**Text book and Reference books:**

1. Advanced Engineering Mathematics, E Kreyszig, Wiley-India
2. Higher Algebra, S. K. Mapa, Levant Books.
3. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.

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**ANALOG AND DIGITAL ELECTRONICS**

**Code: 24CS318**

**Max Marks: 70**

**Course Objectives:** The course aims to acquire the basic knowledge of different analog components and their applications, to acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits, and to prepare students to perform the analysis and design of various digital electronic circuits.

**UNIT I**

**(10 Hrs)**

Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators, Astable & Monostable Multivibrators; Schmitt Trigger circuits, 555 Timer.

**UNIT II**

**(10 Hrs)**

Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic expressions by algebraic method.

Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, DeMultiplexer, and Parity Generator

**UNIT III**

**(10 Hrs)**

Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter

Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter

**UNIT IV**

**(10 Hrs)**

A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only [2L]

A/D: successive approximation [2L])

Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)

**Textbook:**

1. Microelectronics Engineering –Sedra & Smith-Oxford.
2. Analog Electronics, A.K. Maini, Khanna Publishing House (AICTE Recommended -2018)
3. Analog Electronics, L.K. Maheswari, Laxmi Publications (AICTE Recommended -2018)
4. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand
5. Digital Electronics – Kharate – Oxford

**Reference books:**

1. Digital Electronics – Logic & Systems by J. Bigmell & R. Donovan; Cambridge Learning.
2. Digital Logic and State Machine Design (3rd Edition) – D. J. Comer, OUP
3. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
4. Bell-Linear IC & OP AMP—Oxford
5. P. Raja- Digital Electronics- Scitech Publications
6. Morris Mano- Digital Logic Design- PHI
7. R. P. Jain—Modern Digital Electronics, 2/e, McGraw-Hill
8. H. Taub & D. Shilling, Digital Integrated Electronics- McGraw-Hill.
9. D. Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
10. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson

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11. J. Bignell & R. Donovan-Digital Electronics-5/e- Cengage Learning.
12. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
13. Floyd & Jain- Digital Fundamentals-Pearson.

**ECONOMICS FOR ENGINEERS**

**Code: 24CM111**

**Max Marks: 70**

**Course Objectives:** The course aims to introduce economic concepts and tools relevant to engineering decisions, including cost analysis, demand-supply, and project evaluation.

**UNIT I**

**(6 Hrs)**

**Economic Decisions Making:** Overview, Problems, Role, Decision Making process.

**Engineering Costs and Estimation:** Fixed, variable, marginal & average costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs, Types of Estimate, Estimating Models- Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits, Case Study- Price and income elasticity of demand in the real world.

**UNIT II**

**(4 Hrs)**

**Cash Flow, Interest and Equivalence:** Cash Flow- Diagrams, Categories and Computation, Time Value of Money, Debt Repayment, Nominal and Effective Interest.

**UNIT III**

**(5 Hrs)**

**Cash Flow & Rate of Return Analysis:** Calculations, Treatment of Salvage value, Annual cash flow analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis, Economic Analysis in the Public Sector- Quantifying and Valuing Benefits & drawbacks.

**UNIT IV**

**(5 Hrs)**

**Inflation and Price Change:** Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs. Commodity Indexes, Use of Price Indexes in Engineering Economic Analysis, Cash Flows that inflate at different Rates.

**UNIT V**

**(5 Hrs)**

**Present Worth Analysis:** End-of-year Convention, Viewpoint of Economic Analysis Studies, Borrowed Money Viewpoint, Effect of Inflation & Deflation, taxes, Economic criteria, applying present worth techniques, multiple alternatives.

**Textbook:**

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa: Economics for Engineers 4e, Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP

**Reference Books:**

1. John A. White, Kenneth E. Case, David B. Pratt, Principles of Engineering Economic Analysis, John Wiley
2. Sullivan and Wicks: Engineering Economy, Pearson
3. R. Paneer Seelvan: Engineering Economics, PHI
4. Michael R. Lindeburg: Engineering Economic Analysis, Professional Pub

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**INTRODUCTION TO POLITICAL SCIENCE**

**Code: 24PS101**

**Max Marks: 70**

**Course Objectives:** The objective of the course is to provide foundational knowledge of political systems, governance structures, ideologies, and the role of citizens in democratic societies.

**UNIT I**

**(5 Hrs)**

**Political Science and Political Theory:** Meaning, Nature and Scope of Political Science; Approaches: Traditional, Philosophical, Historical and Marxist; Modern Approaches: Behaviouralism and Post- Behaviouralism; Relationship of Political Science with History, Economics, and Sociology.

**UNIT II**

**(5 Hrs)**

**State: Origin and Nature:** Definition and Elements of State; Difference between State, Society, and Association; Theories of Origin of State: Historical and Social Contract; Theories of Nature of State: Liberal and Marxist; Sovereignty: Monistic and Pluralistic theory.

**UNIT III**

**(5 Hrs)**

**Key concepts in Political Science:** Equality: Definitions and Dimensions; Liberty: Definitions; Positive and Negative Liberty; Justice: Definitions; Liberal and Marxist; Interrelationship between Liberty and Equality.

**UNIT IV**

**(5 Hrs)**

**Issues in Political Science:** Liberalism: Definition and Features; Nationalism: Definition and Features; Multiculturalism: Definition and Features.

**Text Book:**

1. Alan Ryan, (1993) 'Liberalism' in R. Goodin & P. Petit (eds) A Companion to Contemporary Political Philosophy, Oxford: Blackwell.
2. Anthony Arblaster, (1984) The Rise and Decline of Western Liberalism, Oxford: Blackwell.

**Reference Books:**

1. Arora, N. D. (2006) Theory of State: Plato to Marx, Delhi: K K Publications.
2. Ashok Acharya, (2008) 'Liberalism' in Rajeev Bhargava & Ashok Acharya, (eds.) Political Theory: An Introduction, New Delhi: Pearson Longman.
3. Barker, Ernest (1951) Principles of Social and Political Theory, New York, Oxford University Press.
4. Barrow, Clyde W. (1993), Critical Theories of the State: Marxist, Neo-Marxist, Post Marxist, London: The University of Wisconsin Press.

**ARYAVART INTERNATIONAL UNIVERSITY**  
**Tilthai, Dharmanagar, North Tripura**

**JAVA LAB**

**Code: 24CS491**

**Max Marks: 70**

**(BASED ON 24CS401) Java Programming**

**Core Practical (Implement minimum 10 out of 15 practical)**

1. Write a program declaring a class Rectangle with data member's length and breadth and member functions Input, Output and Calc Area.
2. Write a program to demonstrate use of method overloading to calculate area of square, rectangle and triangle.
3. Write a program to demonstrate the use of static variable, static method and static block.
4. Write a program to demonstrate concept of ``this``.
5. Write a program to demonstrate multi-level and hierarchical inheritance.
6. Write a program to use super() to invoke base class constructor.
7. Write a program to demonstrate run-time polymorphism.
8. Write a program to demonstrate the concept of aggregation.
9. Write a program to demonstrate the concept of abstract class with constructor and ``final`` method.
10. Write a program to demonstrate the concept of interface when two interfaces have unique methods and same data members.
11. Write a program to demonstrate checked exception during file handling.
12. Write a program to demonstrate unchecked exception.
13. Write a program to demonstrate creation of multiple child threads.
14. Write a program to use Byte stream class to read from a text file and display the content on the output screen.
15. Write a program to demonstrate any event handling.

**Application Based Practical (Implement minimum 5 out of 10 practical)**

1. Create a class employee which have name, age and address of employee, include functions getdata() and showdata(), getdata() takes the input from the user, showdata() display the data in following format:  
*Name:*  
*Age:*  
*Address:*
2. Write a Java program to perform basic Calculator operations. Make a menu driven program to select operation to perform (+ - \* /). Take 2 integers and perform operation as chosen by user.
3. Write a program to make use of Buffered Stream to read lines from the keyboard until 'STOP' is typed.
4. Write a program declaring a Java class called Savings Account with members ``account Number`` and ``Balance``. Provide member functions as ``deposit Amount ()`` and ``withdraw Amount ()``. If user tries to withdraw an amount greater than their balance then throw a user-defined exception.
5. Write a program creating 2 threads using Runnable interface. Print your name in ``run ()`` method of first class and "Hello Java" in ``run ()`` method of second thread.
6. Write program that uses swings to display combination of RGB using 3 scrollbars.
7. Write a swing application that uses at least 5 swing controls.
8. Write a program to implement border layout using Swing.
9. Write a java program to insert and update details data in the database.
10. Write a java program to retrieve data from database and display it on GUI.

**Note:**

1. **In total 15 practical to be implemented. 2 additional practical may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirement of the course.**

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**DIGITAL LOGIC DESIGN LAB**

**Code: 24CS395**

**Max Marks: 70**

**(BASED ON 24CS2305) Digital Logic Design:**

**LIST OF EXPERIMENTS (Hardware)**

1. Realization of Boolean Expressions using Gates.
2. Design and realization of logic gates using universal gates.
3. Design and realization of a 4 – bit Gray to Binary and Binary to Gray Converter.
4. Verify the functionality of Mux and De-Mux ICs.
5. Verify the functionality of Encoder and Decoder ICs.
6. Design and realization of 4-bit comparator.
7. Verify the functionality of D & T Flip-Flop ICs.
8. Verify the functionality of S-R & J-K Flip-Flop ICs.
9. Mod-N counter using 7490 and 74190.
10. Shifts register IC 7495.

**LIST OF EXPERIMENTS (Hardware)**

VHDL Programming:

1. Write structural and dataflow VHDL models for
  - a. Half adder / Half subtractor
  - b. Full adder / Full subtractor
2. Write a VHDL program in structural model for
  - a. 16:1 mux realization
  - b. 3:8 decoder realization through 2:4 decoder
3. Write a VHDL program in behavioural model for
  - a. 3:8 decoder
  - b. 8:3 encoder
4. Write a VHDL program in structural and behavioural models for 8 bit asynchronous up-down counter
5. Write a VHDL program in structural model for 8-bit Universal Shift Register

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**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each (1x10 = 10)  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks

**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks

ARYAVART INTERNATIONAL UNIVERSITY

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Syllabus for B Tech (CSE-AIML)

Semester 4

<b>Theory</b>										
<b>Course Code</b>	<b>Topic</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	<b>Theory Marks</b>	<b>Internal Marks</b>	<b>Practical Marks</b>	<b>Total Marks</b>	
24MT106	Probability and Statistics	4	0	0	4	70	30	0	100	
24CS304	Design Analysis and Algorithm	4	0	0	4	70	30	0	100	
24CS202	Database Management System	4	0	0	4	70	30	0	100	
24GN101	Environmental Studies	2	0	0	2	70	30	0	100	
<b>Discipline Specific Elective (DSE-2) (Choose any one)</b>										
24MT414	Optimization Technique	3	1	0	4	70	30	0	100	
24CS402	Software Engineering	3	1	0	4	70	30	0	100	
<b>Practical</b>										
24CS493	Design Analysis and Algorithm Lab	0	0	2	2	0	30	70	100	
24CS292	Database Management System Lab	0	0	2	2	0	30	70	100	
<b>Total</b>					<b>22</b>	<b>420</b>	<b>210</b>	<b>70</b>	<b>700</b>	

**Detailed Syllabus**

**PROBABILITY AND STATISTICS**

**Code: 24MT106**

Max. Marks: 70

**Course Objectives:** The course "Probability and Statistics" is designed to provide students with a strong foundation in both probability theory and statistical methods. The course covers key topics such as probability distributions, random variables, statistical inference, hypothesis testing, correlation, regression analysis, and sampling methods. Students will learn how to apply probability concepts to model uncertainty and how to use statistical techniques to analyze and interpret data. Emphasis is placed on understanding concepts like mean, variance, standard deviation, and confidence intervals, as well as mastering the use of statistical tools for data-driven decision-making.

**UNIT I**

**(06 Hrs)**

Algebra of Sets: sets and classes, limit of a sequence of sets, rings, sigma-rings, fields, sigma-fields, monotone classes. Probability: Classical, relative frequency, and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems.

**UNIT II**

**(12 Hrs)**

Random Variables: Discrete, continuous, and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality, problems.

Special Distributions: Discrete uniform, binomial, geometric, negative binomial, hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, Pareto, beta, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability and hazard rate, reliability of series and parallel systems, problems.

The function of a random variable, problems.

**UNIT III**

**(10 Hrs)**

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution, and problems.

Transformations: functions of random vectors, distributions of order statistics, distributions of sums of random variables, problems.

Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems.

**UNIT IV**

**(12 Hrs)**

Descriptive Statistics: Graphical representation, measures of locations and variability.

Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions, problems.

Testing of Hypotheses: Null and alternative hypotheses, the critical and 8 acceptance regions, two types of error, power of the test, the most powerful test and Nyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications, problems.

**TEXTBOOKS:**

1. "An Introduction to Probability and Statistics" by V.K. Rohatgi & A.K. Md.E.Saleh.
2. "Introduction to Probability and Statistics" by J.S. Milton & J. C. Arnold.
3. "Introduction to Probability Theory and Statistical Inference" by H. J. Larson.

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**REFERENCE BOOKS:**

1. "Introduction to Probability and Statistics for Engineers and Scientists" by S.M. Ross.
  2. "A First Course in Probability" by S.M. Ross.
- "Probability and Statistics in Engineering" by W.W. Hines, D.C. Montgomery, D.M. Gpldsman & C. M.

**DESIGN AND ANALYSIS OF ALGORITHMS**

**Code: 24CS304**

Max Marks: 70

**Course Objectives:** The objective of the course is to design efficient algorithms, analyze their time and space complexity, and understand algorithmic strategies such as divide and conquer, greedy, dynamic programming, and backtracking.

**UNIT I: Introduction**

**(08 Hrs)**

Algorithm - Pseudo Code for Expressing Algorithms - Performance Analysis- Space Complexity - Time Complexity- Asymptotic Notation - Big Oh Notation - Omega Notation - Theta Notation and Little Oh Notation. - Recurrences - Substitution method, Recursion-tree method, Master method.

**UNIT II: Disjoint Sets, Divide and Conquer**

**(08 Hrs)**

Disjoint Sets: Disjoint Set Operations - Union and Find Algorithms.  
Divide and Conquer: General Method - Applications-Binary Search – Quick Sort - Merge Sort-Strassen's Matrix Multiplication.

**UNIT III: Dynamic Programming**

**(08 Hrs)**

General Method –Applications-Matrix Chain Multiplication - Optimal Binary Search Trees - 0/1 Knapsack Problem - All Pairs Shortest Path Problem - Travelling Sales Person Problem – Reliability Design Problem.

**UNIT IV: Greedy Method and Backtracking**

**(08 Hrs)**

Greedy Method: General Method –Applications- Job Sequencing with Deadlines - Knapsack Problem - Minimum Cost Spanning Trees - Single Source Shortest Path Problem - Backtracking:  
General Method – Applications-N-Queens Problem - Sum of Subsets Problem - Graph Colouring - Hamiltonian Cycles.

**UNIT V: Branch and Bound, Np-Hard and Np-Complete Problems**

**(08 Hrs)**

Branch and Bound: General Method - Applications - Travelling Sales Person Problem - 0/1 Knapsack Problem- LC Branch and Bound Solution - FIFO Branch and Bound Solution.  
NP Hard and NP-Complete Problems: Basic Concepts - Non-deterministic algorithms - NP – Hard and NP Complete Classes - Cook's Theorem.

**Textbook:**

1. Ellis Horowitz, Satraj Sahni, Sanguthevar Rajasekharan, "Fundamentals of Computer Algorithms", Universities Press, 2nd Edition, 2015.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D, "The Design And Analysis Of Computer Algorithms", Pearson India, 1st Edition, 2013.

**Reference Books:**

1. Knuth Donald E, "Art of Computer Programming: Fundamental Algorithms Volume 1 - Fundamental Algorithms", Third Edition, Pearson Publishers, 2011.
2. Levitin A, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, 2012.
3. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.
4. Jon Kleinberg, Éva Tardos , Algorithm Design, Pearson education, 2014.

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**DATABASE MANAGEMENT SYSTEM**

**Code: 24CS202**

Max Marks: 70

**Course Objectives:** The objective of the course is to learn database design, modeling, SQL, and transaction management for efficient storage, retrieval, and manipulation of data.

**UNIT I**

**(10 Hrs)**

**Introduction:** An overview of database management systems, Characteristics of database approach, DBMS architecture, client/server, data Models, Introduction to Distributed Data processing, schema and instances, data independence.

**Data Modelling using Entity Relationship Model:** Basic introduction about the terminologies like Entity, Entity types, entity set, notation for ER diagram, attributes and keys, Types of attributes (composite, derived and multi-valued attributes) and keys (Super Key, candidate key, primary key), relationships, relation types, weak entities, enhanced E-R, specialization and generalization.

**UNIT II**

**(12 Hrs)**

**Introduction to SQL:** Overview, Characteristics of SQL. Advantages of SQL, SQL data types and literals.

**Types of SQL commands:** DDL, DML, DCL. Basic SQL Queries.

**Logical operators:** BETWEEN, IN, AND, OR, and NOT.

**Null Values:** Disallowing Null Values, Comparisons Using Null Values.

**Integrity constraints:** Primary Key, Not NULL, Unique, Check, Referential key.

Introduction to Nested Queries, Correlated Nested Queries, Set-Comparison Operators, Aggregate Operators: The GROUP BY and HAVING Clauses.

**Joins:** Inner joins, Outer Joins, Left outer, Right outer, full outer joins.

**Overview of other SQL Objects:** Views, Sequences, Indexes, Triggers, and stored procedures.

**UNIT III**

**(10 Hrs)**

**Relational Data Models:** Relational model terminology domains, Attributes, Tuples, Relations, characteristics of relations, relational constraints, domain constraints, key constraints, and constraints on null, relational DB schema. Codd's Rules.

**Relational algebra:** Basic operations, selection, and projection.

**Set Theoretic operations:** Union, Intersection, set difference, and division (Order, Relational calculus: Domain, Tuple, Well Formed Formula, specification, quantifiers).

**Join operations:** Inner, Outer, Left outer, Right outer, and full outer join.

**ER to relational mapping:** Steps to map the ER diagram to the relational schema.

**Data Normalization:** Functional dependencies, Armstrong's inference rule, & Normalization (Up to BCNF).

**UNIT IV**

**(8 Hrs)**

**Transaction Processing:** Definition of Transaction, Desirable ACID properties.

**Database recovery and Database Security:** System failure, Backup & recovery Techniques, Authentication, Authorization.

Overview of Query by Language, NoSQL databases.

**Textbook:**

1. R. Elmars and SB Navathe, "Fundamentals of Database Systems", Pearson, 5th Ed.
2. Singh S.K., "Database System Concepts, design and application", Pearson Education [TB3] TB3.
3. Ramakrishnan and Gherke, "Database Management Systems", TMH.
4. Bipin Desai, "An Introduction to Database Systems", Galgotia Publications, 1991.

**Reference Books:**

1. Abraham Silberschatz, Henry Korth, S. Sudarshan, "Database Systems Concepts", 6th Edition, McGraw-Hill, 2010.
2. Jim Melton, Alan Simon, "Understanding the new SQL: A complete Guide", Morgan Kaufmann Publishers, 1993.
3. A. K. Majumdar, P. Battacharya, "Database Management Systems, TMH, 2017.

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**ENVIRONMENTAL STUDIES**

**Code: 24GN101**

Max Marks: 70

**Course Objectives:** The objective of the course is to Understand the Fundamentals of the Environment, Create Awareness of Environmental Issues, Promote Sustainable Development, Understand the Importance of Natural Resource Management, Learn about Biodiversity and its Conservation, Examine Environmental Legislation and Policies, Explore the Human-Environment Relationship, Encourage Environmental Ethics and Responsibility, Develop Skills for Environmental Problem-Solving and Promote Community Engagement and Environmental Action.

**UNIT I**

**(5 Hrs)**

**Introduction to Environmental Studies:**

- Environmental studies: Nature, Scope and Importance; Components of environment: atmosphere, hydrosphere, lithosphere, and biosphere; Concept of sustainability and sustainable development.
- Emergence of environmental issues: Climate change, Global warming, Ozone layer depletion, Acid rain, etc.; International agreements and programmes: Earth Summit, UNFCCC, Montreal and Kyoto protocols, Convention on Biological Diversity (CBD), Ramsar Convention, UNEP, CITES, etc.

**UNIT II**

**(5 Hrs)**

**Ecosystems and Natural Resources:**

- Definition and concept of Ecosystem; Structure of ecosystem (biotic and abiotic components); Functions of Ecosystem: Physical (energy flow), Biological (food chains, food web, ecological succession), ecological pyramids and homeostasis; Types of Ecosystems: Tundra, Forest, Grassland, Desert, Aquatic (ponds, streams, lakes, rivers, oceans, estuaries); importance and threats with relevant examples from India.
- Ecosystem services (Provisioning, Regulating, Cultural, and Supporting); Ecosystem preservation and conservation strategies; Basics of Ecosystem restoration.
- Energy resources: Renewable and non-renewable energy sources; Use of alternate energy sources; Growing energy needs; Energy contents of coal, petroleum, natural gas, and bio gas; Agro-residues as a biomass energy source.

**UNIT III**

**(5 Hrs)**

**Biodiversity and Conservation**

- Definition of Biodiversity; Levels of biological diversity: genetic, species, and ecosystem diversity.
- India as a mega-biodiversity nation; Biogeographic zones of India; Biodiversity hotspots; Endemic and endangered species of India; IUCN Red List criteria and categories.
- Value of biodiversity: Ecological, economic, social, ethical, aesthetic, and informational values of biodiversity with examples.
- Threats to biodiversity: Habitat loss, degradation, and fragmentation; Poaching of wildlife; Man-wildlife conflicts; Biological invasion with emphasis on Indian biodiversity; Current mass extinction crisis.
- Biodiversity conservation strategies: in-situ and ex-situ methods of conservation (National Parks, Wildlife Sanctuaries, and Biosphere reserves).

**UNIT IV**

**(5 Hrs)**

**Environmental Pollution and Control Measures:**

- Environmental pollution (Air, water, soil, thermal, and noise): causes, effects, and controls; Primary and secondary air pollutants; Air and water quality standards.
- Nuclear hazards and human health risks.
- Solid waste management: Control measures for various types of urban, industrial waste, Hazardous waste, E-waste, etc.; Waste segregation and disposal.

**TEXT BOOK:**

1. Sanjay Kumar Batra, Kanchan Batra, Harpreet Kaur; Environmental Studies; Taxmann's, Fifth Edition.
2. M.M. Sulphery; Introduction to Environment Management; PHI Learning, 2019
3. S.P. Mishra, S.N. Pandey; Essential Environmental Studies; Ane Books Pvt. Ltd.; Sixth Edition.

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**REFERENCE BOOKS:**

1. Asthana, D. K. (2006). Textbook of Environmental Studies. S. Chand Publishing.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Bharucha, E. (2013). Textbook of Environmental Studies for Undergraduate Courses. Universities Press.
4. Mahapatra, R., Jeevan, S.S., Das, S. (Eds) (2017). Environment Reader for Universities, Centre for Science and Environment, New Delhi.
5. Masters, G. M. & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
6. Odum, E. P., Odum, H. T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.
7. Sharma, P. D. & Sharma, P. D. (2005). Ecology and Environment. Rastogi Publications.

**OPTIMIZATION TECHNIQUE**

**Code: 24MT414**

Max Marks: 70

**Course Objectives:** The course aims to enable students to use MATLAB to implement important optimization methods, learn efficient computational procedures to solve optimization problems, and cast engineering minima/maxima problems into an optimization framework.

**UNIT I**

**(10 Hrs)**

Introduction: Historical Development, Engineering applications of optimization, Statement of an optimization problem, Classification of optimization problems

Classical Optimization Techniques: Single variable optimization, Constrained and unconstrained multivariable optimization, Relevant applications

**UNIT II**

**(10 Hrs)**

Linear Programming: Standard form of a linear programming problem, Simplex method, Duality in linear programming, Quadratic programming, Stochastic linear programming, Relevant applications

Nonlinear Programming: Unimodal function, Interpolation methods, Direct and indirect methods, Relevant applications

**UNIT III**

**(10 Hrs)**

Geometric Programming: Unconstrained and constrained geometric programming problems, Geometric programming with mixed inequality

Integer Programming: Integer linear programming, Integer nonlinear programming, Relevant applications

**UNIT IV**

**(10 Hrs)**

Game Theory: Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy.

Dominance theory

Genetic Algorithms: Introduction, Representation methods, Selection methods, Operators, Replacement methods, Relevant applications.

**Textbooks and Reference Books:**

1. Rao, S. S., & Rao, S. S., Engineering optimization: theory and practice. John Wiley & Sons.
2. Hadley, G., Linear programming, Narosa Publishing house.
3. Taha, H. A., Operations research: An introduction. Pearson Education India.
4. Deb, K., Optimization for engineering design: Algorithms and examples. PHI Learning Pvt. Ltd.
5. Kumar, D. N., Multicriterion analysis in engineering and management. PHI Learning Pvt. Ltd.

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**SOFTWARE ENGINEERING**

**Code: 24CS402**

Max Marks: 70

**Course Objectives:** The objective of the course is to understand software development life cycles, methodologies, project management, and quality assurance for building reliable and scalable software systems.

**UNIT I** **(10 Hrs)**

**Introduction of software engineering:** Software Crisis, Software life cycle models, Waterfall, Prototype, Spiral – Models, Agile model.

**Software Requirements analysis & specifications:** Requirement engineering, requirement elicitation techniques like FAST, QFD, Requirement analysis using (DFD use-case, sequence and class diagram (with case studies), ER Diagrams, Requirements documentation: SRS, Characteristics & organization of SRS.

**UNIT II** **(10 Hrs)**

**Software Project Planning:** Software Metrics-Definition and Need, Types of Metrics-Product, Process and Project Metrics, Size Estimation like lines of Code & Function Count, Halstead Software Science measure, Cost Estimation: Need, Models COCOMO: Basic model, Intermediate model.

**Risk Management:** Software Risks, Types of risk, risk management activities: risk assessment, risk control.

**UNIT III** **(10 Hrs)**

**Software Design:** Cohesion & Coupling, Classification of Cohesiveness & Coupling.

**Quality management:** Quality concept, software quality assurance, Total Quality Management (TQM), software review, software inspection.

**Software Implementation:** Structured coding techniques, coding style, Standards and guidelines, documentation guidelines. Reverse Engineering, Software Re-engineering, Configuration Management.

**UNIT IV** **(10 Hrs)**

**Software Testing:** Testing Process, Levels of Testing: Unit testing, Integration testing and system testing. Types of Testing: Manual testing, Automation Testing. Methods of Testing- , Black box, White box and Grey Box Testing. Validation, Verification, Alpha-Beta testing, Acceptance testing, Functional Testing and its types, Structural Testing Difference between: Testing and Debugging.

**Software Maintenance:** Management of Maintenance, The Maintenance Process and Types of maintenance: Preventive, Perceptive, Adaptive and Corrective Maintenance. Maintenance tools and techniques.

**Textbook:**

1. K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2nd Ed., New Age International, 2005.
2. I. Sommerville, "Software Engineering", 9th Edition, Pearson Edu

**Reference Books:**

1. Jibitesh Mishra and Ashok Mohanty, "Software Engineering", Pearson
2. R. S. Pressman, "Software Engineering – A practitioner's approach", 5th Ed., McGraw Hill Int. Ed., 2001.
3. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**DESIGN AND ANALYSIS OF ALGORITHMS**

**Code: 24CS493**

**Max. Marks: 70**

**(Based on 24CS304: Design and Analysis of Algorithm)**

**The following are two suggestive databases. The students may use either or both databases for their core practical. However, the instructor may provide any other databases for executing these practical.**

**List of Experiments:**

**Divide and Conquer:**

1. Implement Binary Search using the Divide and Conquer approach. Implement Merge Sort using the Divide and Conquer approach
2. Implement Quick Sort using the Divide and Conquer approach  
Find the maximum and Minimum element from an array of integers using the Divide and Conquer approach
3. Find the minimum number of scalar multiplications needed for a chain of matrices
4. Implement all pairs of Shortest path for a graph (Floyd-Warshall Algorithm)  
Implement Traveling Salesman Problem
5. Implement Single Source Shortest Path for a graph (Dijkstra, Bellman-Ford Algorithm)

**Brunch and Bound:**

1. Implement 15 Puzzle Problem

**Backtracking:**

1. Implement 8 Queen problem
2. Graph Coloring Problem Hamiltonian Problem

**Greedy method**

1. Knapsack Problem  
Job sequencing with deadlines
2. Minimum Cost Spanning Tree by Prim's Algorithm  
Minimum Cost Spanning Tree by Kruskal's Algorithm

**Graph Traversal Algorithm:**

1. Implement Breadth First Search (BFS)  
Implement Depth First Search (DFS)

**Note:**

1. **In total, 10 practical to be implemented. 2 additional practicals may be given by the course instructor.**
2. **This is a suggestive list of programs. However, the instructor may add programs as per the requirements of the course.**

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**DATABASE MANAGEMENT SYSTEM LAB**

**Code: 24CS292**

**Max. Marks: 70**

(BASED ON 24CS202) Database Management System:

**Core Practical (Implement all the mentioned practical)**

**The following are two suggestive databases. The students may use either or both databases for their core practical. However, the instructor may provide any other databases for executing these practical.**

**1. COLLEGE DATABASE:**

STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID)

SUBJECT (Subcode, Title, Sem, Credits)

IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

**2. COMPANY DATABASE:**

EMPLOYEE (SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION (DNo, DLoc)

PROJECT (PNo, PName, PLocation, DNo) WORKS\_ON (SSN, PNo, Hours)

1. Draw an E-R diagram from the given entities and their attributes.
2. Convert the E-R diagram into a Relational model with proper constraints.
3. Write queries to execute the following DDL commands:  
CREATE: Create the structure of a table with at least five columns ALTER: Change the size of a particular column.  
Add a new column to the existing table. Remove a column from the table.  
DROP: Destroy the table along with its data.
4. Write queries to execute the following DML commands: INSERT: Insert five records in each table. UPDATE: Modify data in single and multiple columns in a table. DELETE: Delete selective and all records from a table
5. Write queries to execute following DML command: SELECT: Retrieve the entire contents of the table. Retrieve the selective contents (based on provided conditions) from a table. Retrieve contents from a table based on various operators i.e. string operators, logical operators and conditional operators, Boolean operators.  
Sort the data in ascending and descending order in a table on the basis of one column or more than one column.
6. Create table using following integrity constraints:
  - Primary Key
  - Unique Key
  - Not Null
  - Check Default
  - Foreign Key
7. Write queries to execute following Aggregate functions Sum, Avg, Count, Minimum and Maximum value of a numeric column of a table using aggregate function
8. Retrieve data from a table using alias names.
9. Retrieve data of a table using nested queries.
10. Retrieve data from more than one table using inner join, left outer, right outer and full outer Joins
11. Create view from one table and more than one table.
12. Create index on a column of a table.

**Application Based Practical:**

1. Consider the Insurance Company's Database given below. The primary keys are underlined and the data types are specified.
  - a. PERSON(driver\_id# : string, name : string, address : string)
  - b. CAR(regno : string, model : string, year : int)
  - c. ACCIDENT(report\_number:int,acc\_date:date,location:string)
  - d. OWNS(driver\_id# : string, regno : string)
  - e. PARTICIPATED(driver\_id#: string, regno: string, report\_number: int, damage\_amount: number(10,2) )
2. Create the above tables by properly specified the primary key and the foreign key.
3. Enter at least five tuples for each relation.
4. Demonstrate how you can:
  - a. Update the damage amount for the car with a specific reg. no, the accident with report

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- number 12 to 25000.
- b. Add a new accident to the database.
  5. Find the total number of people who owned cars that were involved in accident in 2002.
  6. Find the number of accident in which cars belonging to a specific model were involved.
  7. Consider the following schema of a library management system. Write the SQL queries for the questions given below:
    - a. Student(Stud\_no : integer, Stud\_name: string)
    - b. Membership(Mem\_no: integer, Stud\_no: integer)
    - c. Book\_(book\_no: integer, book\_name:string, author: string)
    - d. Iss\_rec\_(iss\_no:integer, iss\_date: date, Mem\_no: integer, book\_no: integer)
  8. Create the tables with the appropriate integrity constraints.
  9. Insert around 10 records in each of the tables.
  10. Display all records for all tables.
  11. List all the student names with their membership numbers.
  12. List all the issues for the current date with student and Book names.
  13. List the details of students who borrowed book whose author is Elmars & Navathe.
  14. Give account of how many books have been bought by each student.
  15. Give a list of books taken by student with stud\_no as 1005.
  16. Delete the List of books details which are issued as of today.
  17. Create a view which lists out the iss\_no, iss\_date, stud\_name, book name.
  18. Use the relations below to write SQL queries to solve the business problems specified.
    - a. CLIENT (clientno#, name, client\_referred\_by#)
    - b. ORDER(orderno#, clientno#, order\_date, empid#)
    - c. ORDER\_LINE(orderno#,orderlinenumber#,item\_number#,no\_of\_items,item\_ cost, shipping\_date)
    - d. ITEM(item\_number#, item\_type, cost)
    - e. EMPLOYEE(empid#, emp\_type#, deptno, salary, firstname, lastname)
    - f. Notes:
  19. Column followed by # is the primary key of the table.
  20. Each client may be referred by another client. If so, the client number of the referring client is stored in referred\_by.
  21. The total cost for a particular order line= no\_of\_items\*item\_cost.c.
  22. Write queries for the following
    - a. Create all the above tables.
    - b. Insert at least five records.
    - c. Display all the rows and columns in the CLIENT table. Sort by client name in reverse alphabetical order.
    - d. Display the item number and total cost for each order line (total cost= no. of items X item cost). Name the calculated column TOTAL COST.
    - e. Display all the client numbers in the ORDER table. Remove duplicates.
    - f. Display the order number and client number from the ORDER table. Out put the result in the format. Client <clientno> ordered <orderno>
    - g. Display full details from the ORDER\_LINE table where the item number is (first condition) between 1 and 200 (no > or < operators) OR the item number is greater than 1000 AND (second condition) the item cost is not in the list 1000, 2000, 3000 OR the order number is not equal to 1000.
    - h. Display the client name and order date for all orders.
    - i. Repeat query (6) but also display all clients who have never ordered anything.
    - j. Display the client name and order date for all orders using the join keywords.
    - k. Display the client name and order date for all orders using the JOIN method.
    - l. Display the client number, order date and shipping date for all orders where the shipping date is between three and six months after the order date.
    - m. Display the client number and name and the client number and name of the person who referred that client.
    - n. Display the client name in uppercase only and in lowercase only.
    - o. Display the second to fifth characters in each client name.

**Note:**

3. In total, 15 practical to be implemented. 2 additional practicals may be given by the course instructor.
4. This is a suggestive list of programs. However, the instructor may add programs as per the requirements of the course.

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**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each ( $1 \times 10 = 10$ )  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each ( $2 \times 6 = 12$ )  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each ( $3 \times 6 = 18$ )  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each ( $5 \times 6 = 30$ )

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks  
**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks

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**Syllabus for B Tech (AIML)**

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**Semester 5**

<b>Theory</b>										
<b>Course Code</b>	<b>Topic</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	<b>Theory Marks</b>	<b>Internal Marks</b>	<b>Practical Marks</b>	<b>Total Marks</b>	
24CS412	Introduction to Artificial Intelligence	3	1	0	4	70	30	0	100	
24CS509	Introduction to Machine Learning	4	0	0	4	70	30	0	100	
24CS503	Operating System	4	0	0	4	70	30	0	100	
<b>Discipline Specific Elective (DSE-3) (Choose any one)</b>										
24CS303	Computer Networks	3	1	0	4	70	30	0	100	
24CS502	Cloud Computing	3	1	0	4	70	30	0	100	
<b>General Elective (GE-2) (Choose any one)</b>										
24MG515	Introduction to Industrial Management	2	0	0	2	70	30	0	100	
24MG211	Management for Engineers	2	0	0	2	70	30	0	100	
<b>Practical</b>										
24CS594	AIML Lab	0	0	2	2	0	30	70	100	
24CS591	Linux-OS Lab	0	0	2	2	0	30	70	100	
<b>Total</b>					<b>22</b>	<b>350</b>	<b>210</b>	<b>140</b>	<b>700</b>	

**Detailed Syllabus**

**INTRODUCTION TO ARTIFICIAL INTELLIGENCE**

**Code: 24CS412**

**Max Marks: 70**

**Course Objective:** The objective of the course is to introduce core AI concepts such as problem-solving, knowledge representation, machine learning, and intelligent agent design.

**UNIT I**

**(10 Hrs)**

**Overview of AI:** Introduction to AI, Importance of AI, AI and its related field, AI techniques, Criteria for success. Problems, problem space and search: Defining the problem as a state space search, Production Systems and its characteristics, Issues in the design of the search programs.

**Heuristic search techniques:** Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction.

**UNIT II**

**(10 Hrs)**

**Knowledge Representation:** Definition and importance of knowledge, Knowledge representation, various approaches used in knowledge representation, Issues in knowledge representation.

**Logical Reasoning:** Logical agents, propositional logic, inferences, Syntax and semantics of First Order Logic, Inference in First Order Logic Knowledge Base, forward chaining, backward chaining, unification, resolution, Expert system: Case study of Expert system in PROLOG.

**UNIT III**

**(10 Hrs)**

**Handling Uncertainty:** Non-Monotonic Reasoning, Probabilistic reasoning, Bayes 'Theorem, Certainty factors and Rule-based Systems, Bayesian Networks, Dempster-Shafer Theory, Introduction to Fuzzy logic. Fuzzy set definition & types. Membership functions. Designing a fuzzy set for a given application.

**Natural Language Processing:** Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

**UNIT IV**

**(10 Hrs)**

**Learning:** Introduction to Learning, Rote Learning, learning by taking advice, learning in problem solving, learning from examples: Induction, Explanation-based Learning, Discovery, Analogy, Neural Networks, and Genetic Learning.

**Textbook:**

1. Rich and Knight, "Artificial Intelligence", Tata McGraw Hill, 1992.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Second Edition (Indian Reprint: Pearson Education).

**Reference Books:**

1. Ivan Bratko, "Prolog Programming for AI", Addison Wesley.
2. George F. Luger, "Artificial Intelligence" Pearson Education.
3. Ben Coppin, "Artificial Intelligence Illuminated" Jones and Bartlett Publisher.

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**INTRODUCTION TO MACHINE LEARNING**

**Code: 24CS509**

**Max Marks: 70**

**Course Objectives:** The objective of the course is to enable students to comprehend the concept of supervised and unsupervised learning techniques, to differentiate regression, classification, and clustering techniques, to implement their algorithms, to analyze the performance of various machine learning techniques, and to select appropriate features for training machine learning algorithms.

**UNIT I: (10 Hrs)**

**Introduction to Machine Learning**

Introduction to Machine Learning (ML); Feature engineering; Learning Paradigm, Generalization of hypothesis, VC Dimension, PAC learning, Applications of ML.

**Data Handling and ANN**

Feature selection Mechanisms, Imbalanced data, Outlier detection- Artificial neural networks, including backpropagation- Applications

**UNIT II (10 Hrs)**

**ML Models and Evaluation**

Regression: Multi-variable regression; Model evaluation; Least squares regression; Regularization; LASSO; Applications of regression, Classification – KNN, Naïve Bayes, SVM, Decision Tree; Training and testing classifier models; Cross-validation; Model evaluation (precision, recall, F1-measure, accuracy, area under curve); Statistical decision theory, including discriminant functions and decision surfaces

**Model Assessment and Inference**

Model assessment and Selection – Ensemble Learning – Boosting, Bagging, Model Inference and Averaging, Bayesian Theory, EM Algorithm

**UNIT III (10 Hrs)**

**Hidden Markov Models**

Hidden Markov Models (HMM) with forward-backward and Viterbi algorithms; Sequence classification using HMM; Conditional random fields; Applications of sequence classification, such as part-of-speech tagging

**Association Rules**

Mining Association Rules in Large Databases. Mining Frequent Patterns-- basic concepts - Efficient and scalable frequent item set mining -methods, Apriori algorithm, FP-Growth algorithm

**UNIT IV (10 Hrs)**

**Clustering**

K-Means, Hierarchical Clustering – Single, complete, Average linkage; Ward’s algorithm; Minimum spanning tree clustering; BIRCH clustering

**Recent Trends**

Recent Trends and Case Study

**Text Books:**

1. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.
2. Friedman Jerome, Trevor Hastie, and Robert Tibshirani. The Elements of Statistical Learning. Springer-Verlag, 2nd Edition, 2013.
3. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing.

**Reference Books**

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
1. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, Cambridge University Press, 2012.
2. Rajiv Chopra, Machine Learning, Khanna Book Publishing.

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**OPERATING SYSTEMS**

**Code: 24CS503**

**Max Marks: 70**

**Course Objectives:** The objective of the course is to understand the design and functioning of operating systems, including process management, memory management, file systems, and scheduling.

**UNIT I (8 Hrs)**

**Introduction to OS:** Functionality of OS - OS design issues - Structuring methods (monolithic, layered, modular, micro-kernel models) - Abstractions, processes.

**OS Principles:** System calls, System/Application Call Interface – Protection: User/Kernel modes – Interrupts.

**UNIT II (10 Hrs)**

**Scheduling:** Processes Scheduling - CPU Scheduling: Pre-emptive, non-pre-emptive – Multiprocessor scheduling – Deadlocks - Resource allocation and management - Deadlock handling mechanisms: prevention, avoidance, detection, recovery.

**Concurrency:** Inter-process communication, Synchronization - Implementing synchronization primitives (Peterson's solution, Bakery algorithm, synchronization hardware) - Semaphores – Classical synchronization problems, Monitors: Solution to Dining Philosophers problem.

**UNIT III (8 Hrs)**

**Memory Management:** Main memory management, Memory allocation strategies, Virtual memory: Hardware support for virtual memory (caching, TLB) – Paging - Segmentation - Demand Paging - Page Faults – Page Replacement –Thrashing.

**UNIT IV (8 Hrs)**

**Storage Management, Protection and Security:** Disk structure and attachment – Disk scheduling algorithms (seek time, rotational latency based)-System threats and security – Policy vs mechanism - Access vs authentication.

**UNIT V (6 Hrs)**

**System protection:** Access matrix – Capability-based systems - OS: performance, scaling, future directions in mobile OS, Recent Trends.

**Textbook:**

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley(2018).
2. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

**Reference Books:**

1. Ramez Elmasri, A.Gil Carrick, David Levine, Operating Systems, A Spiral Approach-McGraw Hill Higher Education (2010).
2. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces, Arpaci- Dusseau Books, Inc (2015).
3. Andrew S. Tanenbaum, Modern Operating Systems, Pearson, 4th Edition (2016).
4. William Stallings, Operating Systems: Internals and Design Principles, Pearson, 9th Edition (2018).

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**COMPUTER NETWORKS**

**Code: 24CS303**

**Max Marks: 70**

**Course Objective:** The objective of the course is to understand the principles, protocols, and architecture of computer networks, including data transmission, routing, and network security.

**UNIT I** **(10 Hrs)**

**Basic Concepts:** Components of data communication, distributed processing, Line configuration, topology, transmission mode, and categories of networks.

**OSI and TCP/IP Models:** Layers and their functions, comparison of models.

**Transmission Media:** Guided and unguided, Attenuation, distortion, noise, throughput, propagation speed and time, wavelength, Shannon Capacity.

**UNIT II** **(10 Hrs)**

**Telephony:** Multiplexing, WDM, TDM, FDM, circuit switching, packet switching and message switching.

**Data Link Layer:** Types of errors, Framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back- NARQ, Selective repeat ARQ.

**UNIT III** **(10 Hrs)**

**Network Layer:** Internetworking & Devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway, Modems.

**Addressing:** IPv4 and IPv6 addressing, IPv4 subnetting; Routing: Unicast Routing Protocols: RIP, OSPF, BGP;

**Routing:** Routing Methods- Static and Dynamic Routing, Routing basic commands, Distance vector protocol, Link state protocol.

**UNIT IV** **(10 Hrs)**

**Transport and upper layers in OSI Model:** Transport layer functions and Protocols, connection management, functions of session layers, Presentation layer, and Application layer.

**Textbook:**

1. A. S. Tanenbaum, "Computer Networks"; Pearson Education Asia, 4th Ed., 2003.
2. Behrouz A. Forouzan, "Data Communication and Networking", 2nd edition, Tata Mc Graw Hill.

**Reference Books:**

1. D. E. Comer, "Internetworking with TCP/IP", Pearson Education Asia, 2001.
2. William Stallings, "Data and computer communications", Pearson education Asia, 7th Ed., 2002.
3. Leinwand, A., Pinsky, B. (2001). Cisco router configuration. United Kingdom: Cisco Press.

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**CLOUD COMPUTING**

**Code: 24CS502**

Max Marks: 70

**Course Objectives:** The primary objectives of cloud computing include increasing efficiency, scalability, and flexibility of IT resources, while reducing costs and complexity. By leveraging cloud services, organizations can access computing resources on-demand, easily scale up or down based on their needs, and benefit from pay-as-you-go pricing models. This enables businesses to focus on their core competencies, innovate more rapidly, and respond quickly to changing market demands without significant upfront investments in hardware and infrastructure.

**UNIT I** **(10 Hrs)**

Cloud Computing Overview – Services of Internet, Origins of Cloud computing – Cloud components – Essential characteristics – On-demand self-service, The vision of cloud computing – Characteristics, benefits, and Challenges ahead

**UNIT II** **(10 Hrs)**

Cloud Computing Architecture-Introduction – Internet as a Platform, The cloud reference model - Types of clouds - Economics of the cloud, Computing platforms and technologies, Cloud computing economics, Cloud infrastructure - Economics of private clouds - Software productivity in the cloud - Economics of scale: public vs. private clouds.

**UNIT III** **(10 Hrs)**

Principles of Parallel and Distributed Computing: Parallel vs. distributed computing - Elements of parallel computing - Hardware architectures for parallel processing, Approaches to parallel programming - Laws of caution.

**UNIT IV** **(10 Hrs)**

Virtualization: Introduction - Characteristics of virtualized environments - Taxonomy of virtualization techniques - Virtualization and cloud computing - Pros and cons of virtualization - Technology example: VMware: full virtualization, Types of hardware virtualization: Full virtualization - partial virtualization - paravirtualization

**Textbook:**

1. Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, “Mastering Cloud Computing” - Foundations and Applications Programming, MK publications, 2013.
2. Gautam Shroff, “Enterprise Cloud Computing: Technology, Architecture, Applications” by Cambridge University Press, 2010.

**Reference Books:**

1. Michael J. Kavis, “Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)”, John Wiley & Sons Inc., Jan 2014.

**INTRODUCTION TO INDUSTRIAL MANAGEMENT**

**Code: 24MG515**

Max Marks: 70

**Course Objectives:**

**UNIT I: Introduction**

**(08 Hrs)**

System- concept, definition, types, parameters, variables and behavior.

Management – definition and functions.

Organization structure:

- i. Definition.
- ii. Goals.
- iii. Factors considered in formulating structure.
- iv. Types.
- v. Advantages and disadvantages.
- vi. Applications.

Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management.

Organizational culture and climate– meaning, differences and factors affecting them.

Moral-factors affecting moral.

Relationship between morality and productivity.

Job satisfaction- factors influencing job satisfaction.

Important provisions of factory act and the Labor Laws.

**UNIT II: Critical Path Method (CPM) and Program Evaluation Review Technique (PERT) (08 Hrs)**

CPM & PERT-meaning, features, difference, applications.

Understand different terms used in a network diagram.

Draw a network diagram for a real-life project containing 10-15 activities, computation of LPO, and EPO.

(Take minimum three examples)

Determination of the critical path on network.

Floats, their types, and determination of floats.

Crashing of the network, updating, and its applications.

**UNIT III: Materials Management**

**(08 Hrs)**

Material management: definition, functions, importance, and relationship with other departments.

Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in the purchase department.

Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice.

Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores.

Inventory control:

- i. Definition.
- ii. Objectives.
- iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples.
- iv. ABC analysis and other modern methods of analysis.
- v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.).

Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.

**UNIT IV: Production planning and Control (PPC)**

**(08 Hrs)**

Types and examples of production.

PPC:

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- i. Need and importance.
- ii. Functions.
- iii. Forms used and their importance.
- iv. General approach for each type of production.

Scheduling- meaning and need for productivity and utilization.

Gantt chart- Format and method to prepare.

Critical ratio scheduling-method and numeric examples.

Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples.

Bottlenecking- meaning, effect, and ways to reduce.

**UNIT V**

**(08 Hrs)**

Value Analysis (VA) and Cost Control

1. VA-definition, terms used, process and importance.
2. VA flow diagram. DARSIRI method of VA.

Case study of VA, at least two.

Waste-types, sources, and ways to reduce them. Cost control-methods and important guidelines.

Recent Trends in IM:

ERP (Enterprise Resource Planning) - concept, features, and applications.

Important features of MS Project.

Logistics- concept, need, and benefits.

Just in Time (JIT)-concept and benefits.

Supply chain management: concept and benefits.

**Textbook and Reference books:**

1. L.S. Srinath– “CPM & PERT principles and Applications”.
2. Buffa – “Modern Production Management”.
3. N. Nair – “Materials Management”.
4. O. P. Khanna – “Industrial Engineering & Management”.
5. Mikes – “Value Analysis”.
6. S.C. Sharma, “Engineering Management – Industrial Engineering & Management”, Khanna Book Publishing Company, New Delhi.

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**MANAGEMENT FOR ENGINEERS**

**Code: 24MG211**

Max Marks: 70

**Course Objectives:** The objective of the course is to equip engineering students with fundamental management principles, including planning, organizing, leadership, and decision-making in technical environments.

**UNIT I: Introduction to management Theory (8 Hrs)**

Introduction to management theory, Management Defined, Characteristic of Management, and Management as an art-profession, System approaches to Management, Task and Responsibilities of a professional Manager, Levels of Manager and Skill required.

**UNIT II: Management and Organization (8 Hrs)**

Management Process, Planning types, Mission, Goals, Strategy, Programmes, Procedures, Organising, Principles of Organisation, Delegation, Span of Control, Organisation Structures, Directing, Leadership, Motivation, Controlling.

**UNIT III: Productivity and decision making (8 Hrs)**

Concept of productivity and its measurement; Competitiveness; Decision making process; decision making under certainty, risk and uncertainty; Decision trees; Models of decision making

**UNIT IV: Functional areas of management (8 Hrs)**

Introduction to functional areas of management, Operations management, Human resources management, Marketing management, financial management.

**UNIT V: Entrepreneurship (8 Hrs)**

Introduction to entrepreneurship -Entrepreneurship in India, Role of Government, Business plans, Corporate social responsibility, Patents and Intellectual property rights.

**Textbook:**

1. H. Koontz, and H. Weihrich, Essentials of Management: An International Perspective. 8th ed., McGraw- Hill, 2009.
2. Robbins, S. P., Judge, T., Vohra, N. (2013). Organizational Behavior. India: Pearson.

**Reference Books:**

1. P. Kotler, K. L. Keller, A. Koshy, and M. Jha, Marketing Management: A South Asian Perspective. 14th ed., Pearson, 2012.
2. M. Y. Khan, and P. K. Jain, Financial Management, Tata-McGraw Hill, 2008.
3. R. D. Hisrich, and M. P. Peters, Entrepreneurship: Strategy, Developing, and Managing a New Enterprise, 4th ed., McGraw-Hill Education, 1997.
4. D. J. Sumanth, Productivity Engineering and Management, McGraw-Hill Education, 1985.
5. K. Ashwathappa, 'Human Resources and Personnel Management', TMH, 3 rd. edition, 2005.
6. R. B. Chase, Ravi Shankar and F. R. Jacobs, Operations and Supply Chain Management, 14th ed. McGraw Hill Education (India), 2015.
7. P C Tripathi and P N Reddy, Principles of management, TMH, 4th edition, 2008.

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**AIML LAB**

**Code: 24MG594**

Max Marks: 70

**Artificial Intelligence:**

**List of Practicals:**

1. Prolog Representation: Introduction, Logic-Based Representation, Prolog Syntax, Creating, Changing, and Tracing a Prolog Computation, Lists and Recursion in Prolog.
2. Structured Representation and Inheritance Search: Abstract Data Types and Search, Using cut, Control Search in prolog, Abstract Data Types (ADTs) in Prolog.
3. Write a program to implementation of DFS
4. Write a program to implementation of BFS
5. Write a Program to find the solution for traveling salesman Problem
6. Write a program to implement Simulated Annealing Algorithm
7. Write a program to find the solution for wampus world problem
8. Write a program to implement 8 puzzle problem
9. Write a program to implement the Tower of Hanoi problem
10. Write a program to implement A\* Algorithm
11. Write a program to implement the Hill Climbing Algorithm
12. To Study JESS expert system
13. To Study RVD expert system
14. Write a Program to Perform Fibonacci Series
15. Write a Program to Check Sides of a Triangle
16. Write a Program to perform the length of a list
17. Write a Program to Perform Reverse in a list.
18. Write a Prolog program to perform the arithmetic mean.
19. Write a Program to Check Vowels or Not.
20. Machine Learning Algorithms in Prolog: Machine Learning: Version Space Search, Explanation-Based Learning in Prolog.
21. Programming in Lisp: S-Expressions, Syntax of LISP, Lists and Recursive Search, Variables, Datatypes, Higher-Order Functions, Logic Programming in LISP, Lisp-Shell.
22. Semantic Networks, Inheritance and Machine Learning: Semantic Nets, Inheritance, Object-Oriented Lisp, Learning ID3 Algorithm, And Implementing ID3 Algorithm.
23. Java, Representation and Object-Oriented Programming, Problem Spaces and Search, a Logic- Based Reasoning System, an Expert System Shell

**Machine Learning:**

**List of Experiments:**

1. Implement Decision Tree learning.
2. Implement Logistic Regression.
3. Implement classification using a Multilayer perceptron
4. Implement classification using SVM
5. Implement Adaboost
6. Implement Bagging using Random Forests
7. Implement K-means Clustering to Find Natural Patterns in Data
8. Implement Hierarchical clustering
9. Implement K-mode clustering
10. Implement Association Rule Mining using FP Growth
11. Classification based on association rules
12. Implement Gaussian Mixture Model Using the Expectation Maximization
13. Valuing ML algorithm with balanced and unbalanced datasets
14. Comparison of Machine Learning algorithms
15. Implement the k-nearest neighbor algorithm

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**LINUX-OS LAB**

**Code: 24CS591**

Max. Marks: 70

**(BASED ON 24CS501) Operating System & Linux Programming:**

**Core Practical:**

1. Connect to the Linux Server and understand the basic Directory Structure of Linux.
2. To understand help commands like: -man, info, help, what is, apropos.
3. To understand basic directory navigation commands like cat, cd, mv, cp, rm, mkdir, rmdir, file, and pwd commands.
4. To understand basic commands like: date, cal, echo, bc, ls, who, whoami, hostname, uname, tty, alias.
5. To understand vi basics, three modes of vi Editor, how to write, save, and execute a shell script in the vi editor.
6. To understand process-related commands like: -ps, top, pstree, nice, renice in Linux.
7. To understand how to examine and change File permissions.
8. Set a file to be read-only with the chmod command. Interpret the file permissions displayed by the ls -l command.
9. Delete one or more directories with the rmdir command. See what happens if the directory is not empty. Experiment (carefully!) with the rm -r command to delete a directory and its content.
10. Change your directory to the directory exercises. Create a file in that directory, named the file as example1 using the cat command, containing the following text: water, water everywhere, and all the boards did shrink; water, water everywhere, no drop to drink.
11. Write a basic shell script to display the table of a number.
12. Write a basic shell script to input a character from the user and then check whether it is uppercase, lowercase, or a digit.
13. Write a basic shell script to calculate the factorial of a number.
14. Write a basic shell script to input the month number and generate the corresponding calendar.
15. Write a basic shell script to list all directories.
16. Write a basic shell script to display the greatest of three numbers.
17. Write a basic shell script to check whether the number entered by the user is prime or not.

**Note:**

1. In total 15 practical to be implemented. 2 additional practical may be given by the course instructor.
2. This is a suggestive list of programs. However, the instructor may add program as per the requirement of the course.

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**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each (1x10 = 10)  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks

**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks

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Syllabus for B Tech (AIML)

Semester 6

<b>Theory</b>									
<b>Course Code</b>	<b>Topic</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	<b>Theory Marks</b>	<b>Internal Marks</b>	<b>Practical Marks</b>	<b>Total Marks</b>
24CS813	Neural Network and Deep Learning	3	1	0	4	70	30	0	100
24CS606	Soft Computing	4	0	0	4	70	30	0	100
24CS601	Data Warehousing and Data Mining	4	0	0	4	70	30	0	100
<b>Discipline Specific Elective (DSE-4) (Choose any one)</b>									
24CS605	Communication System	4	0	0	4	70	30	0	100
24CS701	Big Data Analytics	4	0	0	4	70	30	0	100
<b>Generic Elective-3 (Choose any one)</b>									
24EN105	Introduction to Linguistics	2	0	0	2	70	30	0	100
24HR101	Human Resource Management	2	0	0	2	70	30	0	100
<b>Practical</b>									
24CS691	Data Warehousing & Data Mining Lab	0	0	2	2	0	30	70	100
<b>Total</b>					<b>24</b>	<b>490</b>	<b>240</b>	<b>70</b>	<b>800</b>

**Detailed Syllabus**

**NEURAL NETWORK AND DEEP LEARNING**

**Code: 24CS813**

Max Marks: 70

**Course Objectives:** Deep learning has resurged with the availability of massive datasets and affordable computing, enabling new applications in computer vision and natural language processing. This course introduces convolutional, recurrent, and other neural network architectures for deep learning. Students design, implement, and train these models to solve real-world problems. The objective of this course is to introduce students to deep learning algorithms and their applications in order to solve real problems.

**UNIT I (10 Hrs)**

Review of Linear Regression and Logistic Regression, Neural Networks, Feedforward & Backpropagation algorithms. Gradient Descent (GD), Batch GD, Stochastic GD, AdaGrad, RMSProp, Regularization, Learning Curves, Bias vs Variance, Early Stopping.

**UNIT II (10 Hrs)**

Image Classification, Convolutional Neural Networks (CNN), Operations - Convolution, Pooling, Stride, Padding, FC layer. Well-known CNN architectures - AlexNet, VGG16, ResNet, InceptionNet. Object Recognition, One Shot Learning, Siamese Network, Face Recognition. Image data augmentation techniques.

**UNIT III (10 Hrs)**

Sequence Models. Recurrent Neural Networks, Back propagation over time. LSTM, GRU. Language Models. Word Embeddings - Word2Vec, GloVe. Encoder-Decoder Models, Attention Mechanism, Transformer, BERT. NLP data augmentation techniques.

**UNIT IV (10 Hrs)**

Auto-encoders, Restricted Boltzmann Machines, Motivation for Sampling, Markov Chains, Training RBMs - Gibbs Sampling, Contrastive Divergence. Generative Adversarial Networks - GANs and applications. Explainability techniques.

**Textbook:**

1. Deep Learning, An MIT Press book, Ian Goodfellow and Yoshua Bengio, and Aaron Courville, <http://www.deeplearningbook.org>, 2016.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to data mining", Pearson Education, 2006.
3. Ravindran, K. M. Ragsdell, and G. V. Reklaitis, ENGINEERING OPTIMIZATION: Methods and Applications, John Wiley & Sons, Inc., 2016.

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**SOFT COMPUTING**

**Code: 24CS606**

Max Marks: 70

**Course Objectives:**

**UNIT I: Introduction**

**(10 Hrs)**

Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm

**UNIT II: Fuzzy sets and Fuzzy logic systems**

**(10 Hrs)**

Classical Sets and Fuzzy Sets and Fuzzy Relations: Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations.

Membership functions: Features of membership functions, standard forms and boundaries, different fuzzification methods.

Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods.

Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning, and Fuzzy

Implication Fuzzy Rule-based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of Fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy

Models – Sugeno Fuzzy Models.

Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems, and Weather forecasting

**UNIT III: Neural Network**

**(10 Hrs)**

Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks,

Biological Neurons and Artificial Neural Network: model of an artificial neuron.

Learning Methods: Hebbian, competitive, Boltzman etc.,

Neural Network models: Perceptron, Adaline, and Madaline networks; single-layer network; Back-propagation and Multi-layer networks.

Competitive learning networks: Kohonen self-organizing networks, Hebbian learning; Hopfield Networks. Neuro-Fuzzy modelling: Applications of Neural Networks: Pattern Recognition and classification

**UNIT IV: Genetic Algorithms**

**(10 Hrs)**

Simple GA, crossover, and mutation, Multi-objective Genetic Algorithm (MOGA).

Applications of Genetic Algorithm: Genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing, and pattern Recognition

PSO: Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

**Textbooks:**

1. Timothy J. Ross. Fuzzy Logic with Engineering Applications. John Wiley and Sons.
2. S. Rajasekaran and G. A. V. Pai. Neural Networks, Fuzzy Logic and Genetic Algorithm. PHI.
3. SN Sivanandam, S. Sumathi. Principles of Soft Computing. John Wiley and Sons.

**Reference Books:**

1. George J. Klir and Bo Yuan. Fuzzy Sets and Fuzzy Logic: Theory and Applications. Prentice Hall.
2. Simon Haykin. Neural Networks: A Comprehensive Foundation. Prentice Hall.

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**DATAWAREHOUSING AND DATA MINING**

**Code: 24CS601**

**Max Marks: 70**

**Course Objective:** The objective of the course is to learn methods for storing, managing, and analyzing large volumes of data using data warehousing and mining techniques for informed decision-making.

**UNIT I: Introduction to Data Warehousing and ETL tools (10 Hrs)**

Overview, Difference between Database System and Data Warehouse, The Compelling Need for data warehousing, Data warehouse – The building Blocks: Defining Features, data warehouses and data marts, overview of the components, three tier architecture, Metadata in the data warehouse.

Defining the business requirements: Dimensional analysis, information packages – a new concept, requirements gathering methods, requirements definition: scope and content.

**UNIT II: Dimensional Modelling and OLAP (10 Hrs)**

Principles of Dimensional Modelling: Objectives, From Requirements to data design, Multi-Dimensional Data Model, Schemas: the STAR schema, the Snowflake schema, fact constellation schema.

OLAP in the Data Warehouse: Demand for Online Analytical Processing, limitations of other analysis methods, OLAP definitions and rules, OLAP characteristics, major features and functions, hyper cubes.

OLAP Operations: Drill-down and roll-up, slice-and-dice, pivot or rotation, OLAP models, overview of variations, the MOLAP model, the ROLAP model, the DOLAP model, ROLAP versus MOLAP, OLAP implementation considerations. Query and Reporting, Executive Information Systems (EIS), Data Warehouse and Business Strategy.

**UNIT III: Data mining and data pre-processing (10 Hrs)**

Data mining: Introduction, What kind of data can be mined, What kind of patterns to be mined, Which technologies are used, What kinds of applications are targeted, Major issues in data mining.

Data pre-processing: Overview of Data pre-processing, data cleaning, data integration, data reduction, data transformation and data discretization, exploring data using IRIS datasets. Introduction to apriori algorithm for association mining rule.

**UNIT IV: Data mining applications, and Data mining Tools (10 Hrs)**

Applications of data mining: Data mining for retail and telecommunication industries, data mining and recommender systems.

Introduction to data mining tools (open source): Weka, Rapid Miner, IBM Watson for classification and clustering algorithms using IRIS Datasets.

**Text Book:**

1. Kamber and Han, "Data Mining Concepts and Techniques", Third edition, Hartcourt India P.Ltd.,2012.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to data mining", Pearson education, 2006
3. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons, 2004

**Reference Books:**

1. Ashok N. Srivastava, Mehran Sahami, "Text Mining Classification, Clustering, and Applications", Published by Chapman and Hall/CRC1st Edition, June 23, 2009.
2. Ian H., Eibe Frank, Mark A. Hall, Christopher Pal "Data Mining: Practical Machine Learning Tools and Techniques" Published by Morgan Kaufmann; 4th edition, December 1, 2016.
3. G. K. Gupta, "Introduction to Data Mining with Case Studies", PHI, 2006.
4. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill, 1 July 2017 RB5. Shmueli, "Data Mining for Business Intelligence: Concepts, Techniques and Applications in Microsoft Excel with XL Miner", Wiley Publications.

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**COMMUNICATION SYSTEM**

**Code: 24CS614**

Max Marks: 70

**Course Objectives:** The aim of this course is to introduce the students to the basic concepts of communication systems. The main objective of this course is to understand and implement the basic analogue and digital communication techniques/circuits with the help of theoretical and practical problem solving. It is required from the students to understand the basic analogue and digital communication techniques which in turn are used as the building blocks of the larger and more complex communication systems.

**UNIT I**

**(10 Hrs)**

**Introduction:** Overview of Communication system, Communication channels, Mathematical Models for Communication Channels.

**Introduction of random Variables:** Definition of random variables, PDF, CDF and its properties, joint PDF, CDF, Marginalized PDF, CDF, WSS wide stationery, strict sense stationery, non-stationery signals, UDF, GDF, RDF, Binomial distribution, White process, Poisson process, Wiener process.

**UNIT II**

**(10 Hrs)**

**Amplitude Modulation:** Need for modulation, Representation of Band Pass signals and systems: Hilbert Transform, In-phase, Quad-phase representations, Power relation, modulation index, Bandwidth efficiency, AM: modulation and demodulation, DSB-SC: Modulation and demodulation, SSB: modulation and demodulation, VSB: modulation and demodulation.

**UNIT III**

**(8 Hrs)**

**Angle Modulation Systems:** Frequency Modulation, Types of Frequency Modulation, Generation of NBFM, WBFM, Transmission BW of FM Signal, Phase Modulation, Relationship between PM& FM.

**Radio Receivers:** Functions & Classification of Radio Receivers, Tuned Radio Frequency (TRF) Receiver, Superheterodyne Receiver, Basic Elements, Receiver Characteristics, Frequency Mixers, AGC Characteristics.

**UNIT IV**

**(12 Hrs)**

**Noise Theory:** Noise, Types of noise, Addition of Noise due to several sources in series and parallel, Generalized Nyquist Theorem for Thermal Noise, Calculation of Thermal Noise for a Single Noise Source, RC Circuits & Multiple Noise sources. Equivalent Noise Bandwidth, Signal to Noise Ratio, Noise-Figure, Noise Temperature, Calculation of Noise Figure.

**Performance of Communication Systems:** Receiver Model, Noise in DSB-SC Receivers, Noise in SSB-SC Receivers, Noise in AM receiver (Using Envelope Detection), Noise in FM Receivers, FM Threshold Effect, Threshold Improvement through Pre-Emphasis and De-Emphasis, Noise in PM system – Comparison of Noise performance in PM and FM, Link budget analysis for radio channels.

**Textbook:**

1. John G. Proakis & Masoud Salehi, —Communication System Engineeringl, Pearson Education.
2. Haykin, S., —Communication Systemsl, John Wiley (2009) 4th ed.

**Reference Books:**

1. Taub, H., “Principles of Communication Systems”, McGraw-Hill (2008) 3rd ed.
2. Kennedy, G., “Electronic Communication Systems”, McGraw-Hill (2008) 4th ed.
3. V. Chandra Sekar “Analog Communication”, Oxford University Press, Incorporated, 2010.
4. John G Proakis, M. Salehi and G. Bauch: “Modern Communication Systems Using MATLAB”, Cengage Learning, 3rd edition, 2013.

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**BIG DATA ANALYTICS**

**Code: 24CS701**

Max Marks: 70

**Course Objectives:** This course gives an overview of Big Data, i.e. storage, retrieval and processing of big data. In addition, it also focuses on the “technologies”, i.e., the tools/algorithms that are available for storage, processing of Big Data. It also helps a student to perform a variety of “analytics” on different data sets and to arrive at positive conclusions.

**UNIT I**

**(8 Hrs)**

**Introduction to Big Data:** Big Data and its Importance – Four V’s of Big Data – Drivers for Big Data – Introduction to Big Data Analytics – Big Data Analytics applications.

**UNIT II**

**(8 Hrs)**

**Big Data Technologies:** Hadoop’s Parallel World – Data discovery – Open source technology for Big Data Analytics – cloud and Big Data – Predictive Analytics – Mobile Business Intelligence and Big Data

**UNIT III**

**(6 Hrs)**

**Introduction Hadoop:** Big Data – Apache Hadoop & Hadoop Eco System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

**UNIT IV**

**(10 Hrs)**

**Hadoop Architecture:** Hadoop: RDBMS Vs Hadoop, Hadoop Overview, Hadoop distributors, HDFS, HDFS Daemons, Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, HDFS Architecture, Hadoop Configuration, Map Reduce Framework, Role of HBase in Big Data processing, HIVE, PIG.

**UNIT V**

**(8 Hrs)**

**Data Analytics with R Machine Learning:** Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering, Social Media Analytics, Mobile Analytics, Big Data Analytics with BigR.

**Textbook:**

1. Big Data Analytics, Seema Acharya, Subhasini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiley CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O’Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

**Reference Books:**

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC Press (2013).
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle Press.
3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al. McGraw-Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

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**INTRODUCTION TO LINGUISTICS**

**Code: 24EN105**

Max Marks: 70

**Course Objectives:** This course introduces the discipline of Linguistics. Students will learn the basic concepts and methods used by linguists in the scientific study of human language. While many key aspects will be illustrated using evidence derived primarily from English, we will discuss evidence from a variety of languages in order to better demonstrate the richness of linguistic diversity. Students will become familiar with how linguists' approach and analyse language in primary fields of linguistic analysis such as morphology (word structure), syntax (phrases and sentences), semantics (meaning), phonetics (types of sound), and phonology (rules of phonetic processes), and language in society, and writing.

**UNIT I** **(5 Hrs)**

Language: Its Origin and Properties; Linguistics: Definition and Scope, Traditional and Modern Linguistics.

**UNIT II** **(5 Hrs)**

Structural Linguists: Ferdinand de Saussure and Leonard Bloomfield; Functional Linguistics: Michael A K Halliday; Mentalistic Approach to Linguistics: Noam Chomsky; Transformational Generative Grammar; Language and Society: Idiolect, Dialect, Sociolect.

**UNIT III** **(5 Hrs)**

Phonetics and Phonology: Speech Mechanism, Production, Classification and Description of English Phonemes; Vowels, Consonants and Diphthongs.

**UNIT IV** **(5 Hrs)**

Supra-segmental Phonology: Syllable, Stress, Intonation; Phonemic/ Phonetic Transcription, Phonemic Transcription of a Dialogue/Passage.

**Textbook:**

1. "An Introduction to Linguistics: Language, Grammar and Semantics" by B. Mangalam.
2. "Modern Linguistics: An Introduction" by Dr. R. L. Varshney.

**Reference Books:**

1. "An Introduction to Linguistics: Language, Grammar and Semantics" by Pushpinder Syal & D.V. Jinda.
2. "A Course in Linguistics" by T. Balasubramanian.
3. "Linguistics: An Introduction" by Krishnaswamy, Verma & Nagarajan.

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**HUMAN RESOURCE MANAGEMENT**

**Code: 24HR101**

Max Marks: 70

**Course Objectives:** The primary objectives of Human resource management are to ensure a seamless experience for the staff and other people associated with management and accomplish organizational goals. Objectives of HRM include ensuring the availability of resources, easy access to data, on-time payroll, ensuring compliance, etc. The objectives of human resource management (HRM) are aligned with the entire interest of the organization for enhancing the productivity and profitability of a business. HRM objectives are basically influenced by organizational goals and verticals. The objective of HRM is to ensure a stable work environment with organized data management and efficient operations.

**UNIT I** **(4 Hrs)**

Meaning, Scope, and Significance of Human Resource Management, Evolution of HRM, Function of HRM. Challenges before HRM in the Present Changing Environment.

**UNIT II** **(4 Hrs)**

HR Planning. Job Analysis, Recruitment, Methods and Techniques of Selection, Induction, Internal Mobility and Separation of Employees, Transfer, Promotion, Demotion, and Separation of Employees.

**UNIT III** **(4 Hrs)**

Industrial Relations, trade Unions, Disputes and their Resolution, Collective Bargaining, Employee Welfare: a Brief Introduction, Workers' Participation in Management.

**UNIT IV** **(4 Hrs)**

Wages and Salary Administration, Economic Objectives of Wages Policy, Social Objectives, Principles of Wage and Salary Administration. Essentials of a Wage and Salary Structure. Factors Affecting wages, Methods of wage Payment. Wage Policy In India. Pay Commission. Wage Boards, Adjudication, Pay Revision in Public Sector- issue and Considerations.

**UNIT V** **(4 Hrs)**

Other Contemporary Issues in HRM- Employee Compensation- Concept, Factors Affecting Employee Compensation Components, of Employee Pay, HR Audit Human Resource Information System. Performance & Skill Based Pay Systems, Voluntary Retirement Scheme (VRS).

**Reference Books:**

1. Rao T. V. and Abraham E., "HRD Practices in Indian Industries – A Trend Report".
2. Santhanam M., "Development of Human Resources."
3. Sharma A. K., "Some Issues in Management Development."
4. Rudrabasavraj M. N., "Executive Development in The Public Sector."
5. B. D. Singh, "Compensation and Reward and Management."

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**DATAWAREHOUSING AND MINING LAB**

**Code: 24CS691**

**Max. Marks: 70**

(BASED ON 24CS601) Data warehousing and Data mining:

**List of Practical:**

1. Listing applications for mining
  2. File format for data mining
  3. conversion of various data files
  4. Training the given dataset for an application
  5. Testing the given dataset for an application
  6. Generating accurate models
  7. Data pre-processing – data filters
  8. Feature selection
  9. Web mining
  10. Text mining
  11. Design of fact & dimension tables
  12. Generating graphs for star schema.
-

**ARYAVART INTERNATIONAL UNIVERSITY**  
**Tilthai, Dharmanagar, North Tripura**

**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each ( $1 \times 10 = 10$ )  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each ( $2 \times 6 = 12$ )  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each ( $3 \times 6 = 18$ )  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each ( $5 \times 6 = 30$ )

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks  
**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks

ARYAVART INTERNATIONAL UNIVERSITY

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Syllabus for B Tech (AIML)

Semester 7

<b>Theory</b>									
Course Code	Topic	L	T	P	Credit	Theory Marks	Internal Marks	Practical Marks	Total Marks
24CS504	Full-Stack Web Development	4	0	0	4	70	30	0	100
24CS711	Digital Signal Processing	4	0	0	4	70	30	0	100
<b>Skill Enhancement Courses (SEC-1) (Choose any one)</b>									
24CS702	Blockchain Technology	2	0	0	2	70	30	0	100
24CS703	Mobile Computing	2	0	0	2	70	30	0	100
24MO701	MOOC I (from SWAYAM Platforms)	3	0	0	3	70	30	0	100
24MO702	MOOC II (from SWAYAM Platform)	3	0	0	3	70	30	0	100
<b>Practical</b>									
24CS593	Full-Stack Web Development Lab	0	0	2	2	0	30	70	100
24IN401	Internship	0	0	4	4	0	0	100	100
<b>Total</b>					<b>22</b>	<b>350</b>	<b>150</b>	<b>170</b>	<b>700</b>

**Detailed Syllabus**

**FULL-STACK WEB DEVELOPMENT**

**Code: 24CS504**

**Max Marks: 70**

**Course Objective:** The objective of the course is to equip students with skills to design, develop, and deploy complete web applications using front-end and back-end technologies.

**UNIT I**

**(8 Hrs)**

Web Development Basics: Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git & GitHub HTML, CSS.

**UNIT II**

**(8 Hrs)**

Frontend Development: Java script basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.

**UNIT III**

**(8 Hrs)**

REACT JS: Introduction to React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication.

**UNIT IV**

**(8 Hrs)**

Java Web Development: JAVA PROGRAMMING BASICS, Model View Controller (MVC) Pattern MVC Architecture using Spring RESTful API using Spring Framework Building an application using Maven.

**UNIT V**

**(8 Hrs)**

Databases & Deployment: Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud.

**Textbook:**

1. Web Design with HTML, CSS, JavaScript and J Query Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas.
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon.
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BY AZAT MARDAN.

**Reference Books:**

1. Full-Stack JavaScript Development by Eric Bush.
2. Mastering Full Stack React Web Development Paperback – April 28, 2017 by Tomasz Dyl, Kamil Przeorski, Maciej Czarnecki.

**ARYAVART INTERNATIONAL UNIVERSITY**  
**Tilthai, Dharmanagar, North Tripura**  
**DIGITAL SIGNAL PROCESSING**

**Code: 24CS711**

Max Marks: 70

**Course Objectives:** The primary objective of this course is to provide a thorough understanding and working knowledge of design, implementation, and analysis of DSP systems.

**UNIT I (8 Hrs)**

**Discrete Time System:** Basic Discrete Time Signals and their classifications, Discrete Time Systems and their classifications, Stability of discrete time system, Analysis and response (convolution sum) of discrete-time linear LTI system, Recursive and Non-recursive discrete time system, Impulse response of LTI system, Correlation of discrete time Signal.

**UNIT II (8 Hrs)**

**Z-Transform and Its Application to the Analysis of LTI Systems:** Z-Transform, Direct Z-Transform, Properties of the Z- Z-Transform, Inverse Z-Transform, Inversion Z-Transform by Power Series Expansion, Inversion of the Z-Transform by Partial-Fraction Expansion, Analysis of Linear Time Invariant Systems in the z-Domain.

**UNIT III (10 Hrs)**

**Discrete Fourier Transform:** Frequency-Domain Sampling and Reconstruction of Discrete-Time Signals, Discrete Fourier Transform, DFT as a Linear Transformation, Relationship of DFT to other Transforms, Properties of DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Use of DFT in Linear Filtering, Filtering of Long Data Sequences.

**Efficient Computation of DFT:** FFT Algorithms, Direct Computation of the DFT, Radix-2 FFT Algorithms, Decimation-In-Time (DIT), Decimation-In-Time (DIF).

**UNIT IV (10 Hrs)**

**Structure and Implementation of FIR and IIR Filter:** Structure for the Realization of Discrete-Time Systems, Structure of FIR Systems: Direct-Form Structure, Cascade-Form Structure, Frequency Sampling Structure, Design of FIR Filters: Symmetric and Anti-symmetric FIR Filters, Design of Linear-Phase FIR Filters by using Windows, Design of Linear-Phase FIR Filters by Frequency Sampling Method. Structure for IIR Systems: Direct- Form Structure, Signal Flow Graphs and Transposed Structure, Cascade-Form Structure, Parallel-Form Structure. Design of IIR Filters.

**UNIT V (6 Hrs)**

**Analog Filters:** IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. **Basic adaptive filter:** Structure of Adaptive FIR filter, System Modelling and Inverse Modelling, MATLAB realization of DFT, FFT, Z-transform, IIR, FIR, and adaptive filter.

**Textbook:**

1. "Digital Signal Processing – Principles, Algorithms and Applications" by J. G. Proakis and D. G. Manolakis, Pearson.
2. "Digital Signal Processing": Tarun Kumar Rawat, Oxford University Press.

**Reference Books:**

1. "Digital Signal Processing" – S. Salivahan, A. Vallavraj and C. Gnanapriya, Tata McGraw Hill.
2. "Digital Signal Processing" – Manson H. Hayes (Schaum's Outlines) Adapted by Subrata Bhattacharya, Tata McGraw Hill.

**ARYAVART INTERNATIONAL UNIVERSITY**  
**Tilthai, Dharmanagar, North Tripura**

**BLOCKCHAIN TECHNOLOGY**

**Code: 24CS702**

Max Marks: 70

**Course Objectives:** The objective of this course is to develop familiarity with theoretical concepts, underlying technology, tools, implementation strategies, and current practices. The course will offer a strong technical understanding of Blockchain technologies, develop familiarity with current technologies, tools, and implementation strategies, and introduce application areas, current practices, and research activity.

**UNIT I**

**(4 Hrs)**

Introduction to Blockchain Technology – Distributed systems – The history of blockchain – Introduction to blockchain – CAP theorem and blockchain – Benefits and limitations of blockchain – Decentralization using blockchain - Methods of decentralization – Routes to decentralization.

**UNIT II**

**(4 Hrs)**

Cryptography in Blockchain: Introduction – cryptographic primitives – Asymmetric cryptography – public and private keys -line interface – Bitcoin improvement proposals (BIPs) – Consensus Algorithms.

**UNIT III**

**(4 Hrs)**

BitCoin Introduction – Transactions – Structure - Transaction types – The structure of a block– The genesis block – The bitcoin network– Wallets and their types– Bitcoin payments– Bitcoin investment and buying and selling bitcoins – Bitcoin installation – Bitcoin programming and the command-line interface – Bitcoin improvement proposals (BIPs).

**UNIT IV**

**(4 Hrs)**

Ethereum - Ethereum blockchain- Elements of the Ethereum blockchain– Precompiled contracts – Accounts and their types – Block header- Ether – Messages – Mining - Clients and wallets – Trading and investment – The yellow paper - The Ethereum network - Applications developed on Ethereum - Scalability and security issues.

**UNIT V**

**(4 Hrs)**

Smart Contract and Hyperledger – History of Smart Contract – Ricardian contracts - The DAO. Hyperledger projects – Hyperledger as a protocol – Fabric - Hyperledger Fabric - Sawtoothlake – Corda Architecture.

**Textbook:**

1. Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd revised edition. Birmingham: Packt Publishing, 2018.

**Reference Books:**

1. A. M. Antonopoulos, Mastering Bitcoin, First edition. Sebastopol, CA: O'Reilly, 2015.
2. Z. Zheng, S. Xie, H. Dai, X. Chen, and H. Wang, — “An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends”, in 2017 IEEE International Congress on Big Data (BigData Congress), 2017, pp.557–564.

**ARYAVART INTERNATIONAL UNIVERSITY**  
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**MOBILE COMPUTING**

**Code: 24CS703**

Max Marks: 70

**Course Objectives:** The objective of this course is to develop an understanding of the ways that mobile technologies can be used for teaching and learning, and also to consider the impact of mobile computing on the field of education.

**UNIT I**

**(5 Hrs)**

**Introduction to Mobile Computing:** History, Types, Benefits, Application, Evolution, Characteristics of Mobile Computing, Security Concerns regarding Mobile Computing, Different Propagation Modes, Wireless Architecture and its types. First-Generation Analogue, Second-Generation TDMA, Second-Generation CDMA, Third- Generation Systems.

**Cellular Concept:** Cellular Systems and Principles of Cellular Networks, Hexagonal geometry cell and concept of frequency reuse, Channel Assignment Strategies, Distance to frequency reuse ratio; Electromagnetic Spectrum.

**Antennas and Propagation:** Antennas, Propagation Modes, Line of Sight Transmission, Fading in the Mobile Environment, Signal Characteristics; Channel Capacity, Multiplexing, Spread Spectrum: DSSS & FHSS, CDMA.

**UNIT II**

**(5 Hrs)**

**Telecommunication Systems: GSM:** Architecture, Channel allocation, call routing, PLMN interface, GSM addresses and identifiers, network aspects, frequency allocation, authentication and security, Handoffs Technique.

**GPRS:** network architecture, network operation, data services, Applications, Billing, and charging.

**UTRAN, UMTS; Mobile Networking:** Medium Access Protocol, Internet Protocol and Transport layer, Medium Access Control: Motivation for specialized MAC, Introduction to multiple Access techniques (MACA).

**UNIT III**

**(5 Hrs)**

**Mobile IP:** Features of Mobile IP and its need, IP packet delivery, Key Mechanism in Mobile IP, Agent Discovery, Registration, Tunnelling and encapsulation, Reverse Tunnelling, Routing (DSDV, DSR), Route optimization, IP Handoff.

**Mobile TCP:** Traditional TCP, Classical TCP, Improvements like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing, Selective Retransmission.

**Wireless Application Protocol:** Introduction, Application, Architecture, Protocol Stack, and Challenges.

**UNIT IV**

**(5 Hrs)**

**Bluetooth:** Introduction, User Scenario, Architecture, protocol stack; IP Mobility, Macro Mobility and Micro Mobility, Introduction to 4G and 5G; LTE, HIPERLAN, Mobile Device Operating Systems, Special Constrains & Requirements, Commercial Mobile Operating Systems, Software Development Kit: iOS, Android, BlackBerry, Windows Phone, M-Commerce, Structure, Mobile Payment System.

**Textbook:**

1. John H. Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
2. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing: Technology, Applications and Service Creation", 2nd Edition, Tata McGraw-Hill, 2010.

**Reference Books:**

1. Andreas F. Molisch, "Wireless Communications", 2<sup>nd</sup> Edition, Wiley –India, 2006.
2. Raj Kamal, "Mobile Computing", 3<sup>rd</sup> Edition, Oxford University Press, 2018.
3. Frank Adelstein, S.K.S. Gupta, Golden G. Richard III and Loren Schwiebert, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional.

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**MOOC I**

**Code: 24MO701**

Max Marks: 70

List of MOOCs enrolled by a learner can be found in the “My Courses” page on SWAYAM Portal (link is available at the top of page, click on logged-in user-name), Current Link is:

<https://swayam.gov.in/mycourses>

The candidate is required to complete a 03-credit Skill Enhancement Course (SEC) from the list of courses available on the SWAYAM online platform.

**MOOC II**

**Code: 24MO702**

Max Marks: 70

List of MOOCs enrolled by a learner can be found in the “My Courses” page on SWAYAM Portal (link is available at the top of page, click on logged-in user-name), Current Link is:

<https://swayam.gov.in/mycourses>

The candidate is required to complete a 03-credit Skill Enhancement Course (SEC) from the list of courses available on the SWAYAM online platform.

**FULL STACK WEB DEVELOPMENT LAB**

**Code: 24CS593**

**Max. Marks: 70**

(BASED ON 24CS504) Full Stack Web Development:

**List of Practical:**

1. Develop a Form and validate using Angular JS.
  2. Create and implement modules and controllers in Angular JS.
  3. Implement Error Handling in Angular JS.
  4. Create and implement Custom directives.
  5. Create a simple web application using Express, Node JS and Angular JS.
  6. Implement CRUD operations on Mongo DB.
  7. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.
  8. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js.
  9. Create a TODO application in react with necessary components and deploy it into github.
  10. A. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman).
- B. For the above application create authorized end points using JWT (JSON Web Token).

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**INTERNSHIP**

**Code: 24IN401**

Max Marks: 70

**Course Objective:** This internship capstone course aims to provide students with an integrative learning experience that combines professional work in a real-world organization with rigorous academic research. Students will develop and apply theoretical knowledge to practical challenges through an action research project, enhancing their problem-solving, critical thinking, and communication skills. This course aims to bridge the gap between academic study and professional practice, preparing students for successful careers in their chosen fields

**Internship Student Engagement Process:** An internship is a structured, hands-on learning experience integrating academic knowledge with pre-professional work activities. It mutually benefits both the student-intern and the host organization. Interns apply foundational skills from their studies to real-world tasks, enhancing their practical experience. Placement sites outline clear expectations, duties, and performance goals for the interns. They also offer regular supervision and feedback to guide the interns' development. This experiential learning helps students build valuable industry-specific skills, gain insights into their chosen field, and improve their employability upon graduation.

**Step 1. Orientation Session:** The orientation session for the internship/capstone project is designed to provide students with a comprehensive overview of what to expect and how to succeed in their upcoming professional experience. The session aims to bridge the gap between academic learning and practical application in a real-world setting. Model curriculum for UG Degree in BBA

**Step 2. Identify an internship:** Students research opportunities that align with their career goals and academic background. They explore various platforms, such as online job boards, networking events, and professional associations, to find positions that offer relevant hands-on experience and skills in their chosen field.

**Step 3. Internship agreement Form:** The Student, Mentor, and internship Coordinator in the Industry will complete the internship agreement form.

**Step 4. Start of Internship:** The internship lasts eight weeks. Interns are expected to commit to 20 hours per week, allowing for a balanced integration of work and learning. The internship mentor will arrange specific schedules. This structure ensures that interns gain substantial experience while accommodating any academic commitments. Regular check-ins and progress reviews will be conducted to support intern development and address any challenges, providing a productive and enriching internship experience.

**Step 5. Submission of Report:**

Front Page: Student Name, Course, Internship Company, Duration, Mentor

Internship Agreement Form

Internship Certificate

Introduction & background of the Company

Roles & responsibilities as an Intern

Weekly work allotment & completion report

Challenges & Solutions

Learning from the internship

Conclusion etc

**Step 6. Internship Evaluation:** The PPT presentation and Viva Voce for internship evaluation is an oral exam where interns present their experiences, learning, and contributions. It involves summarising their role, key projects, and applied skills. Interns discuss the knowledge gained, application of academic theories, and challenges faced, including how they were addressed. They reflect on their professional development and how the internship Model curriculum for UG Degree in BBA influenced their career goals. Feedback from supervisors and industry insights are also shared. Examiners ask questions to delve deeper into the intern's understanding and experiences. This evaluation assesses the intern's ability to articulate their growth and readiness for professional work. The review of the work done by students will be carried out after two weeks of report submission. The internal examiner will evaluate the student's submission.

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**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each ( $1 \times 10 = 10$ )  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each ( $2 \times 6 = 12$ )  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each ( $3 \times 6 = 18$ )  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each ( $5 \times 6 = 30$ )

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks  
**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks

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Syllabus for B Tech (AIML)

Semester 8

Theory									
Course Code	Topic	L	T	P	Credit	Theory Marks	Internal Marks	Practical Marks	Total Marks
24CS811	Natural Language Processing	4	0	0	4	70	30	0	100
24CS603	Internet of Things	4	0	0	4	70	30	0	100
24CS604	Automata & Compiler Design	4	0	0	4	70	30	0	100
24PR501	Major Project	0	0	6	6	0	100	0	100
24PR502	Seminar/Conference Presentation	0	0	2	2	0	100	0	100
24CS693	IoT Lab	0	0	2	2	0	30	70	100
<b>Total</b>					<b>22</b>	<b>210</b>	<b>220</b>	<b>70</b>	<b>500</b>

**Detailed Syllabus**

**NATURAL LANGUAGE PROCESSING**

**Code: 24CS811**

Max Marks: 70

**Course Objectives:** This course aims at teaching the basics about processing of Natural Languages. Natural language processing is the feature of 5th Generation Computer and is part of Artificial intelligence. It teaches about the different phases of natural language processing, methodologies, algorithms, data structures used for Natural Language Processing.

**UNIT I**

**(10 Hrs)**

**Introduction:** Basic concepts of Natural Language Processing, evolution of NLP, issues and challenges in NLP, basic concepts of phases of natural language processing, morphological analysis, syntactic analysis, semantic analysis, pragmatic analysis, tools and techniques used for performing these analyses, ambiguities, Types of ambiguities.

**UNIT II**

**(10 Hrs)**

**Syntactic analysis:** Concept of Grammars, Chomsky hierarchy of grammars, concept of parsing, top-down parsing, bottom-up parsing, bidirectional parsing, generating parse tree, data structures and algorithms used for parsing, tokenizer, Case study of parsers of NLP systems like ELIZA, LUNAR.

**UNIT III**

**(10 Hrs)**

**Semantic Analysis:** understanding meaning, CASE grammars, and transformational grammars used for performing semantic analysis. Resolving ambiguities to generate correct meaning, Word Sense Disambiguation Case Study of the Toolkit of word sense disambiguation used in WORDNET.

**UNIT IV**

**(10 Hrs)**

**Software tools for performing NLP:** English WORDNET, components of WordNet, understanding the NLTK tool for using WordNet, HINDI wordnet, an Indian Govt initiative for language analysis and machine translation.

**Textbook:**

1. Allen, James, "Natural Language Understanding", Second Edition, Benjamin/ Cumming, 1995.
2. Jurafsky, Dan and Martin, James, "Speech and Language Processing", Second Edition, Prentice Hall, 2008.

**Reference Books:**

1. Bharati Akshar, Chaitanya Vineet, Sangal, Rajeev, "Natural Language Processing: A Paninian Perspective", Prentice Hall India Learning Private Limited; EASTERN ECONOMY ed. edition, 1995.
2. Philipp Koehn, Statistical Machine Translation, Cambridge University Press; 1st edition, 2009.
3. U.S. Tiwari and Tanveer Siddiqui, Natural Language Processing and Information Retrieval, Oxford University Press, 2008.

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**INTERNET OF THINGS**

**Code: 24CS603**

Max Marks: 70

**Course Objectives:** This course focuses on the latest microcontrollers with application development, product design and prototyping. The Internet of Things (IOT) is the next wave, world is going to witness. Internet of Things is a term given to the attempt of connecting objects to the internet and also to each other - allowing people and objects themselves to analyse data from various sources in real-time and take necessary actions in an intelligent fashion.

**UNIT I**

**(10 Hrs)**

**Introduction:** Definition, Functional requirements, Characteristics, Foundations, architectures, challenges and issues, Physical design of IoT, Logical design of IoT, Web 3.0 of IoT, IoT World Forum (IoTWF) and Alternative IoT models, IoT Communication Models, IoT in Global Context, Real world scenarios, Different Areas, Examples Trends in the Adaption of the IoT (Cloud Computing, Big Data Analytics, Concepts of Web of Things, Concept of Cloud of Things with emphasis on Mobile Cloud Computing, Smart Objects).

**UNIT II**

**(10 Hrs)**

**Components in IoT:** Control Units, Sensors, Communication modules, Power Sources, Communication Technologies, RFID, Bluetooth, Zigbee, Wi-fi, RF links, Mobile Internet, Wired Communication;

**IoT Protocol and Technology:** RFID, NFC, Wireless Networks, WSN, RTLS, GPS, Agents, Multi-Agent Systems, IoT Protocols: M2M, BacNet, ModBus, Bluetooth, WiFi, ZigBee;

**Web of Things (WoT):** WoT vs. IoT, Architecture;

**Cloud of Things (CoT):** Grid/SOA and Cloud Computing, Standards, Cloud Providers and Systems, Architecture.

**UNIT III**

**(10 Hrs)**

**Data Analytics for IoT:** Introduction, Machine Learning, Big Data Analytics Tools and Technology, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Apache Kafka, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.

**Tools for IoT:** Chef, Chef Case Studies, Puppet, Puppet Case Study – Multi-tier Deployment, NETCONF-YANG Case Studies, IoT Code Generator.

**UNIT IV**

**(10 Hrs)**

**Domain-specific applications of IoT:** Home automation, Industry applications, Surveillance applications, Smart Homes, Ambient Assisted Living, Intelligent Transport, Other IoT applications: Use-Case Examples.

**Developing IoT solutions:** Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Implementation of IoT with Arduino and Raspberry Pi, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.

**Textbook:**

1. A. Bahga, V. Madiseti, "Internet of Things: A Hands-on Approach", 1st Edition, Universities Press, 2015/ Latest Edition.
2. R. Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw-Hill Education Private Limited, 2017/ Latest Edition.

**Reference Books:**

1. D. Uckelmann, M. Harrison, "Architecting the Internet of Things", 1st Ed., Springer, 2011/ Latest Edition.
2. O. Hersent, D. Boswarthick, O. Elloumi, "The Internet of Things – Key applications and Protocols", 2nd Edition, Wiley, 2012/ Latest Edition

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**AUTOMATA AND COMPILER DESIGN**

**Code: 24CS604**

Max Marks: 70

**Course Objectives:** The main objective of this course is to introduce the major concept areas of automata and compiler design and to develop an awareness of the function and complexity of modern compilers. This course is a study of the theory and practice required for the design and implementation of interpreters and compilers for programming languages.

**UNIT I** **(8 Hrs)**

Formal Language and Regular Expressions: Languages, Definition, Languages regular expressions, Finite Automata – DFA, NFA. Conversion of a regular expression to NFA, NFA to DFA. Context Free grammars and parsing, derivation, parse trees, Application of Finite Automata.

**UNIT II** **(8 Hrs)**

Introduction to Compiler, Phases of Compilation, ambiguity LL(K) grammars and LL (1) parsing, Bottom-up parsing, handle pruning, LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. Semantics: Syntax-directed translation, S-attributed and L-attributed grammars.

**UNIT III** **(8 Hrs)**

Intermediate code – abstract syntax tree, translation of simple statements and control flow statements. Context Sensitive features – Chomsky hierarchy of languages and recognizers, type checking, type conversions, equivalence of type expressions, overloading of functions and operations.

**UNIT IV** **(8 Hrs)**

Run time storage: Storage organization, storage allocation strategies, scope access to nonlocal names, Code optimization: Principal Sources of optimization, optimization of basic blocks, peephole optimization.

**UNIT V** **(8 Hrs)**

Code generation: Machine-dependent code generation, object code forms, generic code generation algorithm, register allocation, and assignment. Using DAG representation of the Block.

**Textbooks:**

1. Introduction to Theory of Computation. Sipser, 2nd Edition, Thomson.
2. Compilers: Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education.

**References:**

1. Modern Compiler Construction in C, Andrew W. Appel Cambridge University Press.
2. Compiler Construction, LOUDEN, Thomson.
3. Elements of Compiler Design, A. Meduna, Auerbach Publications, Taylor and Francis Group.
4. Principles of Compiler Design, V. Raghavan, TMH.
5. Engineering a Compiler, K. D. Cooper, L. Torczon, ELSEVIER.

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**MAJOR PROJECT**

**Code: 24PR501**

Max Marks: 70

**PROJECT REPORT**

All the students are required to submit a report based on the project work done by them during the sixth semester.

**SYNOPSIS (SUMMARY/ABSTRACT):**

All students must submit a summary/abstract separately with the project report. Summary, preferably, should be of about 3-4 pages. The content should be as brief as is sufficient enough to explain the objective and implementation of the project that the candidate is going to take up. The write up must adhere to the guidelines and should include the following:

- Name / Title of the Project
- Statement about the Problem
- Why is the particular topic chosen?
- Objective and scope of the Project
- Methodology (including a summary of the project)
- Hardware & Software to be used
- Testing Technologies used
- What contribution would the project make?

**TOPIC OF THE PROJECT-**

This should be explicitly mentioned at the beginning of the Synopsis. Since the topic itself gives a peep into the project to be taken up, candidate is advised to be prudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

**OBJECTIVE AND SCOPE:**

This should give a clear picture of the project. Objective should be clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

**PROCESS DISCRPTION:**

The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFDs / Flowcharts to explain the flow of the information.

**RESOURCES AND LIMITATIONS:**

The requirement of the resources for designing and developing the proposed system must be given. The resources might be in form of the hardware/software or the data from the industry. The limitation of the proposed system in respect of a larger and comprehensive system must be given.

**CONCLUSION:**

The write-up must end with the concluding remarks- briefly describing innovation in the approach for implementing the Project, main achievements and also any other important feature that makes the system stand out from the rest.

**The following suggested guidelines must be followed in preparing the Final Project Report:**

Good quality white A4 size paper should be used for typing and duplication. Care should be taken to avoid smudging while duplicating the copies.

- Page Specification: (Written paper and source code)
- Left margin - 3.0cms
- Right margin- 2.0cms
- Top margin 2.54cms
- Bottom margin 2.54cms
- Page numbers - All text pages as well as Program source code listing should be numbered at the bottom centre of the pages.

**Normal Body Text:** Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above and below para spacing

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**Paragraph Heading Font Size:** 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing.

**Chapter Heading Font Size:** 20, Times New Roman, Centre Aligned, 30 point above and below spacing.

**Coding Font size:** 10, Courier New, Normal

**Submission of Project Report to the University:** The student will submit his/her project report in the prescribed format. The Project Report should include:

1. One copy of the summary/abstract.
2. One hard Copy of the Project Report.
3. The Project Report may be about 75 pages (excluding coding).

**FORMAT OF THE STUDENT PROJECT REPORT ON COMPLETION OF THE PROJECT**

- I. Cover Page as per format
- II. Acknowledgement
- III. Certificate of the project guide
- IV. Synopsis of the Project
- V. Main Report
  - i. Objective & Scope of the Project
  - ii. Theoretical Background Definition of Problem
  - iii. System Analysis & Design vis-a-vis User Requirements
  - iv. System Planning (PERT Chart)
  - v. Methodology adopted; System Implementation & Details of Hardware & Software used System Maintenance & Evaluation
  - vi. Detailed Life Cycle of the Project
    - a. ERD, DFD
    - b. Input and Output Screen Design
    - c. Process involved
    - d. Methodology used testing
    - e. Test Report, Printout of the Report & Code Sheet
- VI. Coding and Screenshots of the project
- VII. Conclusion and Future Scope
- VIII. References

**Formats of various certificates and formatting styles are as:**

1. Certificate from the Guide

CERTIFICATE

This is to certify that this project entitled “ xxxxxx xxxxx xxxxx xxxx xxxx xxx” submitted in partial fulfilment of the degree of Bachelor of Technology (Computer Science Engineering-AIML) to the “xxxxxxxxxxxxxxxxxxxxxxxxxxxxx” through xxxxxx xxxxx done by Mr./Ms. \_\_, Roll No. \_\_\_\_\_ is an authentic work carried out by him/her at \_\_\_\_\_ under my guidance. The matter embodied in this project work has not been submitted earlier for award of any degree to the best of my knowledge and belief.

Signature of the Student

Signature of the Guide

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**2. Project Report Cover Page Format:**

**Title of the Project/report**  
**(Times New Roman, Italic, Font size = 24)**

**Submitted in partial fulfilment of the requirements for the award of the Degree of**  
**Bachelor of Technology (CSE-AIML) (Bookman Old Style, 16 point, centre)**

Submitted to:  
(Guide Name)

Submitted by:  
(Student's name)  
Roll No: College Name:

**3. Self-Certificate by the Students**

SELF CERTIFICATE

This is to certify that the dissertation/project report entitled “.....” is done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Technology (CSE-AIML) under the guidance of..... The matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the Student Name of the Student Roll No.

**4. ACKNOWLEDGEMENTS**

In the “Acknowledgements” page, the writer recognizes his indebtedness for guidance and assistance of the thesis adviser and other members of the faculty. Courtesy demands that he also recognize specific contributions by other persons or institutions such as libraries and research foundations. Acknowledgements should be expressed simply, tastefully, and tactfully.

**ARYAVART INTERNATIONAL UNIVERSITY**  
**Tilthai, Dharmanagar, North Tripura**

**SEMINAR/CONFERENCE PRESENTATION**

**Code: 24PR502**

Max Marks: 70

**OBJECTIVE:**

Seminars/Conferences and Presentations provide a platform to the students, where they can learn from what others are doing, learn about new things, ideas, and important tips related to new technologies. To foster the Innovations happening in upcoming technologies and harnessing the entrepreneurial opportunities, Institutes must provide ample opportunities to the students to learn and yield the advantages of new advancements in the field of technology. It is expected from a student to learn the latest in the industry and write an article related to it and present their findings in front of a panel.

The following points need to be considered while planning and evaluating the presentation

- The seminars must be conducted after every 15 days/ or a month. A minimum of 3-4 seminar sessions can be organized during the semester.
- A minimum of 7-8 slides must be there, which would include the title slide. The first slide should be the Introduction slide, and the last one the reference slide, wherein all the links/book references/paper references to paper must be quoted. The rest of the slides should focus on the technology, application areas, etc.
- The title of the seminar must be related to the field of Information technology and must talk about the latest innovation/technology like IOT, Machine learning, Deep learning, AI Cloud computing, Mobility, Hand held devices, Social Computing, NOSQL Database, CRM, Social CRM, Open Source Application Development Frameworks, Zero Trust Security Framework/ Architecture, Big Data/ Data Lake, Emerging and Innovative Technologies, Conversational AI, Sentiments Analysis, DevOps, Real time Analytics, Fraud Detection. Proper approval must be taken before starting the work.
- Students' feedback must be taken after taking the seminar on what learning they have learned after studying the topics. For this, a feedback form may be designed using the Google Forms utility.

**IOT LAB**

**Code: 24CS693**

Max Marks: 70

(BASED ON 24CS603) Internet of Things:

**List of Practical:**

1. Select any one development board (E.g., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analogue and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Read data from sensor and send it to a requesting client. (using socket communication) Note: The client and server should be connected to same local area network.
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Push sensor data to cloud.
7. Control an actuator through cloud.
8. Accesses the data pushed from sensor to cloud and apply any data analytics or visualization services.
9. Create a mobile app to control an actuator.
10. Design an IoT based air pollution control system which monitors the air pollution by measuring carbon monoxide, ammonia, etc and gives alarm or sends message when the pollution level is more than permitted range.
11. Design an IoT based system which measures the physical and chemical properties of the water and displays the measured values.
12. Identify a problem in your local area or college which can be solved by integrating the things you learned and create a prototype to solve it (Mini Project).
13. Design a business model canvas for a digital display.

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**Theory Paper**

Total: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External: 70 Marks**

10 Question (MCQ): 1 mark each (1x10 = 10)  
Answer any 6 out of 8 (Very Short 20-30 Words): 2 marks each (2x6 = 12)  
Answer any 6 out of 8 (Short 50-70 Words): 3 marks each (3x6 = 18)  
Answer any 6 out of 8 (Long 100-120 Words): 5 marks each (5x6 = 30)

**Internal: 30 Marks**

Two Internal Assessment Examinations will be conducted, each carrying 50 marks. The average of the two scores will be considered and scaled to 15 marks for the final assessment. Additionally, 5 marks will be allotted for assignments submitted, 5 marks for attendance, and 5 marks for general proficiency, making a total of 30 internal assessment marks.

**Lab**

Practical: 100 Marks  
External: 70 Marks  
Internal: 30 Marks

**External (Two programs): 70 Marks**

**Program Writing:** 10 + 10 Marks  
**Algorithm & Flowchart:** 5 + 5 Marks  
**Program Execution:** 15 + 15 Marks  
**Viva:** 10 Marks

**Internal Assessment (30 Marks)**

Internal Assessment Examinations will be conducted, carrying 50 marks  
**Record:** 5 Marks  
**Attendance:** 5 Marks  
**Program Writing:** 15 Marks  
**Program Execution:** 15 Marks  
**Viva:** 10 Marks