Subject List B. Tech

S. No	Code	PTU Code	Subject Name
		Subject List	
1	C101	BTPH104-18	Semiconductor Physics
2	C102*	BTPH114-18	Semiconductor Physics Lab
3	C103	BTAM104-18	Mathematics Paper-I
4	C104	BTEE101-18	Basic Electrical Engineering
5	C105*	BTEE102-18	Basic Electrical Engineering Lab
6	C106	BTME101-18	Engineering Graphics & Design
7	C107	BTCH101-18	Chemistry-I
8	C108*	BTCH102-18	Chemistry-I Lab
9	C109	BTAM204-18	Mathematics Paper-II
10	C110	BTPS101-18	Programming for Problem Solving
11	C111*	BTPS102-18	Programming for Problem Solving Lab
12	C112*	BTMP101-18	Workshop/Manufacturing Practices
13	C113	BTHU101-18	English
14	C114*	BTHU102-18	English Lab
15	C115****	BMPD101-18	Mentoring and Professional Development
16	C116****	BMPD201-18	Mentoring and Professional Development
17	C220	BTES 301-18	Digital Electronics
18	C221	BTCS 301-18	Data structure & Algorithms
19	C222	BTCS 302-18	Object Oriented Programming
20	C223	BTAM 304-18	Mathematics-III
21	C224	HSMC 101/102-18	Development of Societies
22	C225*	BTES 302-18	Digital Electronics Lab
23	C226*	BTCS 303-18	Data structure & Algorithms Lab
24	C227*	BTCS 304-18	Object Oriented Programming lab.
25	C228*	BTCS 305-18	IT Workshop
26	C229****	SIT	Summer Institutional Training
27	C230	BTCS 401-18	Discrete Mathematics
28	C231	BTCS 402-18	Operating Systems
29	C232	BTCS 403-18	Design & Analysis of Algorithms
30	C233	BTES 401-18	Computer Organization & Architecture
31	C234**	EVS101- 18	Environmental Sciences

32	C235	HSMC 122-18	Universal Human Values
33	C236*	BTCS 404-18	Operating Systems Lab
34	C237*	BTCS 405-18	Design & Analysis of Algorithms Lab
35	C238*	BTES 402-18	Computer Organization & Architecture Lab
36	C321	BTCS 501-18	Database Management System
37	C322	BTCS 502-18	Formal Language &Automata Theory
38	C323	BTCS 503-18	Software Engineering
39	C324	BTCS 504-18	Computer Networks
40	C325	BTES 501-18	Enterprise Resource Planning
41	C326	BTCS 520-18	Web Technologies
42	C327**	MC	Constitution of India
43	C328*	BTCS 505-18	Database Management Systems Lab
44	C329*	BTCS 506-18	Software Engineering Lab
45	C330*	BTCS 507-18	Computer Networks Lab
46	C331*	BTCS 522-18	Web Technologies Lab
47	C332*	Ind. Training	Industrial Training
48	C333	BTCS 601-18	Compiler Design
49	C334	BTCS 602-18	Artificial Intelligence
50	C336	BTCS 612-18	Cloud Computing
51	C337	BTCS 618-18	Machine Learning
52	C338	BTCS 620-18	Mobile Application Development
53	C339	BTEC 601-18	Wireless Communication
54	C340*	BTCS 603-18	Project-1
55	C341*	BTCS 604-18	Compiler Design Lab
56	C342*	BTCS 605-18	Artificial Intelligence Lab
57	C344*	BTCS 613-18	Cloud Computing Lab
58	C345*	BTCS 619-18	Machine Learning Lab
59	C346*	BTCS 621-18	Mobile Application Development Lab
60	C410	BTCS-701-18	Network Security and Cryptography
61	C411	BTCS-702-18	Data Mining and Data Warehousing
62	C412	BTEC-905A-18	Routing and Switching
63	C413	BTCS-710-18	Agile Software Development
64	C414	BTCS-716-18	Adhoc and Wireless Sensor Networks
65	C415	BTCS-703-18	Project-II
66	C416*	BTCS-711-18	Agile Software Development Lab
67	C417*	BTCS-717-18	Adhoc and Wireless Sensor Networks Lab
68	C418*	BTCS-801-18	Semester Training

Course Outcomes B. Tech

1ˢᵗ Year (1ˢᵗ and 2ⁿᵈ Semester)

Semiconductor Physics (BTPH104-18): C101	
CO1	Illustrate the fundamental principles and properties of electronic materials.
CO2	Explain the basics of semiconductors and transport of charge carriers in a semiconductor junction.
CO3	Elaborate the interaction of light with semiconductors and its application in semiconductor laser.
CO4	Evaluate the parameters of semiconductor devices using measurement techniques.

Semiconductor Physics Lab (BTPH114-18): C102*	
CO1	Demonstrate some of the theoretical concepts learnt in the theory courses.
CO2	Analysing and applying precise measurements and handling sensitive equipment.
CO3	Propose the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Interpret conclusions from data and develop skills in experimental design.
CO5	Create technical reports which communicate scientific information in a clear and concise manner.

Mathematics - I (BTAM104-18): C103	
CO1	Estimate functions by using fundamental theorems.
CO2	Apply differential and integral calculus to evaluate definite, improper integrals and its applications.
CO3	Determine the existence and uniqueness of the solution of system of linear equations using matrix algebra
CO4	Utilize the acquired knowledge of eigen values and eigen vectors to diagonalize the matrix.
CO5	Relate the concept of Basis and Dimension of a vector space in linear transformation.

Basic Electrical Engineering (BTEE101-18): C104	
CO1	Categorize circuit elements, sources and mathematical analysis of DC circuits
CO2	Analyze the behaviour of AC circuits.
CO3	Interpret the basic magnetic circuits and apply it to the working of electrical machines.
CO4	Classify the components of low voltage electrical installations.

Basic Electrical Engineering Lab (BTEE102-18): C105*	
CO1	Make use of common electrical measuring instruments and interpret the fundamentals of electrical engineering.
CO2	Construct electrical connections and measure power, power factor using appropriate equipment.
CO3	Utilize the knowledge of basic magnetism to understand working of transformers.
CO4	Demonstrate operation of electrical machines, components and their ratings.

Engineering Graphics & Design (BTME 101-21): C106	
CO1	Illustrate and prepare drawings.
CO2	Apply the principles of orthographic projections
CO3	Analyze and visualize of two and three dimensional planes and solids respectively.
CO4	Design and fabricate surfaces of different shapes.
CO5	Construct the objects in three dimensional appearances.

Chemistry - I (BTCH101-18): C107	
CO1	Interpret concepts related to atomic and molecular structure at orbital level as well as categorize various intermolecular forces.
CO2	Infer about thermodynamic functions, chemical equilibria, water chemistry and corrosion.
CO3	Interpretation of data by using different spectroscopic techniques and its daily life applications.
CO4	Explain and distinguish different periodic properties of elements such as ionization energy, electron affinity, electronegativity, oxidation state and polarizability.
CO5	Classify major organic chemical reactions used for the synthesis of molecules as well as drugs.
CO6	Illustrate three dimensional arrangements and isomers possible for a molecule and their properties.

Chemistry-I Lab (BTCH102-18) : C108*	
CO1	Rephrase interactions among molecules on the basis of surface tension, viscosity and Partition Coefficient.
CO2	Develop Polymer and drug molecule as well as analyze salt samples.
CO3	Estimate rate constants of chemical reactions as a function of time.
CO4	Discover acidity and chloride content present in water sample.
CO5	Evaluate adsorption isotherm and extent of adsorption using TLC

Mathematics -II (BTAM204-18): C109	
CO1	Determine different types of statistical tools.
CO2	Apply the concepts of probability and probability distributions to analyze the data
CO3	Examine and predict the relationship between variables using correlation and regression techniques.
CO4	Formulate and test the Hypothesis for different samples.

Programming for Problem Solving (BTPS101-18): C110	
CO1	Demonstrate the knowledge and working of a computer with its parts.
CO2	Formulate simple algorithms and translate the algorithms to programs (in C language).
CO3	Evaluate conditional branching, iteration statements and recursion process.
CO4	Develop coding using arrays and implement various operations using 1D and 2D array (Matrix arithmetic operations).
CO5	Interpret the identified problems using functions and implementing searching and sorting algorithms on the given list as well as construct recursive functions.
CO6	Apply programming to design pointers, structures and file handling.

Programming for Problem Solving Lab (BTPS102-18): C111*	
CO1	Evaluate given algorithms for the development of correct program.
CO2	Identify syntax errors and logical errors at compile and run time for correction.
CO3	Develop iterative as well as recursive programs.
CO4	Formulate data in arrays, strings and structures and manipulate them through a program.
CO5	Create pointers of different types and implement them in defining self-referential structures.
CO6	Design coding to create, read and write to and from simple text files.

Workshop/Manufacturing Practices (BTMP101-18): C112*	
CO1	Interpret the different manufacturing processes which are commonly employed in the industry to fabricate components using different materials
CO2	Apply knowledge to construct different jobs with their own hands.
CO3	Interpret the dimensional accuracies and tolerances possible with different manufacturing processes.
CO4	Develop small devices of their interest.

English (BTHU101-18): C113	
CO1	Improve their vocabulary to use different words and phrases in formulating meaningful sentences.
CO2	Identify and ascertain knowledge about the basic grammatical aspects and sentence structures for developing effective communication.
CO3	Interpret the given text and employ effective writing techniques for organizing and producing clear and coherent forms of expression.
CO4	Identify and interpret the literal and contextual meaning of the given text to Compose their responses accordingly.
CO5	Apply their point of view effectively for developing and generating their ideas in creative written form.
CO6	Compose varied forms of business correspondence and professional documents for the purpose of informing, recognizing, analysing and official reporting.

English Lab (BTHU102-18): C114*	
CO1	Build their listening and speaking skills by acquiring new forms of expressions for lucid communications.
CO2	Formulate structured conversation and put forth their point of view fluently on a variety of topics.
CO3	Overcome their inhibition and feel confident while demonstrating their language skills to make the transitions clear.
CO4	Interpret, analyse and use correct language in general, academic and professional environment.
CO5	Understand and function as per the expectations of the industry to prepare themselves for future interviews.
CO6	Design presentation on a given topic, learn to modulate their voice along with exhibiting the right body language.

Mentoring & Professional Development (MPD101-18): C115**
CO1	Improve themselves by setting and working towards individual goals.
CO2	Demonstrate the importance of moral & ethical values that exemplify professionalism.
CO3	Develop physical fitness, wellness & sports to promote a healthy lifestyle.
CO4	Construct various analytical & training methods for their development.
CO5	Utilize physical activity as a tool to manage stress, pressure & work in life.

Mentoring & Professional Development (MPD201-18): C116**
CO1	Improve themselves by setting and working towards individual goals.
CO2	Demonstrate the importance of moral & ethical values that exemplify professionalism.
CO3	Develop physical fitness, wellness & sports to promote a healthy lifestyle.
CO4	Construct various analytical & training methods for their development.
CO5	Utilize physical activity as a tool to manage stress, pressure & work in life.

2nd Year

3rd Semester

Digital Electronics (BTES 301-18): C220
CO1	Interpret the number system, binary arithmetic, binary codes and their applications
CO2	Demonstrate the role of logic gates in the realization of Boolean function
CO3	Design and development of combinational circuits using problem formulation and logic optimization
CO4	Design and development of sequential circuits using problem formulation and logic optimization
CO5	Construct digital logic circuits using ROM, PLA and PAL units
CO6	Analyzing the operation and performance of A/D and D/A converters and their application in system design

Data Structures & Algorithms (BTCS 301-18): C221
CO1	Demonstrate how the data is organized as well as categorize into various data structures and solve complex engineering problems.
CO2	Utilize appropriate data structure to solve problems efficiently and provide better solution to reduce space and time complexity.
CO3	Illustrate various methods of organizing large amounts of data and identify systematic approach to retrieve data and solve problems.
CO4	Identify and analyze linear and non-linear data structures to understand and design algorithmic solutions for their applications.
CO5	Formulate new solutions for real world problems or improve existing code using well defined algorithms.

Object Oriented Programming (BTCS 302-18): C222	
CO1	Interpret the behaviour of simple programs involving the fundamental programming concepts.
CO2	Outline the meaning of object-oriented paradigm with implementation.
CO3	Illustrate various forms of inheritance and identify systematic approach to access class hierarchy.
CO4	Elaborate the concept of polymorphism and generic programming.
CO5	Combine the concept of exception handling and I/O streams in object-oriented programs

Mathematics-III (BTAM 304-18): C223	
CO1	Demonstrate the concept and use of partial differentiation in various problems and examine the function for maxima and minima and discover its extreme value.
CO2	Determine if an infinite sequence is bounded, monotonic or oscillating and determine the sequence whether it is convergent or divergent by using the appropriate tests.
CO3	Construct and evaluate multiple integrals for regions in the plane and to find Area of the region bounded by curves and to find volume and surface area of solid geometric figures.
CO4	Create, select and utilize the learnt techniques of first degree ordinary differential equations to Model real world problems.
CO5	Obtain the generated solution of an inhomogeneous linear constant coefficient second order differential equation by combining its complementary function with particular integral

Development of Societies (HSMC 101-18): C224	
CO1	Apply the knowledge of the basic social concepts for understanding the different social systems.
CO2	Interpret the different models of Social Structures and their evolution.
CO3	Evaluate the political ideology and comprehend all the governing systems since its emergence.
CO4	Analyze the working scenario of development in pre-British, British and post British period.
CO5	Compare the economic development ideas according to different economists in different eras.

Digital electronics Lab (BTES 302-18): C225*	
CO1	Demonstrate and understand the operations of digital trainer and logic gates using integrated circuits.
CO2	Design and realization of combinational circuits and verification of their operations.
CO3	Design and realization of sequential circuits and verification of their operations.
CO4	Evaluation of operation of different ICs for various applications

Data structure & Algorithms Lab (BTCS 303-18): C226*	
CO1	Apply the knowledge of programming skills to implement and analyze different data structure.
CO2	Outline and implement various data structures algorithms in high level programming language.
CO3	Identify and apply the appropriate data structure to solve real world problems.
CO4	Design and analyze the time and space efficiency of the data structures.
CO5	Implement appropriate searching and sorting techniques for application development.

Object Oriented Programming Using C++ Lab (BTCS 304-18): C227*
CO1	Develop classes incorporating object-oriented techniques.
CO2	Make use of C++ features to program design and implement.
CO3	Illustrate and evaluate the file Input Output mechanisms.
CO4	Utilize C++ to demonstrate practical experience in developing object oriented solutions.
CO5	Implement virtual function to achieve dynamic polymorphism.

IT Workshop (BTCS 305-18): C228*
CO1	Describe various python programming basics and apply them in solving computational problems
CO2	Choose appropriate python looping, control statements to provide better solution.
CO3	Identify and analyse methods of file handling and exception handling
CO4	Develop model database connectivity with front end.
CO5	Apply knowledge for computer assembling and software installation.

Summer Institutional Training: C229**
CO1	Apply knowledge and skills they learned in previous classes to solve real-life problems.
CO2	Make use of techniques, skills and modern engineering tools for engineering practice.
CO3	Develop communication, interpersonal and other critical skills in the job interview process.
CO4	Adapt the professional and ethical responsibilities.
CO5	Analyze the functioning of internship organization and recommend changes for improvement in processes.

4th Semester

Discrete Mathematics (BTCS 401-18): C230
CO1	Elaborate logical sentence in terms of predicates, quantifiers, and logical connectives.
CO2	Construct the solution for a given problem using deductive logic and prove the solution based on logical inference.
CO3	Analyze a given a mathematical problem, classify its algebraic structure.
CO4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
CO5	Design the given problem as graph networks and solve with techniques of graph theory.

Operating System (BTCS 402-18): C231
CO1	Interpret the basic operating system mechanisms such as overall architecture, system calls, user mode and kernel mode
CO2	Compare and contrast concepts related to processes, threads, process scheduling, race conditions and critical sections
CO3	Evaluate and apply CPU scheduling algorithms, deadlock detection and prevention algorithms
CO4	Examine and categorize various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing
CO5	Formulate and implement file management system
CO6	Appraise high-level operating systems concepts such as file systems, disk-scheduling algorithms and various file systems

Design & Analysis of Algorithms (BTCS 403-18): C232

CO1	Compare the correctness of algorithms using inductive proofs and analyze worst-case running times of algorithms using asymptotic analysis.
CO2	Explain important algorithmic design paradigms (brute force, greedy method, dynamic-programming and Backtracking, branch and bound) and apply when an algorithmic design situation calls for it.
CO3	Explain the major graph algorithms and Employ graphs to model engineering problems, when appropriate.
CO4	Describe the classes P, NP, and NP Complete and be able to prove that a certain problem is NP-Complete.
CO5	Analyze approximation/randomized/heuristic algorithms and recite analyses of these algorithms that employ this method of analysis.

Computer Organization & Architecture (BTES 401-18): C233

CO1	Identification of functional units and internal architecture of a microprocessor
CO2	Illustration of instruction set of a microprocessor and performing the arithmetic and logical operations on binary data.
CO3	Categorization of design approaches of control unit and I/O data transfer approaches
CO4	Evaluation and classification of pipelined and parallel processors
CO5	Determine the functions and role of memory systems in processors

Environmental Studies (EVS 101-18): C234**

CO1	Develop the knowledge on various natural resources, their utilization for sustainable lifestyles and their repercussion.
CO2	Discuss the values, threats and conservation of biodiversity and classify various Ecosystems
CO3	Identify and implement technological and economical solution to environmental problems.
CO4	Outline the environmental solutions and perform activities to generate public awareness.
CO5	Demonstrate individuals to conduct activities on social issues, environment awareness campaigns etc.

Universal Human Values (HSMC 122-18): C235

CO1	Identify the need of Self-Exploration and Basic requirements for fulfilment of Aspirations of every Human Being
CO2	Analyse the value of Harmony in the Human Being
CO3	Illustrate the existence of Human being with the Family and Society and understand the idea of Human-Human relationship
CO4	Examine the existence of a Human Being with the Nature to Coexist
CO5	Apply the human values to achieve Ethical Human Conduct and Universal Human Order

Operating System Lab (BTCS 404-18): C236*

CO1	Identify and implement basic services and functionalities of the operating system
CO2	Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority
CO3	Construct the virtual machine to install the various operating systems.
CO4	Implement the commands for files and directories.
CO5	Compute and simulate the concepts of shell programming, files and directories
CO6	Examine the concepts of deadlock in operating systems and implement them in multiprogramming system

Design & Analysis of Algorithms Lab (BTCS 405-18): C237*	
CO1	Implement Algorithm to solve problem by iterative search
CO2	Design algorithms using divide and conquer, greedy and dynamic programming.
CO3	Execute sorting algorithms such as sorting, graph related and combinatorial algorithm in a high level language
CO4	Analyze the performance of merge sort and quick sort algorithms using divide and conquer technique.
CO5	Apply the dynamic programming technique to solve real world problems such as knapsack and TSP.

Computer Organization & Architecture Lab (BTES 402-18): C238*	
CO1	Identification and recognition of computer anatomy - Memory, Ports, Motherboard etc.
CO2	Make use of the computer parts for assembling a PC
CO3	Define the functional units of the processor such as the registers, memory space and other parts available on trainer
CO4	Illustration of instruction set of a microprocessor and perform the arithmetic and logical operations on binary data.

3rd Year
5th Semester

Database Management Systems (BTCS 501-18): C321	
CO1	Describe relational algebra expressions for a query and optimize the Developed expressions
CO2	Design the databases using ER method and normalization.
CO3	Construct the SQL queries for Open source and Commercial DBMS
CO4	Illustrate various methods of organizing data and transaction properties
CO5	Implement the optimization techniques for security handling and enhance knowledge about advance databases

Formal Language & Automata Theory (BTCS 502-18): C322	
CO1	Perceive formal notation for strings, languages and machines.
CO2	Classify finite automata to accept a set of strings of a language.
CO3	Design context free grammars to generate strings of context free language.
CO4	Determine equivalence of languages accepted by Push Down Automata and languages.
CO5	Comparison between computability and non-computability and Decidability and un-decidability.
CO6	Analyse the importance of Co-NP.

Software Engineering (BTCS 503-18): C323	
CO1	Develop a Strategy for the selection of Life cycle models and plan software requirements by analysing and specifying the problem.
CO2	Identify various design issues by specifying software requirements and inspecting coding techniques.
CO3	Formulate an appropriate testing strategy for the given software system.
CO4	Elaborate planning for software project management and ensure quality is enriched.
CO5	Determine state-of-the-art engineering tools for software transformation and reverse engineering work.

Computer Networks (BTCS 504-18): C324
CO1	Develop knowledge of various networking models with respect to functionalities.
CO2	Enhance the major reasons involved in collision and resolve the issues of error detection and correction.
CO3	Assess various protocols to recognise the need of particular protocol to develop network related applications.
CO4	Discover knowledge of routing and congestion control algorithms to develop networking structures.
CO5	Apply the knowledge of different network designs and improvise quality of transmissions and services.
CO6	Design various protocols for end user to develop applications and provide required services to the user.

Enterprise Resource Planning (BTES 501-18): C325
CO1	Describe the use of Enterprise software and its role in integrating business functions.
CO2	Analyze the strategic options for ERP identification and implementation.
CO3	Demonstrate the technical aspect of telecommunication systems, internet and their roles in business environment.
CO4	Develop skills necessary for building and managing relationships with customers, and stakeholders.
CO5	Formulate the reengineered business processes for future directions.

Web technologies (BTCS 520-18): C326
CO1	Analyzing and applying the knowledge of web technology stack to deploy various web services.
CO2	Analyze and evaluate web technology components for formulating web related problems
CO3	Design and develop interactive client server internet application that accommodates user specific requirements and constraint analysis
CO4	Creating dynamic pages with an understanding of functions and objects using web technologies
CO5	Apply advance concepts of web interface and database to build web projects in multidisciplinary environments
CO6	Demonstrate and enhanced knowledge in internet addressing, internet connection, web application and tools for web site creation.

Constitution of India (MC): C327**
CO1	Illustrate basic knowledge about the Constitution of India.
CO2	Explain to the students about their obligations, responsibilities, privileges and rights, duties and get insights on administrative and judicial setup of the country.
CO3	Outline national and patriotic spirit among the students as responsible citizens of the country.
CO4	Relate knowledge about state and central policies, fundamental duties, electoral process, amendment procedure and emergency provisions.
CO5	Analyze the History, features of Indian constitution, the role Governor and Chief Minister, role of state election commission, the decentralization of power between central, state and local self-government.
CO6	Apply the knowledge on directive principle of state policy, the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

Database Management Systems Lab (BTCS 505-18): C328*	
CO1	Describe relational algebra expressions for a query and optimize the Developed expressions
CO2	Design the databases using ER method and normalization.
CO3	Construct the SQL queries for Open source and Commercial DBMS
CO4	Illustrate various methods of organizing data and transaction properties
CO5	Implement the optimization techniques for security handling and enhance knowledge about advance databases

Software Engineering Lab (BTCS 506-18): C329*	
CO1	Demonstration to draft a project plan and track the progress of a project using the Openproj tool.
CO2	Create SRS documents, design documents, test cases, and software configuration management and risk management document.
CO3	Build a Function-oriented and object-oriented software design using tools such as Rational Rose.
CO4	Implement unit testing and integration testing.
CO5	Implement several white Box and Black box testing techniques to test the process.

Computer Networks Lab (BTCS 507-18): C330*	
CO1	Analyse and configure about various networking devices, implement them using various cables and develop understanding of network topologies
CO2	Utilize knowledge of modern network simulation tools to propose solution for efficient working of networks for real world problems.
CO3	Configure network using IP addressing and sub netting.
CO4	Solve various network devices problems using Packet Tracer simulation tool.
CO5	Discover various configuration commands to configure router.

Web Technologies Lab (BTCS 522-18): C331*	
CO1	Analyze a web page and identify its elements and attributes
CO2	Develop web pages using XHTML and Cascading Style Sheets.
CO3	Discuss the basics of Web Application Terminologies, Internet Tools, E – Commerce and other web services.
CO4	Categorize dynamic web pages using Client side programming.
CO5	Demonstrate the use of various website designing tools

Industrial Training: C332*	
CO1	Illustrate knowledge about latest trends of the Industry such as software, hardware and other tools.
CO2	Developing the ability to study projects deeply and systematically to produce solutions for various problems.
CO3	Inference the skills such as communicational and managerial skills of the individual as per the requirement of the Industry.
CO4	Developing moral ethics such as commitment, teamwork spirit to achieve continuous development.
CO5	Utilising the mathematical and engineering concepts for solving the problems of society and industry.

6th Semester

Compiler Design (BTCS 601-18): C333
CO1	Explain concepts on lexical analysis.
CO2	Compare top down and bottom up strategies of syntax analysis.
CO3	Implement techniques of Intermediate code generation.
CO4	Discuss code design issues and design code generator.
CO5	Analyze the technique used for optimized codes.

Artificial Intelligence (BTCS 602-18): C334
CO1	Analyzing the concept of Artificial Intelligence, Agents, their types and structure.
CO2	Demonstrate search strategies to solve the informed and uninformed problems.
CO3	Design and evaluate intelligent expert models for perception and prediction from intelligent environment.
CO4	Evaluating valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
CO5	Demonstrate and enhanced knowledge to select and apply AI tools to analyze information and develop models within constraints of application area.
CO6	Design and develop programs for a reinforcement agent to learn and examine the issues involved in knowledge bases, reasoning systems and planning.

Cloud Computing (BTCS 612-18): C336
CO1	Identify the core concepts of Cloud Computing
CO2	Illustrate the significance of Virtualization along with their technologies
CO3	Analyse Cloud Computing Service models and Deployment models and implementing these to solve problems on the cloud.
CO4	Execution of various Security Strategies for different cloud platforms
CO5	Identify the modern Cloud Platforms along with Cloud Service Providers

Machine Learning (BTCS 618-18): C337
CO1	Analyze methods and theories in the field of machine learning.
CO2	Design and extract features of complex datasets.
CO3	Implement techniques to comment for the Regression.
CO4	Comprehend and apply different classification and clustering techniques.
CO5	Implement the concept of Neural Networks and Genetic Algorithm.

Mobile Application Development (BTCS 620-18): C338
CO1	Outline the basic concepts of android tools and technologies with its recent development
CO2	Identify different design parameters and constraints for application development
CO3	Design smart application using advanced concepts of android programming
CO4	Apply high graphic functionalities to enhance application development
CO5	Analyze different challenges while designing android application

Wireless Communication (BTEC 601-18): C339	
CO1	Demonstrate knowledge in basic concepts of cellular radio system, its design and frequency reuse.
CO2	Analyze the Mobile radio propagation through fading and various multipath diversity techniques.
CO3	Classify and compare various multiple access techniques in wireless communication.
CO4	Identify various wireless standards and channels specifications.
CO5	Interpret various wireless technologies, their evolution and technical aspects in society.

PROJECT-1 (BTCS 603-18): C340*	
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Interpret problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilising a systems approach.
CO4	Construct an engineering project.
CO5	Demonstrate the knowledge, skills and attitudes of a professional engineer.

Compiler Design Lab (BTCS 604-18): C341*	
CO1	Develop the functionalities of Lexical Analyzer
CO2	Demonstrate the functionalities of Predective parsers
CO3	Implement operator precedence parsing
CO4	Analyze the concept of strings
CO5	Build abstract syntax tree

Artificial Intelligence Lab (BTCS 605-18): C342*	
CO1	Apply the concept of uninformed and informed search to build program.
CO2	Identify various AI techniques to conduct game search.
CO3	Interpret the concept of AI to Construct and Design Bayesian network from a given data set.
CO4	Build a program to run a value and policy iteration in a grid world.
CO5	Interpret the concept of reinforcement learning to develop the algorithm.

Cloud Computing Lab (BTCS 613-18): C344*	
CO1	Apply virtualization and understand the core concept of virtualization along with their technologies.
CO2	Design and implement different cloud scheduling algorithm using simulation tool.
CO3	Describe the concept of cloud security and identity management.
CO4	Illustrate the key components of Amazon web Service and other cloud service providers
CO5	Identify various resource management fundamentals and interpret various data, scalability & cloud services.

Machine Learning Lab (BTCS 619-18): C345*
CO1	Design, analyze and visualize the implementation of machine learning algorithms
CO2	Create and develop various algorithms for specific problems with appropriate datasets
CO3	Examine the need for machine learning techniques for specific domain
CO4	Formulate solutions of real time problems with the prediction and visualization
CO5	Evaluate and implement Genetic Algorithms for optimization of engineering solutions

Mobile Application Development Lab (BTCS 621-18): C346*
CO1	Interpret different platforms and tools for the designing of android application
CO2	Build mobile application development environment
CO3	Implement various methods used for the designing and development of an android application
CO4	Design user interfaces with different components
CO5	Analyze application development with testing frameworks

4th Year

7th Semester

Network Security and Cryptography (BTCS 701-18): C410
CO1	Make use of fundamental principles of access control models, techniques and authentication to secure system design.
CO2	Analyze the different cryptographic protocols and techniques and be able to use them.
CO3	Apply methods for content integrity, authentication, and access control.
CO4	Identify and mitigate software security vulnerabilities in existing systems.
CO5	Develop an understanding of security policies and apply methods of Intrusion detection and Prevention.

Data Mining and Data Warehousing (BTCS 702-18): C411
CO1	Illustrate the concept of data warehouse and data mining along with different data models.
CO2	Classify the mathematical foundations of data pre-processing and data mining challenges.
CO3	Demonstrate techniques for pattern prediction and analysis from large dataset
CO4	Evaluate the research and design of new Search engine Software.
CO5	Formulate the performance of various data mining algorithms.

Routing and Switching (BTEC 905A-18): C412
CO1	Demonstrate a basic understanding of small and medium-sized networks, including general network technologies.
CO2	Design small and medium-sized networks and implement the designs.
CO3	Inference the storage technologies into their networks in order to support a variety of applications.
CO4	Construct simple networks and integrate voice, wireless, cloud, security.

Agile Software Development (BTCS 710-18): C413	
CO1	Interpret the concept of agile methodology and its advantages in software development.
CO2	Analyse models for software design.
CO3	Demonstrate the core practices behind various agile frameworks.
CO4	Apply estimation techniques and scheduling project activities.
CO5	Make use of various tools available to agile teams to facilitate the project.
CO6	Analyze implications of agile testing, verifying stories and code integration.

Adhoc and Wireless Sensor Networks (BTCS 716-18): C414	
CO1	Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks and apply this knowledge to identify the suitable routing algorithm based on the network.
CO2	Apply the knowledge to identify appropriate physical and MAC layer protocols
CO3	Asses the transport layer and routing protocols for ad hoc wireless networks with respect to TCP design issues
CO4	Inspect the use of OS used in Wireless Sensor Networks and build basic modules
CO5	Predict the Challenges in security provisioning ,Security Attacks and security issues possible in Adhoc and Sensors Networks

Project-II (BTCS 703-18): C415	
CO1	Analyze how to apply software development methodology on application development.
CO2	Determine about advance programming languages and techniques.
CO3	Identify and solve real world problems.
CO4	Infer how to write technical report.
CO5	Create Test cases and to perform software Testing.
CO6	Interpret the concept of security aspects and backup recovery

| **Agile Software Development Lab (BTCS 711-18): C416***	
CO1	Illustrate the driving forces for taking an Agile Approach to Software Development.
CO2	Outline backlog and user stories.
CO3	Examine various automated tools.
CO4	Discuss Design principle and Refactoring to achieve agility.
CO5	Determine Testing activities within an agile project.

Adhoc and Wireless Sensor Networks Lab (BTCS 717-18): C417*	
CO1	Explain the principles of Wireless sensor networks and to perform its simulation.
CO2	Implement routing protocols using networking tools.
CO3	Identify and study the methodology of various wireless network simulators.
CO4	Infer the Challenges in security provisioning of routing protocols.

8ᵗʰ Semester

Semester Training (BTCS 801-18): 418*
CO1	Illustrate the uses of softwares on Application development.
CO2	Develop knowledge about advance programming techniques and modern tools.
CO3	Identify the real world problems and provide solutions to solve them
CO4	Organize the platform to use the latest technologies like Artificial intelligence, Data science, Cloud computing for making computer algorithms.
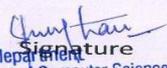
Subject List M. Tech

S. No.	Code	PTU Code	Subject Name
**Subject List**			
1	M1	MTCS-101-18	Mathematical foundations of Computer Science
2	M2	MTCS-102-18	Advanced Data Structures
3	M3	MTCS-105-18	Machine Learning
4	M4	MTCS 108-18	Data Science
5	M5	MTRM 101-18	Research Methodology and IPR
6	M6	MTA-XX	Audit Course
7	M7*	MTCS 103-18	Advanced Data Structures Lab.
8	M8*	MTCS-104-18	Machine Learning Lab
9	M9	MTCS-201-18	Advance Algorithms
10	M10	MTCS-202-18	Soft computing
11	M11	MTCS-208-18	Computer vision
12	M12	MTCS 209-18	Human Computer Interactions
13	M13	MTA-XX	Audit Course
14	M14*	MTCS 203-18	Advance Algorithms Lab
15	M15*	MTCS 204-18	Computer vision Lab
16	M16	MTCS-205-18	Mini Project with seminar
17	M17	MTCS-304-18	Optimization Techniques
18	M18	MTOE 303-18	Operations Research
19	M19	MTCS 301-18	Dissertation -I
20	M20	MTCS 305-18	Institutional Training
21	M21	MTCS 401-18	Dissertation - II

Course Outcomes M.Tech

1ˢᵗ Year

1ˢᵗ Semester

Mathematical Foundation of Computer Science (MTCS 101-18): M1	
CO1	Identify the characteristics of different discrete and continuous distributions and the type of statistical situation to which different distributions can be applied.
CO2	Demonstrate understanding of the theory of sampling distribution and maximum likelihood estimation.
CO3	Make use of graphs as unifying theme for various combinatorial problems.
CO4	Interpret the methods of statistical inference and the role that sampling distributions play in those methods.
CO5	Develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design and concurrency.

Advanced Data Structure (MTCS 102-18): M2	
CO1	Choose appropriate data structures and algorithms, understand the concept of advanced abstract data type and use it to design algorithms to solve complex engineering problems.
CO2	Constructing various symbol tables using hash techniques to solve problems efficiently and provide better solution in terms of complexity.
CO3	Identify various algorithms for skip list & trees and come up with analysis of efficiency and proofs of correctness
CO4	Develop algorithms for text processing applications and analyse their performance.
CO5	Select algorithm design approaches to solve computational geometry problems in a specific manner to improve performance.

Machine Learning (MTCS 105-18): M3	
CO1	Identify the basics of learning problems with hypothesis and version spaces.
CO2	Demonstrate the features of machine learning to apply on real world problems.
CO3	Categorize the machine learning algorithms as supervised and unsupervised learning approach and analyse them.
CO4	Analyse the concept of neural networks for learning linear and non-linear activation functions.
CO5	Elaborate the concepts in Bayesian analysis from probability models and methods.
CO6	Analyse and design various Genetic Algorithm for optimization of engineering problems.

Data Science (MTCS 108-18): M4	
CO1	Illustrate with the knowledge and expertise to become a proficient data scientist.
CO2	Demonstrate an understanding of statistics and machine learning concepts that are vital for data science
CO3	Build Python code to statistically analyses a dataset
CO4	Evaluate data visualizations based on their design and use for communicating stories from data
CO5	Create database connectivity with front end

Research Methodology-IPR (MTRM 101-18): M5	
CO1	Summarize research problem formulation.
CO2	Analyse research related information.
CO3	Plan a well-structured research paper and scientific presentations.
CO4	Assess various IPR components and process of filing.
CO5	Infer the adequate knowledge on patent and rights.

Audit Course - English for Research Paper Writing (MTA-A01): M6	
CO1	Outline that how to improve your writing skills
CO2	Identify techniques improve level of readability
CO3	Develop skills of writing each section of the paper
CO4	Analyzing skills required to write a quality paper
CO5	Improve technical thinking and creative abilities

Advanced Data Structure Lab (MTCS 103-18): M7*	
CO1	Analyze algorithms and to determine algorithm correctness and complexity using hashing techniques.
CO2	Design programs using a variety of data structures, including list, tree structures and analyse their complexity.
CO3	Implement and know the application of algorithms for computational geometry problems
CO4	Illustrate how text processing algorithms can be used to solve various real time problems.
CO5	Apply and implement learned algorithms design techniques in a project to get exposure to solve problems.

Machine Learning Lab (MTCS 104-18): M8*	
CO1	Make use of the various machine learning tools.
CO2	Implement and analyse the procedures for supervised and unsupervised learning.
CO3	Design and implement Python programs to solve real time problems.
CO4	Apply appropriate datasets to implement SVM classification and analyse them through graphical outcomes.
CO5	Apply and implement learned algorithms design techniques in a project to get exposure to solve problems.

2nd Semester

Advanced Algorithm (MTCS 201-18): M9	
CO1	Analyze the complexity/performance of different algorithms.
CO2	Determine the appropriate algorithms for solving a particular set of problems.
CO3	Conclude necessary mathematical abstraction to solve problems.
CO4	Categorize the different problems in various classes according to their computation difficulties.
CO5	Discuss recent activities in the field of the advanced data structure.

Soft Computing (MTCS 202-18): M10	
CO1	Infer the concepts of soft computing techniques and identify their roles in building intelligent machines.
CO2	Implement fuzzy logic and neural based methods to handle uncertainty and solve various engineering problems.
CO3	Apply genetic algorithms to combinatorial optimization problems.
CO4	Implementation of the different methods using tools and libraries.
CO5	Evaluate recent trends of machine learning and deep learning algorithms with its application.

Computer Vision (MTCS 208-18): M11	
CO1	Interpret the basics of Image Formation, Measurement, and, Analysis
CO2	Analyze various Image Detection and Segmentation techniques
CO3	Implement Dimensionality reduction methods for Feature Extraction
CO4	Applying several Clustering and Classification algorithms using different classifier techniques

Human Computer Interaction (MTCS 209-18): M12	
CO1	Explain the structure of models and theories of human computer interaction and vision.
CO2	Identify and apply the guidelines for user interface.
CO3	Examine the architecture of mobile Human Computer interaction.
CO4	Design an interactive web interface on the basis of models studied.

Audit Course - English for Research Paper Writing (MTA-A01): M13	
CO1	Interpret that how to improve your writing skills
CO2	Identify techniques improve level of readability
CO3	Develop skills of writing each section of the paper
CO4	Analyzing skills required to write a quality paper
CO5	Improve technical thinking and creative abilities

Advanced Algorithm Lab (MTCS 203-18): M14*	
CO1	Implement Dijkstra's algorithm for single-source shortest path in a weighted directed graph.
CO2	Determine all-pairs shortest path using Floyd-Warshall algorithm.
CO3	Formulate inverse of a triangular matrix using divide and conquer strategy
CO4	Compile modulo representation from base (decimal/hexa) representation.
CO5	Implement FFT.

Computer Vision Lab (MTCS 204-18): M15*	
CO1	Developed the practical skills necessary to build computer vision applications
CO2	Analyze various Image Detection and Segmentation techniques
CO3	Perceive exposure to Object and Scene Recognition and categorization from images
CO4	Discuss the principles of state-of-the-art Deep Neural Networks

Mini Project with seminar (MTCS 205-18): M16
CO1	Inspect about advance programming tools and techniques
CO2	Identify and solve real-world problems
CO3	Improve skills to write technical report
CO4	Develop moral ethics such as commitment, teamwork spirit to achieve continuous development
CO5	Propose and communicate ideas clearly in a creative manner

2nd Year

3rd Semester

Optimization Techniques (MTCS 304-18): M17
CO1	Demonstrate the applications of optimization in engineering and Formulate optimization problems.
CO2	Solve various optimization problems through the application of optimal criteria.
CO3	Analyze mathematical programming branches for the solution of various NP-hard problems.
CO4	Evaluate different optimization algorithms along with their applications.
CO5	Identify the solution to various real-life problems with recent trends in the optimization algorithms

Operations Research (MTOE 303-18): M18
CO1	Apply Model Formulation and sensitivity analysis for models.
CO2	Formulate and obtain the optimal solution for Linear Programming problems.
CO3	Appraise the optimal solution for non-linear programming problems.
CO4	Estimate the Scheduling and sequencing model of real problem.
CO5	Formulate the dynamic programming to solve the real world problem of discrete and continuous variables.

Dissertation - I (MTCS 301-18): M19
CO1	Demonstrate sound fundamentals in a chosen area of computing
CO2	Identify and formulate a problem of research interest in the chosen area of computing
CO3	Analyze the computing problem and propose solutions
CO4	Apply the emerging technologies like – Blockchain, IoT, Robotics, ML, AI, Datamining, Big Data Analytics in solving some challenging problem in chosen area
CO5	Illustrate the work at all stages of the project

Institutional Training (MTCS 305-18): M20
CO1	Organize opportunities for practical, hands-on learning from practitioners in the students' areas of specialization.
CO2	Discuss use of advanced tools and techniques encountered during industrial training and visit.
CO3	Interview with industrial personnel and follow engineering practices and discipline prescribed in industry.
CO4	Take part in preparing professional work reports and presentations.

4ᵗʰ Semester

Dissertation - II (MTCS 401-18): M21
CO1	Identify a suitable problem to be solved computationally
CO2	Analysis proposed solutions to the identified computing problem
CO3	Design and develop solutions to the problem and analyze results
CO4	Originate a thesis and defend the thesis on the work done
CO5	Perceive the knowledge base in the chosen area of computing, adhering to ethical practices at every stage
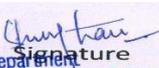
Signature

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