

Department of Mechanical Engineering

Course Structure & Syllabus for B. Tech



(2026 Passed out Students)
B. Tech. in Mechanical Engineering
(Approved by Academic Council and Board of Studies)

GIFT Autonomous, Bhubaneswar
(Approved by AICTE, New Delhi, affiliated to BPUT, Rourkela)
Recognized under section 2(f) of the UGC act, 1956
At- Gramadiha, Po. Gangapada, Via-Janla, Dist-Khorda,
Pin code: 752054

B. Tech. in Mechanical Engineering

Mechanical engineering involves scientific analysis, problem-solving and knowledge integration using appropriate tools to model, design, produce and maintain products or systems containing mechanical elements to meet the desired requirements.

The revised model curriculum takes into cognizance the prevailing and emerging requirements of the industry and society. It provides a balanced mix of courses related to science, engineering, technology and practice (labs, projects), as well as humanities.

Given the rising importance of electronics, information and communication technology in all aspects of life, the relevant courses have been introduced or strengthened.

Students are provided greater flexibility in electives based on their career aspirations. They can suitably orient themselves toward academics, research, innovation, industry, entrepreneurship or any other direction.

The revised model curriculum is aligned with the New Education Policy, which promotes holistic, experiential and inter-disciplinary education. Hands-on learning, relevant lab experiments and examples from industry have been emphasized.

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The Program Outcomes (POs) for UG Engineering programme defined by NBA.

Department POs, PEOs, &PSOs

Program Outcomes (POs):

Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an Engineering Specialization to the solution of complex engineering problems.

Problem Analysis: Identify, formulate, review research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern tool usage: Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including predication and modelling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs)

PEO-1: Our graduates will be competent with strong technological background to analyze data, formulate and undertake industrial problems, and obtain viable solutions.

PEO-2: Our graduates will be able to work on multi-disciplinary projects using modern tools and adapt to present changes by inculcating the habit of lifelong learning.

PEO-3: Our graduates will be able to work in the renewable energy sector for the welfare of society as responsible citizens with good ethics.

Program Specific Outcome (PSOs)

PSO-1: Our graduates would have the knowledge and abilities required to work in the mechanical engineering industry, which includes power plants, manufacturing, and automotive.

PSO-2: Our graduates would be proficient in current mechanical engineering software and techniques such as CAD/CAM, FEA, and CFD for designing and analysing mechanical systems and components.

PSO-3: Our graduates would be dedicated to applying sustainability ideas into mechanical engineering practices and participating in several national-level research projects.

Course Types & Definitions

L	Lecture
T	Tutorial
P	Laboratory/Practical/ Sessional
C	Credits
WCH	Weekly Contact Hours
BS	Basic Sciences
HS	Humanities & Social Sciences (including Management) ES
PC	Engineering Sciences Professional Core
PE	Professional Elective
OE	Open Elective
MC	Mandatory Course
SC	Skill Course
EEC	Employability Enhancement Course
SEPD	Skill Enhancement and Personality Development

Scheme of Evaluation
Mark Distribution for Internal & External Examinations for B.Tech

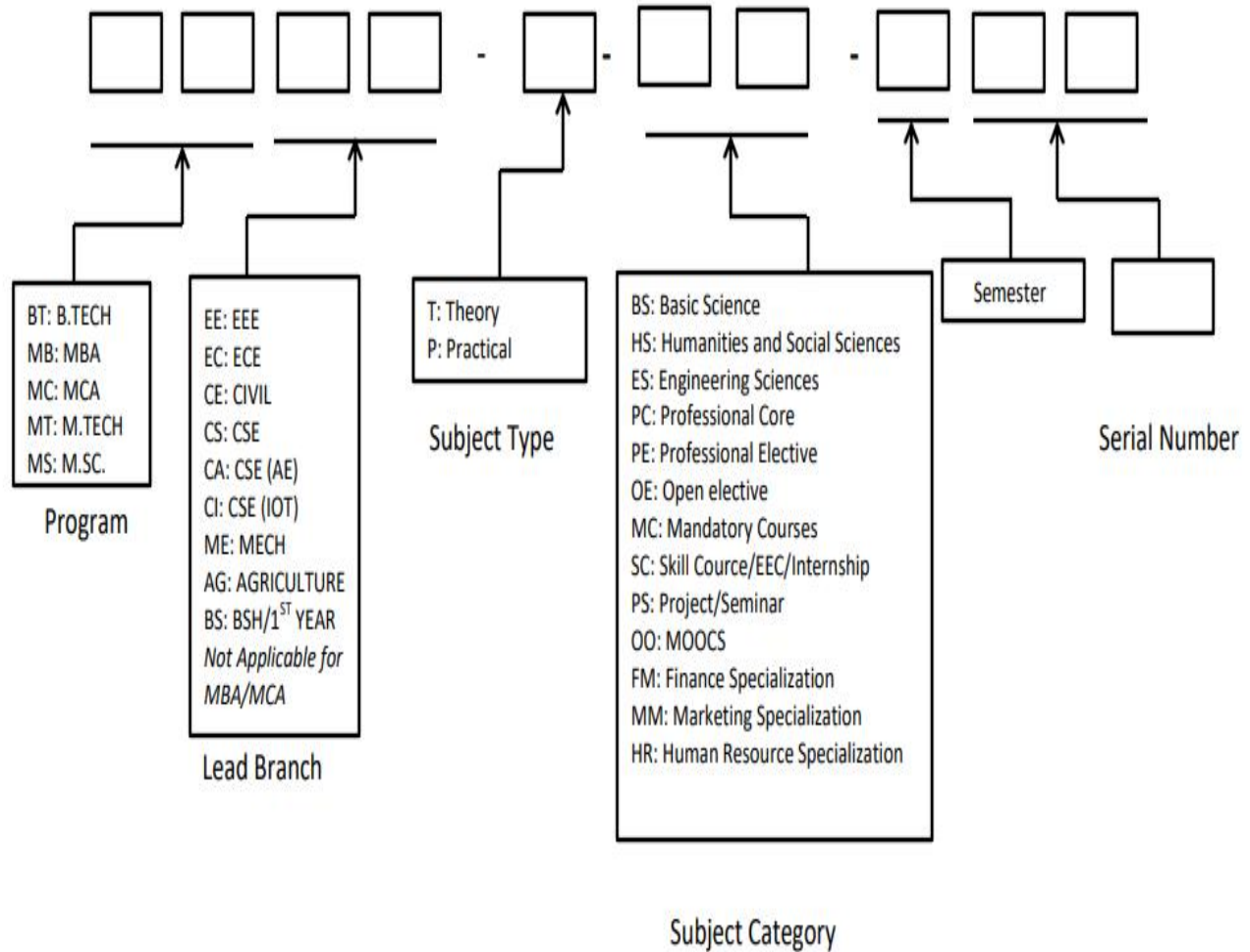
Internal Examination					
Sl. No	Type of Test	Mark	Frequency	Total Mark	Reduced Mark
1	Modular Test	25	2	50	50
2	Online Quiz Test	10	6	60	10
3	Assignment	5	2	10	10
4	Subject Specific Project / Special Quiz – 6 Nos.	100 /10	1 /6	100 /60	15
5	Attendance	15	1	15	15
					100
Pass Mark					45

External Examination				
Sl. No	Type of Test	Mark	Frequency	Total Mark
1	End Semester Examination	100	1	100
Pass Mark				35

Instructions:

1. Each student must appear in all of the above internal examinations without fail.
2. No exemption or accommodation of request will be entertained.
3. In case of exigency, or self-illness the student must submit ample evidence to re-appear the test. Since the schedule of the examination is non-negotiable, the request shall be sent to the competent authority.
4. Appearance of modular tests is part of the curriculum; hence each student is urged to appear for each modular test. Due penalty as per the examination rule shall be imposed.
5. For not qualifying or to improve the individual subject score in internal the student must appear on the improvement test after successful registration in CMS.

Subject Code Format



Course Structure, 2023-24 B. Tech. ME

First Semester						Second Semester					
Theory						Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit	Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	BS	BTBS-T-BS-111	Mathematics I	3-0-0	3	1	BS	BTBS-T-BS-211	Mathematics II	3-0-0	3
2	BS	BTBS-T-BS-113	Applied Chemistry	3-0-0	3	2	BS	BTBS-T-BS-112	Elements of Engineering Physics	3-0-0	3
3	ES	BTBS-T-ES-112	Basic Electronics Engg.	3-0-0	3	3	ES	BTBS-T-ES-111	Basic Electrical Engg.	3-0-0	3
4	ES	BTBS-T-ES-113	Basic Programming Skills	3-0-0	3	4	ES	BTBS-T-ES-213	Programming Using Data Structure	3-0-0	3
5	ES	BTBS-T-ES-115	Basic Civil Engineering	2-0-0	2	5	ES	BTBS-T-ES-114	Basic Mechanical Engg	2-0-0	2
6	HS	BTBS-T-HS-111	English for Engineers-I	2-0-0	1	6	HS	BTBS-T-HS-211	English for Engineers-II	2-0-0	1
Total Hours/ Credit (Theory)				18	15	Total Hours/ Credit (Theory)				16	15
Practical						Practical					
1	BS	BTBS-P-BS-103	Applied Chemistry Lab	0-0-2	1	1	BS	BTBS-P-BS-102	Elements of Engineering Physics Lab	0-0-2	1
2	ES	BTBS-P-ES-102	Basic Electronics Engg. Lab	0-0-2	1	2	ES	BTBS-P-ES-101	Basic Electrical Engg. Lab	0-0-2	1
3	ES	BTBS-P-ES-113	Basic Programming Skill Lab	0-0-3	1.5	3	ES	BTBS-P-ES-213	Programming Using Data Structure Lab	0-0-3	1.5
4	ES	BTBS-P-ES-102	Basic Civil Engineering lab	0-0-2	1	4	ES	BTBS-P-ES-114	Basic Mechanical Engg lab	0-0-2	1
5	ES	BTBS-P-ES-105	Workshop Practice-I	0-0-3	1.5	5	ES	BTBS-P-ES-104	Engineering Graphics with AutoCAD	0-0-3	1.5
6	HS	BTBS-P-HS-111	English for Engineers Lab-I	0-0-2	1	6	HS	BTBS-P-HS-211	English for Engineers Lab-II	0-0-2	1
7	PS	BTPS-P-PS-101	Project-I	0-0-2	1	7	MC	BTSC-P-AE-101	Ability Enhancement Training - A	0-0-2	1
						8	PS	BTPS-P-PS-201	Project-II	0-0-2	1
Total Hours/ Credit (Practical)				18	6	Total Hours/ Credit (Practical)				20	9
Grand Total Hours/ Credit				36	24	Grand Total Hours/ Credit				36	24

1st Year B. Tech (Mechanical Engineering) Contents

B. Tech (1st and 2nd Semester)	
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Applied Chemistry	33-34
Basic Electronics Engineering	35-36
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Type	Code	Mathematics - I	L-T-P	Credits	Marks
BS	BTBS-T-BS-111		3-0-0	3	150

Objectives	The objective of this course is to familiarize the students with the knowledge and concepts of ordinary differential equations and applications, solution of system of linear equations using matrix, Eigen vectors & Eigen values of matrices with applications.
Pre-Requisites	A good knowledge of trigonometry along with basics of differential and integral calculus of one variable and coordinate geometry of two and three dimensions.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module	Topics	Hours
Module-1	Solution of first order differential equations: Variable Separable, Exact Differential Equation, Integrating Factors, Linear equation, Bernoulli's equation, Application to real life problems: Growth and Decay	8 Hours
Module-2	Second order differential equations with constant coefficients, Euler-Cauchy equation. Non-homogeneous Equation, Method of Undetermined Coefficients	7 Hours
Module-3	Introduction to vector space, sub space, Linearly independence and dependent of vectors, Basis of dimension, Introduction to linear transformation.	8 Hours
Module-4	Solution of system of linear equations, Gauss elimination method, Rank of a matrix. Inverse of a matrix, Gauss-Jordan methods, Eigen values and Eigen vectors.	7 Hours
Module-5	Vector Differential Calculus: Vector and Scalar functions and Fields, Derivatives, Curves, Tangents and Arc length, Gradient, Divergence and Curl with applications.	7 Hours
Module-6	Average, Problems on Ages, Percentage, Profit and Loss, Ratio and Proportion, Time and Work, Time and Distance, Simple and Compound Interest.	8 Hours
Total		45 Hours

Text Books:

T1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India.
T2. B. V. Raman, Higher Engineering Mathematics, Mc Graw Hill Education Pvt. Ltd.
T3. R. S. Aggarwal, Quantitative Aptitude For Competitive Examinations, S. Chand publication.

Reference Books:

R1. S. Pal and S. C. Bhunia, Engineering Mathematics, Oxford University Press.
R2. P. V. O'Neil, Advanced Engineering Mathematics, Cengage Learning.
R3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication.
R4. A. Sharma, Quantitative Aptitude, Mc Graw Hill

Online Resources:

1. <https://nptel.ac.in/courses/111106100>
2. <https://nptel.ac.in/courses/111105121>
3. <https://nptel.ac.in/courses/111104137>
4. <https://nptel.ac.in/courses/111107108>
5. <https://nptel.ac.in/courses/111106051>
6. <https://nptel.ac.in/courses/111105134>

Course Outcomes: At the end of this course, the students will be able to:

CO1	Find the general solution of first and second order ordinary differential equations and use the general solution to find the specific solution for given initial value problems.
CO2	Solve and demonstrate various physical models through second order differential equations.
CO3	Use the understanding of matrix algebra to solve systems of linear equations, harmonics problems, population models etc. arising in various engineering fields.
CO4	Demonstrate knowledge and applications of Eigen value problems related to engineering disciplines.
CO5	Application of mathematics for engineers through MATLAB.
CO6	Know the basic concepts of quantitative aptitude to meet real life requirements.

Type	Code	Mathematics - II	L-T-P	Credits	Marks
BS	BTBS-T-BS-211		3-0-0	3	150

Objectives	The objective of this course is to familiarize the students with the knowledge and concepts of numerical methods to solve the system of linear equations & ordinary differential equations, interpolation, and applications of vector integral calculus.
Pre-Requisites	A sound knowledge of linear algebra, basic calculus, and matrix algebra.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module	Topics	Hours
Module-1	Introduction to Beta and Gamma functions, Vector Integral Calculus: Line Integrals, Double Integrals, Green's Theorem and its application, Basics of Triple Integral	9 Hours
Module-2	Root finding of algebraic and transcendental equations: Bisection method, Secant and Regula-falsi methods, Newton's method, Fixed point iteration method, Rate of convergence.	7 Hours
Module-3	Interpolation: Lagrange interpolation, Newton's divided difference interpolation, Newton's forward and backward interpolation	7 Hours
Module-4	Numerical differentiation and Integration: Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's rule, 2-point and 3-point Gauss Legendre rule. Solution of First order Differential Equation: Euler method, Runge-Kutta Method of order 2 and 4	7 Hours
Module-5	Series Completion, Coding-Decoding, Data Sufficiency, Basic concepts on Probability and statistics.	7 Hours
Module-6	Basics of MATLAB: Starting MATLAB, Creating MATLAB variables, Controlling the hierarchy of operations or precedence, Managing the workspace, Getting help Mathematical functions & Basic plotting, Creating simple plots, Adding titles, axis labels, and annotations, Multiple data sets in one plot, Specifying line styles and colors. Matrix generation, Entering a matrix, Colon operator, Creating a sub-matrix, Deleting row or column, Dimension, Transposing a matrix. Array operations and Linear equations Matrix arithmetic operations, Array arithmetic operations, Solving linear equations	8 Hours
Total		45 Hours

Text Books:

- T1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India.
- T2. B. V. Raman, Higher Engineering Mathematics, Mc Graw Hill Education Pvt. Ltd.
- T3. R. S. Aggarwal, A Modern Approach to Verbal & Non-verbal reasoning, S. Chand publication.

Reference Books:

- R1. S. Pal and S. C. Bhunia, Engineering Mathematics, Oxford University Press.
R2. P. V. O'Neil, Advanced Engineering Mathematics, Cengage Learning.
R3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication.
R4. B. P. Acharya, R. N. Das, A Course on Numerical Analysis, Kalyani Publishers
R5. R. Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, Wiley

Online Resources:

1. <https://nptel.ac.in/courses/127106019>
2. <https://nptel.ac.in/courses/111102111>
3. <https://nptel.ac.in/courses/111105122>
4. <https://nptel.ac.in/courses/111105121>
5. <https://nptel.ac.in/courses/111105134>

Course Outcomes: At the end of this course, the students will be able to:

CO1	Apply the numerical methods to find the approximate solutions of algebraic and transcendental equations.
CO2	Evaluate the real time problems using MATLAB.
CO3	Solve the numerical solution of differential equations and use of various techniques for evaluating the integrals.
CO4	Calculate line integrals in two dimensions for differential forms and also calculate double integrals in Cartesian and polar coordinates over the domains.
CO5	Know the basic concepts of verbal, non-verbal reasoning and logical ability for better employability.
CO6	Understand the basic concepts of mathematical theory of probability.

Type	Code	Basic Programming Skills	L-T-P	Credits	Marks
ES	BTBS-T-ES-113		3-0-0	3	150

Objectives	To expose to the field of Problem Solving and Programing
Pre-Requisites	Knowledge of Mathematics in Secondary Education
Teaching Pedagogy	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on real life problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Algorithm, Representation of Algorithm: Flowchart/Pseudo-code with examples. From algorithms to programs; C Program source code, C Program structure, basic syntax, data types, variables, constants, storage class, syntax and logical errors in compilation, object and executable code, Arithmetic expressions, operators and precedence.	8
Module-2	Decision making: Conditional Branching, if statement, if else statement, nested if else statement, switch, nested switch statements, Iteration and loops, break, continue, Decision making Application in solving real life problems.	7
Module-3	Functions, Parameter passing in functions, call by value, idea of call by reference, recursion with examples of Finding Factorial, Fibonacci series, local and global variables, static variables.	7
Module-4	Arrays: Arrays (1-D, 2-D), initialization, Accessing Array Elements, Matrix applications, passing arrays to functions, Character arrays and Strings. Arduino based Programming: Overview of the Arduino UNO Components, Analog and Digital Read, Controlling output.	9
Module-5	Pointers, Pointer arithmetic, dynamic memory allocation, pointer to array and array of pointers, Linear Search, Bubble Sort	7
Module-6	Structures, Array of structures, union, structure vs union, passing structure to function, File handling: ASCII and binary Files.	7
Total		45

Text Books:

1. E. Balagurusamy, Programming in ANSI C, 8th Edition, Tata McGraw Hill, 2019
2. Herbert Schild, C: The Complete Reference, Tata McGraw Hill

Reference Books:

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication Pvt. Ltd
2. Rajaraman, V., Computer Programming in C, PHI Publications
3. Somashekara, M. T., Guru, D. S. , Manjunatha, K. S., Problem Solving With C, PHI
4. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications New Delhi, 2019
5. The Arduino Projects Book, Scot Fitzgerald and Michael Shiloh, 2022,
(<https://www.uio.no/studier/emner/matnat/ifi/IN1060/v21/arduino/arduino-projects-book.pdf>)

Course Outcomes: At the end of this course, the students will be able to:

CO1	Formulate simple algorithms for problem solving and translate the algorithms to programs.
CO2	Execute the programs and correct syntax and logical errors.
CO3	Implement different conditional branching and loops for problem solving.
CO4	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO5	Use arrays, pointers and structures to formulate algorithms and programs.
CO6	Apply programming to solve searching and sorting problems.

Type	Code	Programming Using Data Structure	L-T-P	Credits	Marks
ES	BTES-T-ES-213		3-0-0	3	150
Objectives		Exploring basic data structures concept used in Industries			
Pre-Requisites		Knowledge of Mathematics in Secondary Education and basic Programming concept.			
Teaching Scheme		Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on real-life problem-solving activities.			

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction: Basic Terminologies: Algorithm Analysis: Mathematical Background, Model, Analyze, Running Time Calculations, Asymptotic Notations, classification of data structure. Basic data structure: 1d-Array and 2d-Array Data Structure Operations: insertion, deletion, traversal Sparse matrix, address calculation of Array, ADT (Abstract Data type), DMA (Dynamic memory allocation), pointer, Self-referential structure. A comparison between DMA and SMA. De-allocation Strategy, Buddy System, Compaction.	7
Module-2	Stacks and Queues: ADT Stack array representation and its operations: Algorithms Applications of Stacks: Expression Conversion and evaluation of expression and corresponding algorithms, application of stack. ADT queue, Types of Queues: Simple Queue, Circular Queue, Priority Queue; Array representation and Operations on each type of Queues: Algorithms and their analysis, application of queue. (Simulation, CPU Scheduling in Multiprogramming Environment, Round Robin Algorithm), Priority Queues.	8
Module-3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.	7
Module-4	Sorting and searching: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Radix sort; Performance and Comparison among all the methods, Searching: Linear search, Binary search and time complexity and space complexity analysis, Hashing: Hash function and technics of hashing, External sorting.	8
Module-5	Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Binary Search Tree, Tree Traversing, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis, Red black trees: definition and operation, Applications of all trees.	8
Module-6	Graph: Basic Terminologies and Representations (Adjacency matrix and linked list representation), Graph search and traversal algorithms and complexity analysis, classification of graph Minimum spanning tree (Kruskal and prims algorithm), Shortest path algorithm: Dijkstra's algorithm, topological sorting.	6
Total		44

Text Books:

T1. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press

T2. Data Structures with C (Schaum's Outline Series), Seymour Lipschutz, TMH

Reference Books:

R1. Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B.A. orouzan, Cengage Learning

R2. Data Structures And Algorithms A.V.Aho, J. E. Hopcroft, and J. D. Ullman, ||, Pearson Education, First Edition Reprint 2003R3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication.

R3. How to solve it by Computer, 2nd Impression by R. G. Dormey, Pearson Education

R4. Data Structures using C — A. S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education

Course Outcomes:

At the end of this course, the students will be able to:

CO1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation.
CO2	Understand basic data structures such as arrays, linked lists, stacks and queues.
CO3	Understand the implementation and application of linear data structure.
CO4	Understanding of tree traversal techniques and their application.
CO5	Understand the graph traversal and its application In real life.
CO6	Understand Algorithm for different sorting, searching techniques and their running.

Type	Code	Basic Electrical Engineering	L-T-P	Credits	Marks
ES	BTBS-T-ES-111		3-0-0	3	150
Objectives		To expose to the field of electrical &electronics engineering, and to acquire the fundamental knowledge in the field.			
Pre-Requisites		Knowledge of Physics and Mathematics in Secondary Education			
Teaching Pedagogy		Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.			
Detailed Syllabus					
Module-	Topics				Hours
Module-1	Introduction to Electrical system: An overview of Electrical Engineering, Sources of energy. DC Circuits: Study of Electrical Elements (R, L, C). Ohm’s Law. Series & Parallel combination. KCL, KVL, Nodal & Mesh analysis. Star Delta Conversion. Superposition theorem, Thevevnin’s theorem, Maximum power transfer theorem.				7
Module-2	AC fundamentals: Sinusoidal Wave form, Peak, RMS, Average value. Concept of Real Power, Reactive Power, Apparent Power &Power factor. Analysis of 1- phases AC circuit. Concept of resonance in series and parallel R-L-C circuits. Introduction to poly phase system. Line & Phase quantity in star and delta connection, Analysis of poly phases balanced AC circuit.				9
Module-3	Introduction to poly phase system. Line & Phase quantity in star and delta connection, Analysis of poly phases balanced AC circuit. Magnetic circuits: Electro magnetism, simple magnetic circuit, magnetic material, B-H curve.				6
Module-4	Electrical Machines: Basic Construction, working principle & Application of DC generator, DC Motor, 3 phase & single-phase induction motor, Alternator, 1-phaseTransformer and Special Motors (Stepper & BLDC).				8
Module-5	Fundamentals of Power system: - Thermal, Hydro and Nuclear power generation, Renewable source of Power generation and general structure of electrical Transmission, Distribution, and Utilization & Conservations. Electrical Installations & wiring: Layout of LT switchgear, Switch fuse unit (SFU), MCB, ELCB, MCCB. Type of earthing & Different types of Domestic Wiring use for domestic purpose.				6
Module-6	Electrical Safety: Safety Procedure for working on electrical mains & Apparatus, Electrical hazard, its preventions & Protections, Fire preventions & protection for electrical installations. First aid in electrical Injuries. Artificial respiration & chest compression for accidents victims. Importance of IE rules and Electrical License rules. Different luminaries, Batteries, cells and their applications.				4
Total					40

Text Books:

T1.D. P. Kothari and I. J. Nagrath, " Basic Electrical Engineering", Tata McGraw Hill. T2. Principles of Electrical Safety, Peter E. Sutherland, Wiley-IEEE Press.

Reference Books:

R1. "Basic Electrical Engineering" by Mittle, V and Arvind Mittle, Tata McGraw Hil. R2.E. Hughes, "Electrical and Electronics Technology", Pearson.
R3. Principles of Electrical Engineering and Electronics- V K Mehta, Rohit Mehta, S Chand. R4. "Basic Electrical Engineering" by C L Wadhwa, New Age pub.
R5.D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

R6. Electrical Safety Handbook, 4th Edition Hardcover by John Cadick Mary Capelli-Schellpfeffer Dennis Neitzel Al Winfield

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc23_ee62
2. https://onlinecourses.nptel.ac.in/noc23_ee17
3. https://onlinecourses.nptel.ac.in/noc23_ee65
4. https://onlinecourses.nptel.ac.in/noc23_ee66
5. https://onlinecourses.nptel.ac.in/noc23_ee15
6. https://onlinecourses.nptel.ac.in/noc22_ee90
7. https://onlinecourses.nptel.ac.in/noc22_ee93

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the fundamentals of DC circuits and Network theorems
CO2	Analyses of different problems of electrical AC circuits.
CO3	Apply the concept of magnetic circuits.
CO4	Identify different types electrical machineries and its applications
CO5	Design the earthling and wiring for domestic utilization.
CO6	Evaluate the energy consumption of different luminaries.

Type	Code	Basic Electronics Engineering	L-T-P	Credits	Marks
ES	BTBS-T-ES-112		3-0-0	3	150

Objectives	To expose to the field of electronics engineering, and to acquire the fundamental knowledge in the field.
Pre-Requisites	Knowledge of Physics and Mathematics in Secondary Education
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction to Electronics and Communication Engineering: Basic Electronics components (active, passive), Signal, Spectrum, Frequency Band and Industrial application (VLSI, Microwave, RF, Telecommunication, Fiber Optics, RADAR, Signal Processing). Basic Communication Block Diagram and concept of Transmitter, Receiver and Channel. Diodes: Overview of Semiconductors. Working principle and characteristics of PN junction. Diode applications (half-wave and full-wave rectifier)	8
Module-2	Bipolar Junction Transistor: Construction, CE transistor amplifier: Operation and Input-output characteristics, Transistor Biasing: Fixed bias, self-bias, Voltage divider bias, (Relationship between α , β), Transistor as switch, as an Amplifier.	8
Module-3	Introduction to Microprocessors and Microcontrollers: Evolution Of Vacuum Tubes, What Is A Transistor, What Is VLSI, Transistors And VLSI, What Is A Microprocessor? VLSI & Microprocessors, understanding Bits & Bytes, Evolution Of Microprocessors: What Are Microcontrollers? Difference between Microprocessors and Microcontrollers, What Is An Embedded System? Is Micro Controller An Embedded System? Semiconductor Chips In The Digital Age	6
Module-4	The Manufacturing Of Microprocessor Chips, The Ecosystem For Manufacturing Microprocessor Chips, The Global Landscape Of Semiconductor Chip Manufacturing, The Growing Landscape Of Microprocessor Chip Manufacturing In India Introduction to Sensors and their Applications :Introduction to different types of Sensors: Temperature sensor, Moisture Sensor, Rain Sensor, LDR, IR, Smoke Sensor.	6
Module-5	Basics of Digital Electronics: Number System, Inter conversion of Number Systems, Binary Arithmetic, Boolean Algebra, Simplification of Boolean Expressions ,Demorgan's Theorem, SOP and POS expression.	6
Module-6	Digital logic Gates (AND, OR, NOT, NAND, NOR, EXOR, EX-NOR); Realization of Basic logic gates using universal gates, Combinational Circuits- Half-Adder, Full- Adder, Half-Subtractor, Full-Subtractor. Fundamental concept of MUX (4x1)DMUX(1x4)	6
Total		40

Text Books:

- 1 Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylested and Louis Nashelsky, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092
- 2 Digital Design, 5th Edition M.Morris Mano and Michael D Ciletti Pearson
- 3 B.Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications

Reference Books:

- 1 Principles of Electrical Engineering and Electronics-V K Mehta, Rohit Mehta, S.Chand
- 2 E. Hughes, "Electrical and Electronics Technology", Pearson.
- 3 Microelectronic Circuits, 7th Edition Adel S.Sedra and Kenneth C Smith Oxford University Press
- 4 Fundamentals of Digital Circuits, 4th Edition A Anand Kumar PHI
- 5 Integrated Electronics, 2nd Edition Jacob Millman and Christos Halkias Tata McGraw Hills
- 6 A course in Electrical and Electronic Measurements and Instrumentation Author: A K Sawhney Publisher: Dhanpat Rai & Co. (P) Limited.

Online Resources:

- 1 https://onlinecourses.nptel.ac.in/noc23_ee62
- 2 https://onlinecourses.nptel.ac.in/noc23_ee17
- 3 https://onlinecourses.nptel.ac.in/noc23_ee65
- 4 https://onlinecourses.nptel.ac.in/noc23_ee66
- 5 https://onlinecourses.nptel.ac.in/noc23_ee15
- 6 https://onlinecourses.nptel.ac.in/noc22_ee90
- 7 https://onlinecourses.nptel.ac.in/noc22_ee93

COURSE OUTCOMES:

CO1	To give knowledge about basic electronic components , industrial applications and fundamentals of communication.
CO2	To understand the basic operation and applications of Diode.
CO3	To understand the construction, working and application of BJT.
CO4	To give knowledge about microprocessors, microcontrollers, chip designing and sensor operation.
CO5	To study basic concepts of digital electronics
CO6	To analyze simple combinational circuits.

Type	Code	Elements of Engineering Physics	L-T-P	Credits	Marks
BS	BTBS-T-BS-112		3-0-0	3	150

Objectives	To expose students to the fundamental principles of mechanical waves and optics., To enable the students to understand basic concepts of Electromagnetic theory, quantum mechanics and statistical physics, To acquaint the students with fundamental behavior of semiconducting and superconducting materials, To aware the students on the principle of Laser and fiber optics.
Pre-Requisites	Basic fundamental of Elementary Physics and mathematics.
Teaching Pedagogy	Regular classroom lectures with the use of ICT and sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus:

Module	Topics	Hours
Module-1	Oscillation Simple Harmonic Motion, Damped Harmonic Motion, forced Harmonic Motion, resonance (Velocity and Amplitude), coupled oscillations.	8 Hours
Module-2	Waves Wave and wave equation, Superposition of waves, Interference, Young's double slit experiment, Newton's rings, Diffraction, Fraunhofer diffraction by single slit, Diffraction Grating, Polarization, Malus' Law, Brewster's	8 Hours
Module-3	Electromagnetism Divergence, Curl and Gradient, Line, Surface and volume integral, Gauss divergence theorem, Stokes theorem (Only Statements, no proof), Gauss's law, Ampere's law and Faraday's law of electromagnetic induction, Maxwell's equations in integral and differential form.	6 Hours
Module-4	Concept of Quantum mechanics and Statistical Physics Black body radiation, Planck's law, photo electric effect (concept and equation), Compton Scattering, Pair Production, Matter waves, de Broglie hypothesis, Heisenberg's Uncertainty Principle and its application, Schrodinger's wave equation – Time independent and Time dependent equations, Free particle, Particle in a one-dimensional rigid box. Statistical Mechanics: Statistical distribution, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac distribution function (Elementary concept)	8 Hours
Module-5	Semiconductor Physics and Superconductivity Semiconductors: Defects in solids (Elementary idea), Concept of energy bands in solids, carrier concentration and conductivity in semiconductors with temperature dependence, construction and working of PN junction diode. Superconductivity: Superconducting Phenomenon, Critical parameters, Meissner effect, Type I & Type II superconductors, BCS theory and	7 Hours

Module-6	Laser and Fiber Optics Laser: Spontaneous and stimulated emission, Einstein's coefficients, Population inversion, Light amplification, Basic laser action, Types of laser, Ruby and He-Ne lasers, applications. Fiber Optics: Optical fiber and its principle, acceptance angle, numerical aperture for step and graded index fibers, attenuation mechanism in optical fibers, applications of optical fibers.	8 Hours
Total		45 Hours

Experiential Learning:

The student will carry out a subject specific project on the topic covered in the syllabus. They will submit a project and a project report which will be evaluated by the concern subject teacher

Text Books:

- T1. Concepts of Modern Physics: A Beiser, S Mahajan, S. Raychaudhuri
T2. Principles of Engineering Physics-Vol. I and II by M. Khan & S. Panigrahi, Cambridge university Press
T3. Engineering Physics: H. K Mallik, A. K Singh, McGraw Hill Education Press

Reference Books:

- R1. Engineering Physics: D. R Joshi, McGraw Hill Education Press
R2. Optics: A. K. Ghatak
R3. Introduction to Solid State Physics: S. O. Pillai
R4. Feynman Lectures on Physics –Vol.-I, Vol.-II, Vol.-III

Online Resources:

1. <https://nptel.ac.in/courses/122106027>
2. <https://nptel.ac.in/courses/115105121>
3. https://onlinecourses.nptel.ac.in/noc22_ph06/preview
4. <https://nptel.ac.in/courses/115105097>
5. <https://nptel.ac.in/courses/108106161>

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the concepts of oscillations and its applicability.
CO2	Illustrate various physical phenomena of wave nature of light.
CO3	Acquire the basic knowledge of electromagnetic theory.
CO4	Summarize the principle of Statistical Physics, Quantum mechanics and its applications.
CO5	Describe the behaviors of semiconductors and superconductors.
CO6	Explain the working principle of laser and optical fiber.

Type	Code	Applied Chemistry	L-T-P	Credits	Marks
BS	BTBS-T-BS-113		3-0-0	3	150
Objectives		The objective of this course is to build knowledge of students about basic concepts and application of Chemistry from Industrial, Pharmaceutical, research, agriculture and life science point of view.			
Pre-Requisites		A fundamental knowledge of Quantum, Inorganic chemistry, along with basics of Periodic table, properties of metal are to be clear.			
Teaching Pedagogy		Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.			

Module-#	Topics	Hours
Module-1	Quantum Mechanics and its application: Failure of classical mechanics and introduction to quantum mechanics, Photoelectric effect, de Broglie equation, Heisenberg's uncertainty principle, Postulates of Quantum mechanics, Schrodinger's wave equation, Particle in One dimensional box, Significance of Eigen value and Eigen function. Zero point energy.	7
Module-2	Phase rule and its application: Definition of phase, component and degree of freedom, one component system, Water, Sulphur system, Curves and triple points, meta stable triple point, Two component alloy systems: Bi-Cd, eutectic system	6
Module-3	Electro Chemistry and its application: Electrode potential, Electro chemical cells, Dry cell, Alkaline battery, Ni-Cd battery, Pb-acid storage cell, Fuel Cell, examples, Advantages, Disadvantages. Corrosion: Mechanism of corrosion, differential aeration corrosion, water line corrosion, Pitting, stress, galvanic corrosion, Caustic embrittlement, Factors affecting corrosion, Corrosion Control, corrosion inhibitors: Cathodic protection, Metal coatings	11
Module-4	Fuel: Classification, calorific value, GCV, NCV, Bomb Calorimeter, refining of crude oil, cracking, fuel for I/C engine, knocking, anti-knocking, Octane rating. Cetane rating, Combustion calculations. Gaseous fuel: LPG, CNG, Biogas fuel, Alternate Fuels,	8
Module-5	Polymer: Degree of polymerization, Thermosetting and thermoplastic polymer with examples: Polythene, PVC, Nylon-6, Nylon-6:6, PMMA, PS, Teflon, Phenol-formaldehyde resin and their applications, Rubber: Natural rubber, Vulcanized rubber	7
Module-6	Nano materials: Introduction, Classification, characteristics, 0D, 1D, 2D Nano materials, CNT, Nanowire, Nanotube, Nano cone, graphene, fullerence, Synthesis: Top Down & Bottom-Up approach, Application to Agriculture, Pharmaceutical and Research.	6
Total		45 Hours

Text Books:

- T1. Theory & Practical's of Engineering Chemistry, By Shashi Chawla, Publisher: Dhanpati Rai & CO.(Pvt.) Ltd
T2. Engineering Chemistry Vol-I & II, Author: Jain & Jain, Publisher: Dhanpati Rai Publishing Company. T3. Engineering Chemistry, Author: Prasant Rath, 2015, Cenage Learning India Pvt, Ltd
T4. Textbook on Engineering chemistry. Author: Achyutananda acharya & Biswit Samantaray, publisher: Pearson

Reference Books:

- R1. Theory & practicals of engineering chemistry, by Shashi Chawla, publisher: Dhanpati Rai & CO.(Pvt.) Ltd
R2. Engineering chemistry vol-i & II, author: Jain & Jain, publisher: Dhanpati Rai publishing company. R3. A textbook of engineering chemistry, author: Dr. Rajshree Khare publisher: S.K. Kataria & sons.
R4. Textbook of nanoscience and nanotechnology. McGraw Hill Education (India) Pvt. Ltd., 2012.
R5. Nanostructures & Nanomaterials: synthesis, properties and applications- g. Cao and Y. Wang, world scientific Pvt. Ltd.; 2nd edition

Online Resources:

1. <https://www.energy.gov/eere/fuelcells/fuel-cells>
2. <https://www.britannica.com/science/polymer>
3. <https://www.niehs.nih.gov/health/topics/agents/sya-nano/index.cfm>
4. https://afdc.energy.gov/vehicles/fuel_cell.html
5. <https://www.researchgate.net/publication/258761372>

Type	Code	English for Engineers – I	L-T-P	Credits	Mark
BS	BTBS-T-HS-111		2-0-0	1	150

Objectives	To develop the understanding of communication in different context, to identify the basics of professional Writing, to acquire basic proficiency in English including reading and listening, comprehension, writing and speaking skills.
Pre-Requisites	NONE
Teaching Pedagogy	Regular classroom lectures with use of the interaction, experiential, activity oriented.

Detailed Syllabus:

Module-	Topics	Hours
Module-1	Importance of Communication: Communication through English in a Globalized World, Understanding Communication loop, Factors Responsible	04
Module-2	Communication Types: Verbal & Non-Verbal Communication, Barriers and Filters	04
Module-3	Nature and Style of sensible Writing: Describing, Defining, Classifying, Providing examples or evidence, 7c's for effective writing	04
Module-4	Principles of English Phonology: Consonant sounds of English, Vowel sounds of English, Syllable and Stress Pattern	06
Module-5	Literature Appreciation: A.P.J Abdul Kalam from Wings of Fire, A.P.J Abdul Kalam with Arun Tiwari, Life Doesn't Frighten Me Poem by Maya Angelou	04
Module-6	Commentary on Literary Works: "Spoken English & Broken English" by Bernard Shaw, "How to Fail at Almost Everything and Still Win Big" by Scott Adams	04
	Total	22

Reference Books:

- R1. An Introduction to Professional English and Soft Skills - Das et al.- Foundation Books
 R2. Understanding Human Communication - by Ronald B. Adler
 R3. Understanding Body language by Scott Rouse
 R4. Guide to Phonetics and Phonology by Suhas Mahajan

Course Outcomes: At the end of this course, the students will be able to:

CO1	Learn the fundamentals of communication
CO2	Understand the basic professional writing
CO3	Evaluate Literary convention

Type	Code	English for Engineers-II	L-T-P	Credit	Marks
HS	BTBS-T-HS-211		2-0-0	1	100

Objectives	To understand the nuances Professional Communication, To prepare students for real world interaction, To enhance the soft skill competency of learners
Pre-Requisites	To have a common understanding of concepts of communication.
Teaching Pedagogy	Real world-based teaching learning pedagogy.

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Importance of Business Communication: Importance of Business Communication, Patterns of Communication: Formal & Informal External & Internal Communication	5
Module-2	Communication challenge at workplace: Cross cultural communication Oral presentation	4
Module-3	Professional Writing: Formal Letters, E-mail writing, Business Reports, Social Media Contents and Posts	4
Module-4	Communication for Employment: Cover Letter, Resume Building, Group Discussion Job Interview	5
Module-5	Soft Skills at workplace: Team Work Leadership Skills	4
Module-6	Literature Appreciation: "The One Thing" by Garry Keller An Interview with Microsoft CEO: Satya Nadella by Sudipta Sengupta, TNN, March 10,2023	4
Total		26

Reference Books:

- R1. Corporate Soft Skills-Sarvesh Gulati- Rupa Publications
R2. Mastering the art of Effective Communication by Dinesh Msalhotra
R3. Excellence in Business Communication - John V. Thill, Courtland Bovee R4.
Mastering Interviews and Group Discussions by Dinesh Mathur

Online Resources:

<https://communicationmgmt.usc.edu>
<https://nptel.ac.in>

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the various forms and Channels of communication in a corporate world
CO2	Develop skills to meet the placement challenges
CO3	Implement different forms of writing for professional needs
CO4	Acquiring skills set to sustain the professional careers.

Type	Code	Constitution of India	L-T-P	Credits	Marks
MC	BTBS-T-MC-112		2-0-0	1	100

Objectives	The objective of this subject is to provide understanding of the basic concepts of Indian Constitution and various organs created by the constitution including their functions. The course acquaints students with the constitutional design of state structures and institutions, and their actual working over time.
Pre-Requisites	Basic knowledge of Indian history, overall idea on India's political system.
Teaching Pedagogy	Regular classroom lectures with use of ICT as and when required and each session is planned to be interactive.

Detailed Syllabus:

Module-#	Topics	Hours
Module-1	Introduction to Indian Constitution, Historical perspective of the constitution of India. Preamble of Indian constitution, Salient features of Indian constitution, Fundamental Rights, Fundamental Duties and its legal status, Directive principles of state policy -its importance and Implementation.	5
Module-2	Federal structure and distribution of legislative and financial powers between the Union and the States, The Union legislature - The Parliament - The Lok Sabha and the Rajya Sabha, Composition, powers and functions.	4
Module-3	The Union executive, The President of India (with powers and functions), Vice-President, The Council of Ministers and the Prime Minister - Powers and functions.	4
Module-4	State Government, The State Legislature - composition, powers and functions, State executive, Governor (with powers and functions).	3
Module-5	Amendment of the Constitutional Powers and Procedure, Emergency Provisions: National Emergency, President Rule, Financial Emergency. Scheme of the Fundamental Right to Equality Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21. Local Self Government - Constitutional Scheme in India.	5
Module-6	The Indian Judicial System - the Supreme Court and the High Court's composition, jurisdiction and functions, Judicial review, Judicial activism, independence of Judiciary in India	4
Total		25

Text Books:

- T1. D. D. Basu, Introduction of Constitution of India, 22nd Edition, LexisNexis, 2015.
- T2. K. Subas, An Introduction to India's Constitution and Constitutional Law, 5th Edition, National Book Trust India, 2011.
- T3. Sharma, B.K. Introduction to India's Constitution.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Provide basic information about Indian constitution.
CO2	Analyze the legalities and related issues of drafting, adoption and enforcement of the Indian Constitution as a fundamental law of the nation and the provisions and privileges of Indian Citizenship.
CO3	Understand and judiciously use the fundamental rights and privileges envisaged in the Constitution.
CO4	Analyze the major dimensions of Indian Political System and to contribute in protecting and Preserving the sovereignty and integrity of India.
CO5	Know the successful functioning of democracy in India
CO6	Understand their obligations, responsibilities, privileges & rights, duties and the role that they Have to play in deciding the Administrative Machinery of the country.

Type	Code	Basic Civil Engineering	L-T-P	Credits	Marks
ES	BTBS-T-ES-115		3-0-0	3	150

Objectives	To expose to the field of Civil Engineering, and to acquire the fundamental knowledge in the said field.
Pre-Requisites	Knowledge of Physics, Mathematics and computer programming in Secondary Education
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on group task, project planning and video demonstration.

Detailed Syllabus:

Module #	Topics	Hours
Module-1	Introduction to Construction materials Basics of Civil Engineering & Broad disciplines of Civil Engineering Building components and Materials – Brick, Stone, Cement, Concrete, Steel, Timber (composition, function and uses). concept of smart building. New and smart Materials – fly ash, new-age concrete, recycling of materials.	8 Hours
Module-2	Field Survey: Scale, plan, map, principles of survey, Linear measurements, Ranging, Compass Survey, Bearing of a line, Levelling, Introduction to Modern Survey Instruments (EDM and Total Station), GIS and GPS (Introduction only).	8 Hours
Module-3	Transportation engineering - Different modes of transport, classification of road, , Introduction to Railway , Airport ,Bridges, concept of Tunnels and Metro rail (underground and overhead), Basics of Port and Harbor – Concept of inland waterways.	6 Hours
Module-4	Fundamentals of Soil Mechanics, Hydrology Fundamentals of soil classification, properties, foundation (deep and shallow) and types. Fundamentals of Water Resource engineering- sources and Introduction to hydraulic structures like canals, siphons, weirs, dams etc.	8 Hours
Module-5	Water supply Introduction, sources of water, advantages and disadvantages of water supply, water supply system and its components. Types of flow, Pumps- its types, centrifugal pump its principle, components and its limitations. Pressure Regulator, Working of Pressure Regulator.	6 Hours
Module-6	Sensors: Introduction, Types of sensor, uses and use of relay in tanks. Solenoid valve - experiential Solenoid valve types, Solenoid valves working principle, Advanced plumbing Technologies, plumbing in Building, plumbing system, Purpose of plumbing system, plumbing safety tools, plumbing tools, Safety during work, Fitting and fixtures in domestic building, Plumbing business tools, Valves, Types of joints	8 Hours

	Waste Water Treatment Sewage, Characteristics of sewage, effect of sewage on ecosystem, waste water treatment, Importance of waste water, its treatment process. Sewage system, types of sewerage system	
Total		45 Hours

Text Books:

- T1. Basic Civil Engineering, S.Gopi, Pearson.
T2. Basics of Civil Engineering, M.S. Palanichamy, McGraw Hill.

Reference Books:

- R1. Surveying Vol -1, R Agor, Khanna Publisher.
R2. Water supply and Waste water engineering, S.K. Garg.
R3. Introduction to Bridge Engineering, D. Jhonson Victor.
R4. Engineering Materials, S C Rangwala, Charotar Publishing House.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Recall the composition, function, and uses of construction materials such as brick, stone, cement, concrete, steel, and timber.
CO2	Comprehend the concept of smart buildings, new and smart materials including fly ash, new-age concrete, and material recycling.
CO3	Apply principles of field survey including scale, plan, map, linear measurements, compass survey, leveling, and the use of modern survey instruments like EDM and Total Station.
CO4	Analyze transportation engineering concepts including different modes of transport, classification of roads, railways, airports, bridges, tunnels, metro rails, ports, and harbors.
CO5	Evaluate fundamentals of soil mechanics, hydrology, and water resource engineering including soil classification, properties, foundations, hydraulic structures, and water supply systems.
CO6	Design and implement solutions for wastewater treatment, understanding sewage characteristics, treatment processes, sewerage systems, and the importance of wastewater treatment in preserving ecosystems.

Type	Code	Basic Mechanical Engineering	L-T-P	Credits	Marks
ES	BTBS-T-ES-114		2-0-0	2	150

Objectives	To expose to the field of Mechanical Engineering, and to acquire the fundamental knowledge in the said field.
Pre-Requisites	Knowledge of Physics, Mathematics and computer programming in Secondary
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus:

Module	Topics	Hours
Module -1	Basic Thermodynamics: Systems, Properties, Process, State, Cycle, Internal energy, Enthalpy, Zeroth Law, First law and Second Law of Thermodynamics, Basic Concept Entropy, Properties of ideal gas, Properties of pure substances, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables. Related numerical.	8 Hours
Module -2	Application of Thermodynamics: Single stage air compressor, Steam Power Plant, I.C. Engines (Brief Description on working principles with Schematic diagrams only), Refrigeration system and types of refrigerants. Heat transfer and its modes and principle (Concepts only).	6 Hours
Module -3	Engineering Materials: Classification of engineering materials & its properties. Introduction to Manufacturing processes: Welding, Casting, Forming (Basics only) Additive manufacturing (3D printing) and Subtractive Manufacturing	6 Hours
Module -4	Basic Power transmission devices: Belt, Gear drives, clutch, brakes (Working principle only). Introduction to Robotics and automation: Robot anatomy, Joints and links and common robot configurations. Automation kit.	6 Hours
Module -5	Elements of Fluid Mechanics: Fluid Statics, Concept on buoyancy and floatation Kinematics and Dynamics (Concepts only), Hydraulic machines, types and working principle only.	8 Hours
Module -6	Mechanical Measurement: Concept of measurements, errors in measurement, measurement of Temperature, Pressure, Velocity, and Flow. (Working principle only.)	6 Hours
Total		40 Hours

TEXT BOOKS:

T1	Basic Mechanical Engineering by Pravin Kumar, Pearson.
T2	Text book of Elements of Mechanical Engineering, S T Murthy, Universities press.
T3	Cengel, Y., Boles, "Thermodynamics", Mc-Graw Hill, 2001.

REFERENCE BOOKS:

R1	Basic Mechanical Engineering by Basant Agrawal, C M Agrawal, Willey .
R2	Elements of Mechanical Engineering by J K Kittur and G D Gokak, Willey.
R3	Engineering Thermodynamics by P. Chattopadhyaya, Oxford University Press.
R4	Basic Mechanical Engineering by D. Mishra, P. K Parida, S.S.Sahoo, India Tech Publishing.
R5	Engineering Materials, S C Rangwala, Charotar Publishing House.

At the end of this course, the students will be able to:

CO1	Understand the Laws of Thermodynamics.
CO2	Being aware of how crucial thermodynamics is to IC engines, power plants, refrigerators, and Heat Pump.
CO3	Have a fundamental understanding of welding, Casting, Forming and other manufacturing techniques.
CO4	Recognize fundamental power transfer mechanisms and aware of the fundamental robotics system.
CO5	Being aware of fluid mechanics and hydraulic machines.
CO6	Understand the working of different mechanical measuring instruments.

Type	Code	Elements of Engineering Physics Laboratory	L-T-P	Credits	Marks
BS	BTBS-P-BS-1 Q		0-0-2	1	100

Objectives	To enable the students to perform experiments based on the physical phenomenon and correlate between the theory and principles associated with it.
Pre-Requisites	Knowledge of elementary Physics and mathematics
TeachingPedagogy	Regular practical classes with use of virtual lab, sessions are planned to be interactive with focus on problem solving activities using software tools.

Detailed Syllabus

Module	Topics	Hours
Experiment-1	Determination of acceleration due to gravity (g) by bar pendulum.	2 Hours
Experiment-2	Determination of rigidity modulus by using Barton's apparatus.	2 Hours
Experiment-3	Determination of surface tension of a given liquid by capillary rise method.	2 Hours
Experiment-4	Determination of wavelength of an unknown monochromatic source of light using Newton's ring apparatus.	2 Hours
Experiment-5	Plotting of $V \sim I$ characteristics of PN junction diode.	2 Hours
Experiment-6	Determination of Young's modulus by using Searle's apparatus	2 Hours
Experiment-7	Plotting of input and output characteristics of BJT (Bipolar junction	2 Hours
Experiment-8	Determination of grating element of a plane diffraction grating.	2 Hours
Experiment-9	Determination of co-efficient of thermal conductivity of a bad conductor by Lee's disc method.	2 Hours
Experiment-10	Verification of laws of vibrations in a stretched string using Sonometre.	2 Hours
Total		20 Hours
	BEYOND SYLLABUS	
Experiment-11	To find out the resistance of unknown wire by using Meter/ Wheatstone bridge	2 Hours
Experiment-12	Determination of Hall coefficient of a semiconducting material	2 Hours
Experiment-13	Determination the wave length of LASER source of using diffraction.	2 Hours
Experiment-14	Determination of resistivity of semiconductor by Four-probe method.	2 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the laws of oscillation and vibration.
CO2	Illustrate the electrical characteristics of semiconductor devices.
CO3	Demonstrate the wave nature of light
CO4	Determine the thermal conductivity of the material.
CO5	Verify the characteristics of Wheatstone bridge and Meter bridge

Type	Code	Applied Chemistry Laboratory	L-T-P	Credits	Marks
BS	BTBS-P-BS-103		0-0-2	1	100

Objectives	The laboratory will help the students on the volumetric analysis, calculations based on mass- volume relation etc. The students will get knowledge on the synthesis of different medicines, preparation of soap & detergents etc. The students will get knowledge on the operation of different equipment's.
Pre-Requisites	Knowledge of chemistry in Secondary Education.
Teaching Pedagogy	Regular practical classes with use of virtual lab as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Standardization of KMnO_4 by using sodium oxalate. Determination of Fe^{2+} ion in a double salt.	2 Hours
Experiment-2	Preparation of Aspirin	2 Hours
Experiment-3	To determine Dissolved oxygen in a given sample of water	2 Hours
Experiment-4	Determine the amount of Sodium Hydroxide and Sodium carbonate in the given solution using Standard acid	2 Hours
Experiment-5	Estimation of Ca^{2+} ion in a sample of limestone	2 Hours
Experiment-6	Determination of partition coefficient of I_2 between benzene and water.	2 Hours
Experiment-7	Determination of flash and fire point of an oil by Pensky Martine's apparatus.	2 Hours
Experiment-8	Determination of viscosity of lubricating oil by Redwood viscometer.	2 Hours
Experiment-9	Determination of available chlorine in a sample of bleaching powder	2 Hours
Experiment-10	Determination of TH value of water by EDTA method.	2 Hours
	BEYOND SYLLABUS	
Experiment-11	Preparation of soap and detergent.	2 Hours
	Total	22 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Acquire knowledge on the basic volumetric analysis.
CO2	Classify various fuels based on combustion parameters and understand the working Principle based on their properties.
CO3	Know the importance of analytical techniques, instrumentation and applications
CO4	Impart knowledge on of water quality parameters and treatment of water.
CO5	Acquire Knowledge about synthesis and preparation of drugs, soap etc.

Indicative Projects

1. Preparation Detergent Powder From Paddy Husk
2. Quantity of Presence of Casein in Different Samples of Milk
3. Preparation of Organic Dye.
4. Preparation of Toilet Soaps
5. Presence of Oxalate Ions in Guava Fruit and Different Stages of Ripening.
6. Sterilization of Water Using Bleaching Powder.
7. Preparation of ash brick.
8. Preparation of Gelatin.
9. Preparation of Paracetamol.
10. Preparation of Ink.
11. Effect of Potassium Bisulphate as a Food Preservative.

Type	Code	Basic Electrical Engineering Laboratory	L-T-P	Credits	Marks
ES	BTBS-P-ES-101		0-0-2	1	100

Objectives	To train the students in conducting load tests on electrical circuit and equipment's To gain practical experience in characterizing electrical machinery.
Pre-Requisites	Knowledge of Physics and Mathematics in Secondary Education
Teaching Pedagogy	Regular practical classes with use of virtual lab as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Study of Different Electrical measuring Instruments and other electrical equipment	2 Hours
Experiment-2	Verification of thevenin's theorem using DC circuits.	2 Hours
Experiment-3	Verification of Superposition theorem using DC circuits.	2 Hours
Experiment-4	Verification of Maximum power transfer theorem using DC circuits.	2 Hours
Experiment-5	Measurement of Voltage, current, power and power factor calculation in series R-L-C circuit.	2 Hours
Experiment-6	Verification and calculation of Resonance frequency in series R-L-C circuit.	2 Hours
Experiment-7	Connection and Demonstration of Domestic Wiring System	2 Hours
Experiment-8	Connection and Running of DC Motors, DC generators, 3- phase Induction motors and 1- phase Transformers	2 Hours
Experiment-9	Power and phase measurements in three phase system by two wattmeter method	2 Hours
Experiment-10	OC and SC test on single phase transformer	2 Hours
BEYOND SYLLABUS		
Experiment-11	Verification of Ohm's Law	2 Hours
Experiment-12	Verification of B-H curve	2 Hours
Total		24 Hours

Online Resources

1. <http://vlabs.iitkgp.ernet.in/be/>
2. <http://sl-coep.vlabs.ac.in/>

Course Outcomes: At the end of this course, the students will be able to:

CO1	Identify different Electrical Instruments and measure different parameters.
CO2	Study connection and demonstration of DC generators, motors and wiring systems.
CO3	Study design and connection of Different Lamps
CO4	Identify active and passive electronic components and handle measuring instruments like
CO5	Design different circuits using diode, BJT and opamps.
CO6	Design and analyze logic gates

Indicative Projects

SL. NO.	NAME OF THE PROJECT
1	Mobile Charger
2	Extension Board
3	Multiple USB Port
4	Brushless DC Motor Driver
5	Small Transformers Upto 7V.
6	Small Model Of Bio-Gas Plant
7	Temperature Control 12v DC Fan
8	Making Of Led Bulbs.

Type	Code	Basic Electronics Engineering Laboratory	L-T-P	Credits	Marks
ES	BTBS-P-ES-102		0-0-2	1	100

Objectives	To train the students in conducting load tests on electrical machines To gain practical experience in characterizing electronic devices To train the students to use CRO and DSO for measurements
Pre-Requisites	Knowledge of Physics and Mathematics in Secondary Education
Teaching Scheme	Regular practical classes with use of virtual lab as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Study of Different Electrical measuring Instruments and other electrical equipment	2 Hours
Experiment-2	Measurement of Voltage, current, power and power factor calculation in series R-L-C circuit.	2 Hours
Experiment-3	Connection and Running of DC Motors, DC generators, 3- phase Induction motors and 1- phase Transformers.	2 Hours
Experiment-4	Connection and Demonstration of Domestic Wiring System.	2 Hours
Experiment-5	Model Study & Connection of Different Lamps (Mercury Vapor Lamp, Tungsten, LED Bulbs, Fluorescents, CFL)	2 Hours
Experiment-6	A:- Identification of electronic components, devices and Basic Sensors, B:- Study and use of CRO/ DSO, Function generator to view and measure different wave forms.	2 Hours
Experiment-7	Design of Simple Diode Circuit and Study of V-I characteristics of semiconductor Diode & calculation of DC and AC Resistance	2 Hours
Experiment-8	Design of Half – wave rectifier and full wave rectifier circuits, and calculation of efficiency	2 Hours
Experiment-9	Design of inverting and non- inverting amplifiers using Op-Amp to view and measure waveforms	2 Hours
Experiment-10	Study and truth table verification of logic gates.	2 Hours
BEYOND SYLLABUS		
Experiment-11	Design of simple BJT Bias circuit to draw VI characteristics (input & output) of a NPN transistor (in CE configuration)	2 Hours
Experiment-12	Verification of Ohm's Law	2 Hours
Total		24 Hours

Online Resources:

1. <http://vlabs.iitkgp.ernet.in/be/>
2. <http://sl-coep.vlabs.ac.in/>

CO1	To identify different Electrical Instruments and measure different parameters.
CO2	To study connection and demonstration of DC generators, motors and wiring systems.
CO3	To study design and connection of Different Lamps
CO4	To identify active and passive electronic components and handle measuring instruments like CRO and DSO.
CO5	To design different circuits using diode, BJT and opamps.
CO6	To design and analyze logic gates

Indicative Projects

SL. NO.	NAME OF THE PROJECT
1	Night light using LDR.
2	Automatic Fan ON/OFF using Temperature Sensor.
3	Moisture Controller using Moisture Sensor.
4	Fire Alarm using Temperature Sensor.
5	Light ON /OFF using Piezo Sensor.
6	Clap sound Operated using Sound Sensor.
7	Rain Detector
8	Power supply Circuit
9	Touch less Doorbell
10	Motion Detector using Ultrasonic Sensor

Type	Code	Basic Programming Skills Laboratory	L-T-P	Credits	Marks
ES	BTES-P-ES-1 3		0-0- 3	1.5	100

Objectives	To expose to the field of Problem Solving and Programing
Pre-Requisites	Knowledge of Mathematics in Secondary Education
Teaching Pedagogy	Regular Lab with use of ICT. Each session is planned to be interactive with focus on real life problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Familiarity with basic UNIX/LINUX command, vi editor. Sample C Program.	2 Hours
Experiment-2	Programs on arithmetic expressions, operators, and precedence.	2 Hours
Experiment-3	Programs on Conditional Branching.	2 Hours
Experiment-4	Programs on Loops.	2 Hours
Experiment-5	Programs on single dimensional array.	2 Hours
Experiment-6	Programs on two-dimensional array.	2 Hours
Experiment-7	Programs on Functions.	2 Hours
Experiment-8	Programs on Recursive Functions.	2 Hours
Experiment-9	Programs on Pointers.	2 Hours
Experiment-10	Programs on Dynamic Memory Allocation.	2 Hours
Experiment-11	Programs on Structure.	2 Hours
Experiment-12	Programs on Union.	2 Hours
Experiment-13	Programs on File Handling.	2 Hours
Experiment-14	Implementation of Linear search.	2 Hours
Experiment-15	Implementation of sorting algorithm: Bubble Sort	2 Hours
Experiment-16	Arduino Programming – Introduction to Sensors, Introduction to Microcontrollers.	2 Hours
Experiment-17	Programing, Serial Communication	2 Hours
Experiment-18	Arduino based Project	2 Hours
	Total	38 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Remember basic understanding of computer and basic concepts of running programs.
CO2	Understand the concepts of decision making and looping for solving problems.
CO3	Learn to concise and precise on implementing pseudo code using functions
CO4	Illustrate the usages of array, function and pointer in programming.
CO5	Select the user define data type structure, union and enum for problem solving.
CO6	Develop projects using different file handling functions.

Projects using C Programing

- 1) Unit Converter
- 2) Customer Billing System in a Shopping Mall
- 3) Banking Management System
- 4) University Grading System
- 5) Bus Ticket Reservation System
- 6) Home Automation System
- 7) Digital Wall Clock
- 8) Book Support Automation
- 9) Lab Management System
- 10) Nursery Management System

Arduino based Project

- 1) Obstacle detection using Arduino
- 2) Controlling 4 LEDs to make different patterns
- 3) Voice Activation System
- 4) Use Humidity Sensor using Arduino
- 5) Arduino Based Color Detector
- 6) Touch Dimmer Switch Circuit Using Arduino
- 7) Wireless Door Bell
- 8) Arduino Traffic Light Controller
- 9) Frequency Counter Using Arduino
- 10) Arduino 4-Digit 7-Segment LED Display
- 11) Arduino based Digital Thermometer
- 12) Arduino Light Sensor
- 13) Portable Ultrasonic Range Meter
- 14) Security Alarm System Using Arduino
- 15) Arduino Alarm Clock
- 16) Interfacing LCD with Arduino

Type	Subject Code	Basic Mechanical Engineering Laboratory	L-T-P	Credits	Marks
ES	BTBS-P-ES-114		0-0-2	1	100

Module-#	Topics
Objectives	To train the students in conducting experiment and get acquainted with different measuring devices, gain practical experience on Refrigerator, IC engine, Hydraulic Machines, Power transmission system and Gear trains.
Pre-Requisites	Knowledge of Physics and Mathematics in Secondary Education
Teaching Scheme	Regular practical classes with use of virtual lab as and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Experiments to be done	Hours
Experiment-1	To measure the pressure at a point using Bourdon- tube pressure gauge.	2
Experiment-2	To measure the difference of pressure between two points using U-tube manometer.	2
Experiment-3	Determination of Refrigeration effect in a vapour-compression refrigeration system test rig.	2
Experiment-4	Verification of Bernoulli's Theorem using a Bernoulli's apparatus.	2
Experiment-5	Determination of pressure ratio of a centrifugal pump.	2
Experiment-6	Determination of pressure ratio of a reciprocating pump.	2
Experiment-7	Demonstration of power transmission system.	2
Experiment-8	Determination of speed ratio of Simple, Compound & reverted Gear train.	2
Experiment-9	Determination of pressure ratio of a single stage air-compressor	2
Experiment-10	Demonstration of two-stroke petrol and diesel engines.	2
Experiment-11	Demonstration of four-stroke petrol and diesel engines.	2
Total		22 Hours

At the end of the semester students will able to:

CO1	Experience different pressure and flow measuring instruments.
CO2	Experience working principle of refrigerator and IC engines.
CO3	Get knowledge about application of Bernoulli's Theorem and Meta centre.
CO4	Get knowledge of different types of hydraulic machines.
CO5	Experience different types gear trains and able to find out mechanical advantage and gear.
CO6	Get idea of power transmission system.

Type	Code	Basic Civil Engineering Laboratory	L-T-P	Credits	Marks
ES	BTES-P-ES-102		0-0-2	1	100

Objectives	To train the students in conducting different test on engineering materials. To gain practical experience in characterizing soil and handling hydraulic machines. To train the students to use different measuring instruments.
Pre-Requisites	Knowledge of Physics and Chemistry in Secondary Education
Teaching Pedagogy	Regular practical classes with use of virtual labs and when required, sessions are planned to be interactive with focus on problem-solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Water absorption test of brick.	2 Hours
Experiment-2	Compressive strength of Brick.	2 Hours
Experiment-3	Determination of Specific gravity of soil	2 Hours
Experiment-4	Sieve Analysis of Soil.	2 Hours
Experiment-5	Study of different instruments used in survey.	2 Hours
Experiment-6	Compressive strength of Concrete.	2 Hours
Experiment-7	Study of Different types of pipe fittings	2 Hours
Experiment-8	Measurement of bearing of a line.	2 Hours
Experiment-9	Study of Solenoid Valve	2 Hours
Experiment-10	Study of Sensors.	2 Hours
Total		20 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO-1	Identify the different properties of building materials
CO-2	Understanding the different modes of transportation
CO-3	Study of engineering properties of soil
CO-4	Analyze of water supply system by sensors and solenoids
CO-5	Evaluating different types of pumps
CO-6	Explore the uses of different instruments used in civil engineering work

Indicative Projects (Civil)

1. Intelligent transportation system. – prototype
2. Glass fiber reinforced concrete.
3. pH test of drinking water in gift campus.
4. Preparation of building blocks.
5. Identification of different parts of dam – prototype

Type	Code	Engineering Graphics with Auto-CAD	L-T-P	Credits	Marks
ES	BTES-P-ES-104		0-0-3	1.5	100

Objectives	To develop the ability to produce simple Engineering Drawings based on current practice and to increase the skill to read the Product, Manufacturing, and Construction drawings used in Industries.
Pre-Requisites	Basic Knowledge on simple Geometry And shape of Simple Solid's
Teaching Pedagogy	Regular practical classes with use of virtual labs and when required sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	To prepare a sheet on Lines and their uses.	3Hours
Experiment-2	To prepare a sheet on Lettering, dimensioning.	3Hours
Experiment-3	To prepare a sheet on Projection of point and lines.	3Hours
Experiment-4	To prepare a sheet on Projection of planes & Solids .	3Hours
Experiment-5	To draw Lines/Planes/ solids using Auto CAD.	3Hours
Experiment-6	To prepare a sheet on section of Solid and development of surfaces.	3Hours
Experiment-7	To draw the Ortho graphics projections of solids and sectioning using Auto CAD.	3Hours
Experiment-8	To Prepare a sheet on isometric projections.	3Hours
Experiment-9	To draw isometric view of solids using Auto CAD.	3Hours
Experiment-10	To prepare a sheet on Building Drawing.	3Hours
	BEYOND SYLLABUS	
Experiment-11	To draw Ortho Graphic views of standard Isometric Solids.	3 Hours
Total		33 Hours

After completing this course, the students should be able to:

CO1	Understand the visual aspect of engineering drawing, scales and Orthographic Projections
CO2	Acquire knowledge on projection of points, lines and plane surfaces and solids.
CO3	Understand the basics of Auto CAD, Commands and Toolbar.
CO4	Apply modern engineering tools like Auto CAD and creating working drawings on sectioning of Solids and development of surfaces.
CO5	Able to draw Isometric view of standard Solids using Auto CAD.
CO6	Apply the knowledge to create building drawings

Indicative Projects

1. 2D Drawing from Simple 3D Object With given Specification.
2. Component Diagram of Simple Physical Sheet Metal Part, Worm Gear, Hub-Shaft.
3. Nut-Bolt-Washer assembly, simple Plastic component
4. 2D Drawing from Simple 3D Object of Agriculture component..
5. Drawing of simple Storage Bin/Silo.
6. Drip Layout Sketch.
7. Drawing of Rooftop Garden Planning
8. Drawing of switch, Led monitor.
9. Drawing of Plug socket, Diode & Transistor.
10. House Wiring Diagram For a room having 1-Lamp, 1-Fan and 1-Plug socket.
11. 2D drawing of Disc Antenna, Common electronics components
12. 2D drawing of Electronics components symbol diagram with circuit.
13. Drawing Of All Simple Graphic Element & Monitor stand..
14. Drawing monitor
15. 2D drawing of Keyboard and CPU.

Type	Code	Workshop Practice –I	L-T-P	Credits	Marks
ES	BTES-P-ES-105		0-0-3	1.5	100

Objectives	The laboratory should help students to understand the role of different tools & its function for different operation by manually or by machine to get different job as required
Pre-Requisites	Knowledge of different geometry in Secondary Education
Teaching Pedagogy	Regular practical classes with use of virtual labs and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	To make a Square from the given mild steel piece	3 Hours
Experiment-2	To make a V-Square fit from the given mild steel piece	3 Hours
Experiment-3	To prepare a Lap Joint with Electric Arc welding.	3 Hours
Experiment-4	To prepare a butt Joint with V-Groove Electric Arc welding. Method.	3 Hours
Experiment-5	To prepare butt/T-joint by gas welding	3 Hours
Experiment-6	To prepare joint by Soldering /Brazing.	3 Hours
Experiment-7	To prepare a job on given specimen in machine shop. (turning, threading, ,knurling,milling,drilling and shaping	3 Hours
Experiment-8	To make the Mortise & tenon –joint wood	3 Hours
Experiment-9	To make the dovetail joint on wood.	3 Hours
Experiment-10	To make tray from sheet metal	3 Hours
	BEYOND SYLLABUS	3 Hours
Experiment-11	To make funnel in sheet metal	3 Hours
Total		33 Hours

After completing this course, the students should be able to:

CO1	Learn the safety measures, different tools and equipment used in mechanical workshop.
CO2	Understand the concept of metal joining process and its engineering application.
CO4	Improve understanding of various fitting jobs & its application.
CO4	Understand the various machining process in Machine shop.
CO5	Learn Hands on practices & Job making in Carpentry Shop.
CO6	Discuss the application of Sheet metal Operation.

Indicative Projects

1. To make Gas cylinder stand by M.S. flat
2. To make Refrigerator stand by wooden plank
3. To make Wooden table
4. To make Partial Parshall flume (Venturi)
5. To make Drop spill way(wooden)
6. To make Indigenous plough(wooden)
7. To make Tray drier (sheet metal)
8. To make T.W. switch board for three switches and one socket
9. To make Sheet metal box to conduit wiring
10. To make Simple open water turbine
11. To make Soldering rod
12. To make Monitor stand
13. To make Phone or Tab stand
14. To make Support IOT kit implementation in ceiling fan hanging support rod
15. To make multimeter board.

Type	Code	English for Engineers –I Laboratory	L-T-P	Credits	Marks
BS	BTSH-P-HS-111		0-0-2	1	100

Objectives	To develop the skills in communication., To evaluate the LSRW skills with efficiency., To distinguish the sub skills of reading comprehension for better understanding., To implement the process of effective writing.
Pre-Requisites	To have basic knowledge on LSRW skills
Teaching Pedagogy	Regular sessions are planned to be interactive with examples to be acquainted with different types of communication context. .

Detailed Syllabus

SL NO	NAME OF THE ACTIVITY	HOURS
ACTIVITY 1	Ice Breaking & Self- Introduction	2 Hours
ACTIVITY 2	The Raman Effect, Reading: Task1- Task 3, Vocabulary: Task4-Task 5 (Prefixes and Suffixes)	2 Hours
ACTIVITY 3	The Raman Effect, Grammar: Identifying Common Errors in Writing. (Task 6 to Task 15)	2 Hours
ACTIVITY 4	The Raman Effect, Writing: (Task 16 to Task 29) Paragraph Writing	2 Hours
ACTIVITY 5	Ancient Architecture, Vocabulary: Task1 to Task 3 (Synonym and Antonym), Grammar: Subject-verb Agreement. (Task 4 to Task 7)	2 Hours
ACTIVITY 6	Ancient Architecture ,Writing: Task11 to Task 18 (Formal Letter)	2 Hours
ACTIVITY 7	Sounds of English	2 Hours
ACTIVITY 8	Sounds of English	2 Hours
ACTIVITY 9	Role Play	2 Hours
ACTIVITY 10	Debate	2 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Develop the understanding of language
CO2	Discuss the rules of language for effective communication
CO3	Analyze the pronunciation of English language
CO4	Recognize different forms of formal writing

Type	Code	Programming Using Data Structure Laboratory	L-T-P	Credits	Marks
ES	BTES-P-ES-2 3		0-0 - 3	1.5	100

Objectives	Exploring basic data structures such as stacks and queues
Pre-Requisites	Knowledge of Mathematics in Secondary Education and basic Programming concept.
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on real-life problem-solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Write a C program to perform matrix addition and multiplication using array	2Hours
Experiment-2	Write a C program to create a stack using an array and perform: push operation & pop operation	2Hours
Experiment-3	Write a C program to create a queue and perform: Push, Pop & Traversal	2Hours
Experiment-4	Write a C program that converts infix expression into postfix expression Using Stack operations.	2Hours
Experiment-5	Write a C program that evaluates postfix expression using Stack operations	2Hours
Experiment-6	Write a C program that uses functions to perform the following operations on Single linked list: (i) Creation (ii) Insertion (iii) Deletion (iv) Traversal	2Hours
Experiment-7	Write a C program that uses functions to perform the following operations on Double linked list: (i) Creation (ii) Insertion (iii) Deletion (iv) Traversal in both ways	2Hours
Experiment-8	Write a C program that uses functions to perform the following operations on Binary Search Tree: (i) Creation	2Hours

	(ii) Insertion (iii) Deletion	
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Experiment-9	Write a C programs that use both recursive and non-recursive functions to perform the Linear search operation for a Key value in a given list of integers Write C program that use both recursive and non-recursive functions to perform the Binary search operation for a Key value in a given list of integers	2Hours
Experiment-10	Write a C program that implement Bubble Sort method to sort a given list of integers in descending order	2Hours
Experiment-11	Write a C program that implements Quick Sort method to sort a given list of integers in ascending order	2Hours
Experiment-12	Write a C program that implements Insertion method to sort a given list of integers in ascending order	2Hours
Experiment-13	Write a C program that implements merge sort method to sort a given list of integers in ascending order	2Hours
Experiment-14	Write a C program that implements heap sort method to sort a given list of integers in ascending order	2Hours
Experiment-15	Write a C program that implements selection sort method to sort a given list of integers in ascending order	2Hours

CO1	To insert and delete elements from appropriate position in an array.
CO2	To search an element and print the total time of occurrence in the array..
CO3	To represent a Sparse Matrix.
CO4	To delete all occurrence of an element in an array.
CO5	Array implementation of Stack.
CO6	Array implementation of Linear Queue.

Indicative Projects (ARDUINO based)

- 1) Contacts directory System
- 2) Texting editor relied on Stacks
- 3) BST which follows the Memorization procedure
- 4) Search system (in Library)
- 5) Snakes and Ladders Game
- 6) Sorted_double_sentinel_list
- 7) Phone directory application using doubly-linked lists
- 8) Spatial indexing with quadtrees
- 9) Numerical representations with random access lists
- 10) Stack-based text editor
- 11) Personal Diary Management System

Type	Code	English for Engineers –II Laboratory	L-T-P	Credits	Mark
BS	BTBS-P-HS-211		0-0-2	1	100

Objectives	To equip the students with different forms of professional writing To acquaint them with interpersonal etiquette to face corporate challenges To understand the nuances of GD-PI
Pre-Requisites	Basic knowledge of applications of communication
Teaching Pedagogy	Application oriented, task based, need based, teaching Pedagogy

Detailed Syllabus

Activity No	Activity Name	Hours
Activity: 1	Blue Jeans Sub Skills of Reading: Task14- Task 15	2 Hours
Activity:2	How a Chinese Billionaire Built Her Fortune Vocabulary: Task1 to Task 3 (Technical and Computer related Terms)	2 Hours
Activity:3	How a Chinese Billionaire Built Her Fortune Writing: Task12 to Task 14(Report)	2 Hours
Activity:4	Sop practice,	2 Hours
Activity:5	Proposal Writing	2Hours
Activity:6	Oral Presentation 1	2 Hours
Activity:7	Oral Presentation 2	2 Hours
Activity:8	Group Discussion1	2 Hours
Activity:9	Group Discussion 2	2 Hours
Activity:10	Mock Interview	2 Hours
Total		20 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Develop knowledge in interpersonal communication.
CO2	Develop skills for corporate readiness.
CO3	Implement the different forms of professional correspondence.
CO4	Apply English grammar and essentials of language skills as per present requirement.

Type	Code	Ability Enhancement Training- A	L-T-P	Credits	Marks
AE	BTSC-P-AE-101		0-0-2	1	100

Detailed Syllabus:

Module #	Topics to be Covered	Hours
Module 1	Introduction Windows OS, OS Commands and operations, Introduction to MS Office MS-Word: Create; open, save, print command of file. Home tab: Edit texts, Format text, Paragraph setting and apply styles. Insert tab: Cover page, blank page, page break, table, picture, clip art, shape, chart, hyperlink, header and footer, Textbox, word art, equation and symbols.	6
Module 2	MS-WORD: Mailing tab : Mail merge, Page Layout tab: margin, orientation, size, columns, watermark, page color, page border, Review tab: spelling and grammar checking, Thesaurus. MS-EXCEL: Create workbook, Home tab, Insert tab: Table, picture, Clip art, Shapes, Charts, Hyperlink, Textbox, Word Art.	4
Module 3	MS-EXCEL: Page Layout tab : Margin, Orientation, Paper size, Print area, Background Formulas tab : Auto sum(sum, average, count numbers,max, min), Insert Function(if, sum if, count if, average if, max if, min if) MS-EXCEL: Data Tab: Sort and filter, Text to column, Remove Duplicate, Data Validation, Group.	6
Module 4	MS-POWER POINT: Create file, Home tab, Insert new slide, change layout Insert tab : Table, picture, Clip art, Shapes, Charts, Hyperlink, Textbox, Word Art, Header Footer, movie, sound. MS-ACCESS: Overview, Home Tab: Views, Records, Sort & amp; Filter Create Tab: Create new Table, Table: Template, Table Design, Insert data. External Data Tab: Import, Export	4
Module 5	Internet Technology : MS-Outlook, E-mail Social media Application: Twitter, Linked-In, Facebook, Instagram GRAMMARLY: Creating and uploading documents, Formatting text , Checking your document for plagiarism. Introduction to AI. ChatGPT : Introduction, ChatGPT in general life, Uses and Applications of ChatGPT: Blog Topics and Keyword Research, Assist in Generating Copy for a Website Editing, Creating, Writing and Debugging Code	4
Module 6	Introduction - 4 Hours Introduction to Principles of Entrepreneurship, Who can become an entrepreneur Traits of successful entrepreneurs, Self-appraisal and Profiling – Individual Exercise Based Motivation - 2 Hours Ways to stay motivated during Entrepreneurship Common challenges in Entrepreneurship and their solutions	6
TOTAL		30

EXPERIMENTS:

Experiment No.	Experiments to be performed	Hours
Experiment-1	Introduction Windows OS, OS Commands and operations, Introduction to MS Office	2
Experiment-2	MS-WORD: Create; open, save, print command of file. Home tab: Edit texts, Format text, Paragraph setting and apply styles.	2
Experiment-3	MS-WORD: Insert tab: Cover page, blank page, page break, table, picture, clip art. shape, chart, hyperlink, header and footer, Textbox, word art, equation and symbols.	2
Experiment-4	MS-WORD: Mailing tab : Mail merge Page Layout tab: margin, orientation, size, columns, watermark, page color, page border, Review tab: spelling and grammar checking, Thesaurus.	2
Experiment-5	MS-EXCEL: Create workbook Home tab: Edit texts, Format text, Paragraph setting and apply styles. Insert tab: Table, picture, Clip art, Shapes, Charts, Hyperlink, Textbox, Word Art.	2
Experiment-6	MS-EXCEL: Page Layout tab : Margin, Orientation, Paper size, Print area, Background.	2
Experiment-7	MS-EXCEL: Formula's tab : Auto sum(sum, average, count numbers, max, min), Insert Function(if, sum if, count if, average if, max if, min if)	2
Experiment-8	MS-EXCEL: Data Tab: Sort and filter, Text to column, Remove Duplicate, Data Validation, Group.	2
Experiment-9	MS-POWER POINT: Create file Home tab: Edit texts, Format text, Paragraph setting and apply styles. Insert new slide, change layout Insert tab : Table, picture, Clip art, Shapes, Charts, Hyperlink, Textbox, Word Art, Header Footer, movie, sound. Design tab : Theme, color, font, background style. Animation Tab: Custom animation, Transition(style, sound, speed), Slide show)	2
Experiment-10	MS-ACCESS: Overview, Home Tab: Views, Records, Sort & amp; Filter Create Tab: Create new Table, Table: Template, Table Design, Insert data. External Data Tab: Import, Export	2
Experiment-11	Internet Technology : MS-Outlook, E-mail Social media Application: Twitter, Linked-In, Facebook, Instagram GRAMMERLY: Creating and uploading documents, Editing text Using Grammarly GO, Formatting text , Checking your document for plagiarism.	2
Experiment-12	ChatGPT : Introduction, ChatGPT in general life, Uses and Applications of ChatGPT: Blog Topics and Keyword Research, Assist in Generating Copy for a Website Proofreading and Editing, Creating WordPress Plugins, Writing and Debugging Code	2
Experiment-13	Introduction to Principles of Entrepreneurship, Who can become an entrepreneur	2
Experiment-14	Traits of successful entrepreneurs Self-appraisal and Profiling – Individual Exercise Based	2
Experiment-15	Ways to stay motivated during Entrepreneurship Common challenges in Entrepreneurship and their solutions	2
TOTAL		30

COURSE OUTCOMES:

CO.1	To give basic fundamental concept about computer system.
CO.2	To get familiar with MS Windows OS.
CO.3	To get hands on expertise in MS Word.
CO.4	Able to solve mathematical problems systematically using MS excel.
CO.5	Able to design professional presentation using MS PowerPoint and manage the information in computer system using MS Access.
CO.6	To gather knowledge about internet technology and its applications.

Text Books:

T1. IT & IS Lab Manual, Department of CSE, GIFT, Bhubaneswar

Reference Books:

R1. Microsoft Office 2010 Introductory by Gary B. Shelly,
Misty E. Vermaat. R2. Entrepreneurship Development by Dr.
R. K. Singhal
R3. Entrepreneurship Development by M.L.Sharma

Syllabus for B. Tech (2nd Year)



(2026 Passed out Students)

B. Tech. in Mechanical Engineering

(Approved by Academic Council and Board of Studies)

GIFT Autonomous, Bhubaneswar

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under section 2(f) of the UGC act, 1956
At- Gramadiha, Po. Gangapada, Via-Janla, Dist-Khorda, Pin code: 752054

Program Outcomes (UG Engineering)

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The Program Outcomes (POs) for UG Engineering programme defined by NBA.

- PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Types & Definitions

L	Lecture
T	Tutorial
P	Laboratory/Practical/ Sessional
WCH	Weekly Contact Hours
BS	Basic Sciences
HS	Humanities & Social Sciences (including Management) ES
PC	Engineering Sciences Professional Core
PE	Professional Elective
OE	Open Elective
MC	Mandatory Course
SC	Skill Course
EEC	Employability Enhancement Course
SEPD	Skill Enhancement and Personality Development

Scheme of Evaluation

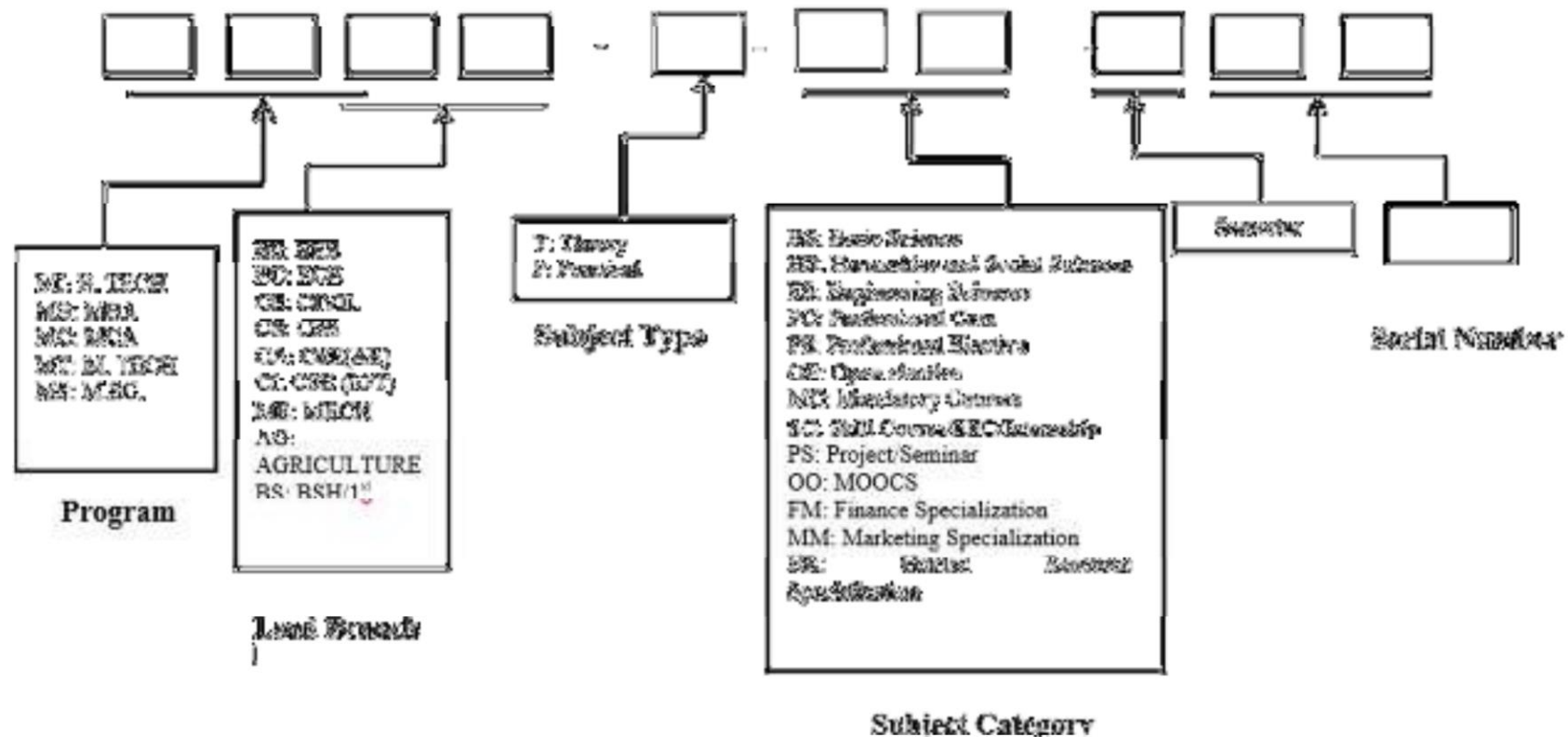
Proposed Internal Examination (B. Tech, Autonomous)					
Sl. No	Type of Test	Mark	Frequency	Total Mark	Reduced Mark
1	Modular Test	25	3	75	50
2	Online Quiz Test	10	6	60	10
3	Assignment	5	2	10	10
4	Subject Specific Project	15	1	15	15
5	Attendance	15	1	15	15
TOTAL				165	100
Pass Mark					45

Proposed External Examination (B. Tech, Autonomous)				
Sl. No	Type of Test	Mark	Frequency	Total Mark
1	End Semester Examination	100	1	100
Pass Mark				35

Instructions:

1. Each student must appear in all of the above internal examinations without fail.
2. No exemption or accommodation of request will be entertained.
3. In case of exigency, or self-illness the student must submit ample evidence to re-appear the test. Since the schedule of the examination is non-negotiable, the request shall be sent to the competent authority.
4. Appearance of modular tests is part of the curriculum; hence each student is urged to appear for each modular test. Due penalty as per the examination rule shall be imposed.
5. For not qualifying or to improve the individual subject score in internal the student must appear on the improvement test after successful registration in CMS.

Subject Code Format



Course Structure, 2023-24 B. Tech. Admission Batch

Third Semester						Fourth Semester					
Theory						Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit	Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	BS	BTBS-T-BS-312	Applied Mathematics	4-0-0	3	1	PC	BTME-T-PC-401	Fluid Mechanics and Machines	4-1-0	3
2	PC	BTME-T-PC-311	Engineering Mechanics of Solids	4-1-0	3	2	PE	BTME-T-PE-402	Strength of Materials	4-1-0	3
3	PE	BTME-T-PE-313	Applied Thermodynamics	4-0-0	3	3	PC	BTME-T-PC-404	Introduction to Material Science and Engineering Materials	4-1-0	3
4	PC	BTME-T-PC-312	Basic Manufacturing Practices	4-0-0	3	4	HS	BTBS-T-HS-301	Organizational Behavior	4-1-0	3
5	HS	BTBS-T-HS-302	Engineering Economics	3-1-0	3	5	PC	BTME-T-PC-403	Mechanisms and Machines	4-1-0	3
6	ES	BTCS-T-ES-301	Object Oriented Programming using JAVA	4-0-0	3	6	OO	BTME-T-OO-401	NPTEL	2-0-0	3
7	MC	BTMC-T-MC-302	Essence of Indian knowledge and Tradition-I	2-0-0	0	7	MC	BTMC-T-MC-301	Environmental Engineering	2-0-0	0
8	SC	BTSC-T-SC-311	Ability Enhancement Training -B	1-0-0	1	8	SC	BTSC-T-AE-401	Ability Enhancement Training -C	2-0-0	1
Total Hours/ Credit (Theory)				29	19	Total Hours/ Credit (Theory)				32	19
Practical						Practical					
1	PC	BTME-P-PC-401	Engineering Mechanics of Solids lab	0-0-3	1	1	PC	BTME-P-PC-404	Machine Drawing Lab	0-0-2	1
2	ES	BTCS-P-ES-301	Object Oriented Programming using JAVA lab	0-0-2	1	2	PC	BTME-P-PC-405	Mechanisms and Machines Lab	0-0-2	1
3	PC	BTPS-P-PC-402	Basic Manufacturing Practices lab	0-0-2	1	3	PC	BTME-P-PC-403	Fluid Mechanics and Machines Lab	0-0-2	1
4	PS	BTPS-P-PS-301	Seminar-1	0-0-2	1	4	PS	BTME-P-PS-401	Project-3	0-0-2	2
5	SC	BTSC-P-SC-301	Evaluation Summer Internship-1	0-0-3	2	Total Hours/ Credit (Practical)				9	5
Total Hours/ Credit (Practical)				10	6	Grand Total Hours/ Credit				39	24
Grand Total Hours/ Credit				39	25	SUMMER INTERNSHIP TRAINING for 30 Days					

**2nd Year B.Tech
(Mechanical Engineering)**

Contents

Second Year B. Tech Curriculum Structure

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Evaluation Scheme
Mark Distribution for Internal& External Examinations for all Courses-2023-24

Proposed Internal Examination (B. Tech, Autonomous)					
Sl. No.	Type of Test	Mark	Frequency	Total Mark	Reduced Mark
1	Modular Test	25	3	100	50
2	Online Quiz Test	10	6	40	10
3	Assignment	10	2	20	10
4	Subject Specific Project	15	1	15	15
5	Attendance	15	1	15	15
TOTAL				190	100
Pass Mark					45

Proposed External Examination (B. Tech, Autonomous)				
Sl. No.	Type of Test	Mark	Frequency	Total Mark
1.	End Semester Examination	100	1	100
Pass Mark				35

Instructions: -

1. Each student must appear in all of the above internal examinations without fail.
2. No exemption or accommodation of request will be entertained.
3. In case of exigency, or self-illness the student must submit ample evidence to re-appear the test. Since the schedule of the examination is non-negotiable, the request shall be sent to the competent authority.
4. Appearance of modular tests is part of the curriculum; hence each student is urged to appear for each modular test. Due penalty as per the examination rule shall be imposed.
5. For not qualifying or to improve the individual subject score in internal the student must appear on the improvement test after successful registration in CMS.

3rd Semester

Type	Code	Applied Mathematics	L-T-P	Credits	Marks
BS	BTBS-T-BS-312		4-0-0	3	150
Objectives	The objective of this course is to familiarize the students with the knowledge and concepts of 1. Laplace & Fourier transformations, 2. PDEs, complex analysis 3. Probability.				
Pre-Requisites	A basic knowledge of calculus, and elementary probability theory.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Laplace transformation, Inverse Laplace transformation, Unit step function, Dirac’s delta function, Convolution, applications in solving differential equations, and Integral Equations.				8
Module-II	Fourier series, Fourier expansion of functions of any period, Even and odd functions, Half range Expansion, Fourier transform and Fourier Integral.				6
Module-III	Fourier Integral, Fourier transform, Fourier sine and cosine transforms, Basic Properties.				6
Module-IV	Partial Differential Equations: Basic concepts, Solution of PDE by separating variables, Vibration of Springs, D’Alembert’s Solution of wave equation, Heat equation: Solution by Fourier series, Heat equation: Solution by Fourier Integrals and transforms.				9
Module V	Introduction to Complex analysis: Complex plane, polar form, power and roots, Exponential and logarithmic functions, Limit, Continuity and Derivatives, Analytic functions, Cauchy Reimann equations, Harmonic function.				8
Module-VI	Advance Probability: Random variables, Probability distributions, Mean and variance of a distribution, Binomial, Poisson and Normal distributions.				8
Total					45 Hours

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, Wiley India.
2. B. V. Raman, Higher Engineering Mathematics, Mc Graw Hill Education Pvt. Ltd.

Reference Books

1. S. Pal and S. C. Bhunia, Engineering Mathematics, Oxford University Press.
2. P. V. O'Neil, Advanced Engineering Mathematics, Cengage Learning.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publication.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Apply the knowledge of Laplace transform to solve the complex engineering problems.
CO2	Find the Fourier series and Fourier transforms of functions.
CO3	Illustrate the applications of Laplace & Fourier Transformations.
CO4	Understand the heat and wave equations.
CO5	Understand the concepts of Analytic function.
CO6	Understand the basic concept on probability and various distributions.

Experiential Learning:

1. Comparison of elongation of different material
2. Co-planar forces
3. Friction and its application
4. Types of beams and its application

Type	Code	Engineering Mechanics of	L-T-P	Credits	Marks
PC	BT-ME-T-PC-311	Solids	4-1-0	3	150
Objectives	Student will able: 1. To Compute the force, moment; determine the centroid and moment of inertia of different geometrical figures. 2. To understand the concept of stress and strain, principal stresses and principal planes. 3. To understand the concept of shear fore and bending moment due to transverse load on beams; determine deflection of beams using different methods.				
Pre-Requisites	Class12th level mathematics, Physics.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction to Engineering Mechanics: Concurrent forces on a plane: Composition and resolution of forces and equilibrium of Concurrent co- planar forces, Methods of moment, Friction: Laws of friction, coefficient of friction, Static friction, Kinetic friction, Angle of friction, cone of friction.				8
Module-II	Centre of Gravity and Centroid: Parallel forces in a plane-. Centre of parallel forces and center of gravity, centroid of composite plane figure and curves, Distributed parallel forces in a plane. General case of forces in a plane- composition of forces in a plane and equilibrium of forces in a plane.				6
Module-III	Moment of Inertia Moments of Inertia- Plane figure with respect to an axis in its plane and perpendicular to the plane- parallel axis theorem, Moment of Inertia of material bodies.				6
Module-IV	Simple Stress and strain: stress, strain, Saint–Venant Principle, Elongation of a bar, factor of safety, Composite bars in tension and compression, temperature stresses, statically indeterminate problems, Relation between elastic constant.				6
Module V	Shear force and Bending Moment: shear force, bending moment, Relation between Shear force and bending moment, bending moment diagram for cantilever, simply supported beam.				8
Module-VI	Slope and Deflection of Beams Equation of Simple Bending, Slope and Deflection of beam, Double integration method, Area moment method, Strain energy method.				6
Total					40 Hours

Text Books:

1. Applied Mechanics & Strength of Material –By I.B. Prasad.
2. Engineering Mechanics by Book by S.S.Bhavikatti, NEWAGE International Publishers.
3. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & Company Ltd., New Delhi, 7th edition, 2018.
4. Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2017

Reference Books

1. Singh.D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021.
2. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
3. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the different types of force and concept of friction
CO2	Understand the concept of center of gravity and centroid
CO3	Explain various theories like equilibrium of forces and moment of inertia
CO4	Understand the different types of stress and strain, properties of material and engineering constant
CO5	Draw and understand shear force and bending moment diagram
CO6	Formulate the relation between simple bending theory and deflection theory of beam

Type	Code	Applied Thermodynamics	L-T-P	Credits	Marks
PE	BTME-T-PE-313		4-0-0	3	150
Objectives	The students will be able to learn: 1. The first and second laws of thermodynamics and its application in day-to-day life. 2. The fundamentals of pure substance (water) and its application in Rankine cycle. 3. The working principle of air compressor and thermodynamic applications involved.				
Pre-Requisites	Knowledge of Mathematics and physics in Secondary Education, fundamentals of thermodynamics.				
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.				
Module	Topics				Hours
Module-1	Basic Concepts: Review of basics of thermodynamics. Properties, different thermodynamic systems, Equilibrium State, path and process. Quasi-static process, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of works. Indicator diagram. Zeroth law of thermodynamics– Applications and concept of temperature and thermal equilibrium. First law of thermodynamics, applications to closed and open systems, steady state and unsteady state processes, general energy equation and applications to thermal equipment.				8
Module-II	Second Law of Thermodynamics: Kelvin-Planck and Clausius statements, heat engines and heat pump, reversibility, Carnot cycle, Carnot theorem, High- and low-grade energy. Exergy balance. Third law of thermodynamics.				6
Module-III	Entropy. Concept of entropy, T-s diagram, TdS Equations, entropy change for- pure substance, ideal gases-different processes, principle of increase in entropy.				6
Module-IV	Properties of Steam: Definition & Properties of Steam, Formation of steam Representation on P-V, T-S, H-S, & T-H diagram, Use of steam table & Mollier chart for finding unknown properties, solve simple numerical.				6
Module V	Vapour Power Cycles-Rankine cycle- Ideal and actual cycle–Applications. Cycle efficiency–Simple Rankine cycle. Cycle Improvement Methods-Superheat, Reheat Regenerative, Economizer and Air preheater. Simple numerical.				8
Module-VI	Reciprocating Air Compressors- Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.				6
	Total				40 Hours

Text Books:

1. Thermodynamics by P K Nag
2. Applied Thermodynamics by D S Kumar, S K Kataria & Sons

Reference Text Books:

1. Engineering Thermodynamics by M S Rathore
2. Applied Thermodynamics paperback-1, January-2018 by Onkar Singh
3. Applied Thermodynamics by TDE as top Pearson Education, 5th edition

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the basic concepts of thermodynamics
CO2	Understand the foundation of heat and work transfer
CO3	Understand the foundation for power plants, heat engines and heat pump.
CO4	Understand basics of modelling of power plants and their associated techniques
CO5	Have knowledge regarding different thermodynamic cycles.
CO6	Understand the concept of different types air compressors

Experiential Learning:

1. Energy equation (flow/non-flow process)
2. Application of heat engine
3. Application of heat pump
4. Application of first law of thermodynamics –Small projects on steam power plant
5. Application of Otto cycle, Diesel cycle, Dual cycle
6. Single stage and multistage air compressor

Type	Code	Basic Manufacturing Practices	L-T-P	Credits	Marks
PC	BTME-T-PC-312		4-0-0	3	150
Objectives	Student will able: 1. Understand the fundamental principles of Good Manufacturing Practices (GMP) related to quality control, regulatory compliance, and industry best practices. 2. Develop skills for maintaining consistent product quality 3. Stay updated on industry regulations and compliance requirements.				
Pre-Requisites	Fundamental of physics, chemistry, some exposure to manufacturing trends.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Evolution of manufacturing processes. Classification of manufacturing processes. Introduction to casting; types of patterns, pattern materials and pattern allowances. Molding Materials - sand molding, metal molding, investment molding, shell molding. Moulding sand and it's composition (binders, additives). Properties of molding sand and sand testing. Core materials, chills and chaplets. Gating system components and functions. Melting furnaces cupola, resistance furnace, induction and arc furnace. Solidification of casting, concept of directional solidifications. Solidification time and Chvorinov's rule. Degasification and inoculation of metals. Casting methods like continuous casting, centrifugal casting, disc casting. Casting defects.				8
Module-II	Classification of welding processes, Fusion welding: Oxy-fuel gas welding, types of flames and uses, Arc welding: Arc welding equipment's, methods of arc initiation, arc stability and metal transfer. TIG(GTAW) and MIG(GMAW) welding, resistance welding and Thermit welding. Weldability. Modern welding methods like plasma Arc, Laser Beam, Electron Beam, Ultrasonic, Explosive friction welding and thermit welding. Brazing and soldering. Electrodes and its coatings. Welding defects: causes and remedies for welding defects. Destructive and non-destructive testing of welding and casting. Edge preparation in butt welding.				6
Module-III	Forging: Classification of forging processes, forging machines & equipment's, forging defects, Rolling: Classification of rolling processes, types of rolling mills. Extrusion: Classification of extrusion processes, Extrusion equipment, Extrusion of tubes & seamless pipes. Drawing: Drawing equipment & dies. Sheet metal working. (blanking, piercing/punching, perforating, lancing, notching, bending) Process details, applications, and material considerations.				6

Module-IV	Machining Processes: Introduction to machining. Types of machining processes (turning, milling, drilling, grinding, etc.). Process details, cutting tools, parameters, and applications. Brief introduction to powder metallurgy processes: Process steps, powder preparation, compaction, sintering. Applications, advantages, limitations.	9
Module V	Surface Treatment and Coating: Introduction to surface treatment. Surface finishing processes (painting, plating, thermal spraying, etc.). Coating techniques (PVD & CVD, applications, benefits	8
Module-VI	Introduction to Automation, Basic elements of automated systems- levels of automation Introduction to Computer Integrated Manufacturing. Flexible. Manufacturing. Digital Transformation in manufacturing-Trends and Challenges, Industry 4.0. Additive manufacturing	8
Total		45 Hours

Text Books:

1. P.L.Jain, Principles of Foundry Technology, 2009, 5th edition, TMH Publications.
2. P.N.Rao, Manufacturing Technology Foundry, Forming and Welding, 2003, 2nd Edition.
3. P.C.Sharma, Production Technology, S. Chand.

Reference Books

1. Parmar R.S, Welding Engineering and Technology, 2013, Khanna Publishers.
2. John K.C, Metal casting and Joining, 2015, PHI publications.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Knowledge about the basic concept of foundry.
CO2	Understanding different joining processes.
CO3	Understand about advanced joining processes.
CO4	Understand plastic deformation in metals in metal forming processes.
CO5	Understand about the sheet metal working processes.
CO6	Understand the concept of automation in manufacturing along with additive manufacturing.

Experiential Learning:

1. Preparation of wooden pattern
2. Preparation of sand mould
3. Welding practices using arc welding, gas welding, TIG and MIG welding
4. Rolling practice using different rolling mills
5. Preparation of samples using 3D printing

Type	Code	Essence of Indian knowledge and Tradition-I	L-T-P	Credits	Marks
MC	BTMC-T-MC-302		3-0-0	0	100
Objectives	The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic lifestyle of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.				
Pre-Requisites					
Teaching Pedagogy					
Module	Topics				Hours
Module -I	Introduction to traditional knowledge- Define Traditional Knowledge- Nature and Characteristics- Scope and Importance- kinds of Traditional Knowledge- The historical impact of social change on Traditional Knowledge Systems- Value of Traditional knowledge in global economy.				8
Module -II	Basic structure of Indian Knowledge System Veda - Rigveda, Samaveda, Yajurveda, and Atharvaveda				8
Module -III	Upaveda - (Ayurved, Dhanurveda, Gandharva Veda & Sthapatyaveda)				6
Module -IV	Vedanga-(Shiksha, Kalpa, Nirukta, Vyakarana,Jyotisha,Chanda)&Upanga (Dharmashastra, Meemamsa, purana & Tarka Shastra)				6
Module -V	Modern Science and Indian Knowledge System				6
Module -VI	Yoga and Holistic Health				6
	Total				40

Course Outcomes:

Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Type	Code	Engineering Mechanics of	L-T-P	Credits	Marks
PC	BT-ME-P-PC-401	Solids Lab	0-0-3	1	100
Objectives	1. Analyze the Behavior of solid bodies under various types of loading 2. Apply knowledge of materials and structural elements 3. Develop problem-solving skills using analytical methods				
Pre-Requisites	Fundamental of physics, Vector calculus, ordinary and partial differential equations, some exposure to complex variables. Undergraduate course in material science or a background in engineering mechanics				
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus					
Experiment No.	NAME OF THE EXPERIMENT				Hours
Experiment No. 1	Verification of Polygon Law				3
Experiment No. 2	Determine Radius of gyration of compound Pendulum				3
Experiment No. 3	Determine coefficient of friction of inclined plane apparatus				3
Experiment No. 4	Determine tensile and compressive strength of different material using UTM				3
Experiment No. 5	Determine fatigue strength of material				3
Experiment No. 6	Determine torsional strength of material				3
Experiment No. 7	Estimation of spring constant under tension and compression				3
Experiment No. 8	Strain measurement using strain gauge				3
Experiment No. 9	Determine of impact strength using IZOD				3
Experiment No. 10	Determine hardness of material				3
	Total				30 Hours
Course Outcomes: At the end of this course, the students will be able to:					
CO1	To know about application of force in different field				
CO2	To know the difference of smooth surface and rough surface				
CO3	To know about the importance of tensile and compressive strength of material in design				
CO4	To know about the application of spring				

CO5	To know about the stress and strain
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Type	Code	Object Oriented Programming Language using JAVA Lab	L-T-P	Credits	Marks
ES	BTCS-P-ES-301		0-0-3	1	150
Objectives	To expose to the field of Problem Solving and Programming				
Pre-Requisites	Knowledge of Mathematics in Secondary Education				
Teaching Pedagogy	Regular Lab with use of ICT. Each session is planned to be interactive with focus on real-life problem-solving activities.				

Detailed Syllabus

Experiment No	NAME OF THE EXPERIMENT	HOURS
Experiment- 1	Introduction, compiling and executing java program	2
Experiment -2	Data types, variables and design control structures	2
Experiment- 3	Loop control structures	2
Experiment- 4	Introduction to object and class	2
Experiment- 5	Inheritance, polymorphism and abstract class	2
Experiment- 6	package	2
Experiment- 7	Interfaces, Inner classes	2
Experiment- 8	Exception handling and java threads	2
Experiment- 9	Java applets	2
Experiment- 10	AWT and swings	2
Total		20 Hours

Type	Code	Basic Manufacturing Practices Lab	L-T-P	Credits	Marks
PC	BT-ME-P-PC-402		0-0-3	1	100
Objectives	To expose to the practical field of Manufacturing processes.				
Pre-Requisites	Manufacturing tools like pattern, mould, furnace, welding and forming equipment				
Teaching Pedagogy	Laboratory practices with use of with assisting tools as and when required, sessions are planned to be interactive with focus on practical activities.				
Experiment No.	NAME OF THE EXPERIMENT				Hours
Experiment No. 1	Determination of grain size, clay content, permeability and green compressive strength of Moulding sand				3
Experiment No. 2	Foundry Practices				3
Experiment No. 3	Preparation of a wood pattern.				3
Experiment No. 4	Determination of strength of brazed and solder joints				3
Experiment No. 5	Practice and preparation of job in TIG/MIG welding				3
Experiment No. 6	Practice and preparation of job in sheet metal using processes like forming and deep drawing.				3
Experiment No. 7	Demonstration of different rolling mills				3
Experiment No. 8	Demonstration of Extrusion processes				3
	Total				24 Hours
Course Outcomes: At the end of this course, the students will be able to:					
CO1	To know about application of force in different field				
CO2	To know the difference of smooth surface and rough surface				
CO3	To know about the importance of tensile and compressive strength of material in design				
CO4	To know about the application of spring				
CO5	To know about the stress and strain				

Type	Code	ESI-I	L-T-P	Credits	Marks
SC	BTSC-P-SC-301		0-0-3	2	100

Objectives	To encourage the students to study advanced engineering developments To prepare and present technical reports. To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.
Pre-Requisites	Knowledge of Speaking with globally accepted language, subject analysis, practical implementation.
Teaching Pedagogy	Regular contact with interns and evaluation with record keeping.

METHOD OF EVALUATION:

- 1 During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes.
- 2 In a session of one period per week, 5 students are expected to present the seminar.
- 3 Each student is expected to present at least twice during the semester and the student is evaluated based on that.
- 4 At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report.
- 5 A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
- 6 Evaluation is 100% internal.

Course Outcomes: At the end of this course, the students will be able to:

CO1	State the functioning of organization and observe changes for self-improvement.
CO2	Explain how the internship placement site fits into a broader career field.
CO3	Apply appropriate workplace behaviors in a professional setting.
CO4	Solve real life challenges in the workplace by analyzing work environment and conditions, and selecting.
CO5	Evaluate the internship experience in terms of personal, educational and career needs.
CO6	Develop ideas for suitable start-ups to become successful entrepreneur.

4th Semester

Type	Code	Fluid Mechanics and Machines	L-T-P	Credits	Marks
PC	BTME-T-PC-401		4-1-0	3	150
Objectives	1. Understand Basic Principles of Fluid Mechanics 2. Evaluate Performance of Hydraulic Turbines 3. Analyze Pump Functionality and Characteristic Curves				
Pre-Requisites	Fundamental of physics, Vector calculus, ordinary and partial differential equations, some exposure to complex variables. Undergraduate course in fluid mechanics or a background in Newtonian mechanics.				
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.				

Detailed Syllabus

Module	Topics	Hours
Module -I	Introduction: Scope of fluid mechanics and its development as a science, Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.	7
Module -II	Pressure variation in fluids statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer. Hydrostatic process on submerged surfaces, force on a horizontal submerged plane surface, force on a vertical submerged plane surface. Buoyancy and floatation. Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.	8
Module -III	Fluid kinematics: Eulerian and Lagrangian description of fluid flow, stream function and velocity potential function. Streamline, path line and streak lines and stream tube. Classification of fluid flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, Mathematical definitions of rotational, and irrotational flows, Reynolds's transport theorem, differential equation of continuity. Circulation, Flow net	7
Module -IV	Fluid dynamics: Introduction, Introduction to N-S equation, Euler's equation along a streamline, energy equation, Bernoulli's equation and its application to siphon, venturi meter, orifice meter, Pitot tube. Flow in pipes and ducts: Loss due to friction, Minor energy losses in pipes Hydraulic Gradient Line (HGL), Total Energy Line (TEL), Power transmission in the fluid flow in pipes, fluid flow in pipes in series and parallel. Concept of Boundary layer separation of boundary layer and its control.	8
	Impact of jets, Euler's equation - Theory of roto-dynamic machines – various efficiencies–velocity components at entry and exit of the rotor-velocity triangles.	

Module -V	Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine. Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in Pelton wheel efficiency and performance curves.	8
	Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation.	
Module -VI	Centrifugal Pump: constructional features, vane shape, velocity triangles, Efficiencies, Multi-stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation. Positive displacement pumps: Reciprocating Pump, working principle, Discharge, work done and power requirement, Slip, Indicator diagram	6
Total		44 Hours

Text Books:

1. Modi, P.N. & Seth, S.M., "Hydraulics & Fluid Mechanics Including Hydraulic Machines", Standard Book House, 2017
2. Bansal, R.K., "Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, 2011

Reference Books:

1. K. Subramanya, "Theory and Applications of Fluid Mechanics", Tata McGraw-Hill Publishing Company Ltd., 1993
2. Vijay Gupta and Santosh K. Gupta, "Fluid Mechanics and its Applications", Wiley Eastern Ltd., 1984

Course Outcomes: At the end of this course, the students will be able to:

CO1	To understand the properties of fluids and types of fluids.
CO2	Apply conservation laws to fluid flow problems in engineering applications and examine the stability of floating bodies
CO3	Apply Euler's Equation of motion and Bernoulli's equation for flow measuring devices and hydraulic machines.
CO4	To understand the concepts of fluid flow measurement and flow through pipes.
CO5	To understand the concepts of fluid flow measurement and flow through pipes.
CO6	To determine the basic principles and characteristic curves of turbines and pumps.

1. Preparation of Instrument to Measure Density of Materials
2. Small Project to Observe and Calculate Capillary Rise and Fall
3. Small Project to Calculate Metacentric Height
4. Small Project to Verify Bernoulli's Equation
5. Small Project to Verify Pascal's Equation
6. Small Project to Verify Fluid Friction

Type	Code	Strength of Materials	L-T-P	Credits	Marks
PC	BTME-T-PE-402		4-1-0	3	150

Objectives	The students will be exposed to 1. 2-D and 3-D state of stresses, principal stresses, Mohr's circle 2. Elastic Strain energy, concept of fracture mechanics and repeated stresses 3. Pressure vessels and composite materials
Pre-Requisites	Elementary Mechanics of solids
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module	Topics	Hours
Module -I	Elementary concept of elasticity , stresses in three dimensions, Principal Stresses, Stress Invariants, Mohr's Circle for 2-D and 3-D state of stress, State of pure shear, plane stress. Differential equations of equilibrium.	7
Module -II	Analysis of strain , State of strain at a point, Strain Invariant, Principal Strains, Plane state of strain, Mohr's Circle for 2-D and 3-D state of strain, compatibility conditions. Energy Methods: Work done by forces and elastic strain energy stored. Reciprocal relations, Castigliano's theorems.	7
Module -III	Slope and Deflection of Beams : Slope and Deflection of beam, Double integration method, Area moment method, Strain energy method.	8
Module -IV	Repeated stresses and fatigue in metals, endurance limit and factors affecting it, and fatigue design theory, Goodman, Gerber and Soderberg criteria, Concept of stress concentration, Notch sensitivity. Introduction to Fracture Mechanics : Basic modes of fracture, Fracture toughness evaluation.	8
Module -V	Pressure vessels : Thin pressure vessels: cylindrical and spherical vessels, Thick-walled cylinder subjected to internal and external pressures, Compound cylinders, Shrink fit.	6
Module -VI	Theory of column : long column, Euler's column formula, Lateral buckling, Critical Load, slenderness ratio, eccentric load of short column.	6
	Total	42 Hours

Text Books:

1. Advanced Mechanics of Solids, L.S. Srinath, Tata McGraw Hill
2. Advanced Mechanics of Materials: Boresi and Schmidt, Wiley

Reference book:

1. Advanced Mechanics of Materials: Siley and Smith
2. Strength of Materials Vol.II, by S.Timoshenko
3. Mechanical Metallurgy by Dieter
4. Strength of Materials by G. H. Ryder, Macmillan Press
5. Mechanics of Materials by Beer and Johnston, Tata-McGraw Hill
6. Mechanics of Materials by R.C.Hibbeler, Pearson Education
7. Mechanics of Materials by William F. Riley, Leroy D. Sturges & Don H. Morris, Wiley Student.
8. Mechanics of Materials by James M. Gere, Thomson Learning
9. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall of India
10. Strength of Materials by S.S. Rattan, Tata McGraw Hill

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the concept of state of stress and stress distribution due to different type of load
CO2	Understand the state of strain, concept of strain energy stored and work done by the forces.
CO3	Evaluate slope and deflection due to transverse loading on the beam using concept of bending moment
CO4	Interpret mode of fracture due to static and fatigue loading
CO5	Relate basic concept of force and stress to analyze stresses in pressure vessels
CO6	Evaluate lateral buckling long and short column due to critical loading and eccentric loading.

Experiential Learning:

1. Drawing Mohr's circle for 2D and 3D state of stress using CAD model
2. Model of different types of beams and loading conditions
3. Model showing different basic modes of failure (opening, tearing and shearing modes)
4. Pressure vessels (thick cylinder and thin cylinder)
5. Model on composite material

Type	Code	Introduction to Physical Metallurgy & Engineering Materials	L-T-P	Credits	Marks
PC	BTME-T-PC-404		4-1-0	3	150
Objectives	The objective of this course is To expose basic knowledge of Material science.				
Pre-Requisites	General Chemistry, materials and processes.				
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.				

Detail Syllabus:

Module	Topics	Hours
Module -I	Classification of Engineering Materials , properties of materials: mechanical, physical, chemical & technological, Selection of engineering material. Atomic bonding in solids. Crystal structures: Unit cells, Crystal systems, Common crystal structures in metals, crystallographic directions & planes, calculation of packing density.	6
Module -II	Imperfections in crystals- Types and causes of point defects & line defects, Surface defects and volume defects. Effect of imperfection on material properties. Concept of plastic deformation of metals, critical resolved shear stress, deformation by slip and twinning, Effect of deformation on material properties. plastic deformation in polycrystalline metals, yield point phenomenon and its related effects.	8
Module -III	Recovery; Recrystallization and Grain Growth. Cold Working, Hot working. Types of solid solutions, Hume-Ruthery rules for solid solutions, factors governing solids solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor. Phase diagram: Binary phase diagrams (a) Isomorphism system, (b) Eutectic system, (c) Peritectic system, (d) Eutectoid system and (e) Peritectoid system. Lever rule and its application. Effect of non-equilibrium cooling, coring and homogenization.	8
Module -IV	Iron–Iron carbide phase diagram , with salient micro-constituents of Iron and Steel. TTT-diagram: Purpose & Process of heat treatment: Annealing, normalizing, hardening, tempering Effect of heat treatment on properties of steel, Hardenability of steel & factor affecting hardenability	6

Module -V	Ferrous alloys: classification, composition and application of carbon and alloy steel. Tool steel: Effect of various alloying elements such as Cr, Mn, Ni, V, Mo. Non-Ferrous alloys: Composition and application of Duralumin, γ - alloy, bronze, brass, bell metal, Monel metal and Babbitt metal. Cutting tool material.	6
Module -VI	Nonmetals: Properties and application of thermosetting and thermoplastic polymers. Classification, composition, properties and uses of particulate based and fiber reinforced composites. Classification and uses of ceramics.	6
Total		40 Hours

Text Books:

1. Physical Metallurgy: Principles and Practice by Ragahvan, PHI
2. Materials Science and Engineering by W.D.Callister, Wiley and Sons Inc

Reference Books:

1. Mechanical Metallurgy by George E.Dieter
2. Introduction to Physical Metallurgy by Sidney H.Avner, Tata McGraw Hill

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understanding the structure and properties of the materials.
CO2	Interpret different types of imperfection present in materials and its effects.
CO3	Learn the concept and effect of deformation and dislocation on material properties
CO4	Comprehending micro-structural changes during iron-carbon phase transformation process.
CO5	Comprehending effect of heat treatment and its effect towards change in material properties.
CO6	Realizing application area of ferrous, non-ferrous metals and alloys.

Experiential Learning:

1. Study of Crystal structure through Ball model.
2. Specimen preparation for Tensile test/Impact test and evaluating Yield strength, UTs or Impact strength
3. Study of microstructures for different specimens in Metallurgical Microscope.
4. Experience the impact of materials on structures, machines and household appliances

Type	Code	Mechanisms and Machines	L-T-P	Credits	Marks
PC	BTME-T-PC-403		4-1-0	3	150
Objectives	1. Understand the kinematics and dynamics of machines				
	2. Explore different types of linkages and mechanisms, including four-bar linkages, slider- crank mechanisms, and gear trains.				
	3. Apply knowledge of kinematics and dynamics to create functional and optimized mechanisms.				
Pre-Requisites	Students must have the knowledge on Basic Engineering Mechanics, Force, Torque, Moment.				
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus					
Module	Topics				Hours
Module -1	Kinematic fundamental: Basic Kinematic concepts and definitions, Degrees of freedom. Elementary Mechanism: Link, joint, Kinematic Pair, Classification of kinematic pairs, Kinematic chain and mechanism, Gruebler’s criterion, Inversion of mechanism, Grashof criteria, four bar linkage and their inversions, Single slider crank mechanism, Double slider crank mechanism and them inversion. Transmission angle and toggle position, Mechanical advantage.				8
Module -2	Kinematic Analysis: Graphical analysis of position, velocity and acceleration of four bar and Slider crank mechanisms. Instantaneous Centre method, Aronhold-Kennedy Theorem, Rubbing velocity at a Pin-joint. Coriolis component of acceleration.				6
Module -3	Combined Static and Inertia Force Analysis: Inertia forces analysis, velocity and acceleration of slider crank mechanism by analytical method, engine force analysis - piston effort, force acting along the connecting rod, crank effort. dynamically equivalent system, compound pendulum, correction couple.				6
Module -4	Gear and Gear Trains: Gear Terminology and definitions, Theory of shape and action of tooth properties and methods of generation of standard tooth profiles, Standard proportions, Force analysis, Interference and Undercutting, Methods for eliminating Interference, Minimum number of teeth to avoid interference. Analysis of mechanism Trains: Simple Train, Compound train, Reverted train, Epicyclic train and their applications.				6
Module -5	Turning Moment Diagram and Flywheel: Turning moment diagram. Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed. Flywheel of an internal combustion engine and for a punch machine. Determination of flywheel size from Turning Moment Diagram.				6

Module -6	Mechanism for Control (Governors): Governors - Watt, Porter, Proell, Hartnell, Wilson Hartnell Governor. Performance parameters: Sensitiveness, Stability, Hunting, Isochronism. Governor Effort and Power, Controlling Force & Controlling Force Curve, Friction & insensitiveness, Comparison between governor and flywheel. Mechanism for Control (Gyroscope): Introduction to Gyroscopes. Gyroscopic forces and Couple. Effect of Gyroscopic Couple on Aeroplanes, Gyroscopic stabilization of ship, Stability of Two Wheelers and Four Wheelers. Rigid disc at an angle fixed to rotating shaft.	8
	Total	40
		Hours

Text Books:

- 1 Theory of Machines by R.S. Khurmi, J.K. Gupta, S.Chand Publications
- 2 Theory of Machines by S.S.Rattan, TataMacGrawHill

Reference Books:

- 1 Kinematics and Dynamics of Machinery by R L Norton, Tata MacGraw Hill
- 2 Theory of Machines by Thomas Bevan, CBSPublications
- 3 Kinematics and Dynamics of Machinery by Charles E. Wilsonand,J.PeterSaddler
- 4 Theory of Machines and Mechanisms by John J. Uicker Jr.,Gordon, R.Pennockand Joseph E. Shigley, Oxford University Press

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand different types of mechanisms and their inversions.
CO2	Evaluation of Coriolis component of acceleration.
CO3	Interpret dynamic analysis of slider crank mechanism in engines.
CO4	Explain dynamic force analysis of gear mechanism.
CO5	Interpret dynamic analysis of flywheel for engines as well as for different machines.
CO6	Develop concepts of speed control systems for engines, and gyro-stabilizers for ships and aeroplanes.

Experiential Learning:

1. Model Preparation of Mechanisms to understand Grashof's Law.
2. Preparation of CAD model to understand the Coriolis component of acceleration.
3. Model Preparation of Single Slider Crank Mechanism.
4. Preparation of Physical or animated model of Simple Gear Train.
5. Use of Flywheel in IC engine.
6. Gyroscopic effect in a rotating disc.

Type	Code	Environmental Engineering	L-T-P	Credits	Marks
MC	BTMC-T-MC-301		2-0-0	0	150

Objectives	1. To Assess societal, health, safety and legal issues by applying Environmental Engineering knowledge. 1. To Make use of their knowledge to interpret the data by experimental analysis to provide valid conclusions 2. To Identify, formulate, review research literature and analyze complex Environmental Engineering problems using fundamentals of mathematics, sciences and engineering. 3. To develop solutions for Environmental Engineering problems and design system components and processes to meet the specified needs with appropriate consideration for the public health and safety. 4. To Apply the knowledge of mathematics, Science and Engineering fundamentals for solution of problems of Environmental Engineering.
Pre-Requisites	Knowledge of Science and technology in Secondary level.
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Module	Topics	Hours
Module -I	Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space. Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor. Natural Resources covering Renewable and Non- renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative). Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.	12
Module -II	Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print National Ambient Air quality Standards, Noise standards, Vehicle emission standards	12
Module -III	Drinking water standard (IS 10500), Water Quality Criteria and wastewater	

	effluent standards Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination Working principles of ready-made water filter/purification system commercially available Lay out of a wastewater treatment plant and working of each unit.	10
Module -IV	Solid waste management: Source, classification and composition of Municipal Solid Waste (MSW), Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill Biomedical Waste management – sources, treatment (principles only) and disposal Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only) Introduction to e-waste management. Environmental impact Assessment: Project screening for EIA, Scoping studies Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).	10
	Total	44 Hours

Text Book:

1. Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

1. Environmental Engineering, H.S. Peavy, D.R. Rowe and G. Tchobanoglous, McGraw Hill, 1985.
2. Introduction to Environmental Engineering, M. L. Davis and D. A Cornwell, McGraw Hill International, 2005.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Assess societal, health, safety and legal issues by applying Environmental Engineering knowledge.
CO2	Make use of their knowledge to interpret the data by experimental analysis to provide valid conclusions
CO3	Identify, formulate, review research literature and analyze complex Environmental Engineering problems using fundamentals of mathematics, sciences and engineering.
CO4	Develop solutions for Environmental Engineering problems and design system components and processes to meet the specified needs with appropriate consideration for the public health and safety.
CO5	Apply the knowledge of mathematics, Science and Engineering fundamentals for solution of problems of Environmental Engineering.
CO6	Assess societal, health, safety and legal issues by applying Environmental Engineering knowledge.

Type	Code	Machine Drawing Lab	L-T-P	Credits	Marks
PC	BT-ME-P-PC-404		0-0-2	1	100

Objectives	To acquire the knowledge of CAD software and its features. To familiarize the students with Indian Standards on drawing practices. To impart knowledge of thread forms, fasteners, keys, joints and couplings. To make the students understand and interpret drawings of machine components leading to preparation of Assembly drawings manually and using CAD packages. To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.
Pre-Requisites	Knowledge of Engineering Graphics. Knowledge about functioning of various mechanical components and simple component drawing by using CAD software.
Teaching Pedagogy	Students will be exposed to CAD software in computational lab. Drawing of machine components will be done using CAD software under the supervision of expert faculties.

Detailed Syllabus

Experiment no.	NAME OF THE EXPERIMENT	Hours
Experiment no. 1	Introduction: Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines.	3
Experiment no. 2	Sections of Solids: Sections of Pyramids, Prisms, Cubes, Cones and Cylinders resting only on their bases True shape of sections. Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines (with section planes indicated on the part)	3
Experiment no. 3	Thread Forms: Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.	3
Experiment no. 4	Fasteners: Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly)	3
Experiment no. 5	Keys and Joints: Parallel key, Taper key, Feather key and Gib-head key. Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.	3
Experiment no. 6	Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)	3
Experiment no. 7	Assembly Drawings: I.C. Engine connecting rod, Plummer block (Pedestal Bearing)	3
Experiment no. 8	Assembly Drawings: Lever Safety Valve Screw jack (Bottle type)	3
Experiment no. 9	Assembly Drawings: Screw jack (Bottle type)	3
Experiment no. 10	Assembly Drawings: Tailstock of lathe	3
Total		30 Hours

Textbooks:

1. Machine Drawing by K.R. Gopala Krishna (Subhash Publication)
2. Machine Drawing by N.D.Bhat & V.M. Panchal (Charoratar publishing house)
3. Machine Drawing by N. Siddeshwar, P. Kanniah, V.V.S. Sastri (Tata McGraw Hill)

Course Outcomes: At the end of this course, the students will be able to:

CO1	Identify the national and international standards pertaining to machine drawing
CO2	Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings.
CO3	Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.
CO4	Interpret the Machining and surface finish symbols on the component drawings.
CO5	Preparation of the part or assembly drawings as per the conventions.

Type	Code	Mechanisms and Machines Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-405		0-0-2	1	150

Objectives	1. Understand the dynamics of cams and gyroscopes and apply these concepts to real-world engineering problems. 2. Study governors and evaluate their speed regulation mechanisms. 3. Explore the effects of vibrations in mechanical systems and analyze their impact on machine performance.
Pre-Requisites	Students must have the knowledge on Basic Engineering Mechanics, Force, Torque, Moment.
Teaching Pedagogy	Regular class room lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.

Detailed Syllabus

Experiment No.	NAME OF THE EXPERIMENT	Hours
Experiment No.1	Working model of Slider Crank mechanism.	3
Experiment No.2	Working model of Whitworth quick return motion mechanism	3
Experiment No.3	Position analysis of elliptical trammel using virtual lab.	3
Experiment No.4	Determination of gyroscopic couple using gyroscopic test rig.	3
Experiment No.5	Performance characteristics of a spring-loaded governor.	3
Experiment No.6	Experiment on static and dynamic balancing apparatus.	3
Experiment No.7	Study of various types of gear train with interference and undercutting in gear drives.	3
Experiment No.8	Experiment on Cam Analysis Apparatus.	3
Experiment No.9	Experiment on Journal bearing apparatus.	3
Experiment No.10	Determination of moment of inertia of flywheel.	3
Total		30 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the concepts and application of links, mechanisms and machines.
CO2	Develop working model using the concept of different types of mechanisms.
CO3	Analyse the concept of balancing of machineries.
CO4	Evaluate the performance characteristics of different types of governors.
CO5	Evaluate the performance of different cams and followers.

Type	Code	Fluid Mechanics and Machines	L-T-P	Credits	Marks
PC	BT-ME-P-PC-403	Laboratory	0-0-2	1	100
Objectives	1. Understand Basic Principles of Fluid Mechanics 2. Evaluate Performance of Hydraulic Turbines 3. Analyze Pump Functionality and Characteristic Curves				
Pre-Requisites	Fundamental of physics, Vector calculus, ordinary and partial differential equations, some exposure to complex variables. Undergraduate course in fluid mechanics or a background in Newtonian mechanics.				
Teaching Pedagogy	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on practical problem-solving activities.				
Experiment No.	NAME OF THE EXPERIMENT				Hours
Experiment No. 1	Determination of metacentric height and Application to stability of floating bodies.				3
Experiment No. 2	Verification of Bernoulli Theorem				3
Experiment No. 3	Determination of C_v & C_d of orifice Meter				3
Experiment No. 4	Calibration of bourdon tube pressure gauge & measurement of pressure using manometers.				3
Experiment No. 5	Determination of Darcy's coefficient on pipe friction apparatus				3
Experiment No. 6	Experiment on impact of Jets				3
Experiment No. 7	Experiments on performance of Pelton Turbine				3
Experiment No. 8	Experiments on performance of Francis Turbine				3
Experiment No. 9	Experiments on performance of centrifugal pump				3
Experiment No. 10	Experiments on performance of reciprocating pump				3
	Total				30 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	To know about bourdon tube pressure gauge & measurement of pressure
CO2	To know difference in application of venturi meter & orifice meter.
CO3	To know about the importance of meta center & center of buoyancy
CO4	To know about the application and performance of hydraulic Turbines
CO5	To know about the application and performance of hydraulic Pumps

Syllabus for B. Tech (3rdYear)



(2026 Passed out Students)

B. Tech. in Mechanical Engineering

(Approved by Academic Council and Board of Studies)

GIFT Autonomous, Bhubaneswar

(Approved by AICTE, New Delhi, Affiliated to BPUT, Rourkela) Recognized under
section 2(f) of the UGC act, 1956

At-Gramadiha, Po. Gangapada, Via-Janla, Dist-Khorda, Pin code: 752054

Program Outcomes (UG Engineering)

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The Program Outcomes (POs) for UG Engineering programmes defined by NBA.

- PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Types & Definitions

L	Lecture
T	Tutorial
P	Laboratory/Practical/ Sessional
WCH	Weekly Contact Hours
BS	Basic Sciences
HS	Humanities & Social Sciences (including Management) ES
PC	Engineering Sciences Professional Core
PE	Professional Elective
OE	Open Elective
MC	Mandatory Course
SC	Skill Course
EEC	Employability Enhancement Course
SEPD	Skill Enhancement and Personality Development

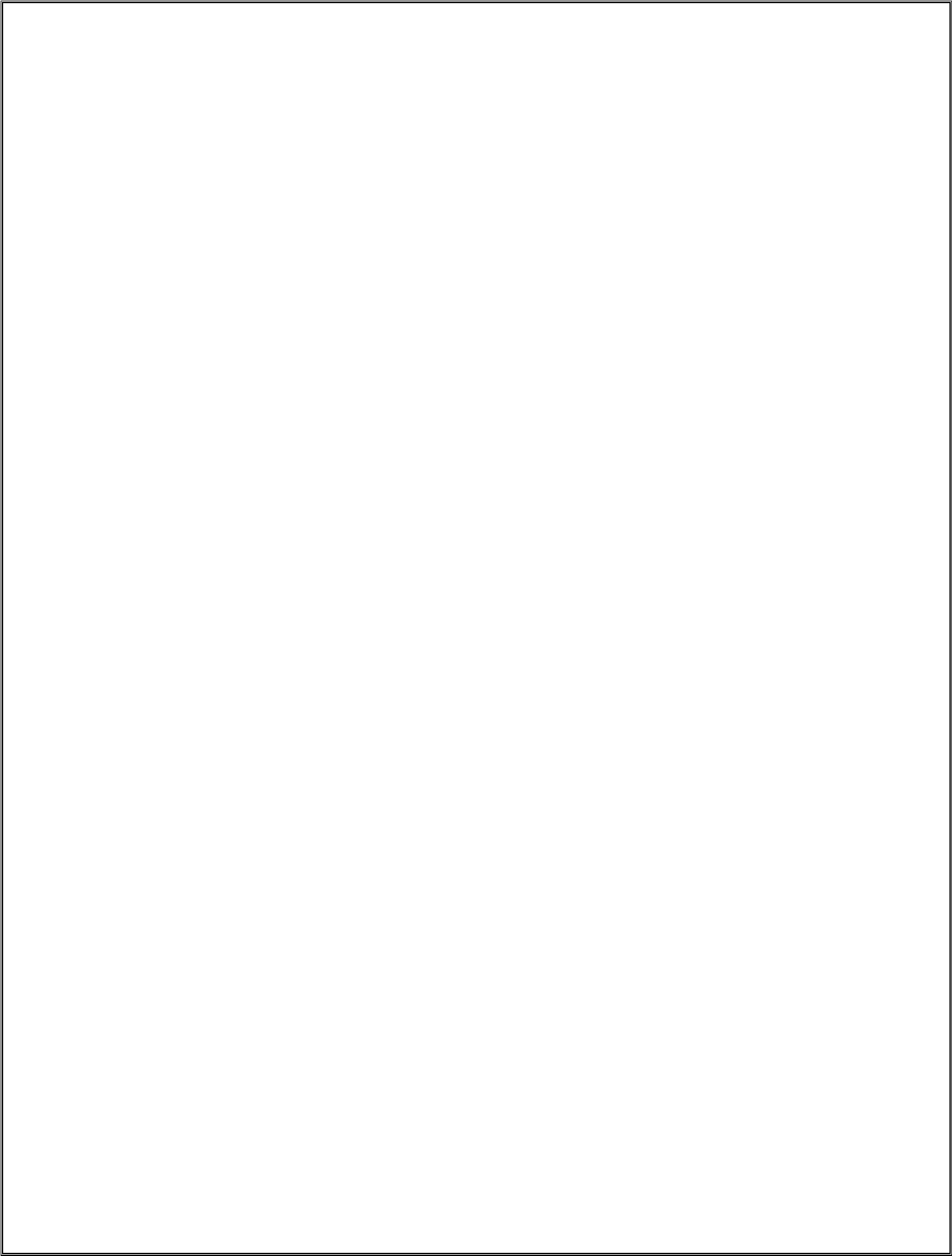
Scheme of Evaluation

Proposed Internal Examination (B. Tech, Autonomous)					
Sl. No	Type of Test	Mark	Frequency	Total Mark	Reduced Mark
1	Modular Test	25	3	75	50
2	Online Quiz Test	10	6	60	10
3	Assignment	5	2	10	10
4	Subject Specific Project	15	1	15	15
5	Attendance	15	1	15	15
TOTAL				165	100
Pass Mark					45

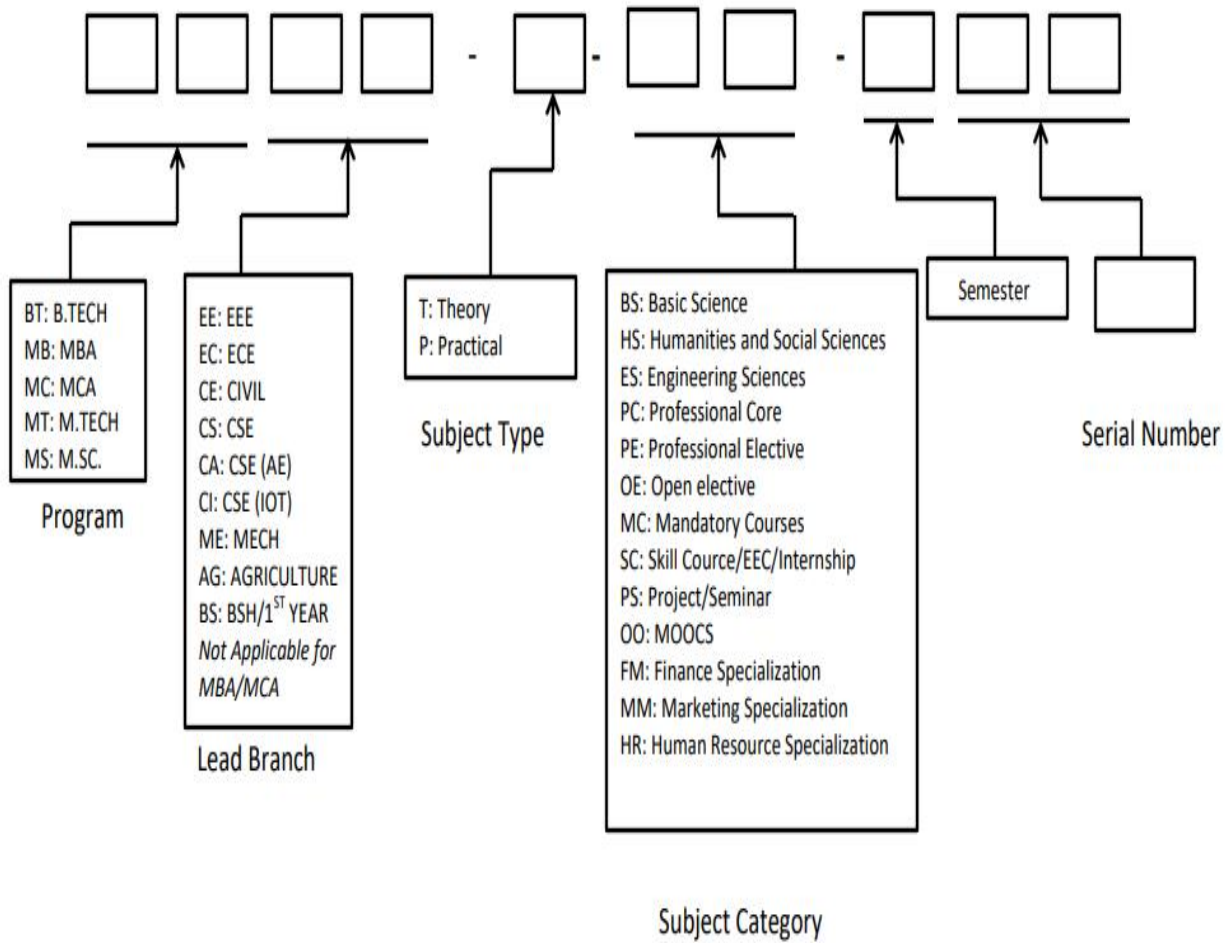
Proposed External Examination (B. Tech, Autonomous)				
Sl. No	Type of Test	Mark	Frequency	Total Mark
1	End Semester Examination	100	1	100
Pass Mark				35

Instructions:

1. Each student must appear in all of the above internal examinations without fail.
2. No exemption or accommodation of request will be entertained.
3. In case of exigency, or self-illness the student must submit ample evidence to re-appear the test. Since the schedule of the examination is non-negotiable, the request shall be sent to the competent authority.
4. Appearance of modular tests is part of the curriculum; hence each student is urged to appear for each modular test. Due penalty as per the examination rule shall be imposed.
5. For not qualifying or to improve the individual subject score in internal the student must appear on the improvement test after successful registration in CMS.



Subject Code Format



Course Structure, 2022-23 B. Tech. Admission Batch

Fifth Semester					
Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	PC	BTME-T-PC-501	Machine Design	4-0-0	3
2	PC	BTME-T-PC-502	Internal Combustion Engines and Gas Turbines (ICGT)	4-1-0	3
3	PC	BTME-T-PC-503	Machining Science & Technology	4-0-0	3
4	PC	BTME-T-PC-504	CAD/CAM	4-0-0	3
5	OE	BTME-T-OE-501	Power Plant Engineering	3-1-0	3
6	MC	BTMC-T-MC-501	Universal Human Value	4-0-0	0
7	AEC	BTSC-T-AE-501	Employment Enhancement Training-3	2-0-0	1
Total Hours/ Credit (Theory)				29	16
Practicals					
1	PC	BTME-P-PC-501	Machine Design Lab	0-0-3	1.5
2	PC	BTME-P-PC-502	CAD/CAM Lab	0-0-2	1.5
3	PC	BTME-P-PC-503	IC Engine Lab	0-0-2	1
4	PC	BTME-P-PC-504	MST lab	0-0-3	1
5	SC	BTSC-P-SC-502	Evaluation of Summer Internship-2	0-0-3	2
6	PS	BTPS-P-PS-503	Seminar-II	0-0-2	1
Total Hours/ Credit (Practical)				10	8
Grand Total Hours/ Credit				39	24

Sixth Semester					
Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	BS	BTBS-T-BS-601	Optimization Engineering	4-0-0	3
2	PC	BTME-T-PC-601	Metrology Quality Control and Reliability Engineering	4-0-0	3
3	PE	BTME-T-PE-602	Mechanical Vibration , Product Design and Production Tooling (PDPT)	4-1-0	3
4	PC	BTME-T-PC-603	Heat Transfer (HT)	4-0-0	3
5	OE	BTME-T-OE-601	Entrepreneurship Development	4-1-0	3
6	OO	BTME-T-OO-601	NPTEL	2-0-0	3
7	MC	BTMC-T-MC-601	Essence of Indian Knowledge Tradition - II	2-0-0	0
8	AEC	BTSC-T-AE-604	Employment Enhancement Training-4	4-0-0	1
Total Hours/ Credit (Theory)				32	19
Practicals					
1	PC	BTME-P-PC-601	MQCR LAB	0-0-2	1
2	PC	BTME-P-PC-602	HT LAB	0-0-2	1
3	PS	BTPS-P-PS-601	Project IV	0-0-2	2
Total Hours/ Credit (Practical)				9	4
Grand Total Hours/ Credit				39	23
SUMMER INTERNSHIP TRAINING for 30 Days					

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Third Year B.Tech Curriculum Structure

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Evaluation Scheme

Mark Distribution for Internal& External Examinations for all Courses-2023-24

Proposed Internal Examination (B. Tech, Autonomous)					
Sl. No.	Type of Test	Mark	Frequency	Total Mark	Reduced Mark
1	Modular Test	25	4	100	50
2	Online Quiz Test	10	4	40	10
3	Assignment	10	2	20	10
4	Subject Specific Project	15	1	15	15
5	Attendance	15	1	15	15
TOTAL				190	100
Pass Mark					45

Proposed External Examination (B. Tech, Autonomous)				
Sl. No.	Type of Test	Mark	Frequency	Total Mark
1.	End Semester Examination	100	1	100
Pass Mark				35

Instructions: -

1. Each student must appear in all of the above internal examinations without fail.
2. No exemption or accommodation of request will be entertained.
3. In case of exigency, or self-illness the student must submit ample evidence to re-appear the test. Since the schedule of the examination is non-negotiable, the request shall be sent to the competent authority.
4. Appearance of modular tests is part of the curriculum; hence each student is urged to appear for each modular test. Due penalty as per the examination rule shall be imposed.
5. For not qualifying or to improve the individual subject score in internal the student must appear on the improvement test after successful registration in CMS.

5th Semester

Type	Code	Machine Design	L-T-P	Credits	Marks
PC	BTME-T-PC-501		4-0-0	3	150
Objectives	The objective of this course is to familiarize the students with the 1. Knowledge and concepts of Machine Design. 2. Design of machine elements considering loading and failure conditions 3. Design of machine elements (like springs and bearings) according to their place of application				
Pre-Requisites	Basic knowledge of Engineering mechanics and mechanics of solids				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Mechanical engineering design: Introduction to design procedure, Stages in design, Code and Standardization, Interchangeability, Preferred numbers, Fits and Tolerances.				6
Module-II	Use of Data books. Fundamentals of Machine Design: Types of loads, Modes of failure, factor of safety concepts, Theories of Failure, Material selection.				7
Module-III	Machine Element Design: Design of Joints: Rivets, Boiler joints, welded joint and threaded fasteners based on different types of loading, Power screw design with square thread such as screw jack.				8
Module-IV	Design of Keys, Shaft: Classification of keys and pins, Design of sunk key, Design of shafts: based on strength, torsional rigidity and fluctuating load, ASME code for shaft design.				8
Module V	Design of Mechanical Springs: Types of helical springs, Design of Helical springs, bulking of spring, spring surge, end condition of springs, Design of leaf springs: nipping.				6
Module-VI	Brief over view of Bearings: Rolling contact bearing, Life of rolling contact bearing, selection of rolling contact bearing. Design of sliding contact bearing, Sommerfeld Number.				7
Total					42 Hours

Text Books:

1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill
2. Mechanical Engineering Design, J.E.Shigley, C.R.Mischke, R.G.Budynas and K.J.Nisbett,TMH

Reference Books:

1. Machine Design, Pandya and Shah, Charotar Book Stall
2. Fundamentals of Machine Component Design by R.C.Juvinall and K.M.Marshek, JohnWiley & Sons.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the use of codes, standards, preferred number, design data book in machine design
CO2	Design different load carrying joints
CO3	Design power transmission system
CO4	Design rolling contact and sliding contact bearings
CO5	Design spring for different application
CO6	Design different types of joints used for power transmission

Experiential Learning:

1. Representation of types of loading (Tensile, Compressive, Shear)
2. Calculation of preferred no
3. Model of Muff coupling
4. Model of screw jack
5. Collection of different types of springs
6. Knuckle joint
7. Cotter joint
8. Riveted joint
9. Welded joint
10. Screw joint

Type	Code	Internal Combustion Engines and Gas Turbines	L-T-P	Credits	Marks
PC	BTME-T-PC-502		4-1-0	3	150
Objectives	The objective of this course is to familiarize the students with the 1. The thermodynamic analysis of Cycles and IC engine components 2. Combustion of fuel inside the engines and Performance of fuels under different conditions 3. Dynamics involved in the working principle of different engines.				
Pre-Requisites	Class12th level mathematics, Physics.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction: Classification, Engine nomenclature, engine operating and performance parameters, Valve timing diagram of SI and CI engines, Comparison of SI and CI engines. Thermodynamic Analysis of cycles: Air standard and fuel–air cycle analysis of Otto, Diesel and limited pressure cycles. Effect of design and operating parameters on cycle efficiency. Modified fuel-air cycle considering heat losses and valve timing.				8
Module-II	Carburetion: Factors Affecting Carburetion, Principle of Carburetion, Simple Carburettor and its drawbacks, Calculation of the Air-Fuel Ratio, Modern Carburettors. Fuel Injection: Functional Requirements of an Injection System, Classification of Injection Systems, Fuel Feed Pump, Injection Pump, Injection Pump Governor, Mechanical Governor, Pneumatic Governor, Fuel Injector, Nozzle, Injection in SI Engine, Electronic Injection Systems, Multi-Point Fuel Injection (MPFI) System, Functional Divisions of MPFI System, Injection Timing, Group Gasoline Injection System, Electronic Diesel Injection System. Ignition: Energy requirement for ignition, requirements of an ignition system, conventional ignition systems, modern ignition systems (TCI and CDI), firing order, Ignition timing, Spark advance mechanism,				8
Module-III	Combustion: Fuels and combustion in S.I. engines, knocking and fuel rating. Energy balance, volumetric efficiency, measurement of indicated and brake power. Comparison of various types of combustion chambers. Testing and Performance: Engine dynamics and torque analysis (Power, fuel & air measurement methods, Performance characteristic curves of SI & CI engines, variables affecting performance and methods to improve engine performance).				8

Module-IV	Super Charging & Scavenging: Supercharging, Scavenging, Variable compression ratio engine. Wankel rotary combustion engine. Alternative fuels for IC engines like LPG, CNG, Alcohols, Hydrogen etc., their need, properties, engine modification and performance.	6
Module V	Cooling & Lubricating Systems, Engine Emission & Controls: Air cooling & water-cooling systems, Effect of cooling on power output & efficiency, Properties of lubricants and different types of lubricating system. Modern developments in IC Engines, EGR, MPFI, CRDI, GDI, HCCI, dual fuel engine, Lean burn engine, Stratified engine (basic principles). Engine Emission and Control: Exhaust emissions, its measurement and control. Fault diagnosis of S.I. Engines. Modeling of I.C. Engine Combustion.	4
Module-VI	Gas Turbines: Introduction, Open and closed cycle gas turbines, Analysis of practical gas turbine cycle. Air-Craft Propulsion: Analysis of Turbo Jet, Turbo Prop, Turbofan & Ram jet engines. Axial Flow & Centrifugal Compressor: Basic construction of centrifugal and axial flow compressor, Velocity diagram, performance characteristics of centrifugal and axial flow compressor, effects of slip, surging and stalling on compressor.	10
Total		44 Hours

Text Books:

1. IC Engines, Mathur& Sharma
2. Internal Combustion Engines, V. Ganesan, TMH, 3rd edition
3. Gas Turbines, V. Ganesan, TMH, 3rd edition

Reference Books:

1. Fundamentals IC Engines, J. B. Heywood, McGraw Hill
2. A course in IC Engines, V. M. Domkundwar, Dhanpat Rai and sons
3. Gas Turbines, Cohen and Roser
4. An Introduction to Energy Conversion, Vol.III, V. Kadambi and Manohar Prasad, New Age International
5. Fundamentals of Internal Combustion Engines, H. N. Gupta, PHI
6. Internal Combustion Engines, K.K. Ramalingam, Scitech Publications

Course Outcomes: At the end of this course, the students will be able to:

CO1	Students must be able to understand the types of air-cycles and loss factors.
CO2	Types of fuel injection system and need of fuel injector, carburettor, types of fuel used and combustion mechanism.
CO3	Performance measurement methods and improvement of combustion mechanism using cooling and lubrication.
CO4	Use of alternative fuels if any required.
CO5	Understand about cooling system, engine emission and control.
CO6	Performance of gas turbine cycle and its improvement using auxiliary equipment.

Experiential Learning:

1. To prepare a small carburettor for fuel-air mixture.
2. To prepare fuel injector to understand the mechanism of diesel engine.
3. To understand the slider-Crank mechanism with cylinder piston arrangement.
4. To prepare a small model of valve-timing diagram.
5. To prepare a small model for the ignition system of a petrol engine.
6. To understand the gas-turbine cycle for power plant.
7. To understand the cooling system for an engine.
8. To understand the power measurement using a dynamometer.

Type	Code	Machining Science & Technology	L-T-P	Credits	Marks
PC	BTME-T-PC-503		4-0-0	3	150
Objectives	Students will able to 1. Understand the concept of machining science, chip formation and cutting tools 2. Understand the concept of traditional and non-traditional machining; 3. Acquire knowledge of special mechanisms in different machines.				
Pre-Requisites	Basic Machining				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction to machining science, chip formation, types of chip, orthogonal and oblique cutting, Cutting tool and its elements. Effect of Geometrical parameters on cutting force and surface finish, chip thickness ratio. Geometry of cutting tools in ASA and ORS, Mechanics of chip formation, Merchant’s theory, velocity relationship and force relationship, numerical, Cutting tool materials.				7
Module-II	Types of Tool Wear: Flank wear, Crater wear; heat generation in metal cutting, function, characteristics and types of cutting fluid; Tool life and Taylor's equation; Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tool dynamometer, Drill tool dynamometer. Economics of machining.				6
Module-III	Conventional machining process, machine tools and their specifications, working principles of Turning, Drilling, Shaping, Planning, Milling, Grinding (surface and cylindrical and internal) along with different mechanisms used: Indexing mechanism and thread cutting mechanism, Quick return mechanism				9
Module-IV	Tool holding and job holding methods in different Machine tools. surface roughness measurement, use of measuring tools: Vernier calliper, micrometer.				4
Module V	Production Machine tools – Capstan and turret lathes, single spindle and multi spindle semiautomatics, Gear shaper and Gear hobbing machines, Copying lathe and transfer machine. CNC machine tools and their applications.				8
Module-VI	Introduction to non-traditional Machining processes: need and applications of NTM in modern industries, Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM , Abrasive Jet Machining				6
Total					40 Hours

Text Books:

1. Fundamentals of Machining and Machine Tools, G.Boothroyd and W.A.Knight, CRC Press
2. Metal Cutting Principles, M.C.Shaw, Oxford University Press
3. Metal Cutting Theory and Practice, A.Bhattacharya, Central Book Publishers

Reference Books:

1. Production Technology, P. C. Sharma, S. Chand Publication
2. Manufacturing Technology – by P.N.Rao, Tata McGraw Hill publication.
3. Modern Manufacturing Processes, P.C.Pandey, H.S.Shan, Tata McGraw Hill
4. Manufacturing Science, Ghosh and Mallik, East West Press.
5. Principles of Metal Cutting, G.Kuppuswamy, Universities Press
6. Metal Cutting and Machine Tools, G.T.Reddy, Scitech

Course Outcomes: At the end of this course, the students will be able to:

CO1	Knowledge about the fundamentals of Machining and Machine Tools.
CO2	Calculate the cutting force and velocity of a tool.
CO3	Knowledge about Conventional machining process and machine tools.
CO4	Knowledge about jigs and fixtures
CO5	Knowledge about Production machine tools.
CO6	Knowledge about Non-traditional Machining processes.

Experiential Learning:

1. To prepare required job using lathe.
2. To design a small tool using machining parameters.
3. To prepare complex contours using various M/Cs.
4. Knowledge of non-conventional machining process.
5. Handling of CNC machine.

Type	Code	Strength of Materials	L-T-P	Credits	Marks
PC	BTME-T-PC-504		4-0-0	3	150
Objectives	The students will be exposed to 1. 2-D and 3-D state of stresses, principal stresses, Mohr’s circle 2. Elastic Strain energy, concept of fracture mechanics and repeated stresses 3. Pressure vessels and composite materials				
Pre-Requisites	Elementary Mechanics of solids.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Elementary concept of elasticity, stresses in three dimensions, Principal Stresses, Stress Invariants, Mohr’s Circle for 2-D and 3-D state of stress, State of pure shear, plane stress. Differential equations of equilibrium.				7
Module-II	Analysis of strain, State of strain at a point, Strain Invariant, Principal Strains, Plane state of strain, Mohr’s Circle for 2-D and 3-D state of strain, compatibility conditions. Energy Methods: Work done by forces and elastic strain energy stored. Reciprocal relations, Castiglione’s theorems.				7
Module-III	Slope and Deflection of Beams: Slope and Deflection of beam, Double integration method, Area moment method, Strain energy method.				8
Module-IV	Repeated stresses and fatigue in metals, endurance limit and factors affecting it, and fatigue design theory, Goodman, Gerber and Soderberg criteria, Concept of stress concentration, Notch sensitivity. Introduction to Fracture Mechanics: Basic modes of fracture, Fracture toughness evaluation.				8
Module V	Pressure vessels: Thin pressure vessels: cylindrical and spherical vessels, Thick-walled cylinder subjected to internal and external pressures, Compound cylinders, Shrink fit.				6
Module-VI	Theory of column: long column, Euler’s column formula, Lateral buckling, Critical Load, slenderness ratio, eccentric load of short column.				6
Total					42 Hours

Text Books:

1. Advanced Mechanics of Solids, L.S. Srinath, Tata McGraw Hill
2. Advanced Mechanics of Materials: Boresi and Schmidt, Wiley

Reference Books

1. Advanced Mechanics of Materials: Siley and Smith
2. Strength of Materials Vol.II, by S.Timoshenko
3. Mechanical Metallurgy by Dieter
4. Strength of Materials by G. H. Ryder, Macmillan Press
5. Mechanics of Materials by Beer and Johnston, Tata McGraw Hill
6. Mechanics of Materials by R.C.Hibbeler, Pearson Education
7. Mechanics of Materials by William F.Riley, Leroy D.Sturges & Don H.Morris, Wiley Student.
8. Mechanics of Materials by James M. Gere, Thomson Learning
9. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall of India
10. Strength of Materials by S.S.Rattan, Tata McGraw Hill

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the concept of state of stress and stress distribution due to different type of load
CO2	Understand the state of strain, concept of strain energy stored and work done by the forces.
CO3	Evaluate slope and deflection due to transverse loading on the beam using concept of bending moment
CO4	Interpret mode of fracture due to static and fatigue loading
CO5	Relate basic concept of force and stress to analyze stresses in pressure vessels
CO6	Evaluate lateral buckling long and short column due to critical loading and eccentric loading.

Experiential Learning:

1. Drawing Mohr's circle for 2D and 3D state of stress using CAD model
2. Model of different types of beams and loading conditions
3. Model showing different basic modes of failure (opening, tearing and shearing modes)
4. Pressure vessels (thick cylinder and thin cylinder)
5. Model on composite material

Type	Code	Power Plant Engineering	L-T-P	Credits	Marks
OE	BTME-T-OE-501		3-1-0	3	150
Objectives	The students will be able to understand: 1. Learn the different sources of power produced. 2. Understand the concept of power generation from a power plant. 3. Design the different components of a power plant.				
Pre-Requisites	Basic Thermodynamics				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction: Power plants – types and classification based on energy sources.				2
Module-II	Coal based Thermal Power Plants: Basic Rankine cycle and its modifications; Layout of modern coal power plant; Super critical boilers, FBC boilers; Turbines, condensers, steam and heating rates; Subsystems of thermal power plants; Fuel and ash handling; Draught system; Feed water treatment; Binary cycles and cogeneration systems.				8
Module-III	Gas Turbine and Combined Cycle Power Plants: Brayton cycle analysis and optimization; Components of gas turbine power plants; Combined cycle power plants; Integrated Gasifier based Combined Cycle (IGCC) systems.				6
Module-IV	Nuclear Power Plants: Basics of nuclear energy conversion; Layout and subsystems of nuclear power plants; Boiling Water Reactor (BWR); Pressurized Water Reactor (PWR); CANDU Reactor; Pressurized Heavy Water Reactor (PHWR); Fast Breeder Reactors (FBR); Gas cooled and liquid metal cooled reactors; Safety measures for nuclear power plants.				8
Module V	Hydroelectric Power Plants: Classification; Typical layout and components. Renewable Power Systems: Principles of wind, tidal, solar photo-voltaic, solar thermal, geothermal, biogas and fuel cell power systems.				4
Module-VI	Energy Economics and Environment: Economic and environmental issues; Power tariffs; Load distribution parameters; Load curve; Capital and operating cost of different power plants; Pollution control technologies including waste disposal options for coal and nuclear plants.				6
Total					34 Hours

Text Books:

1. "Theory and Applications of Fluid Mechanics" by K. Subramanya
2. "Power Plant Engineering" by Manoj Kumar Gupta

Reference Books

1. "Power Plant Engineering" by Larry Drbal, Kayla Westra, and Pat Boston
2. "Power Plant Instrumentation and Control Handbook" by Swapan Basu

Course Outcomes: At the end of this course, the students will be able to:

CO1	Learn the source of power generation utilizing natural resources.
CO2	Understand the power generation process in a power plant.
CO3	Evaluate the energy production from a definite power plant.
CO4	Design the different components of a power plant.
CO5	Effect of generation on the environment.
CO6	Calculate the energy economics and its utilization after its production.

Experiential Learning:

1. Overall idea of a model power plant running.
2. Calculation of power production and consumption of a power plant.
3. Ability to design a power plant.
4. Precaution measure to save energy.
5. Safety of environment and human being.

Type	Code	Universal Human Values	L-T-P	Credits	Marks
MC	BTME-T-MC-501		4-0-0	0	150
Objectives	1-To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings. 2-To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way. 3-To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.				
Pre-Requisites	Any under graduate student				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Foundations of Value Education-A Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education); Understanding Value Education; Self-exploration as the Process for Value Education.				3
Module-II	Foundations of Value Education-B Continuous Happiness and Prosperity-the Basic Human Aspiration; Happiness and Prosperity-Current Scenario; Method to Fulfill the Basic Human Aspirations.				3
Module-III	Harmony in the Human Life, Relationships and Society-A Understanding Human being as the Co-existence of the Self and the Body; Distinguishing between the Needs of the Self and the Body; Achieving Harmony: Integrating Self and the Body; Harmony in the Family and Society.				4
Module-IV	Harmony in the Human Life, Relationships and Society- B 'Trust' & ‘Respect’–as Foundational Values in Relationship; Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society &Universal Human Order.				3
Module V	Harmony in the Nature/Existence & Professional Ethics-A Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature; Realizing Existence as Co-existence at All Levels				3
Module-VI	Harmony in the Nature/Existence & Professional Ethics-B The Holistic Perception of Harmony in Existence; Natural Acceptance of Human Values; Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics– Ethical Decision Making & Transition towards Value-based Life and Profession.				4
Total					20 Hours

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, 2. Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. Gaur. R.R.Sangal. R. Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009.
5. Small is Beautiful - E. F Schumacher.
6. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Reference Books

1. Dr. Ritu Saryan, Universal Human Values and Professional Ethics

Course Outcomes: At the end of this course, the students will be able to:

CO1	To understand and analyses the foundations of value education, essentials of human values and skills, self-exploration, happiness and prosperity.
CO2	Understand and analyze the foundations of value education, continuous happiness, and prosperity and basic human aspirations.
CO3	Identify and evaluate the role of harmony in human life, relationship and harmony in family and society.
CO4	Understand and associate the holistic perception of harmony at all levels such as existence of trust and respect, justice in human-to-human relationship.
CO5	Develop appropriate technologies and management patterns to create harmony in professional and personal lives, harmony in the Nature/Existence such as understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfillment.
CO6	Develop appropriate technologies and management patterns to create harmony in professional and personal lives like Natural Acceptance of Human Values.

Experiential Learning:

1. Essence of human being.
2. Adoption of society.
3. Holistic nature.
4. Family Relation
5. Relation with others

Type	Code	EET-III	L-T-P	Credits	Marks
AEC	BTSC-T-AE-501		2-0-0	0.5	100
Objectives	The students will be able to understand: 1. To provide job related knowledge to the students 2. To bridge the gap between skills possessed by the students and the abilities that is looked for by the organization. 3. To develop an attitude of constant self-improvement throughout their career				
Pre-Requisites	To help students practice and understand the various company pattern tests.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Thermodynamics: systems; properties of pure substances, behaviour of ideal and real gases; zero and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations. Power Engineering: Air and gas compressors; vapor and gas power cycles, concepts of regeneration and reheat.				5
Module-II	Applications: Power Engineering: Air and gas compressors; vapor, and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Types of Engines, Air-standard Otto, Diesel and dual cycles.				5
Module-III	Refrigeration and air-conditioning: Vapor and gas refrigeration and heat pump cycles; properties of moist air, psychometric chart, basic psychometric processes. Turbo machinery: Impulse and reaction principles, velocity diagrams, Peloton-wheel, Francis and Kaplan turbines; steam and gas turbine				5
Module-IV	Engineering Materials: Structure and properties of engineering, materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Introduction to Physical Metallurgy: Reactions and Processes, Iron Carbon Diagram, Types of steels and Alloy formation.				5
Module V	Basic Manufacturing Processes: Welding, its types, Soldering and Brazing, Casting, its types, defects, uses, Milling, Drilling, Grinding, Sheet Metal Processes and other related processes. Manufacturing Technology: Cutting Angles, Machining processes and criteria.				5
Module-VI	Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools; additive manufacturing Introduction of AUTOCAD: Draw commands, Cartesian coordinate system, Modify commands, Text command layers blocks, Isometric drawings,2D fundamentals.				5
Total					30 Hours

Text Books:

1. Thermal Engineering-P.K.Nag
2. Physical Metallurgy by Lakhtin
3. Manufacturing Technology: P.N.Rao

Reference Books

1. Thermodynamics: An Engineering Approach by Yunus A Cengel
2. Mechanical Engineering Objectives by RS Khurmi

Course Outcomes: At the end of this course, the students will be able to:

CO1	To help students explore their values and career choices through individual skill assessments.
CO2	To make realistic employment choices and to identify the steps necessary to achieve a goal.
CO3	To encourage students to make smarter career decisions in accordance with their interests, abilities and prepares them for the future.
CO4	To disseminate knowledge and appropriate skill practices through recognized systems of training and testing.
CO5	To Match the objectives with company goals.

Type	Code	Machine Design Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-501		0-0-3	2	150
Objectives	The students will be able to understand: 1. The knowledge of Mechanical engineering in designing joints and couplings 2. The knowledge of thermal engineering and strength of materials to design IC Engine parts. 3. knowledge of material properties and mechanical advantage lever, spring and flywheel				
Pre-Requisites	Knowledge of Engineering Mechanics, Mechanics of solids, Engineering Graphics software.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Students will perform design based on the theoretical knowledge, they will use the dimensions obtained to do the modelling, apply the load and boundary conditions and analyse using the CAD software (any 6)					
Module	Topics				Hours
Experiment-1	Design of Cotter/ Knuckle Joint				3
Experiment-2	Design of Rigid coupling				3
Experiment-3	Design of Flexible coupling				3
Experiment-4	Design of Footstep Bearing				3
Experiment-5	Design of Pressure vessel/Boiler				3
Experiment-6	Design of IC engine parts				3
Experiment-7	Design of screwed joint for Eccentric loading				3
Experiment-8	Design of Lever				3
Experiment-9	Design of spring used for Safety valve				3
Experiment-10	Design of Flywheel				3
Total					30 Hours

Text Books:

Design Hand Book:

1. P.S.G. Design Data Hand Book, PSG College of Tech Coimbatore
2. Design Data Hand Book, K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
3. Design Hand Book by S.M.Jalaluddin; Anuradha Agencies Publications
4. Design Data Hand Book by K.Mahadevan and B.Reddy,CBS Publishers

Course Outcomes: At the end of this course, the students will be able to:

CO1	Design of riveted joint for pressure vessel
CO2	Design load bearing joints for eccentric loading
CO3	Design coupling for power transmission from one shaft to another
CO4	Design bearings for different applications
CO5	Design spring and lever
CO6	Design IC engine parts and flywheel

Type	Code	CAD/CAM Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-502		0-0-3	2	150
Objectives	Students will able to: 1. Expose to the field of Limits Fits and interchangeability 2. Use of CAD software for modeling of simple machine parts 3. Learn coding for CAM programming for CNC machines				
Pre-Requisites	Knowledge of Engineering Drawing and CAD software				
Teaching Scheme	Regular Lab with use of CAD software. Each session is planned to be interactive with focus on real-life problem-solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Experiment-1	Introduction- Role of CAD in product design process- GD&T, Limits, Fits- Basics				3
Experiment-2	Sketching: Development of part drawings for various components in the form of orthographic Representation of dimensioning and tolerances.				3
Experiment-3	Study of Solid modeling Package (CATIA-V5). Solid Modeling of simple machine parts.				3
Experiment-4	Detailing and assembly of flange coupling using CATIA-V5				3
Experiment-5	Detailing and assembly of screw jack using CATIA-V5				3
Experiment-6	Detailing and assembly of cotter and knuckle joint using CATIA-V5				3
Experiment-7	Introduction-CAM-Manual part programming-Computer aided part programming basics				3
Experiment-8	Manual part programming for step turning operation in CNC turning centre.				3
Experiment-9	Manual part programming for drilling operation.				3
Experiment-10	NC code generation for pocket milling, and drilling operation using N-X software.				3
Total					30 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand and interpret machine manufacturing drawings
CO2	Modeling of simple machine parts and assemblies from the part drawings using standard high-end CAD softwares.
CO3	Apply engineering drawing standards as per BIS conventions.
CO4	Understand how to generate CNC Turning and Milling codes for different operations using standard CAM packages.
CO5	Prepare manual part program as well as CNC part program and perform for machining.

Type	Code	Internal Combustion Engines and Gas Turbines Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-503		0-0-3	1	150
Objectives	Students will be exposed to: 1.Components and performance of SI and CI engines (single cylinder and multi-cylinder) 2. Practical study of carburetor and fuel injection system 3. Practical performance of variable compression ratio				
Pre-Requisites	Basic Thermodynamics				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on practical problem-solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Experiment-1	To draw valve timing diagram of a petrol/diesel engine & study of its impact on the performance of an IC engine.				3
Experiment-2	To conduct load test or performance test on a single cylinder C.I. Engine				3
Experiment-3	To conduct load test or performance test on a single cylinder S.I. Engine				3
Experiment-4	To conduct Performance test or Morse test on the multi-cylinder S.I. Engine				3
Experiment-5	Model study of Solex Carburetor				3
Experiment-6	To prepare the heat balance sheet on single cylinder, C.I. Engine				3
Experiment-7	Model study of Fuel injection system of diesel engine				3
Experiment-8	To conduct performance test on Variable Compression Ratio Engine				3
Total					24 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understand the operation mechanism of S.I. and C.I. engine.
CO2	The methods of calculation of efficiency of single cylinder and multi-cylinder SI and CI engines.
CO3	Heat balance sheet calculation will provide the principle of energy conservation.
CO4	Methods applied to improve the efficiency of the engine.

Type	Code	Manufacturing Science and Technology Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-504		0-0-3	1	150
Objectives	Students will able to 1.Expose to the field of manual and numerical machining processes. 2. Explore the possible modeling using machining parameters. 3.Learn coding for CNC machining processes.				
Pre-Requisites	Knowledge of Speaking with globally accepted language and subject analysis.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Experiment-1	Job on lathe with taper turning, thread cutting, knurling and groove cutting (3 experiments).				3
Experiment-2	Gear cutting (with index head) on milling machine				3
Experiment-3	Working with shaper, Planner and slotting machine.				3
Experiment-4	Working with surface and cylindrical grinding.				3
Experiment-5	Determination of cutting force using Lathe tool dynamometer.				3
Experiment-6	Determination of cutting force in drilling using drill tool dynamometer.				3
Experiment-7	Study of Non-traditional machining processes. (USM, AJM, EDM, ECM)				3
Experiment-8	Study of CNC Lathe and demonstration of making job in CNC lathe.				3
Experiment-9	Study of CNC Milling machine and demonstration of making job in CNC Milling machine				3
Total					27 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Learn the various machining processes using Lathe.
CO2	Understand the processes involved in the Lathe, Milling, shaper and slotting M/C.
CO3	Analyze to calculate the cutting force using dynamometer.
CO4	Analyze to study the non-traditional Machining processes.
CO5	Design the machining processes in numerical controlled M/C.
CO6	Demonstration of Machining process using numerical controlled machine.

Type	Code	Evaluation of Summer Internship-II	L-T-P	Credits	Marks
SC	BTSC-P-SC-501		0-0-2	1	150
Objectives	1. To encourage the students to study advanced engineering developments 2. To prepare and present technical reports. 3. To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.				
Pre-Requisites	Knowledge of Speaking with globally accepted language and subject analysis.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				

METHOD OF EVALUATION:

During the seminar session each student is expected to prepare and present a topic on engineering /technology, for duration of about 8 to 10 minutes.

1. In a session of one period per week, 5 students are expected to present the seminar.
2. Each student is expected to present at least twice during the semester and the student is evaluated based on that.
3. At the end of the semester, he/she can submit a report on his / her topic of seminar and marks are awarded based on the report.
4. A Faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
5. Evaluation is 100% internal.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Outline the topics on modern technology; prepare implementation of the same as the presentation.
CO2	Understanding the technologies used by extracting the new things to be implemented by reviewing the journals/research papers.
CO3	Sketch the application of the technology for the use of the mankind.
CO4	Analyse and correlate the new technology with the subject of interest for further study.
CO5	Evaluate, plan and reframe the technology with the communication skills for a better explanation and presentation.
CO6	Modify and design the concept into the realistic world.

Type	Code	Seminar-II	L-T-P	Credits	Marks
PS	BTPS-P-PS-501		0-0-2	1	150
Objectives	1. To encourage the students to study advanced engineering developments 2. To prepare and present technical reports. 3. To encourage the students to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.				
Pre-Requisites	Knowledge of Speaking with globally accepted language and subject analysis.				
Teaching Scheme	Regular seminar presentation and evaluation with record keeping.				

METHOD OF EVALUATION:

1. During the seminar session each student is expected to prepare and present a topic on engineering/technology, for duration of about 8 to 10 minutes.
2. In a session of one period per week, 5 students are expected to present the seminar.
3. Each student is expected to present at least twice during the semester and the student is evaluated based on that.
4. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are awarded based on the report.
5. A Faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
6. Evaluation is 100% internal.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Outline the topics on modern technology; prepare implementation of the same as the presentation.
CO2	Understanding the technologies used by extracting the new things to be implemented by reviewing the journals/research papers.
CO3	Sketch the application of the technology for the use of the mankind.
CO4	Analyse and correlate the new technology with the subject of interest for further study.
CO5	Evaluate, plan and reframe the technology with the communication skills for a better explanation and presentation.
CO6	Modify and design the concept into the realistic world.

Type	Code	Optimization in Engineering	L-T-P	Credits	Marks
BS	BTBS-T-BS-601		4-0-0	3	150
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Idea of engineering optimization problems, modeling of problems and principle of modelling, Linear Programming: Formulation of LPP, Graphical solution.				5
Module-II	Simplex method, Big-M method, Dual simplex method, Duality theory.				7
Module-III	Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel’s approximation method, Degeneracy, Optimality test, MODI method, Assignment problems: Hungarian method for solution of Assignment problems. Travel Salesman problem.				10
Module-IV	Non-linear programming: Introduction to non-linear programming. Unconstraint optimization: Fibonacci and Golden Section Search method.				5
Module V	Non-linear programming problem: Constrained optimization with equality constraint: Lagrange multiplier method. Constrained optimization with inequality constraint: Kuhn-Tucker condition.				5
Module-VI	Inventory Theory: General characteristics, Deterministic Inventory models: EOQ model with constant rate of demand, different rates of demand, EPQ Model.				8
Total					40 Hours

Text Books:

1. Operation Research: J K Sharma Macmillan India Ltd.
2. Operation Research, Prabhakar Pai, Oxford University Press
3. Operations Research, H.A.Taha, A.M.Natarajan, P.Balasubramanie, A.Tamilarasi,Pearson Education, Eighth Edition.
4. Engineering Optimization, S Rao, New Age International Pvt Ltd, 2003.

Reference Books:

1. Operations Research, F.S.Hiller, G.J.Lieberman, Tata McGraw Hill, Eighth Edition,2005
2. Operations Research, P.K.Gupta, D.S.Hira, S.Chand and Company Ltd, 2014.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Outline the topics on modern technology; prepare implementation of the same as the presentation.
CO2	Understanding the technologies used by extracting the new things to be implemented by reviewing the journals/research papers.
CO3	Sketch the application of the technology for the use of the mankind.
CO4	Analyse and correlate the new technology with the subject of interest for further study.
CO5	Evaluate, plan and reframe the technology with the communication skills for a better explanation and presentation.
CO6	Modify and design the concept into the realistic world.

Type	Code	Metrology, Quality, Control and Reliability	L-T-P	Credits	Marks
PC	BTME-T-PC-601		4-0-0	3	150
Objectives	The students will be able to understand: 1. Understand the basic principles and different methods of measuring errors, tolerances. 2. Study various thread profiles and measurement of roughness of the surfaces. 3. Study of reliability and its various variables.				
Pre-Requisites	Basic Science and quality assurance				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction: Need of inspection, sources of errors, basic types of errors precision and accuracy. Method of estimating accuracy and precision, standard and their evolutions. Simple measurement tools: Rules, calipers, height gauges, micrometres, depth gauge dial indicator, slip gauges, sine bar.				8
Module-II	Limit, fits and tolerance and gauge design: Basic concepts of limit fits and tolerance interchangeability and selective assembly, ISO system of tolerance, Taylor’s principle of gauge design Gauge design-basic design rules for plug and ring gauges.				6
Module-III	Interferometers: Types of light sources and interferometers, Types of scale and grading, optical flats. Screw thread measurement: Standard thread profiles, effective diameter, measurement of effective diameter by 2 wires and 3 wires methods. Best wire size.				9
Module-IV	Surface roughness: Source of surface irregularities in manufacturing. Roughness and waviness RMC and CLA values measurement of surface roughness using Taylor Hobson’s Talysurf.				5
Module V	Statistical quality control: Frequency distribution, process capability variables and attributes control chart (X & R chart) for variables, control chart for attributes (p,np and C chart) OC curve single and double sampling plan.				7
Module-VI	Reliability: Definition, relationship of reliability with maintainability and availability, failure data analysis- bath tub curve, system reliability, reliability improvement.				5
Total					40 Hours

Text Books:

1. Engineering. Metrology by R. K. Jain, Khanna pub.

Reference Books:

1. A text book of metrology by M. Mahajan Dhanpat Rai and Co pvt Ltd.
2. Statistical quality control by M.Mahajan Dhanpat Rai and Co pvt Ltd.
3. Reliability Engineering. By L.S.S.Srinath East west press.

Course Outcomes: At the end of this course, the students will be able to:

CO1	Identify and compare different type of errors, limits, fits and clearances as well as instruments necessary to measure the all those.
CO2	Analyze the influence of all operating parameters of all errors, limits, fits and clearances.
CO3	Understand the principles of measuring thread profiles and its operating parameters.
CO4	Select the right type of components for particular measuring devices for the roughness and to find out its source.
CO5	Design different type of statistical quality control using variables and attributes.
CO6	Identify and compare different type of reliability with maintainability and availability as well as steps necessary for its improvement.

Experiential Learning:

1. Error analysis
2. Design of Limits, Fits and Clearance
3. Measurement of thread profiles.
4. Roughness measurement
5. Statistical quality control & Reliability.

Type	Code	Mechanical Vibration	L-T-P	Credits	Marks
PE	BTME-T-PE-602		4-1-0	3	150
Objectives	The students will be able to understand: To understand fundamentals of free and forced vibrations & various techniques of measurement and control of vibration				
Pre-Requisites	Ordinary differential equations, Concepts of velocity, acceleration, force and energy, Newton’s laws of motion, Matrix algebra				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction to Mechanical Vibration, effect of vibration, S.H.M, Principle of Superposition applied to S.H.M. Beat phenomenon, Fourier analysis, Concept of Degree of Freedom, Elements of vibration & Types of vibration. Undamped free vibration of Single DOF systems-Modelling of vibrating systems, Evaluation of Natural frequency by differential equations, energy & Rayleigh’s method, Equivalent systems.				8
Module-II	Damped free vibration of Single DOF systems-Types of Damping, Equivalent viscous damping, resonance, Equation of motion of a SDOF having viscous damping, Concept of critical damping and its effect, study of vibration response of viscous damped systems for cases of under damping, critical damping and over damping, Logarithmic decrement.				6
Module-III	Forced vibration of Single DOF systems-Forced vibration with harmonic excitation. Reciprocating & rotating unbalance mass, Vibration isolation and force transmissibility, motion transmissibility. Instrumentation for vibration analysis- Transducers and vibration pickup, Vibrometer, Accelerometer, Velocity pickup or Velometer				8
Module-IV	Whirling of shaft with single disc and without damping, concept of critical speed and its effect on rotating shaft. Undamped vibration of two DOF systems – Free vibration spring coupled and mass coupled systems, longitudinal, Torsional & Transverse of two DOF systems, influence coefficient technique, Undamped vibration absorber.				6
Module V	Introduction to multi-DOF systems-Normal mode vibration, coordinate coupling-closed coupled and far coupled systems. Orthogonality of mode shapes. Method of matrix iteration, Holzer & Stodala method.				6
Module-VI	Torsional vibration of two, three and multi-rotor systems. Dunkerley’s lower bound approximation method. Continuous Systems-Vibration of strings, longitudinal vibration of rods, torsional vibration of rods, Transverse vibration of Euler-beams.				6

Total

**40
Hours**

Text Books:

1. Theory of vibration with application-W.T Thomson & M D Dahleh, Pearson education.
2. Introduction to Theory & practice of mechanical vibration – J S Rao & K. Gupta-New age

Reference Books

1. Mechanical vibration-S.S Rao, Pearson education.
2. Mechanical vibration-V.P Singh, Dhanpat Rai Pvt.ltd

Course Outcomes: At the end of this course, the students will be able to:

CO1	Understanding the vibrating systems & effects of energy-removal mechanisms i.e. damping.
CO2	Estimate natural frequency for single DOF Undamped & damped free vibratory systems
CO3	Examining vibration measuring instruments for industrial / real life applications.
CO4	Estimate natural frequencies, mode shapes for 2 DOF Undamped free vibratory systems
CO5	Compute the natural frequencies and mode shapes of a multi degree of freedom system
CO6	Select the numerical methods to determine natural frequencies of the beam and rotor systems.

Experiential Learning:

1. Utensil/Tool Design for people with Parkinson's diseases
2. Vibration Analysis of a Half-Car Model.
3. Hot spot technique in cricket.
4. Mass Damper in Automobile
5. Tuned mass Damper
6. Pass by Noise controller by Hybrid Muffler
7. Shock Absorber for Rickshaw
8. Smart Pump

Type	Code	Heat Transfer	L-T-P	Credits	Marks
PC	BTME-T-PC-603		3-1-0	3	150
Objectives	The students will be able to: 1.Understand the concept of conduction heat transfer, 2.Understand the concept of convection heat transfer 3.Understand the concept of radiation heat transfer, fins & heat exchanger				
Pre-Requisites	Basic thermodynamics Engineering Mathematics				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Modes of heat transfer: conduction, convection, and radiation, Mechanism & basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity, Thermal conductance &Thermal resistance, Contact resistance, convective heat transfer coefficient, radiation heat transfer coefficient, Electrical analogy, Mechanism of conduction: Derivation of the generalized heat conduction equation in Cartesian coordinates, polar cylindrical and polar spherical coordinates. Different types of boundary conditions encountered in heat conduction problems. Solution of the one-dimensional steady state heat conduction equation with constant thermal conductivity and without internal heat generation in Cartesian coordinates. Extension of the solution to composite walls by electrical analogy. Thermal contact resistance, Effect of variable thermal conductivity on temperature distribution in plane wall.				2
Module-II	Solution of the one-dimensional steady state heat conduction equation with constant thermal conductivity and without internal heat generation in Cylindrical and Spherical coordinates. Extension of the solution to composite cylinders/spheres by electrical analogy. Heat transfer in extended surfaces (pin fins) without heat generation, long fin, short fin with insulated tip and without insulated tip and fin connected between two heat sources. Fin efficiency and fin effectiveness. Conduction in solids with negligible internal temperature gradient (Lumped heat analysis).				8
Module-III	Introduction to convective flow - forced and free. Conservation equations for mass, momentum and energy for 2-dimensional convective heat transfer in case of incompressible flow, Hydrodynamic and thermal boundary layers for flow over a flat plate. Critical Reynolds number; general expressions for drag coefficient and drag force Reynolds Colbourn analogy. Thermal boundary layer; general expression for local heat transfer coefficient.				6

Module-IV	Average heat transfer Coefficient ; Nusselt number. Flow inside a duct- velocity boundary layer, hydrodynamic entrance length and hydrodynamically developed flow; flow through tubes (internal flow).: Dimensional analysis for forced and free convection, Nusselt number. Concept of thermal boundary layer, Prandtl number, Expressions for local and average values of heat transfer coefficients for a flat plate. Experimental correlations for forced and free convection for various geometries.	8
Module V	Introduction, Radiation properties , definitions of various terms used in radiation heat transfer; Absorptivity, reflectivity & transmissivity. Emissive power & emissivity, Kirchoff's identity, Planck's relation for monochromatic emissive power of a black body, Derivation of Stefan- Boltzmann law and Wien's displacement law from Planck's relation, Radiation shape factor, Relation for shape factor and shape factor algebra. Heat exchange between blackbodies through non-absorbing medium. Gray bodies and real bodies, Heat exchange between gray bodies. Radiosity and irradiation.	4
Module-VI	Introduction, Types of heat exchanger , The overall heat transfer coefficient and fouling factors, LMTD and - NTU analysis of heat exchangers.	6
Total		34 Hours

Text Books:

1. Engineering Heat and Mass Transfer, Mahesh M. Rathore, Laxmi Publications
2. Heat and Mass Transfer: A Practical Approach, Y.A.Cengel, Tata Macgraw Hills Education Private Limited
3. Heat Transfer by P.K. Nag, TMH

Reference Books:

1. Fundamentals of Engineering Heat and Mass Transfer: R.C.Sachdeva, New Age International Publishers, 4th Edition
2. Heat and Mass Transfer: Domkundwar and Arora, Danpatrai and sons
3. Heat Transfer: R.K.Rajput, Laxmi Publications.

Course Outcomes: At the end of this course, the students will be able to:

CO1	To know about the different modes of heat transfer
CO2	To understand various thermal properties of different material
CO3	To analyze convective heat transfer in 1-Dimensional & 2-Dimensional form
CO4	To study dimensional analysis of forced & free convection with different experimental co-relations
CO5	To study the fundamental laws of radiations & its application
CO6	To design the heat exchanger devices using heat transfer.

Experiential Learning:

1. To visualize different modes of heat transfer
2. To understand the effectiveness of fins for higher rate of cooling
3. Demonstration of Natural Convection
4. To study the significance of radiation for different thermodynamic application

Type	Code	Essence of Indian Knowledge Tradition – II	L-T-P	Credits	Marks
MC	BTMC-T-MC-601		2-0-0	0	100
Objectives	The students will be able to understand: 1. Defining the concepts of Indian tradition Knowledge 2. Understanding the importance of roots of knowledge system 3. Implementing the traditional knowledge to the day-to-day life				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Introduction to Traditional Knowledge (Definition TK its Nature, characteristics and scope).				5
Module-II	Protection and significance of Traditional knowledge (Significance of TK Protection, Value of TK, role of Govt.to harness TK)				5
Module-III	Legal Frame work and TK (Forest Dwellers Forest right act 2001, 2002, 2006.)				5
Module-IV	Traditional knowledge and Intellectual property (Systems & Legal concepts for the protection of traditional knowledge)				5
Module V	Traditional knowledge and Engineering (Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge)				5
Module-VI	Importance of conservation and sustainable development of environment Management of Biodiversity (Traditional societies dependence on environment, Food security of the country and protection of TK)				5
Total					30 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Identify the concept of Traditional knowledge and its importance.
CO2	Explain the need and importance of protecting traditional knowledge.
CO3	Illustrate the various enactments related to the protection of traditional knowledge.
CO4	Interpret the concepts of Intellectual property to protect the traditional knowledge.
CO5	Explain the importance of Traditional knowledge in Agriculture and Medicine.

Type	Code	EET-IV	L-T-P	Credits	Marks
AEC	BTSC-T-AE-604		4-0-0	1	100
Objectives	The students will be able to understand: 1. To provide job related knowledge to the students 2. To bridge the gap between skills possessed by the students and the abilities that is looked for by the organization. 3.To develop an attitude of constant self-improvement throughout their career				
Pre-Requisites	To help students practice and understand the various company pattern tests.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-1	Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications, virtual work				5
Module-II	Kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Mechanics of Materials.				5
Module-III	Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.				5
Module-IV	Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds				5
Module V	Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.				5
Module-VI	Fluid Mechanics: Fluid properties; fluid acceleration; differential equations of continuity and momentum; Bernoulli’s equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.				5
Total					30

Text Books:

1. Strength of Materials by James M Gere, Stephen P Timoshenko
2. The Theory of Machines by S Ratan
3. Engineering Mechanics- New Age International by S Bhavikatti
4. A Textbook of Fluid Mechanics by R.K. Bansal

Reference Books:

1. Mechanical Vibrations by G K Grover
2. Fluid Mechanics by Cengel & Cimbala.

Course Outcomes: At the end of this course, the students will be able to:

CO1	To help students explore their values and career choices through individual skill assessments.
CO2	To make realistic employment choices and to identify the steps necessary to achieve a goal.
CO3	To encourage students to make smarter career decisions in accordance with their interests, abilities and prepares them for the future.
CO4	To disseminate knowledge and appropriate skill practices through recognized systems of training and testing.
CO5	To Match the objectives with company goals.

Type	Code	Metrology, Quality Control & Reliability Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-601		0-0-2	1	150
Objectives	Students will able to: 1. Hands on experience in precise measurement techniques 2. Quality assurance practices, 3. Reliability asseement of engineering components.				
Pre-Requisites	Knowledge of Metrology, Quality control & Reliability Engineering theory.				
Teaching Scheme	Laboratory practices with use of assisting tools as and when required, sessions are planned to be interactive with focus on practical activities.				
Detailed Syllabus:					
Module	Topics				Hours
Experiment-1	Hardness testing using Rockwell and Vickers’s hardness testers.				3
Experiment-2	Optical Profile measurement.				3
Experiment-3	Measurement of thread parameters				3
Experiment-4	Force and torque measurement.				3
Experiment-5	Inspection of geometric features using Coordinate Measuring Machine (CMM).				3
Experiment-6	Measurement of surface roughness.				3
Experiment-7	Calibration of Vernier Calipers and micrometers.				3
Experiment-8	Study of linear and angular measurements.				3
Experiment-9	Flatness measurement using dial indicator and surface plate.				3
Experiment-10	N-n-destructive testing (NDT) methods: Ultrasonic testing.				3
Total					30 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Proficiency in measurement techniques
CO2	Understanding of calibration and precision.
CO3	Application of quality control methods.
CO4	Reliability of assessment skills.
CO5	Non-destructive testing of competence.
CO6	Integration of theory and practice.

Type	Code	Heat Transfer Lab	L-T-P	Credits	Marks
PC	BTME-P-PC-602		0-0-3	1	150
Objectives	Students will able to: 1. Understand the fundamentals of heat transfer processes. 2. Calculate the quantity of heat transfer in various processes. 3. Experience the principles of heat transfer in various equipments.				
Pre-Requisites	Fundamentals of heat transfer.				
Teaching Scheme	Laboratory practices with use of assisting tools as and when required, sessions are planned to be interactive with focus on practical activities.				
Detailed Syllabus:					
Module	Topics				Hours
Experiment-1	Determination of Thermal conductivity of composite slab				3
Experiment-2	Determination of heat transfer coefficient in natural/forced convention.				3
Experiment-3	Determination of surface emissivity				3
Experiment-4	Performance test on parallel flow and counter flow heat exchanger				3
Experiment-5	Efficiency and effectiveness of fins (Natural /Forced convection)				3
Experiment-6	Determination of Critical heat flux during boiling heat transfer.				3
Experiment-7	Verification of Stefan Boltzmann’s law.				3
Experiment-8	Measurement of thermal conductivity of metal rod				3
Experiment-9	Determination of thermal conductivity of insulating powder.				3
Total					27 Hours

Course Outcomes: At the end of this course, the students will be able to:

CO1	Learn the basic principles of conduction, convection and radiation.
CO2	Understand the mode of heat transfer in different equipment.
CO3	Explain the mode of heat transfer in industrial equipments.
CO4	Design the various components of heat transfer equipments.
CO5	Compare the performance of different types of heat transfer modes in various components.
CO6	Design of heat exchanger and its application in engineering equipments.

Type	Code	Project-IV	L-T-P	Credits	Marks
PS	BTME-P-PS-601		0-0-3	2	150

Objectives:

This course is aimed to provide more weightage for project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Course Structure for B. Tech (4th Year)



(2026 Passed out Students)

B. Tech. in Mechanical Engineering

(Approved by Academic Council and Board of Studies)

GIFT Autonomous, Bhubaneswar

(Approved by AICTE, New Delhi, affiliated to BPUT, Rourkela) Recognized under section 2(f) of the UGC act, 1956

At-Gramadiha, Po. Gangapada, Via-Janla, Dist-Khorda, Pin code: 752054

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Course Types & Definitions

L	Lecture
T	Tutorial
P	Laboratory/Practical/ Sessional
C	Credits
WCH	Weekly Contact Hours
BS	Basic Sciences
HS	Humanities & Social Sciences (including Management) ES
	Engineering Sciences
PC	Professional Core
PE	Professional Elective
OE	Open Elective
MC	Mandatory Course
SC	Skill Course
EEC	Employability Enhancement Course
SEPD	Skill Enhancement and Personality Development

Scheme of Evaluation
Mark Distribution for Internal & External Examinations for B.Tech

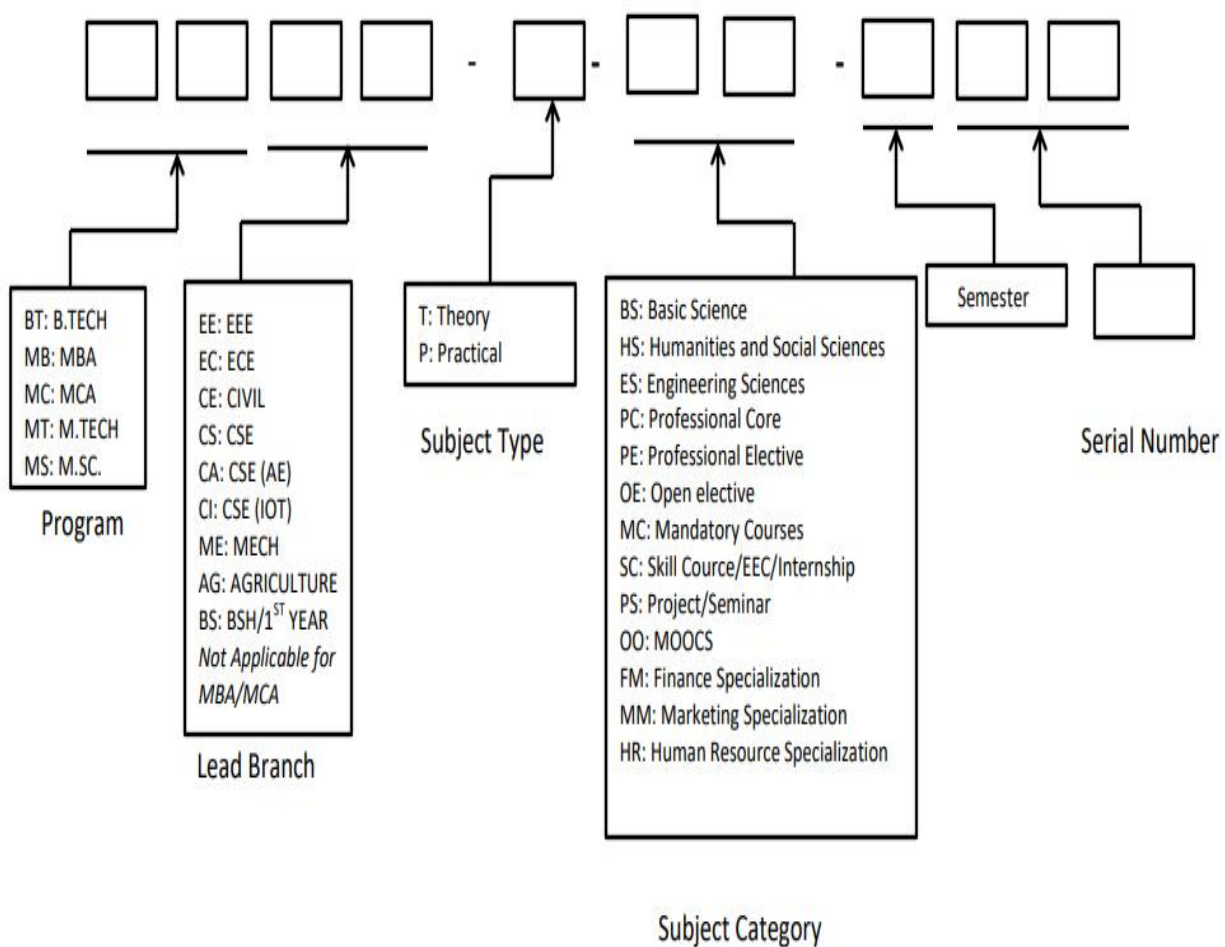
Internal Examination					
Sl. No	Type of Test	Mark	Frequency	Total Mark	Reduced Mark
1	Modular Test	25	2	50	50
2	Online Quiz Test	10	6	60	10
3	Assignment	5	2	10	10
4	Subject Specific Project / Special Quiz – 6 Nos.	100 /10	1 /6	100 /60	15
5	Attendance	15	1	15	15
					100
Pass Mark					45

External Examination				
Sl. No	Type of Test	Mark	Frequency	Total Mark
1	End Semester Examination	100	1	100
Pass Mark				35

Instructions:

1. Each student must appear in all of the above internal examinations without fail.
2. No exemption or accommodation of request will be entertained.
3. In case of exigency, or self-illness the student must submit ample evidence to re-appear the test. Since the schedule of the examination is non-negotiable, the request shall be sent to the competent authority.
4. Appearance of modular tests is part of the curriculum; hence each student is urged to appear for each modular test. Due penalty as per the examination rule shall be imposed.
5. For not qualifying or to improve the individual subject score in internal the student must appear on the improvement test after successful registration in CMS.

Subject Code Format



COURSE STRUCTURE FOR 2026-27 ADMISSION BATCH											
Seventh Semester						Eighth Semester					
Theory						Theory					
Sl. No.	Category	Course Code	Course Title	L-T-P	Credit	Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	HS	BTBS-T-HS-701	Organizational Behavior	3-0-0	2						
2	PE	BTME-T-PE-701	Refrigeration & Air Conditioning(T)	4-1-0	3						
3	PC	BTME-T-PC-702	Production and Operation Management	4-0-0	3						
4	PC	BTME-T-PC-701	Mechatronics	4-1-0	3						
5	PE	BTME-T-PE-702	Industrial Safety Engineering(IS)	4-1-0	3						
6	OE	BTME-T-OE-701	Disaster Management	4-1-0	3						
Total Hours/ Credit (Theory)				27	17	Total Hours/ Credit (Theory)					0
Practical						Practical					
1	PE	BTME-P-PE-701	Refrigeration & Air Conditioning Lab(T)	0-0-4	2	1	PS	BTME-P-PS-801	Major Project	0-0-24	12
2	PS	BTPS-P-PS-701	Evaluation of Summer Internship - III	0-0-4	2						
3	PS	BTME-P-PS-703	Company Specific Viva-Voce-II	0-0-2	1						
4	PS	BTPS-P-PS-702	Seminar-II	0-0-2	1						
Total Hours/ Credit (Practical)				12	6	Total Hours/ Credit (Practical)				24	12
Grand Total Hours/ Credit				39	23	Grand Total Hours/ Credit				24	12
						Total Credits					165

4th Year B. Tech (Mechanical Engineering)

SEMESTER – VII

Sl. no	Category of Course	Course Code	Course Title	Teching			Evaluation Scheme				Total Marks	Credits
				L	T	P	Theory		Practical			
							CIE	ESE	Progressive Assesment	End Exam		
1	HS	BTBS-T-HS-701	Organizational Behavior	2	0	0	50	100			150	2
2	PE	BTME-T-PE-701	Refrigeration & Air Conditioning(T)	3	0	0	50	100			150	3
3	PC	BTME-T-PC-702	Production and Operation Management	3	0	0	50	100			150	3
4	PC	BTME-T-PC-701	Mechatronics	3	0	0	50	100			150	3
5	PE	BTME-T-PE-702	Industrial Safety Engineering(IS)	3	0	0	50	100			150	3
6	OE	BTME-T-OE-701	Disaster Management	3	0	0	50	100			150	3
7	PE	BTME-P-PE-701	Refrigeration & Air Conditioning Lab(T)	0	0	4			70	30	100	2
8	PS	BTPS-P-PS-701	Evaluation of Summer Internship - III	0	0	2			70	30	100	2
9	PS	BTME-P-PS-703	Company Specific Viva-Voce-II	0	0	2			70	30	100	1
10	PS	BTPS-P-PS-702	Seminar-II	0	0	2			70	30	100	1
TOTAL				17	0	10					1300	23

7 th Semester	BTME-T-PC-701	Refrigeration and Air conditioning	L-T-P 5-1-0	Credits 4
Objectives	1. The students will be able to learn: 2. To familiarize with the terminology associated with refrigeration systems and air-conditioning. 3. To understand basic refrigeration processes 4. To understand the basics of psychometric and practice of applied psychometrics. 5. To acquire the skills required to model, analyze and design different refrigeration as well as air conditioning processes and components			
Pre-Requisites:	Basic Thermodynamics and Heat Transfer.			
Teaching Pedagogy	Regular classroom lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.			
Module	Topics			Hours
Module-I	Air Refrigeration System: Introduction, Unit of refrigeration, Coefficient of performance, Reversed Carnot Cycle, Temperature limitations, maximum COP, Bell Coleman air cycle, Simple Air Cycle System for Air-craft with problems.			6 Hours
Module-II	Vapour Compression System: Analysis of theoretical vapour compression cycle, Representation of cycle on T-S and p-h diagram, Simple saturation cycle, sub-cooled cycle and super-heated cycle, Effect of suction and discharge pressure on performance, Actual vapour compression cycle. Problem illustration and solution.			6 Hours
Module-III	Thermoelectric Refrigeration: Basics and Principle. Defining the figure of Merit. (No Problem) Refrigerants: Classification of refrigerants and its Designations-Halocarbon (compounds, Hydrocarbons, Inorganic compounds, Azeotropes, Properties of refrigerants, comparison of common refrigerants, uses of important refrigerants, Brines. Alternative refrigerants (Organic and inorganic compounds). Multi-stage compression and Multi-evaporator systems: Different arrangements of compressors and inter-cooling, Multistage compression with inter-cooling, Multi-evaporator system, Dual compression system. Simple problems.			8 Hours
Module-IV	Vapour Absorption System: Simple Ammonia - absorption system, Improved absorption system, Analysis of vapour absorption system (Specifically of analyzing column and rectifier), Electrolux/Three fluid system, Lithium-bromide-water vapour absorption system, comparison of absorption system with vapour compression system. Simple Problems and solution.			6 Hours

Module-V	Psychrometrics: Properties of air-vapour mixture, Law of water vapour-air mixture, Enthalpy of moisture, Psychrometric chart, simple heating and cooling, Humidification, Dehumidification, Mixture of air streams. Review question and discussions Requirements of comfort air conditioning: Oxygen supply, Heat removal, moisture removal, air motion, purity of air, Thermodynamics of human body, comfort and comfort chart, effective temperature, factors governing optimum effective temperature.	8 Hours
Module-VI	Air Conditioning System: Process in air conditioning: Summer air-conditioning, Winter air-conditioning and year round air-conditioning, Cooling load calculations. Review question and discussions.	6 Hours
	Total	40 Hours

Text Books: -

1. Refrigeration and Air Conditioning by R. C. Arora , PHI Publication
2. Refrigeration and Air conditioning by C. P. Arora, Tata McGraw Hill.
3. Refrigeration and Air Conditioning by S. C. Arora and S. Domkundwar, Dhanpat Rai & Sons.
(Chapters; 3, 4, 5, 6, 7, 11, 16, 17, 19, 20)
4. Refrigeration and Air-conditioning Data book by Manohar Prasad
5. Refrigeration and Air conditioning by P. L. Ballney, Khanna Publishers.
6. Refrigeration and Air conditioning by Manohar Prasad, New Age international publishers

Course Outcomes: At the end of this course, the students will be able to:

CO1	Remembering: Basic concepts of Refrigeration and air-conditioning processes in different conditions.
CO2	Understanding: Simple vapour compression cycle and other non-conventional refrigeration cycles in refrigeration and air-conditioning applications.
CO3	Analyze: Analysis of actual vapour compression cycle and air-condition cycles.
CO4	Develop: Developing the model of binary and multistage evaporator cycles.
CO5	Apply: Applying the knowledge of simple-vapor compression cycle and air-conditioning cycle to other non-conventional energy refrigeration and air-conditioning cycles.
CO6	Design: Design of domestic refrigeration and air-conditioning cycle.

Experiential Learning: -

1. Steady Flow Energy equation to different flow and non-flow processes.
2. Working principle and design of refrigeration and air-conditioning processes.
3. Application of non-conventional refrigeration and air-conditioning processes

Type	Code	Mechatronics	L-T-P	Credits	Marks
PE	BTME-T-PE-702		4-1-0	3	150
Objectives	This course aims at providing fundamental understanding about the elements of a mechatronics system, interfacing, and its practical applications				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module-I	Introduction: Introduction to Mechatronics: Mechatronic system, measurement systems, Introduction to Mechanical, Electricals and thermal systems, Electro-Mechanical, Hydraulic-mechanical System, Typical applications; Examples – automobiles, home appliances, medical instruments, etc.				6 Hours
Module-II	Sensors: Desirable features, Displacement, position and proximity sensors, Velocity, motion and Force sensors. Time of flight sensors, Binary force sensor, temperature and pressure measurement, Transduction principles; Sensitivity, accuracy, range, resolution, noise sources; Signal processing and conditioning; Selection of sensors.				6 Hours
Module-III	Actuators: Pneumatic and hydraulic actuators; Directional control valves, Rotary actuator, Mechanical actuation systems, Electrical actuation Systems-Electrical Systems-Electric motors including DC, AC, BLDC, servo and stepper motors; Solenoids and relays; Active materials – piezoelectric and shape memory alloys. Drive Selection				6 Hours
Module-IV	Machine Controls: Microprocessors and their architecture; Memory and peripheral interfacing; Programming; Microcontrollers; Programmable Logic Controllers; PLC principle and operation; Analog and digital input/output modules; Memory module; Timers, internal relays, counters and data handling; Industrial automation systems; Basic PLC programming; Industry kits (Arduino, Raspberry Pi, etc.).				8 Hours
Module-V	Microcontrollers:8051 Microcontroller, Microprocessor structure, Digital Interfacing, Analog Interfacing, Application Programming-LED blinking, Controlling Step motor. Interfacing: Interfacing microcontrollers with general three –state transistors ,interfacing relays ,interfacing solenoids ,interfacing stepper motor, interfacing with sensors, Interfacing with RS 232 and RS 485.				7 Hours
Module-VI	Micro mechatronic systems: Micro sensors, Micro actuators; Micro fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Case study of Micro Mechatronics systems: Testing of transportation Bridge surface materials, Transducer Calibration system, Strain Gauge Weighting system, Solenoid force, Displacement Calibration System, Thermal Cycle Fatigue of a Ceramic Plate, pH control, Temperature control system, Skip control of a CD Player, Robot Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.				7 Hours
	Total				40 Hours

Text Books/References:

1. Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.).
2. W. Bolton, "Mechatronics," Addison Wesley Longman, 2010
3. A Textbook of Mechatronics, R.K.Rajput, S. Chand & Company Private Limited.
4. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.

NPTEL/SWAYAM Course:

1. Mechatronics & Manufacturing Automation Dr. Shrikrishna N. Joshi IIT Guwahati

Online Resources: 1. <https://nptel.ac.in/courses/107/106/107106090/>

Type	Code	Production and Operations Management	L-T-P	Credits	Marks
PC	BTME-T-PC-702		5-1-0	3	150

Module	Course to be Covered	Hours
Module-I	Introduction: Scope of production management. Production system and resources (machines, tooling, etc.); Types of production (batch, flow and unit), Roles of line supervisors and production managers Product Design. Plant location selection: Factors and techniques, Types of facility layouts: Product, process, cellular, and fixed position layouts. Principles of material handling.	7 Hours
Module-II	Introduction to Forecasting: Introduction to Time-series forecasts, Extrapolative methods, Forecasting Error. Causal Methods of forecasting: Qualitative Methods of Forecasting, Demand forecasting techniques: Quantitative (time series, regression) and qualitative methods, Aggregate production planning and capacity planning, Master production scheduling (MPS) and its significance, Operations scheduling Types (Gantt charts, priority rules).	7 Hours
Module-III	Introduction to Inventory Management, Various costs involved in inventory Management, EOQ Models of Inventory Management, Various variations of EOQ: Inventory Models with Uncertain Demand, Inventory Control and Supply Chain Management, Bullwhip effect and methods to mitigate it. Aggregate Sales and Operations Planning: Aggregate planning Techniques, Material requirement Planning, Improvements in the MRP system, Lot Sizing in MRP Systems	7 Hours
Module-IV	Nature of Quality: Evolution of Quality Management, Modern Quality Management, Total Quality Management, Statistical Concepts in Quality Control Acceptance Sampling: 7 QC Tools, Introduction to Six Sigma, Quality Function Deployment, Quality issues in Services	7 Hours
Module-V	Service Facility Layout: JIT Manufacturing, Lean Manufacturing, Kanban Production System, Case Discussions on JIT and Lean Philosophy Maintenance Management: Total Productive Maintenance, Introduction to Project Management, PERT and CPM, Project Risk Management	7 Hours
Module-VI	Process Analysis: Job Design and work Measurement, Manufacturing Process selection and Design, Service Process Selection and Design, Business process Reengineering	5 Hours
TOTAL		40 Hours

TEXT BOOKS:

- 1.S.N.Chary, "Production and Operations Management", Tata McGraw Hill.
- 2.R. Paneerselvam, "Production and Operations Management, Prentice Hall of India.
- 3.L.J. Krajewski and L.P Ritzmen, Operations Management: Strategy and Analysis, Pearson, 2010.

Reference Books:

1. R.B. Chase, F.R. Jacobs and N.J. Aquilano, Operations Management for Competitive Advantage, Tata McGraw Hill, 2011.
2. W. J. Hopp and M. L. Spearman, Factory Physics: Foundations of Manufacturing Management, MGrav Hill International Edition, 2008.

Online Resources: 1 https://onlinecourses.nptel.ac.in/noc20_mg06/preview

COURSE OUTCOMES:

CO.1	To make students understand the meaning and importance of Production Planning and control
CO.2	To provide knowledge on principles of forecasting method, its types and accuracy.
CO.3	To make students aware about the facilities and plant locations, layouts and assemble line balancing
CO.4	To make students understand the inventory management and supply chain management.
CO.5	To provide the knowledge on lean management , JIT, six sigma and quality control
CO.6	To make students acquainted with real life world of Process analysis and Re-engineering

Type	Code	Disaster Management	L-T-P	Credits	Marks
OE	BTME-T-OE-701		5-1-0	3	150

Course Objectives:

1. To understand the concepts of disaster, risk, hazards, and vulnerabilities, and their impact on disaster management.
2. To develop skills in assessing natural hazards, disaster risks, and capacity-building measures for effective disaster response and recovery.
3. To learn strategies for disaster management planning, coping mechanisms, and the role of media and industrial safety in disaster resilience.

Module	Course to be Covered	Hours
Module-I	Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards.	8 Hours
Module-II	Characteristics and damage potential of natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards.	7 Hours
Module-III	Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief.	7 Hours
Module-IV	Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels.	7 Hours
Module-V	Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.	7 Hours
Module-VI	Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans.	5 Hours
TOTAL		40 Hours

Course outcomes:

At the end of the course, the student will be able to:

1. Understand disaster concepts, risk, hazards, and vulnerabilities at global and regional levels.
2. Analyze natural hazards, damage potential, and vulnerability assessments for floods and earthquakes.
3. Apply disaster management principles for response, recovery, and relief planning.
4. Evaluate capacity-building measures and resources to reduce disaster risks.
5. Analyze coping strategies, industrial safety, and the role of mass media in disaster management.
6. Design disaster management plans and strategies based on policies and planning.

Type	Code	Industrial Safety	L-T-P	Credits	Marks
PE	BTME-T-PE-704		4-1-0	4	150
Objectives	To familiarize students with various industrial safety regulations and practices, guidelines, and standards, including OSHA (Occupational Safety and Health Administration) regulations and ISO standards related to safety in the workplace.				
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on problem solving activities.				
Detailed Syllabus:					
Module	Topics				Hours
Module 1	(Safety introduction) Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety.				6
Module 2	Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages. Personal protection in the work environment, Types of PPEs, Personal protective equipment- respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate.				6
Module 3	Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.				6
Module 4	Machinery Safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking				8
Module 5	Material Handling equipment-operation & maintenance. Maintenance of common elements- wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries. Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards				7
Module 6	Inventory analysis, Fire and explosion hazard rating of process plants -The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP)) – methodology, criticality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).				7
	Total				40

Text Books:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997). *Safety management in Industry*. Jaico Publishing House, New Delhi.

7th Semester	BTME-P-PC-701	Refrigeration and Air conditioning Laboratory	L-T-P 0-0-3	3 Credits
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Objectives	The students will be able to learn: 1. To familiarize with the terminology associated with refrigeration systems and air-conditioning. 2. To understand basic refrigeration processes 3. To understand the basics of psychometric and practice of applied psychometrics. 4. To acquire the skills required to model, analyse and design different refrigeration as well as air conditioning processes and components
Pre-Requisites:	Engineering Thermodynamics and Heat Transfer
Teaching Pedagogy	Regular classroom lectures with use of ICT and when required, sessions are planned to be interactive with focus on problem solving activities.

Experiment No.	Topics	Hours
Experiment -1	Determination of C.O. P on vapor compression system	3 Hours
Experiment -2	Determination of C.O. P on vapor absorption system	3 Hours
Experiment -3	Performance test on Air-conditioning test rig (Window type)	3 Hours
Experiment -4	Performance test on Air-conditioning test rig (Duct type)	3 Hours
Experiment -5	Determination of C.O.P of Ice plant	3 Hours
Experiment -6	Determination of C.O.P of Heat Pump	3 Hours
Experiment -7	Performance analysis in an experimental cooling tower.	3 Hours
Experiment-8	Study of different psychometric terms and processes.	3 Hours
Experiment - 9	Design of Air Conditioning System and load calculation for residential and commercial buildings.	3 Hours
Experiment - 10	Study of measurement devices of all experimental set-ups used in RAC laboratory.	3 Hours
	Total	30 Hours

Course Outcomes:

- CO1: Understand the working principle of Refrigeration systems.
- CO2: Determine the methods to increase the COP of Refrigeration cycles.
- CO3: Estimate COP, Work input and Heat absorption from various refrigeration systems.
- CO4: Calculate the performance of Cooling tower.
- CO5: Design load calculation for residential and commercial building

SEMESTER – VIII

Sl. no	Category of Course	Course Code	Course Title	Teching			Evaluation Scheme				Total Marks	Credits
				L	T	P	Theory		Practical			
							CIE	ESE	Progressive Assesment	End Exam		
1	PS	BTPS-P-PS-801	Major Project/Internship	0	0	16				400	400	12
TOTAL				0	0	16					400	12

Objectives:

It is intended to start the project work early in the seventh semester and carry out both design and fabrication of a mechanical device whose working can be demonstrated. The design is expected to be completed in the seventh semester and the fabrication and demonstration will be carried out in the eighth semester.