Syllabus for
B.Tech (1st Year)
(2022 Admission Batch)

All Branches

(Approved by Academic Council and Board of Studies)

GIFT Autonomous College
(Approved by AICTE, New Delhi, Affiliated to BPUT, Rourkela)
Recognised under section 2(f) of the UGC act, 1956
At. Gramadiha, Po. Gangapada, Via. Janla, Dist- Khorda, Pincode: 752054

1st Year Course Structure

First Semester

Theory

Sl. No.	Category	Course Code	Course Title	WCH L-T-P	Credit
1	BS	BTBS-T-BS-101	Introduction to Mathematics I	4-1-0	3
2	BS	BTBS-T-BS-102/ BTBS-T-BS-103	Elements of Engineering Physics / Applied Chemistry	4-0-0	2
3	ES	BTBS-T-ES-101/ BTBS-T-ES-102	Basic Electrical and Electronics Engg./ Basic Mechanical and Civil Engineering	4-2-0	3
4	ES	BTBS-T-ES-103	Basic Programming Skills	4-1-0	3
5	HS	BTBS-T-HS-101	Communicative English -I	1-0-0	1
6	SC	BTBS-T-SC-101	SEPD-1 (Skill Enhancement and Personality Development)	2-0-0	1
7	MC	BTBS-T-MC-101/ BTBS-T-MC-102	IT & IS /Constitution of India	2-0-0	0
			Total Hours/ Credit **(Theory)**	25	13

Practical

1	BS	BTBS-P-BS-102/ BTBS-P-BS-103	Elements of Engineering Physics Lab/ Applied Chemistry Lab	0-0-2	1
2	ES	BTBS-P-ES-101/ BTBS-P-ES-102	Basic Electrical and Electronics Engg. Lab/ Basic Mechanical and Civil Engineering Lab	0-0-2	1
3	ES	BTBS-P-ES-103	Basic Programming Skill Lab	0-0-4	2
4	ES	BTBS-P-ES-104/ BTBS-P-ES-105	Engineering Graphics with AutoCAD / Workshop Practice-I	0-0-3	1.5
5	HS	BTBS-P-HS-101	Communicative English Lab-I	0-0-3	1.5
			Total Hours/ Credit (Practical)	14	7
			Grand Total Hours/ Credit (Practical)	**39**	**20**

Second Semester

Theory

Sl. No.	Category	Course Code	Course Title	WCH L-T-P	Credit
1	BS	BTBS-T-BS-201	Introduction to Mathematics II	4-1-0	3
2	BS	BTBS-T-BS-102/ BTBS-T-BS-103	Elements of Engineering Physics / Applied Chemistry	4-0-0	2
3	ES	BTBS-T-ES-101/ BTBS-T-ES-102	Basic Electrical and Electronics Engg./ Basic Mechanical and Civil Engineering	4-2-0	3
4	ES	BTBS-T-ES-203	Programming Using Data Structure	4-1-0	3
5	HS	BTBS-T-HS-201	Communicative English -II	1-0-0	1
6	SC	BTBS-T-SC-201	SEPD-2 (Skill Enhancement and Personality Development)	2-0-0	1
7	MC	BTBS-T-MC-101/ BTBS-T-MC-102	IT & IS /Constitution of India	2-0-0	0
		12	Total Hours/ Credit **(Theory)**	25	13

Practical

1	BS	BTBS-P-BS-102/ BTBS-P-BS-103	Elements of Engineering Physics Lab/ Applied Chemistry Lab	0-0-2	1
2	ES	BTBS-P-ES-101/ BTBS-P-ES-102	Basic Electrical and Electronics Engg. Lab/ Basic Mechanical and Civil Engineering Lab	0-0-2	1
3	ES	BTBS-P-ES-203	Programming Using Data Structure Lab	0-0-4	2
4	ES	BTBS-P-ES-104/ BTBS-P-ES-105	Engineering Graphics with AutoCAD / Workshop Practice-I	0-0-3	1.5
5	HS	BTBS-P-HS-201	Communicative English Lab-II	0-0-3	1.5
			Total Hours/ Credit (Practical)	14	7
			Grand Total Hours/ Credit (Practical)	**39**	**20**

SUMMER INTERNSHIP TRAINING for 30 Days

✓ Approved by Academic Council in the 1st ACM dated 07.01.2023

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 are:

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 analyse 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.

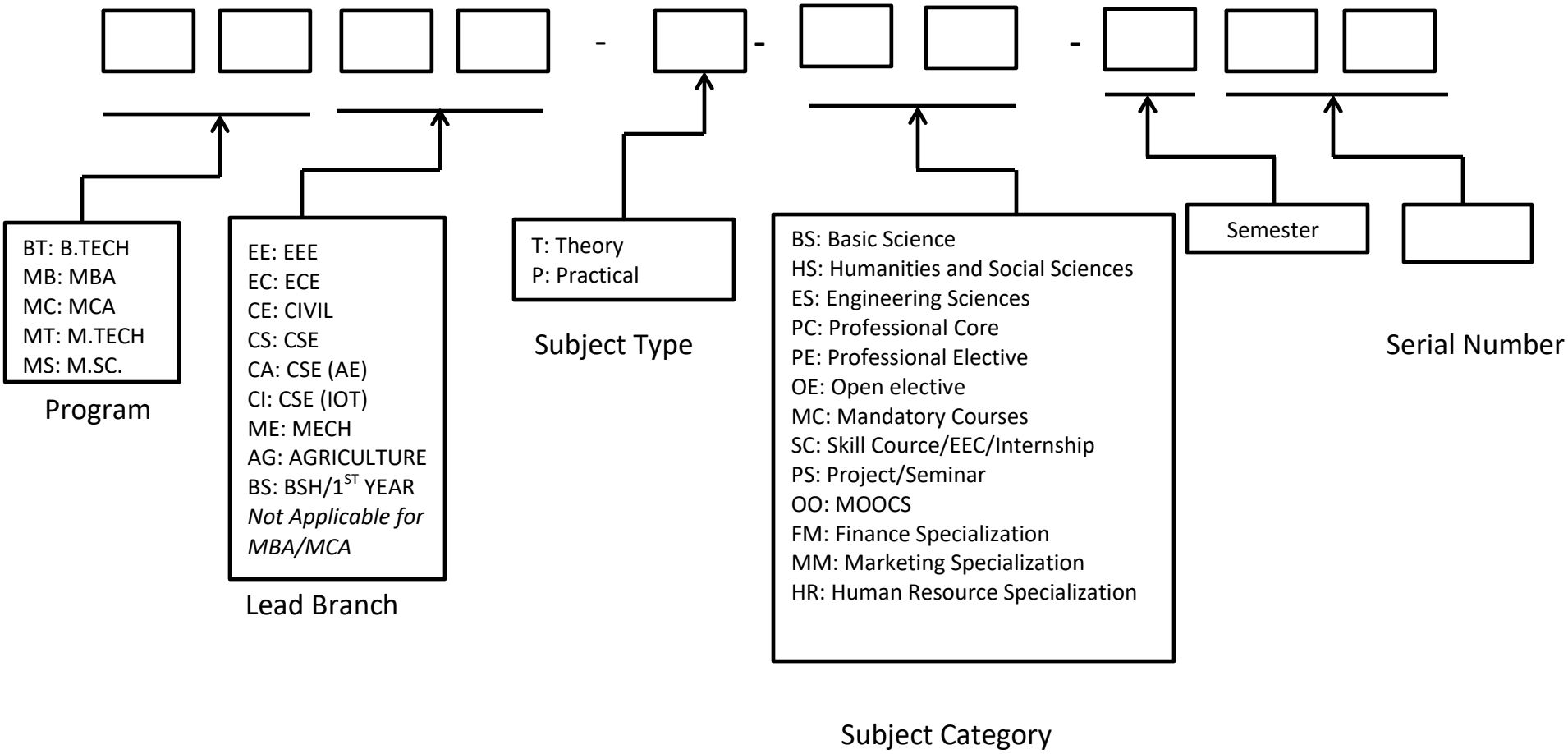
PO11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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	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

Subject Code Format



Part I
1st Year B. Tech.
(Common to All Branches)

Contents

First Year B.Tech

Curriculum Structure

B.Tech (1st Semester & II nd Semester)

Evaluation process

1. Evaluation Process of Theory Subjects:

Components	Marks	Frequency	Assigned To
Quiz Test	5	2	Concerned Faculty
Surprise Test	5	2	Concerned Faculty
Assignment	5	2	Concerned Faculty
Attendance	5	Closing of Instruction	To be retrieved from CMS
Mini Project	10	1 (Before Closing of Instruction)	Concerned Faculty
Mid-Semester Examination	20	1	Examination Cell
End-Semester Examination	100	1	Examination Cell
Total	**150**		

2. Evaluation Process of Practical Subjects:

Components	Marks	Frequency	Assigned To
Attendance	10	Closing of Instruction	To be retrieved from CMS
Daily Performance & Viva-voce	40	On the day of Experiment	Concerned Faculty (Upload in CMS in weekly basis)
Lab Record	20	On the day of Experiment	Concerned Faculty
End-Semester Lab Test	30	1	At the end of the semester as per the schedule published by Examination Cell
Total	**100**		

3. Evaluation Process of Skill Courses:

Components	Marks	Frequency	Assigned To
End-Semester Examination	100	1	Examination Cell/ Concerned Faculty
Total	**100**		

4. Evaluation Process of Mandatory Courses:

Components	Marks	Frequency	Assigned To
In-Semester Evaluation	100	1	Examination Cell/ Concerned Faculty
Total	**100**		

Type	Code		L-T-P	Credits	Marks
BS	BTBS-T-BS-101	**Introduction to Mathematics - I**	4-1-0	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
Speed Math	Average, Problems on Ages, Percentage, Profit and Loss, Ratio and Proportion, Time	
Module-1	Solution of first order differential equations, Linear equation, Bernoulli's equation. Second order differential equations with constant coefficients, Euler-Cauchy equation. Non-homogeneous equations: Method of undetermined coefficients, Variation of Parameters, Applications to Electric Circuits.	**10 Hours**
Module-2	Introduction to vector space, subspace, span, linearly independent and linearly dependent vectors, solution of system of linear equations, Gauss elimination, Determinant, Rank of a matrix, Inverse of a matrix by Gauss-Jordan Method.	**8 Hours**
Module-3	Eigen value, Eigen vector, Symmetric, Skew-symmetric and Orthogonal matrices, Hermitian, Skew-Hermitian, and Unitary matrices, Similarity of matrices, Diagonalization, Quadratic Form.	**8 Hours**
Module-4	Partial differentiation, Maxima and Minima for function of two variables. Vector Differential Calculus: Vector and Scalar functions and Fields, Derivatives, Curves, Tangents and Arc length, Gradient, Divergence, and Curl.	**11 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.

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 Education Pvt. Ltd
R5. R. S. Aggarwal, Quantitative Aptitude For Competitive Examinations, S. Chand publication.

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	Know the basic concepts of quantitative aptitude to meet real life requirements.
CO2	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.
CO3	Solve and demonstrate various physical models through second order differential equations.
CO4	Use the understanding of matrix algebra to solve systems of linear equations, harmonics problems, population models etc. arising in various engineering fields.
CO5	Demonstrate knowledge and applications of Eigen value problems related to engineering disciplines.
CO6	Understand the vector function and fields for design and construction of systems.

Type	Code		L-T-P	Credits	Marks
BS	BTBS-T-BS-102	**Elements of Engineering Physics**	4-0-0	2	150

Objectives	1. To expose students to the fundamental principles and laws of mechanics in Physics to understand the types of motion. 2. To analyze the concepts of mechanics, oscillations, waves and optics to prepare the students for advanced level courses. 3. To demonstrate the ability to identify and apply the appropriate analytic, numerical, and mathematical reasoning, to situations of the physical world. 4. To adaptability to new developments in science and technology.
Pre-Requisites	Class 12^{th} level Physics course
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	**Oscillation, waves and Mechanical Properties** Simple, damped and forced oscillations, resonance, coupled oscillations. 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 Law. Mechanical Properties of Matter Stress, strain, Hooke's law, elastic constants and their relations, stress-strain diagrams	**12 Hours**
Module-2	**Electromagnetism and Concept of Quantum mechanics** 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. Black body radiation, Planck's law, photo electric effect (concept and equation), 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.	**10 Hours**

Module-3	**Engineering Materials** Semiconducting Material: 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. Dielectric materials, Dielectric Polarization, Dielectric Breakdown, Dielectric constant and loss, Electromagnetic wave in dielectric medium. Superconducting materials: Superconductivity, Critical parameters, Meissner effect, Type I & Type II superconductors, BCS theory, applications of super conducting materials. Nano material: Classifications, Quantum confinement, surface to volume ratio, Graphene and its structure, Application.	**10 Hours**
Module-4	**Quantum Statistics and Optoelectronic devices** Statistical Mechanics: Statistical distributions: Maxwell-Boltzmann, Molecular Energies in an ideal gas, Bose-Einstein and Fermi-Dirac statistics. 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.	**12 Hours**
Total		**44 Hours**

Text Books:

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

Reference Books:

R1. Electronic Devices and Circuits - Millman, Halkias and Jit, Tata McGraw Hill
R2. Concepts of Modern Physics : A Beiser, S Mahajan, S. Raichoudhury
R3. Optics: A. K. Ghatak
R4. Introduction to Solid State Physics: S. O. Pillai
R5. Properties of matter: D. S. Mathur

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 waves, oscillation and its significance.
CO2	Acquire skills to apply formulas of optics and wave physics.
CO3	Gain Acquire Knowledge of basic concepts of electric and magnetic fields.
CO4	Develop the concept of different engineering material and their applications.
CO5	Understand the basic knowledge of thermodynamic and use them to solve practical problems.
CO6	Develop a comprehension of the current basis of broad knowledge in Modern physics.

Type	Code		L-T-P	Credits	Marks
BS	BTBS-T-BS-103	**Applied Chemistry**	4-1-0	2	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.

Detailed Syllabus

Module-#	Topics	Hours
Module-1	**Quantum Mechanics and its application**: Failure of classical mechanics and introduction to quantum mechanics, Photoelectric effect, Postulates of Quantum mechanics, Schrodinger's wave equation (Derivation not required), Particle in One dimensional box, Significance of eigen value and eigen function. Zero point energy. **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	**7+5=12 Hours**
Module-2	**Electro Chemistry and its application**: Electro chemical cells, Dry cell, Alkaline battery, Ni-Cd battery, Li-ion Battery, Pb-acid storage cell **Fuel Cells:** Definition, Different types of fuel cell, Hydrogen blue fuel cell, FCEVs **Corrosion**: Theory and mechanism of corrosion, Types, differential aeration corrosion, water line corrosion, Pitting, stress, SCC, galvanic corrosion, Caustic embrittlement, Factors affecting corrosion, Corrosion Control, corrosion inhibitors: Cathodic protection, Metal coatings	**5+2+6=13 Hours**

Module-3	**Fuel**: Classification, calorific value, refining of crude oil, cracking, fuel for I/C engine, knocking, anti-knocking, Octane rating. Diesel engine fuels, Cetane rating, Combustion calculations. Gaseous fuel: LPG, CNG, Biogas fuel, Alternate Fuels, carbon foot print, carbon trading **Polymer**: Degree of polymerization, Thermosetting and thermoplastic polymer with examples: Polethene, PVC, Nylon-6, Teflon and their applications, Rubber: Natural rubber, Vulcanized rubber.	**8+4=12 Hours**
Module-4	**Nano materials**: Introduction, Classification, characteristics, 0D,1D, 2D Nanomaterials, Synthesis: Top Down & Bottom Up approach, Application to Pharmaceutical and Research .	**8 Hours**
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 & practical's 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

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

CO1	Describe graphs of one and two component system (curves) and their characteristics.
CO2	Solve quantum energy related problem and determine the quantized energy of different energy levels.
CO3	Explain the methodology of corrosion occurrence in different cases and its prevention to optimum level.
CO4	Explore the concepts and methods of blending of fuels with better Cetane and Octane number.
CO5	Use the concept of Polymer Synthesis, new material synthesis methodologies and types of nanomaterial.

Type	Code		L-T-P	Credits	Marks
ES	BTBS-T-ES-101	**Basic Electrical and Electronics Engineering**	4-2-0	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 power system: An overview of Electrical Engineering, Sources of energy, steam, hydro and nuclear power generation, Renewable source of Power generating station and general structure of electrical Transmission, Distribution, Utilization & Conservations. DC Circuits: Study of Electrical Elements (R, L, C). Ohm's Law. Series & Parallel combination. KCL, KVL, Nodal & Mesh analysis. Star Delta Conversion. 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. Introduction to 3- phase system. Line & Phase quantity in star and delta connection, Analysis of 3- phases balanced AC circuit.	**9 Hours**
Module-2	Magnetic circuits: Electro magnetism, simple magnetic circuit, magnetic material, B-H curve. Electrical Machines: Construction, working principle & Application of DC generator, DC Motor, single phase & 3-phase transformer, 3 phase & single phase induction motor, Alternator & Special Motors (Stepper & BLDC) Electrical Installations & wiring: Layout of LT switchgear, Switch fuse unit (SFU), MCB, ELCB, MCCB, Type of earthing & Different types of Domestic Wiring. 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. IE rules and Electrical License rules. Different Illumination, Batteries and their applications	**13 Hours**
Module-3	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, clipper,	**13 Hours**

	clamper and zener /Avalanche Breakdown). Bipolar Junction Transistor :Construction, Operation of Bipolar Junction Transistor and Transistor Biasing : Fixed Bias, Voltage divider bias, CB, CE, CC (Relationship between α, β, γ) circuit configuration Input-output characteristics, Transistor as a switch, as an Amplifier . Op-Amp: The Operational Amplifier (Op-Amp): The Ideal Op-Amp Characteristics, Virtual ground concept, Inverting and non-inverting configurations, Application of Op-Amp (Summing amplifier, Integrator, Differentiator. Unit Gain Amplifier), 555 Timer.	
Module-4	Basics of Digital Electronics : Number System, Boolean Algebra Digital logic Gates (AND, OR, NOT, NAND, NOR, EXOR, EX-NOR); Realization of Basic logic gates using universal gates, Half-Adder, Full-Adder, Half-Subtractor, Full-Subtractor, fundamentals flip-flops, registers and shift registers . Introduction to Microprocessors and Microcontrollers: Basic block diagram: input, output, ALU, CU, Registers, Difference between microprocessor and microcontroller. Introduction to Sensors and their Applications : Introduction to different types of Sensors: Temperature sensor, Moisture Sensor, Rain Sensor, LDR, IR, Smoke Sensor	**9 Hours**
Total		**44 Hours**

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.

T3.Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.

T4.Digital Design, 5th Edition M. Morris Mano and Michael D Ciletti Pearson

Reference Books:

R1."Basic Electrical Engineering" by Mittle, V and Arvind Mittle, Tata McGraw Hil.

R2.E. Hughes, "Electrical and Electronics Technology", Pearson.

R3.V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India.

R4.Microelectronic Circuits, 7th Edition Adel S Sedra and Kenneth C Smith Oxford University Press

R5.Fundamentals of Digital Circuits, 4th Edition A Anand Kumar PHI

R6. Integrated Electronics, 2nd Edition Jacob Millman and Christos Halkias Tata McGraw Hills

R7. A course in Electrical and Electronic Measurements and Instrumentation Author: AK Sawhney Publisher :

Dhanpat Rai & Co. (P) Limited

R8. A Textbook of Electrical Technology, by Theraja B L and Theraja A K, S Chand.

R9. Principles of Electrical Engineering and Electronics- V K Mehta, Rohit Mehta, S Chand.

R10."Basic Electrical Engineering" by C L Wadhwa, New Age pub.

R11.D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

R12.Electrical Safety Handbook, 4th Edition Hardcover by John Cadick Mary Capelli-Schellpfeffer Dennis Neitzel Al Winfield

R13 B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications

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	Introduce fundamentals idea & techniques about electrical engineering & to provide knowledge about DC, AC & Magnetic Circuits
CO2	Impart conceptual analysis of electrical machineries & to familiarize the students with electrical safety equipment & domestic wiring.
	Inculcate sound understanding of illumination scheme.
CO4	Acquire knowledge about basic electronic components , industrial applications and fundamentals of communication.
CO5	Understand basic operation and applications of Diode, BJT and Op-Amp.
CO6	Explain the basics of digital concepts, sensors , microprocessors and microcontrollers

Type	Code		L-T-P	Credits	Marks
ES	BTBS-T-ES-102	**Basic Mechanical and Civil Engineering**	4-2-0	3	150

Objectives	To expose to the field of civil and mechanical engineering, and to acquire the fundamental knowledge in the field.
Pre-Requisites	Knowledge of Physics and Mathematics in Secondary Education
TeachingPedagogy	Regular classroom lectures with use of ICTas and when required,sessions are planned to be interactive with focus on problemsolving activities.

Detailed Syllabus

Module-#	Topics	Hours
Module-I	**Introduction to Mechanical Engineering and Materials:** Introduction to mechanical engineering & Mechanical systems (Hydraulic, Mechanical & Pneumatic), Robot anatomy, classification based on robots configuration; Polar, cylindrical, Cartesian Coordinate and spherical. Mechanical Sensors, Automation. **Power transmission devices:** Belt, Rope, Gear & Gear drives. Coupling,clutch,brakes. (Working principle only), Mechanical Advantage, Velocity ratio. **Engineering Materials:** Classification of engineering material, Properties-Physical, Chemical & Mechanical, Composition of Cast iron and Carbon steels, Alloy steels their applications., Composites , Plastics and ceramics. Concepts on Metallurgy. Smart materials. **Mechanical Measurement:** Concept of measurements, errors in measurement, measurement of Temperature, Pressure, Velocity, and Flow.(working principle only.)	**1 Hours**
Module-II	**Fundamentals of Thermodynamics: Application** of thermodynamics in daily life, Refrigerants,Steam formation& its properties. Evaporation and Condensation, Desalination, Dry ice Vs Liquid Nitrogen, Aircraft engines and its classifications, Fuels, Rockets. **Application:** Steam power plant, I.C Engine, Refrigerators and Air- Conditioners (Brief description of different components with Schematic diagram only.) BS-VI**. Fluid Properties and their Applications:** Fluid properties, Pascal's Law its application, Bernoulli's theorem.Hydraulic machines: turbines, pumps, their types. Cryogenics.	**11 Hours**

Module-III	**Introduction to Construction materials and Field Survey:** 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 – flyash, new-age concrete, recycling of materials. Infrastructure – habitat, megacities, current and futuristic vision. Scale, plan, map, principles of survey, Linear measurements, Ranging, Compass Survey, Bearing of a line, Introduction to Modern Survey Instruments (EDM and Total Station), GIS and GPS (Introduction only).	**10 Hours**
Module-IV	**Fundamentals of Soil Mechanics, Hydrology and Transportation:** Fundamentals of soil classification, properties, foundation (deep and shallow) and types. Fundamentalsof Irrigation engineering- sources and hydrologic cycle. Introduction to hydraulic structures like canals, siphons, weirs, dams etc. Wastewater Treatment – Sea Water Intrusion – Recharge of Ground Water. Different modes of transport, classification of road, Traffic sign and Road Marking, Introduction to Railway,Airport,Bridges, concept of Tunnels and Metro rail(underground and overhead). Basics of Port and Harbor – Concept of inland waterways.	**12 Hours**
Total		**44 Hours**

TextBooks:

T1. Basic Mechanical Engineering by Pravin Kumar, Pearson .
T2. Text book of Elements of Mechanical Engineering, S T Murthy, Universities press.
T3. Cengal, Y., Boles, "Thermodynamics", Mc-Graw Hill, 2001.
T4. Nakra & Chaudhary , Instrumentation and Measurements, TMH .
T5. Basic Civil Engineering, S.Gopi, Pearson.
T6. Basic of Civil Engineering, M.S. Palanichamy, McGraw Hill.

ReferenceBooks:

R1. Basic Mechanical Engineering by BasantAgrawal, C M Agrawal,Willey .
R2. Elements of Mechanical Engineering by J K Kittur and G D Gokak,Willey.
R3. Engineering Thermodynamics by P. Chattopadhaya, 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 .
R6. Surveying Vol -1, RAgor, Khanna Publisher.
R7. Water supply ana Waste water engineering, S.K. Garg.
R8. Introduction to Bridge Engineering, D. Jhonson Victor.

R9. Engineering Materials, S C Rangwala, Charotar Publishing House.

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

CO-1	Understand the fundamental of robotics, its application & power transmission system.
CO-2	Learn about engineering materials application and some measuring devices.
CO-3	Impart knowledge on thermodynamics, its application & fluid mechanics.
CO-4	Acquire knowledge about importance of Civil Engineering Materials and the aspects of field
CO-5	Understand the soil mechanics and fundamentals of irrigation engineering
CO-6	Formulate an idea in planning and design aspects of transportation engineering

Type	Code		L-T-P	Credits	Marks
ES	BTBS-T-ES-103	**Basic Programming Skills**	4-1-0	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.	**10 Hours**
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.	**8 Hours**
Module-3	Arrays: Arrays (1-D, 2-D), initialization, Accessing Array Elements, Matrix applications, Character arrays and Strings, Pointers, Pointer arithmetic, dynamic memory allocation, pointer to array and array of pointers Linear Search, Bubble Sort	**8 Hours**
Module-4	Functions, Parameter passing in functions, call by value, idea of call by reference, recursion with examples of Finding Factorial, Fibonacci series, and passing arrays to functions, nested function, local and global variables, static variables.	**8 Hours**
Module-5	Structures, Array of structures, union, structure vs union, passing structure to function, File handling: ASCII and binary Files.	**6 Hours**
Total		**40 Hours**

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. A.K.Rath and A. K. Jagadev, "Data Structures and Program Design using C", 2nd Edition, Scitech Publications, 2011
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication Pvt. Ltd
3. Rajaraman, V., Computer Programming in C, PHI Publications
4. Somashekara, M. T., Guru, D. S. , Manjunatha, K. S., Problem Solving With C, PHI
5. Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications New Delhi, 2019

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		L-T-P	Credits	Marks
HS	BTBS-T-HS-101	**Communicative English-I**	2-0-0	1	150

Objectives	To develop the Listening skills to comprehend various forms of communication.
	To evaluate the speaking skills with communicative efficiency.
	To distinguish different types of reading comprehension for better understanding and an
	To implement the requisite skills for effective writing.
Pre-Requisites	To have basic knowledge on LSRW skills
Teaching Pedagogy	Regular classroom lectures with use of PPT when required, sessions are planned to be interactive with examples to be acquainted with different types of communication

Detailed Syllabus

Module-#	Topics	Hours
Module-1	**Relevance of Communication:** Importance of communication in English Language for Technocrats Process and Factors of Communication Applied Grammar (Parts of Speech, Modals, Subject – Verb Agreement, Vocabulary and usage)	**10 hours**
Module-2	**Reading and Writing** Process of Reading, Skimming, Scanning, inferential Reading Process of Writing ,Summarizing and Paraphrasing, Note Making, Notice Writing Minutes & Preparing Agenda	**05 Hours**
Module-3	**Oral Communication** Sounds of English: Vowels and Consonants Sounds, Syllable and its Structure, Word Stress, Indian English and Standard English. Listening :Process and Types of Listening, Strategy of Listening	**10 Hours**
	Total	**25 Hours**

Text Books:
T1. Effective Technical Communication- M Ashraf Rizvi- Tata Mc Graw Hill
T2. Communication Skills- Sanjay Kumar & Puspalata- Oxford
T3. Soft Skills- Dr. K. Alex- S. Chand

Reference Books:
R1. An Introduction to Professional English and Soft Skills - Das et al.- Foundation Books
R2. Corporate Soft Skills-Sarvesh Gulati- Rupa Publications
R3. Corporate Communication- Pragyan Rath,K.Shalini, Debankita Ray-Cengage
R4. The Art of Communicating- Thich Nhat Hanh- Rhuk
R5. Communication Skills- Anjana Tiwari- Khanna Publishing (1st Ed.)

Online Resources:
www.britishcouncil.in
www.eltai.in

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

CO1	Develop the understanding of communication in different environment.
CO2	Evaluate the various Types of Communication
CO3	Analyze the rules for Pronunciation English Language effectively.
CO4	Understand the importance of Reading
CO5	Identify the different forms of Business Writing
CO6	Practice LSRW in the Professional Place

Type	Code	Skill Enhancement and Personality Development (SEPD)-I	L-T-P	Credits	Marks
SC	BTBS-T-SC-101		2-0-0	1	100

Objectives	To significantly raise the employability of the students to a level where they are able to clear campus selection process and at the same time develop an attitude of constant self-improvement throughout their career.
Pre-Requisites	Self-discipline
Teaching Scheme	Regular classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on personality development

Detailed Syllabus

Module-#	Topics	Hours
Module-1	**Self – knowledge:** 1. Exploring habits, attitudes, preferences and experience 2. becoming aware of strengths and weaknesses, talents and problems, emotions and ideas 3. Identifying the optimum means of improving personal performance 4. Identifying areas of expertise and use these to solve problems in new contexts 5. Knowing your ambitions, goals, and values 6. Understanding feelings and emotions: primary feelings and secondary feelings, Self-regulating emotions	**10 Hours**
Module-2	**Self-management** 1. IQ, EQ, SQ, MI 2. Understanding of life story 3. Focusing on Internal narratives 4. Managing change, confusion and uncertainty 5. Sharpening the Intellect 6. Schooling the mind 7. Socializing the individual	**10 Hours**
Total		**20 Hours**

Text Books:
T1.Personality Development by D.P.Sabharwal
T2. Personality Development by L.Kendo
Reference Books:
R1.Here,There & Everywhere by Sudha Murty

R2. Personality Development by Swami Vivekananda

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

CO1	Improve habits, attitudes, preferences and experience
CO2	Identify their own potentials and accept their own limitations
CO3	Overcome their limitations and move towards self esteem
CO4	Maximize self-potential in enabling a holistic development

Type	Code		L-T-P	Credits	Marks
MC	BTBS-T-MC-101	**Information Technology and Information Systems (IT & IS)**	0-0-2	0	100

Objectives	To expose to the fundamental usage of Computer.
Pre-Requisites	Basic knowledge of English in Secondary Education
Teaching Scheme	Regular Lab with use of ICT. Each session is planned to be interactive with focus on real life activities.

Detailed Syllabus

Module-#	Topics	Hours
Module 1	Introduction Windows OS, OS Commands and operations, Introduction to MS Office	**10 Hours**
	MS-Word: Create; open, save, print command of file. Home tab: Edit texts, Format text, Paragraph setting and apply styles.	
	MS-WORD: Insert tab: Cover page, blank page, page break, table, picture, clip art.	
	MS-WORD: Insert tab: shape, chart, hyperlink, header and footer, textbox, word art, equation and symbols.	
	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.	
Module 2	MS-EXCEL: Create workbook, Home tab, Insert tab : Table, picture, Clip art, Shapes, Charts, Hyperlink, Textbox, Word Art.	**10 Hours**
	MS-EXCEL: Page Layout tab : Margin, Orientation, Paper size, print area, Background	
	MS-EXCEL: 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.	
	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-POWERPOINT: Design tab : Theme, color, font, background style. Animation Tab: Custom animation, Transition(style, sound, speed), Slide show.	
	MS-ACCESS: Overview, Home Tab: Views, Records, Sort & Filter Create	

Module 3	Tab: Create new Table,	**10 Hours**
	MS-ACCESS: Table: Template, Table Design, Insert data. External Data Tab: Import, Export	
	Create a resume using MS-Word. Create a table named Student Mark Entry to enter rollno, name, mark of 6 subjects. Enter total and average mark.	
	Create a datasheet contains 100 student information using MS-Excel. Create a column chart named Student Mark Graph that contains name, mark of 6 subjects for five students.	
	Total	**20 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 Editing and Publishing
CO2	Understand the concepts of Paragrapghs, tables, Margins Page Setting
CO3	Learn to concise and precise on implementing Tables and Graphs
CO4	Illustrate the usages of formulae and fundamental Calculations
CO5	Select the data structure for different applications
CO6	Develop projects using MS Office and MS Access

Indicative Projects

MS WORD

1. Preparing a CV
2. Application Writing
3. Mail merge
4. Cover Page and Certificate Design

MS Excel

1. Customer Bill generation
2. Grade sheet preparation
3. Student Performance Analysis
4. Attendance tracking project
5. Daily expense tracking
6. Weather Monitoring Report

Power Point

1. Poster Design
2. Banner Design

3. Information Brochure Design
4. Presentation on GIFT Autonomous College

MS Access

1. Student Database
2. Inventory Management
3. Room Reservation System
4. E-Commerce Database

Type	Code		L-T-P	Credits	Marks
MC	BTBS-T-MC-102	**Constitution of India**	2-0-0	0	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 overt ime.
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.

Evaluation Scheme

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.	**8 Hours**
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, Union executive, President of India (with powers and functions), Vice-President, The Council of Ministers and the Prime Minister - Powers and functions.	**6 Hours**
Module-3	State Government, The State Legislature - composition, powers and functions, State executive, Governor (with powers and functions).	**5 Hours**
Module-4	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 Hours**

Module-5	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 Hours**
Total		**28 Hours**

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.

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		L-T-P	Credits	Marks
BS	BTBS-T-BS-201	**Introduction to Mathematics - II**	4-1-0	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
	Series Completion, Coding-Decoding, Data Sufficiency, Random variable,	
Module-1	Root finding of algebraic and transcendental equations: Bisection method, Secant and Regula-falsi methods, Newton's method, Fixed point iteration method, Rate of convergence.	**8 Hours**
Module-2	Interpolation: Lagrange interpolation, Newton's divided difference interpolation, Newton's forward and backward interpolation, Introduction to Numerical Differentiation.	**8 Hours**
Module-3	Numerical Integration: Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's rule, 2-point and 3-point Gauss Legendre rule. Solution of ordinary differential equations: Euler's method, Modified Euler's method, Runge-Kutta method (2^{nd} and 4^{th} order).	**10 Hours**
Module-4	Vector Integral Calculus: Line Integrals, Independence of Path, Double Integrals, Green's Theorem, Surface Integrals, Triple Integrals, Gauss Theorem, and Stokes's Theorem (without proof).	**12 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.

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. S. Aggarwal, A Modern Approach to Verbal & Non-verbal reasoning, S. Chand publication.

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	Know the basic concepts of verbal, non-verbal reasoning and logical ability for better employability.
CO2	Apply the numerical methods to find the approximate solutions of algebraic and transcendental equations.
CO3	Understand the basic concepts of mathematical theory of probability.
CO4	Solve the numerical solution of differential equations and use of various techniques for evaluating the integrals.
CO5	Calculate line integrals in two dimensions for differential forms and also calculate double integrals in Cartesian and polar coordinates over the domains.
CO6	Apply Green's theorem, Gauss theorem and Stokes's theorem to evaluate line or double or triple integrals.

Type	Code	Programming Using Data Structure	L-T-P	Credits	Marks
ES	BTBS-T-ES-203		4-1-0	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 st ructure: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.	**10 Hours**
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 Queue: Simple Queue, Circular Queue, Priority Queue; Array representation and Operations on each types of Queues: Algorithms and their analysis, application of queue.(Simulation, CPU Scheduling in Multiprogramming Environment, Round Robin Algorithm).. Priority Queues.	**8 Hours**
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.	**8 Hours**
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 Hours**

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. **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 Hours**
Total		**40 Hours**

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. Forouzan, Cengage Learning

R2. Data Structures And Algorithms A.V.Aho, J. E. Hopcroft, and J. D. Ullman, Ⅱ, 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
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 complexity, and basic concept of hash function

Type	Code		L-T-P	Credits	Marks
HS	BTBS-T-HS-201	**Communicative English-II**	2-0-0	1	150

Objectives	
	To develop interpersonal skills
	To enhance presentation skills
	To distinguish different types of letters
	To understand the nuances of business etiquettes.
	Describe the appropriateness of the written contents
	Define various kinds of texts and compose effective business messages.
Pre-Requisites	To have basic knowledge on corporate communication
Teaching Pedagogy	Regular class room lectures with use of PPT when required, sessions are planned to be interactive with activity based teaching.

DetailedSyllabus

Module-#	Topics	Hours
Module-1	**Corporate Communication** Interpersonal Communication ,Non-Verbal Communication, Elements of Non-verbal communication, Presentation-Oral and Power Point Presentation, Group Discussion-Factual GD & Controversial GD	**10 Hours**
Module-2	**Writing Skills** Formal Letters- Letter for placing an order, Letter of Complaint, Job Application Letter Resume Building-Chronological, Functional& Combinational Reports-Format and Components of Long Report ,Format and Components of Short Report, Proposals-Format and Components of Proposal	**8Hours**
Module-3	**Soft Skills** Professional Etiquette, Team work Negotiation Skills	**7 Hours**

TextBooks:

T1. Corporate Communication-Pragyan Rath, K.Shalini, Debankita Ray
T2. Communication Skills- Sanjay Kumar & Puspalata- Oxford
T3. Soft Skills- Dr. K. Alex- S. Chand

ReferenceBooks:

R1. Corporate Soft Skills-Sarvesh Gulati- Rupa Publications
R2. Corporate Communication-Dr, Sapna. M.S.-Trends and Features
R3. Business Communication- Pooja Khanna- Vikas Publishing
R4. Communication Skills- Anjana Tiwari- Khanna Publishing (1st Ed.)

Online Resources:

https://communicationmgmt.usc.edu
www.britishcouncil.org
https://eltai.ac.in

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

CO1	Enhance the elements of communication in a corporate world
CO2	Develop skills to meet the placement challenges
CO3	Justify the different forms of business correspondence
CO4	Implement different forms of writing for business needs
CO5	Identify the different shades of business etiquettes
CO6	Define the importance of teamwork and negotiation skills

Type	Code	Skill Enhancement and Personality Development (SEPD)-II	L-T-P	Credits	Marks
SC	BTBS-T-SC-201		2-0-0	1	100

Objectives	The objective of this course is to help students work on their personality development through an understanding of Soft skills, participate in Group Discussions (GD), present their views in public, perform well in Personal Interviews, and become successful in a corporate scenario
Pre-Requisites	The objective of this course is to help students work on their personality development through an understanding of Soft skills, participate in Group Discussions (GD), present their views in public, perform well in Personal
Teaching Scheme	Ample tasks designed to facilitate communication through pair work, group/team work, individual and group presentations, discussions, role plays, listening to audios, watching videos, business writing and vocabulary

Detailed Syllabus

Module-#	Topics	Hours
Module-1	**Introduction to Group Discussions (GD):** 1. Mock GD 1 2. Mock GD 2. **Interview skills:** 1. Preparing for interviews through mock interview session. 2. Writing a good and effective C.V. and SWOC presentation	**10 Hours**
Module-2	**Assertiveness and EI:** 1. Theory inputs and activities. 2. Conducting Mock Interviews **Team work activity:** 1. Building blocks of a team - discussion & activity. 2. Panel Discussion. **Summarizing and note making**: 1. Techniques and important tips. **Personality assessment:** 1. self-assessment and discussion	**10 Hours**
	Total	**20 Hours**

Text Books:

T1.Personality Development by D.P.Sabharwal
T2. Personality Development by L.Kendo
T3.Effective Technical communication by M.A.Rijvi
T4.English Phonetics of Indian Students by T.Balasubramaniam

Reference Books:

T1.Here, There & Everywhere by Sudha Murty
T2. Personality Development by Swami Vivekananda
T3.Technical communication: Principle and practice by M.Raman and S,Sharma

Online Resources:

1. https://nptel.ac.in/courses/109104107
2. https://nptel.ac.in/courses/109104031

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

CO1	Improve habits, attitudes, preferences and experience
CO2	Identify their own potentials and accept their own limitations
CO3	Overcome their limitations and move towards self esteem
CO4	Maximize self-potential in enabling a holistic development
CO5	Participate effectively in Group Discussions.

Type	Code	Elements of Engineering Physics Laboratory	L-T-P	Credits	Marks
BS	BTBS-P-BS-102		0-0-2	1	100

Objectives	The laboratory should help students to understand the role of direct observation in physics and to distinguish between inferences based on theory and on the outcomes of experiments.
Pre-Requisites	Knowledge of Physics 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	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~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 Sono metre.	**2 Hours**
	BEYOND SYLLABUS	**2 Hours**
Experiment-11	To find out the resistance of unknown wire by using Meter bridge.	**2 Hours**
Total		**22 Hours**

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

CO1	Understand the laws to various process and real system.
CO2	Study basics of semiconductor & devices and their applications in different areas.

CO3	Distinguish the importance of different properties of material.
CO4	Design new instruments with practical knowledge.
CO5	Analyze, interpret and summarize the experimental results and compare with theoretical
CO6	Troubleshoot effectively in laboratory settings.

Indicative Projects

1. To make a periscope to understand the laws of reflection.
2. To make an electromagnet.
3. To make a line following Robot.
4. To make a portable Mobile charger.
5. To make a Rain Alarm /soil moisture Detector.
6. To make an Automatic street light.
7. To make a proto type solar panel.
8. To make a gas leakage detector.
9. To make a temperature sensor.
10. To build an earthquake alarm.
11. To make a coin cell by using super capacitor material.

Type	Code		L-T-P	Credits	Marks
BS	BTBS-P-BS-103	**Applied Chemistry Laboratory**	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 KMnO4 by using sodium oxalate. Determination of $Fe2^{+}$ ion in a double salt.	**2 Hours**
Experiment-2	Preparation of Aspirin	**2 Hours**
Experiment-3	Determination of rate constant for saponification of ester with an alkali-titrimetric	**2 Hours**
Experiment-4	Determination of turbidity of different samples of water by	**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		L-T-P	Credits	Marks
ES	BTBS-P-ES-101	**Basic Electrical and Electronics Engineering Laboratory**	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 Pedagogys	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/

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	Night light using LDR.
2	Automatic Fan ON/OFF using Temperature Sensor.
3	Moisture Controller using Moisture Sensor.
4	IR based security system using IR sensor (Transmitter & Receiver)
5	Fire Alarm using Temperature Sensor.
6	Light ON /OFF using Piezo Sensor.
7	Clap sound Operated using Sound Sensor.
8	Smoke Detector MQ3
9	Light ON /OFF using Metal Detector Sensor.
10	Light ON /OFF using Alcohol Detector MQ.
11	Sound system on/off Rain Detector
12	Motion detector using IR pair.

Type	Code	Basic Mechanical and Civil Engineering Laboratory	L-T-P	Credits	Marks
ES	BTBS-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 labas and when required, sessions are planned to be interactive with focus on problem-solving activities.

Detailed Syllabus

Module-#	Topics	Hours
Experiment-1	Cut-section of two stroke & four stroke petrol and diesel engine.	**2 Hours**
Experiment-2	Centrifugal pump apparatus, Reciprocating pump apparatus. Gear oil Pump	**2 Hours**
Experiment-3	Pelton & Francis Turbine.	**2 Hours**
Experiment-4	Simple ,Compound & reverted Gear train	**2 Hours**
Experiment-5	Model of Domestic refrigerator	**2 Hours**
Experiment-6	Compressive Strength of Brick	**2 Hours**
Experiment-7	Bearing of Line.	**2 Hours**
Experiment-8	Compressive Strength of Cement	**2 Hours**
Experiment-9	Determination of Specific gravity of soil	**2 Hours**
Experiment-10	Study of water quality (pH, Turbidity, TS)	**2 Hours**
	BEYOND SYLLABUS	**2 Hours**
Experiment-11	CNC Wood Router	**2 Hours**
Experiment-12	Study of Total Station.	**2 Hours**
Total		**24 Hours**

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

CO-1	Acquire knowledge on different components and working of IC Engines, turbines and pumps
CO-2	Understand the kinematics of machinery using gear trains
CO-3	Analyze the operation of domestic appliances

CO-4	Identify different properties of building materials.
CO-5	Study the engineering properties of soil.
CO-6	Explore the uses of different instruments used in civil engineering work

Indicative Projects (Mechanical)

1. Component Preparation using 3D Printing
2. Specimen preparation technique for Metallurgical study.
3. To prepare a ship model for verification of Archimedes principle.
4. Model of Steam power plant.
5. Overhead gantry crane of 3-axis movements.
6. Leading & Trailing brake arrangement in Drum Brake
7. High speed reduction in gear drive by using worm & worm wheel.
8. Specimen preparation and its test in UTM.
9. Wind Turbine Model.
10. Preparation hexagonal headed Bolt (Facing & Turning)
11. Specimen preparation and its test in Fatigue testing machine.
12. Water turbine Project Model
13. Preparation hexagonal headed Bolt (Step Turning & Thread Cutting)
14. Preparation of Components/names in CNC Wood Router
15. Bio-fuel preparation and Study.
16. Compound gear train using by using Spur gear.
17. Fast and loose pulley arrangement using Belt drive
18. Development of cone clutch for power transmission.
19. Conversion of Reciprocating to rotary motion using Crank & Connecting rod.

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
6. Pavement layer identification – prototype
7. Concept of suspension bridge –prototype
8. Construction of English bond in cement mortar.
9. Study of properties for the locally available Soil .
10. Testing of compressive strength of the local stone in Khordha.
11. Admixtures used in RMC – visit to plant
12. Preparation of fly ash brick.
13. Seasoning of timber.
14. Types of timber used in construction.
15. Tensile strength test of steel in construction
16. Identification of components of a building – prototype

17. Various field test of cement.

Type	Code		L-T-P	Credits	Marks
ES	BTBS-P-ES-103	**Basic Programming Skills Laboratory**	0-0-4	2	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.	4 Hours
Experiment-5	Programs on single dimensional array and Strings	2 Hours
Experiment-6	Programs on two-dimensional array.	4 Hours
Experiment-7	Programs on Functions.	4 Hours
Experiment-8	Programs on Recursive Functions.	2 Hours
Experiment-9	Programs on Pointers.	4 Hours
Experiment-10	Programs on Structure and Union	4 Hours
Experiment-11	Programs on File Handling.	4 Hours
Experiment-12	Project	6 Hours
	Total	**40 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	Code	Communicative English Lab-I	L-T-P	Credits	Marks
HS	BTBS-P-HS-101		0-0-3	1.5	100

Objectives	
	To develop the skills in communication.
	To evaluate the speaking skills with communicative efficiency.
	To distinguish the sub skills of reading comprehension for better understanding.
	To implement the process of effective writing.
	Describe the appropriateness of the written contents
	Define various kinds of texts and compose effective business messages.
Pre-Requisites	To have basic knowledge on LSRW skills
Teaching Pedagogy	Regular classroom lectures with use of PPT when required, sessions are planned to be interactive with examples to be acquainted with different types of communication

Detailed Syllabus

SL No	NAME OF THE ACTIVITY	HOURS
ACTIVITY 1	Role Play	2 Hours
ACTIVITY 2	Speech	2 Hours
ACTIVITY 3	Narration	2 Hours
ACTIVITY 4	Parts of Speech(New)	2 Hours
ACTIVITY 5	Subject- Verb Agreement	2 Hours
ACTIVITY 6	Auxiliary Verbs	2 Hours
ACTIVITY 7	Sounds of English	2 Hours
ACTIVITY 8	Reading Comprehension	2 Hours
ACTIVITY 9	Formal Letters	2 Hours
ACTIVITY 10	Preparing Agenda & Minutes	2 Hours
Total		**20 Hours**

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

CO1	Develop the understanding of application of language.
CO2	Evaluate the rules of language for effective communication
CO3	Experiment the Pronunciation English Language.
CO4	Application of methods and strategies for Reading.
CO5	Recognize the different forms of Formal Writing
CO6	Discuss LSRW in support to the English language

Type	Code		L-T-P	Credits	Marks
ES	BTBS-P-ES-104	**Engineering Graphics with Auto-CAD Laboratory**	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		L-T-P	Credits	Marks
ES	BTBS-P-ES-105	**Workshop Practice –I Laboratory**	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 V-fit 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 joint by Soldering	**3 Hours**
Experiment-6	To prepare joint by 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 prepare a T-welding by using electric arc welding	**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	Programming Using Data Structure Laboratory	L-T-P	Credits	Marks
ES	BTBS-P-ES-203		0-0-4	2	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 (i) push operation (ii) pop operation	**2Hours**
Experiment-3	Write a C program to create a queue and perform (i) Push (ii) Pop (iii) 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 (ii) Insertion	**2Hours**

	(iii) Deletion	
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 Project

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
12) Tic-Tac-Toe Game

13) Tank Game
14) Travel Agency Management System
15) Pharmacy Management System

Type	Code		L-T-P	Credits	Marks
HS	BTBS-P-HS-201	**Communicative English Laboratory-II**	0-0-3	1.5	100

Objectives	Objective of this course is to enhance presentation skills , equip the students with different forms of business writing and to acquaint them with business etiquette to face corporate challenges
Pre-Requisites	Basic knowledge on corporate communication
Teaching Pedagogy	Regular practical classes with use of virtual lab as and when required and activity and game based session are also planned.

DetailedSyllabus

SL No	NAME OF THE ACTIVITY	HOURS
ACTIVITY 1	Interpersonal Communication	2 Hours
ACTIVITY 2	Non Verbal Communication	2 Hours
ACTIVITY 3	Presentation	2 Hours
ACTIVITY 4	Group Discussion	2 Hours
ACTIVITY 5	Personal Interview	2 Hours
ACTIVITY 6	Formal Letters	2 Hours
ACTIVITY 7	Building Resume	2 Hours
ACTIVITY 8	Report Writing	2 Hours
ACTIVITY 9	Team Work	2 Hours
ACTIVITY 10	Negotiation Skills	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	Evaluate skills for corporate readiness.
CO3	Implement the different forms of business correspondence.
CO4	Recognize better pronunciation and accent in English Language,
CO5	Execute the analytical skills and problem solving skill in a Team.
CO6	Identify the business etiquettes and competent

Syllabus for B. Tech (2nd Year)

(2022-23 Admission Batch)

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	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

1. Evaluation Process of Theory Subjects:

Components	Marks	Frequency	Assigned To
Quiz Test	5	2	Concerned Faculty
Surprise Test	5	2	Concerned Faculty
Assignment	5	2	Concerned Faculty
Attendance	5	Closing of Instruction	To be retrieved from CMS
Mini Project	10	1 (Before Closing of Instruction)	Concerned Faculty
Mid-Semester Examination	20	1	Examination Cell
End-Semester Examination	100	1	Examination Cell
Total	**150**		

2. Evaluation Process of Practical Subjects:

Components	Marks	Frequency	Assigned To
Attendance	10	Closing of Instruction	To be retrieved from CMS
Daily Performance & Viva-voce	40	On the day of Experiment	Concerned Faculty (Uploading CMS in weekly basis)
Lab Record	20	On the day of Experiment	Concerned Faculty
End-Semester Lab Test	30	1	At the end of the semester as per the schedule published by Examination Cell
Total	**100**		

3. Evaluation Process of Skill Courses:

Components	Marks	Frequency	Assigned To
End-Semester Examination	100	1	Examination Cell/Concerned Faculty
Total	**100**		

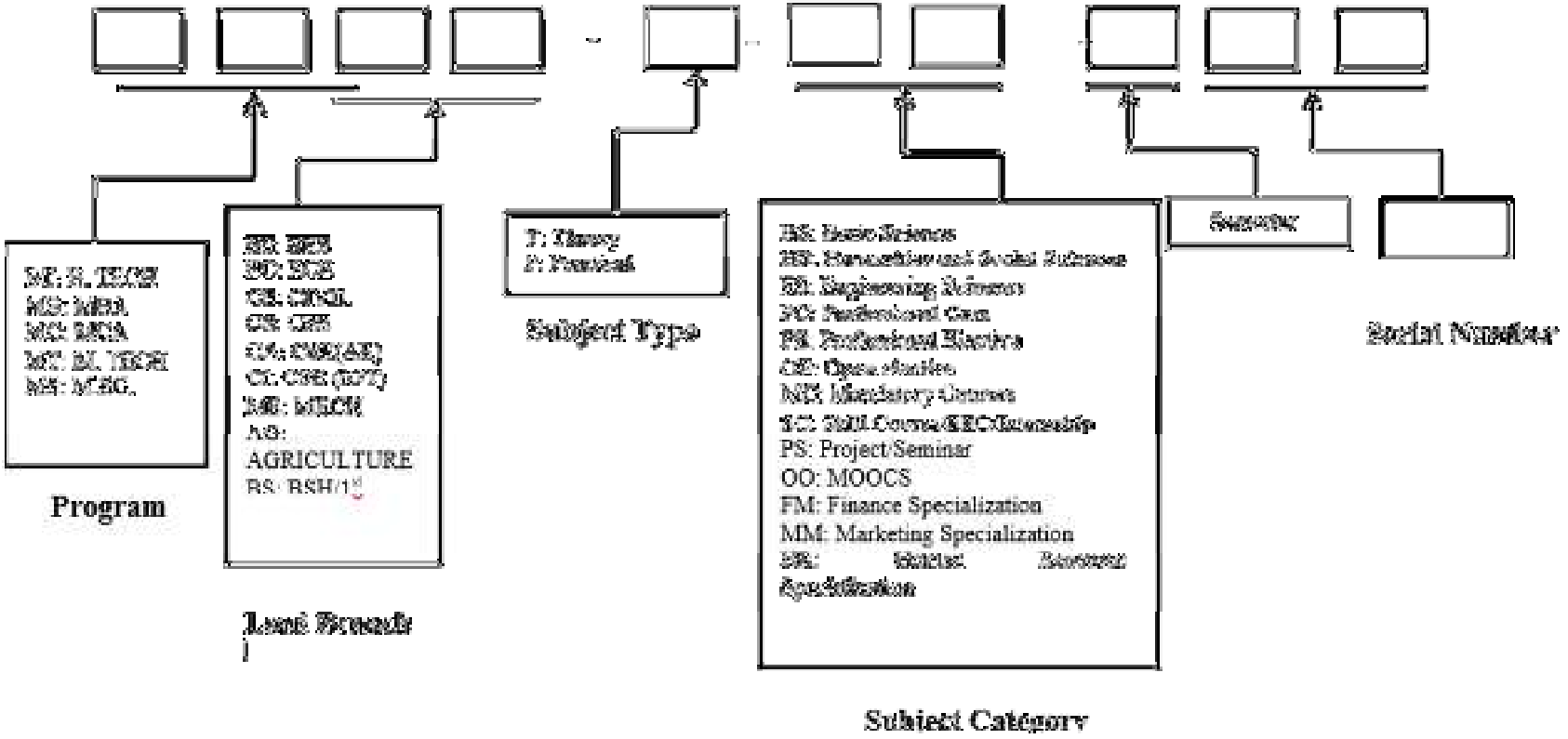
4. Evaluation Process of Mandatory Courses:

Components	Marks	Frequency	Assigned To
In-Semester Evaluation	100	1	Examination Cell/Concerned Faculty
Total	**100**		

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



2nd Year Course Structure

2022-23 Admission Batch

Third Semester

Theory

Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	BS	BTBS-T-BS-302	Applied Mathematics	4-0-0	3
2	PC	BTME-T-PC-301	Engineering Mechanics of Solids	4-1-0	3
3	PE	BTME-T-PE-301	Introduction to Physical Metallurgy and Engineering Material	4-0-0	3
4	PC	BTME-T-PC-302	Basic Manufacturing Practices	4-0-0	3
5	HS	BTBS-T-HS-302	Engineering Economics	3-1-0	3
6	ES	BTCS-T-ES-301	Object Oriented Programming using JAVA	4-0-0	3
7	MC	BTMC-T-MC-302	Essence of Indian knowledge and tradition	2-0-0	0
8	SC	BTSC-T-SC-301	Employability Enhancement Training - 1	1-0-0	1
Total Hours/ Credit (Theory)				29	19

Practicals

1	PC	BTME-P-PC-301	Advanced Machine Drawing	0-0-3	1
2	ES	BTCS-P-ES-301	Object Oriented Programming using JAVA lab	0-0-2	1
3	PS	BTPS-P-PS-301	Seminar-1	0-0-2	1
4	SC	BTSC-P-SC-301	Evaluation Summer Internship-1	0-0-3	2
Total Hours/ Credit (Practical)				10	5
Grand Total Hours/ Credit				**39**	**24**

Fourth Semester

Theory

Sl. No.	Category	Course Code	Course Title	L-T-P	Credit
1	PC	BTME-T-PC-401	Fluid Mechanics and Machines	4-1-0	3
2	PE	BTME-T-PE-401	CAD/CAM	4-1-0	3
3	PC	BTME-T-PC-402	Applied Thermodynamics	4-1-0	3
4	HS	BTBS-T-HS-301	Organizational Behavior	4-1-1	3
5	PC	BTME-T-PC-403	Mechanisms and Machines	4-1-0	3
6	OO	BTME-T-OO-401	NPTEL National programme on Technology Enhanced Learning	2-0-0	3
7	MC	BTMC-T-MC-301	Environmental Engineering	2-0-0	0
8	SC	BTSC-T-SC-401	Employability Enhancement Training - II		1
Total Hours/ Credit (Theory)				32	19

Practicals

1	PC	BTME-P-PC-401	Engineering Mechanics of Solids lab	0-0-2	1
2	PC	BTME-P-PC-403	Fluid Mechanics and Machines Lab	0-0-2	1
3	PS	BTPS-P-PS-401	Project-3	0-0-2	2
4	PC	BTME-P-PC-402	Basic Manufacturing Practices lab	0-0-3	1
Total Hours/ Credit (Practical)				9	5
Grand Total Hours/ Credit				**39**	**24**
SUMMER INTERNSHIP TRAINING for 30 Days					

2nd Year B.Tech
(Mechanical Engineering)

Contents

Second Year B. Tech

Curriculum Structure

3RD SEMESTER

Type	Code	Applied Mathematics	L-T-P	Credits	Marks
BS	BTBS-T-BS-302		4-1-0	3	150

Objectives	The objective of this course is to familiarize the students with the knowledge and concepts of Laplace & Fourier transformations, PDEs, complex analysis and probability.
Pre-Requisites	A basic knowledge of calculus, and elementary probability theory.
TeachingScheme	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.	**10Hours**
Module-2	Fourier series, Fourier expansion of functions of any period, Even and odd functions, Half range Expansion, Fourier transform and Fourier Integral.	**12Hours**
Module-3	Partial Differential Equation: Basic concepts, Solution of PDE by separating variables, D'Alembert's Solution of wave equation, Heat equation: Solution by Fourier series, Heat equation: Solution by Fourier Integrals and transforms.	**11Hours**
Module-4	Complex analysis: Complex plane, polar form, power and roots, analytic function, Cauchy Reimann equations, harmonic function, Laplace functions. Probability: Random variables, Probability distributions, Mean and variance of a distribution, Binomial, Poisson and Normal distributions.	**12Hours**
Total		**45Hours**

TextBooks:

T1.E. Kreyszig, Advanced Engineering Mathematics, Wiley India.

T2.B. V. Raman, Higher Engineering Mathematics, Mc Graw Hill Education Pvt. Ltd.

ReferenceBooks:

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.

Online Resources:

1. https://nptel.ac.in/courses/111104075/
2. https://nptel.ac.in/courses/111104078/
3. https://nptel.ac.in/courses/111104092/
4. https://nptel.ac.in/courses/122104017/
5. https://nptel.ac.in/courses/122104017
6. https://nptel.ac.in/courses/111102111/
7. https://nptel.ac.in/courses/111105035/287
8. https://nptel.ac.in/courses/111105035/28

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.

Type	Code		L-T-P	Credits	Marks
PC	BTME-T-PC-301	**Engineering Mechanics of solids**	4-1-0	3	150

Objectives	1. To Compute the force, moment and their application through solving problems. 2. To determine the centroid and moment of inertia of different geometrical figures. 3. To understand the concept of stress and strain, principal stresses and principal planes. 4. To Analyze the concept the thin cylinder and spherical shell. 5. To study the concept of shear fore and bending moment due to transverse load on beams. 6. To determine deflection of beams using different methods.
Pre-Requisites	Class12th level mathematics, Physics.
Teaching Pedagogy	Regular class room 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, Parallel forces in a plane-. Course outcome: CO1: Understand the different types of forces. CO2: Illustrate the concept of friction. Experiential learning 1. Comparison of elongation of different material 2. Co-planar forces 3. Friction and its application	**08 Hours**
Module-2	**Centroid & moment of inertia:** Centre of parallel forces in a plane and 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. 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 Course outcome: CO3:Understandtheconcepto f centroid CO4:Explainvarioustheorieslikeequilibrium of forces and moment of inertia	**08 Hours**

Module-3	**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. Course outcome: CO5:Understandthedifferenttypesofstressandstrain CO6:Summarizethepropertiesofmaterialandengineeringconstant	**08 Hours**
Module-4	**Shear force and Bending Moment:** shear force ,bending moment , Relation between Shear force and bending moment, bending moment diagram for cantilever, simply supported beam. Course outcome: CO7: Draw and understand shear force and bending moment diagram	**08 Hours**
Module-5	**Slope and Deflection of Beams** Equation of Simple Bending, Slope and Deflection of beam ,Double integration method, Area moment method, Strain energy method Course outcome: CO8:Formulatetherelationbetweensimplebendingtheoryanddeflectiontheory Experiential learning 5.Typesofbeamsanditsapplication	**08 Hours**
Total		**40 Hours**

Textbooks:

- AppliedMechanics&StrengthofMaterial –ByI.B.Prasad.
- EngineeringMechanicsbyBookbyS.S.Bhavikatti,NEWAGEInternationalPublishers.
- RajputR.K."StrengthofMaterials(MechanicsofSolids)",S.Chand&companyLtd.,NewDelhi,7thedition,2018.
- RattanS.S.,"StrengthofMaterials",TataMcGrawHillEducationPvt.Ltd.,NewDelhi,2017

Reference Books:

- Singh.D.K.,"StrengthofMaterials",AneBooksPvtLtd.,NewDelhi, 2021.
- Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
- Beer.F.P. &Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi 2019.

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

CO1	Understand the different types of force.
CO2	Illustrate the concept of friction.
CO3	Understand the concept of center of gravity and centroid
CO4	Explainvarioustheorieslikeequilibrium of forces and moment of inertia
CO5	Understand the different types of stress and strain
CO6	Summarize the properties of material and engineering constant
CO7	Draw and understand shear force and bending moment diagram
CO8	Formulatetherelationbetweensimplebendingtheoryanddeflectiontheory

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	Introduction To Physical Metallurgy & Engineering Materials	L-T-P	Credits	Marks
PE	BTME-T-PE-301		3-1-0	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 classroom lectures with use of ICT as and when required, sessions are planned to be interactive with focus on practical examples with problem & Possibility of solutions.

Detailed Syllabus

Module	Topics	Hours
Module - 1	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. Imperfections in crystals- Types and causes of point defects & line defects, Surface defects and volume defects. Effect of imperfection on material properties. Course outcome: CO1: Understanding the structure and properties of the materials. CO2: Interpret different types of imperfection present in materials and its effects. Experiential Learning: • Study of Crystal structure through Ball model.	**10 Hours**
Module - 2	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. 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, valence factor, crystal structure factor and chemical affinity factor. Course outcome: CO3: Learn the concept and effect of deformation and dislocation on material properties	**10 Hours**

	Experiential Learning: • Specimen preparation for Tensile test/Impact test and finding out the yield strength, UTs or Impact strength.	
Module - 3	**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. Iron–Iron carbide phase diagram, with salient micro-constituents of Iron and Steel. T. T.T. diagram: Purpose & Process of heat treatment: Annealing, normalizing, hardening, tampering Effect of heat treatment on properties of steel, Hardenability of steel & factor affecting hardenability Course outcome: 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. Experiential Learning • Study of microstructuresfor different specimens in Metallurgical Microscope.	**12 Hours**
Module - 4	**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, y- alloy, bronze, brass, bell metal, Monel metal and Babbitt metal .Cutting tool material. **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. Course outcome: CO6: Realizing application area of ferrous, non-ferrous metals and alloys. Experiential Learning: • Experience the impact of materials on structures, machines and household appliances	**08 Hours**
	Total	**40 Hours**

Text Books:

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

Reference Books:

- Mechanical Metallurgy by George E.Dieter
- 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:

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

Type	Code		L-T-P	Credits	Marks
PC	BTME-T-PC-302	**BASIC MANUFACTURING PRACTICES**	3-1-0	3	150

Objectives	To expose to the field of Manufacturing processes.
Pre-Requisites	Fundamentalofphysics,chemistry,someexposuretomanufacturingtrends.
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	Evolutionofmanufacturingprocesses.Classificationofmanufacturingprocesses. Introductiontocasting;typesofpatterns,patternmaterialsandpatternallowances. Molding Materials - sand molding,metal molding,investmentmolding,shell molding. Moulding sand and it'scomposition(binders,additives).Propertiesofmoldingsandandsandtesting.Core materials,chillsandchaplets.Gatingsystemcomponentsandfunctions. Meltingfurnacescupola,resistancefurnace,inductionandarcfurnace.Solidificationofcasting,conceptof directional solidifications. SolidificationtimeandChvorinov'srule. Degasificationandinoculationofmetals.Castingmethodslikecontinuouscasting,centrifugalcasting,disccasting.Casting defects. Course outcome: CO1- Knowledgeaboutthebasicconceptof foundry. Experiential learning- Preparation of wooden pattern Preparation of sand mould	**15 Hours**
Module -2	Classification of weldingprocesses, Fusion welding: Oxy-fuelgas welding, types of flames and uses,Arcwelding:Arcweldingequipment's,methodsofarcinitiation,arcstabilityand metal transfer.TIG(GTAW)andMIG(GMAW)welding,resistanceweldingandThermitwelding Weldablity. Modern welding methods like plasma Arc, Laser Beam, Electron Beam, Ultrasonic,Explosivefrictionweldingandthermitwelding.Brazingandsoldering. Electrodes and its coatings.Weldingdefects:causesandremediesforweldingdefects.Destructiveandnon destructive testing of welding and casting. Edge preparation in butt welding. Course outcome: CO2- Understandingdifferentjoiningprocesses CO3- Understandaboutadvancedjoiningprocesses Experiential learning-	**12 Hours**

	Welding practices using arc welding, gas welding, TIG and MIG welding	
Module -3	Forging:Classificationofforgingprocesses,forgingmachines&equipment's,forgingdefects, Rolling: Classification of rolling processes, types of rolling mills. Extrusion: Classification of extrusion processes, Extrusion equipment, Extrusion of tubes & seamlesspipes. Drawing:Drawingequipment&dies. Sheetmetalworking.Briefintroduction to powder metallurgy processes. Course outcome: CO4- Understandplasticdeformationinmetalsinmetalforming processes CO5- Understandaboutthesheetmetalworking processes Experiential learning- Rolling practice using different rolling mills	**10 Hours**
Module -4	Introduction to Automation, Basic elements of automated systems- levels of automation Introduction to Computer Integrated Manufacturing. Flexible Manufacturing. Digita Transformation in manufacturing-Trends and Challenges, Industry 4.0. Additive manufacturing Course outcome: CO6- Understandtheconceptofautomationinmanufacturingalongwithadditivemanufacturing Experiential learning- Preparation of samples using 3D printing	**06 Hours**
	Total	**43 Hours**

Text Books:

- P.L.Jain,PrinciplesofFoundryTechnology,2009,5thedition,TMHPublications.
- P.N.Rao,ManufacturingTechnologyFoundry,FormingandWelding,2003,2ndEdition.
- P.C.Sharma,ProductionTechnology,S. Chand.

Reference Books:

- ParmarR.S,WeldingEngineeringandTechnology,2013,KhannaPublishers.
- JohnK.C,MetalcastingandJoining,2015,PHIpublications.

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 metalworking processes.
CO6	Understandtheconceptofautomationinmanufacturingalongwithadditivemanufacturing.

Experiential Learning:

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

Type	Code		L-T-P	Credits	Marks
HS	BTBS-T-HS-302	**ENGINEERING ECONOMICS**	3-1-0	3	150

Objectives	This course will expose students to economic theory through the use of mathematical modeling with a focus on economic decision making for engineers
Pre-Requisites	Mathematics
Teaching Pedagogy	Regularclassroomlectureswith useofICTasand whenrequired,sessionsare plannedtobeinteractivewithfocuson real-life problem-solvingactivities.

Detailed Syllabus

Module	Topics	Hours
Module -1	Engineering Economics- Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics. Demand - Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand & its measurement (Simple numerical problems to be solved), Demand Forecasting – Meaning SupplyMeaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).	
Module -2	Production - Production function, Laws of returns: Law of variable proportion, Law of returns to scale Cost and Revenue Concepts - Total Costs, Fixed cost, Variable cost, Total revenue, Average revenue and Marginal revenue, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run, Analysis of cost minimization.	
Module -3	Market - Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).	
Module -4	Time Value of Money- Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence. Evaluation of Engineering Projects-Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects. Depreciation- Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation - Straight line method, Declining balance method, SOYD method, After tax comparison of project.	

	Inflation-Meaning of inflation, types, causes, measures to control inflation. National Income-Definition, Concepts of national income, Method of measuring national income. Banking -Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.	

Text Books:

1 Principles of Economics by Deviga Vengedasalam and Karaunagaran Madhavan, Oxford
2 Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India

Reference Books:

1 C. S. Park, Contemporary Engineering Economics, 6th Edition, Pearson Education, 2015.
2 Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
3 R.Paneer Seelvan, " Engineering Economics", PHI
4 Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd

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

CO1	Remembering: Define the basic concept of micro and macroeconomics, engineering economics and their application in engineering economy.
CO2	Understanding: Evaluate numerically the effects of changes in demand and supply on price determination of products and services.
CO3	Analyze: the macroeconomic environment and financial systems of the country and its impact on business, society and enterprise.
CO4	Develop: the ability to account for time value of money using engineering economy factors and formulas.
CO5	Apply: knowledge of mathematics, economics and engineering principles to solve engineering problems and to analyze decision alternatives in engineering projects considering upon
CO6	Remembering: Define the basic concept of micro and macroeconomics, engineering economics and their application in engineering economy.

Type	Code		L-T-P	Credits	Marks
ES	BTBS-T-ES-301	**OOPs JAVA**	3-1-0	3	150

Objectives	To expose in the field of Programing Language (Core java)
Pre-Requisites	Knowledge of programming in 'C'
Teaching Pedagogy	Regularclassroomlectureswith useofICTasand whenrequired,sessionsare plannedtobeinteractivewithfocuson real-life problem-solvingactivities.

Detailed Syllabus

Module	Topics	Hours
Module -1	Object oriented paradigm: Evolution of programming paradigm, structured versus object-oriented development, Introduction to Object oriented programming concepts: Objects, classes, encapsulation and abstraction, inheritance, polymorphism, dynamic binding, message passing. Executing the program, How Java program executes? What is JVM and its significance in executing a program? Architecture of JVM. Understanding First Program and a step forward, understanding every term of the program, Java Tokens, Datatypes, Operators, what are Operators? Different types of Operators, Typecasting, Control Structures and Arrays, Different types of control structures, Conditional Statements, Loops/ Iterators, Jumping Statements, Java Arrays, Multidimensional Arrays, Taking Input from keyboard, Command Line Arguments, Using Scanner Class, Using Buffered Reader class.	**10 Hours**
Module -2	Object and Classes: Specifying and using classes, access specifies: private, public, functions and data members, default arguments, function overloading, friend functions, static members. Objects: memory considerations for objects, new and delete operators. Constructors - default constructor, parameterized constructor, constructor with dynamic allocation, copy constructor, destructors. Inheritance: Derived and base classes, Class hierarchies, public, private, and protected derivations, constructors in derived classes, destructors in derived classes, constructors' invocation and data members initialization in derived classes, classes within classes, virtual base class.	**8 Hours**
Module -3	Use of super keyword in Java, Polymorphism, Understanding Polymorphism, Types of polymorphism, Significance of Polymorphism in Java, Method Overloading, Constructor Overloading, Method Overriding, Dynamic Method Dispatching. String Manipulations: Introduction to	**8 Hours**

	different classes, String class, String Buffer, String Builder, String Tokenizer	
Module -4	Concept of Wrapper Classes, Introduction to wrapper classes, Different predefined wrapper classes, Predefined Constructors for the wrapper classes. Conversion of types from one type (Object) to another type (Primitive) and Vice versa, Concept of Auto boxing and unboxing. Data Abstraction: Basics of Data Abstraction, Understanding Abstract classes, Understanding Interfaces, Multiple Inheritance Using Interfaces, Packages, Introduction to Packages, Java API Packages, User-Defined Packages, Accessing Packages.	**8 Hours**
Module - 5	Exception handling and Templates: Introduction to exception handling, throw point outside try, Multiple catch, Catch-all, throwing objects. Introduction to templates, class templates, function templates. Files and Streams: Introduction to file handling, hierarchy of file stream classes, opening and closing of files, file modes, file pointers and their manipulators, sequential access, random access.	**6 Hours**
		40

Text Books:

1. Programming in Java. Second Edition. Oxford Higher Education. (Sachin Malhotra/Saurav Choudhary)
2. CORE JAVA For Beginners. (Rashmi Kanta Das), Vikas Publication

Reference Books:

1 JAVA Complete Reference (9th Edition) Herbalt Schelidt
2 Effective Java 3rd Edition by Joshua Bloch (Author)
3 Java For Dummies 6th Edition by Barry A. Burd (Author)

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

CO1	To understand the Object-oriented programming concepts and every term of the program.
CO2	To test and execute the programmes by Object and Classes and implement inheritance property.
CO3	To implement polymorphism and string manipulation.
CO4	To determine data abstraction and wrapper classes to achieve code reusability.
CO5	To understand the hierarchy of file stream classes and the concept of exception handling.

Type	Code		L-T-P	Credits	Marks
MC	BTMC-P-MC-302	**EIKT-1**	3-0-0	0	100

Objectives	The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style 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	Knowledge of Indian history.
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.

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

CO1	Ability to understand, connect up and explain basics of Indian Traditional knowledge in Modern scientific perspective.

- Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष छंद), (iv) उपांग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

Text Book:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan Fritzof Capra, Tao of Physics Fritzof Capra, The wave of Life
3. V N Jha (Eng. Trans,), Tarkasangraha of Annambhatta, Inernational Chinmay Foundation,
4. Swami Vivekananda, PatanjaliYoga Sutra, Ramakrishna Mission, Kolkatta
5. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya,VidyanidhiPrakasham, Delhi, 2016

and maintain attendance also Evaluation is 100% internal.

Type	Code		L-T-P	Credits	Marks
PS	BTME-P-PS-301	**SEMINAR -1**	0-0-2	1	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 and subject analysis.
Teaching Pedagogy	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, five 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.
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		L-T-P	Credits	Marks
PC	BT-ME-P-PC-	**ADVANCED MACHINE DRAWING**	0-0-3	2	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 hours**
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 hours**
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 hours**
Experiment no. 4	**Fasteners:** Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly)	**3 hours**
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 hours**
Experiment no. 6	**Couplings:** Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)	**3 hours**
Experiment no. 7	**Assembly Drawings:** I.C. Engine connecting rod, Plummer block (Pedestal Bearing)	**3 hours**
Experiment no. 8	**Assembly Drawings:** Lever Safety Valve Screw jack (Bottle type)	**3 hours**
Experiment no. 9	**Assembly Drawings:** Screw jack (Bottle type)	**3 hours**
Experiment no. 10	**Assembly Drawings:** Tailstock of lathe	**3 hours**
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		L-T-P	Credits	Marks
CS	BTCS-P-ES-301	**OBJECT ORIENTED PROGRAMMING USING JAVA LAB**	0-0-3	1	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 isplannedtobeinteractivewithfocuson real-life problem-solving activities.

Detailed Syllabus

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

Type	Code		L-T-P	Credits	Marks
SC	BTSC-P-SC-301	**ESI-1**	0-0-3	1	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.
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 appropriate skill sets acquired from the course
CO5 Evaluate the internship experience in terms of personal, educational and career needs.
CO6 Develop ideas for suitable startups to become successful entrepreneur.

Type	Code	EET-I	L-T-P	Credits	Marks
SC	BTSC-T-MC-301		1-0-1	1	150

Objectives	To significantly raise the employability of the students to a level where they are able to clear campus selection process and at the same time develop an attitude of constant self-improvement throughout their career
Pre-Requisites	To help students practiced and understand the various company pattern tests.
Teaching Pedagogy	Regularclassroomlectureswith useofICTasand whenrequired,sessionsare plannedtobeinteractivewithfocuson real life problemsolving activities.

Detailed Syllabus

Module-#	Topics	Hours
Module-1	Introduction to pre- placement talk, Speed maths (speed & accuracy in Addition, Subtraction, Multiplication, Fractions, Percentage, Squares, Cubes, Square Roots, Cube Roots, etc.), Number system (number tree, factors & factorials, base change,finding last digit & last two digits of indices, LCM & HCF,) , Venn Diagrams (visually organize information, compare two or more choices, solve complex mathematical problems, compare data sets, to reason through the logic).	**5 Hours**
Module-2	Syllogism (Introduction to syllogisms, Statements of syllogisms, Application of Venn diagrams, Logical deduction), Blood Relationship (Dialogue/ Conversation Based, Based on puzzles, coding-decoding), Age based problems (Ratio and Sum of Ages Given, Ratio &Product of Ages Given under Problems on Ages, Ratio of Present and Future Ages Given, Ratio of Past &Present Ages Given).Ratio Proportion(direct proportion, inverse proportion, continued proportion).	**5 Hours**
Module-3	Percentage (basic concepts, comparison of percentage, successive percentage), Alligation mixture, Introduction to Data interpretation (analytical methods to review data), Introduction to Data sufficiency (checking and testing a given set of information)	**5 Hours**
Module-4	Percentage(Basic, Comparison of two, Successive ,Product constancy ratio), Profit &Loss(Profit, Loss, Cost Price, Selling Price, Marked Price) , Simple Interest & compound interest, Puzzles(Floor, Scheduling, Double line up, Linear, Square, Box)	**5 Hours**
	Total	**20Hours**

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 develop and practice self-management skills for the work site
CO4	To explore and practice basic communication skills
CO5	To learn skills for discussing and resolving problems on the work site
CO6	To assess and improve personal grooming

Text Books:	
1	Quantitative aptitude by R S Aggarwal
2	Quantitative Aptitude for CAT by Arun Sharma
Reference Books:	
1	Fast Track Objective Arithmetic by Arihant Publications

4TH SEMESTER

Type	Code		L-T-P	Credits	Marks
PC	BTME-T-PC-401	**FLUIDMECHANICSAND MACHINES**	3-1-0	3	150

Objectives	ToexposetothefieldofFluidmechanicsandfluidmachinaries
Pre-Requisites	Fundamentalofphysics,Vectorcalculus,ordinaryandpartialdifferential 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 -1	**Introduction:** Scope of fluid mechanics and its development as ascience, Physical propertyofFluid:Density,specificgravity,specificweight,specificvolume,surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification. Pressure variation in fluids statics: Pressure, Pascal's Law, Pressure variation for incompressiblefluid,atmosphericpressure,absolutepressure,gaugepressureand vacuum pressure, manometer. Hydrostaticprocessonsubmergedsurfaces,forceonahorizontalsubmergedplane surface, force on a vertical submerged plane surface. Buoyancy and floatation, Archimedes'principle,stabilityofimmersedandfloatingbodies,determinationof metacentric height. Course outcome CO1:Tounderstandthepropertiesoffluidsandtypesoffluids. CO2:Applyconservationlawstofluidflowproblemsinengineeringapplicationsandexaminethestability of floating bodies **ExperiencialLearning:** 1. PreparationofinstrumenttomeasureDensityofmaterials. 2. SmallprojecttoObservationandcalculationofCapillaryriseandfall. 3. SmallprojecttoverifyPascal's Equation 4. SmallprojecttoCalculateofMetacentricheight	**15 Hours**
Module	Fluid kinematics: Eulerian and Lagrangian description of fluid flow, stream	**15 Hours**

-2	function andvelocitypotentialfunction.Streamline,pathlineandstreaklinesandstreamtub. Classification of fluid flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, Mathematical definitions of rotational, and irrotational flows, Reynolds transport theorem, differential equation of continuity. Circulation, Flow net Fluiddynamics:Introduction,IntroductiontoN-Sequation,Euler'sequationalonga streamline,energyequation,Bernoulli'sequationanditsapplicationtosiphon,venturem eter, orifice meter,Pitottube. Flow in pipes and ducts: Loss due to friction, Minor energy losses in pipes Hydraulic GradientLine(HGL),TotalEnergyLine(TEL),Powertransmissioninthefluidflow in pipes,fluidflowinpipes inseries andparallel.ConceptofBoundarylayer,separation of boundary layer and its control Course outcome CO3: Tounderstandtheconceptsoffluid flowmeasurementandflowthrough pipes. **ExperiencialLearning:** 5. SmallprojecttoverifyBernoullis Equation 6. Smallprojecttoverifythefluidfriction	
Module -3	Impact of jets, Euler's equation - Theory of roto-dynamic machines – various efficiencies–velocitycomponentsatentryandexitoftherotor-velocitytriangles. Hydraulicturbines:Classification,ImpulseandReactionturbine;Tangential,Radial and axial turbine. Impulseturbine,Peltonwheel,bucketdimensions,numberofbucketsinPeltonwheel efficiency and performance curves. ReactionTurbines:FrancisturbineandKaplanturbine,velocitytriangleand efficiencies,performancecurve.Functionofdrafttubeandcasingcavitation**.** Course outcome CO4: ApplyEuler'sEquationofmotionandBernoulli'sequationforflowmeasuring devices and hydraulic machines. **ExperiencialLearning:** **7.** Smallprojectonhydraulicturbinetoknowtheenergytransmission	**10 Hours**
Module -4	CentrifugalPump:constructionalfeatures,vaneshape,velocitytriangles,Efficiencies, Multi stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation.	**06 Hours**

	PositivedisplacementpumpsReciprocatingPump,Workingprinciple,Discharge, work done and power requirement, Slip, Indicator diagram Course outcome CO5:Tounderstandtheconceptsoffluid flowmeasurementandflowthrough pipes. CO6:Todeterminethebasicprinciplesandcharacteristiccurvesofturbinesandpumps.	
	Total	**40 Hours**

Text Books:

1. Modi,P.N.&Seth,S.M.,"HydraulicsFluidMechanicsIncludingHydraulicsMachines",StandardBook House, 2017
2. Bansal,R.K.,"Textbookoffluidmechanicsandhydraulicmachine"LaxmiPublication,2011

Reference Books:

1. K.Subramanya,"TheoryandApplicationsofFluidMechanics",TataMcGraw-HillPublishingCompany Ltd.,1993
2. VijayGuptaandSantoshK.Gupta,"FluidMechanicsanditsapplications",WileyEasternLtd.,1984.

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

CO1	Tounderstandthepropertiesoffluidsandtypesoffluids.
CO2	Applyconservationlawstofluidflowproblemsinengineeringapplicationsandexaminethestability of floating bodies
CO3	ApplyEuler'sEquationofmotionandBernoulli'sequationforflowmeasuring devices and hydraulic machines..
CO4	Tounderstandtheconceptsoffluid flowmeasurementandflowthrough pipes.
CO5	Tounderstandtheconceptsoffluid flowmeasurementandflowthrough pipes.
CO6	Todeterminethebasicprinciplesandcharacteristiccurvesofturbinesandpumps.

ExperiencialLearning:

1. PreparationofinstrumenttomeaureDensityofmaterials.
2. SmallprojecttoObservationandcalculationofCapillaryriseandfall.
3. SmallprojecttoCalculateofMetacentricheight
4. SmallprojecttoverifyBernoullis Equation
5. SmallprojecttoverifyPascal's Equation
6. Smallprojecttoverifythefluidfriction
7. Smallprojectonhydraulicturbinetoknowtheenergytransmission

Type	Code		L-T-P	Credits	Marks
BS	BTBS-T-HS-401	**ORGANIZATIONAL BEHAVIOUR**	3-1-0	3	150

Objectives	To understand the human interactions in an organization find what is driving it and influence it for getting better results for attaining business goals
Pre-Requisites	Self-motivation and knowledge on human strategy
Teaching Pedagogy	Regularclassroomlectureswith useofICTasand whenrequired,sessionsare plannedtobeinteractivewithfocuson real-life problem-solvingactivities.

Detailed Syllabus

Module	Topics	Hours
Module -1	Focus And Purpose: Definition, need and importance of organizational behavior – Nature and scope –Evolution of Organizational behavior- Organizational behavior models.	**10 Hours**
Module -2	**Individual Behavior** Personality – types – Factors influencing personality – Theories – Ice-burg Model Learning – Types of learners – The learning process – Learning theories – Organizational behavior modification. Misbehavior – Types – Management Intervention. Emotions – Emotional Intelligence Attitudes – Characteristics – Components – Formation – Measurement- Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- perceptual Process. Motivation – importance – Types – Theories of Motivation- Effects on work behavior.	**12 Hours**
Module -3	**Group Behavior** Communication: Importance, Types, Barriers to communication, Communication as a tool for improving Interpersonal Effectiveness Groups In Organization: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building Leadership: Leadership & management, Theories of leadership- Trait theory, Behavioral Theory, Contingency Theory, Leadership & Followership, How to be an Effective Leader	**10 Hours**

	Conflict: Nature of Conflict & Conflict Resolution	
Module -4	**Dynamics Of Organizational Behavior :** Organizational culture and climate – Factors affecting organizational climate – Importance. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change. Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life. Organizational development – Characteristics – objectives –. Organizational effectiveness	**12 Hours**
	Total	**42 Hours**

Text Books:

1 Organizational Behavior : Allison Sheerest, Rachael Collinson, Louis Bevoc • 2017

2 A Textbook of Organizational Behavior with Text and Cases by Gupta C.B.

Reference Books:

1 Organizational Behaviour by Stephen P. Robbins
Authors: Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Publisher: Pearson

2 Essentials of Organizational Behavior Book by Stephen Robbins
Authors: Stephen P. Robbins, Timothy A. Judge , Publisher: Pearson Edition: 2019

3 Organisational Behavior Book by K. Aswathappa
Author(s): K. Aswathappa, Publisher: Himalaya Publishing House Edition: 2018

4 Organizational Behavior Mcshane, S. L/ Glinow, M. A. V. TMH

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

CO1	To understand the conceptual framework of the discipline of OB and its practical applications in the organizational set up.
CO2	To deeply understand the role of individual, groups and structure in achieving organizational goals effectively and efficiently.
CO3	To critically evaluate and analyze various theories and models that contributes in the overall understanding of the discipline.
CO4	To develop creative and innovative ideas that could positively shape the organizations.
CO5	To accept and embrace in working with different people from different cultural and diverse background in the workplace.

Type	Code		L-T-P	Credits	Marks
PC	BTME-T-PC-402	**Applied Thermodynamics**	4-1-0	3	150

Objectives	Toprovideagoodplatformtomechanicalengineeringstudentstounderstand,modeland appreciate concept of dynamics involved in thermal energy transformation.
Pre-Requisites	KnowledgeofMathematicsandphysicsinSecondaryEducation,fundamentalsof 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.

Detailed Syllabus

Module	Topics	Hours
Module -1	**Basic Concepts**: Properties, different thermodynamic systems, thermodynamic 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- Applications. 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, Entropy **Course Outcome:** CO1- To understand the basic concepts of thermodynamics CO2- Understand the foundation of heat and work transfer CO3- Understandthefoundationforpowerplants, heatengines and heat pump. **ExperiencialLearning:** 1. Energyequation (flow/non-flow process) 2. Applicationofheatengine 3. Applicationofheatpump	**12 Hours**
Module -2	**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	**16 Hours**

	chart for finding unknown properties, solve simple numerical. **VapourPower 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. **Course Outcome:** CO4- Understandbasicsofmodelingof power plants andtheirassociatedtechniques **Experiencial Learning:** 4. Application of first law of thermodynamics - Smallprojectsonsteampowerplant	
Module -3	**Gas Power Cycles-** Otto cycle, Diesel cycle, Dual cycle, Brayton cycle (P-V, T-s diagram, derivation of cycle efficiency, simple numerical), Derive work &efficiency of the cycle. **Course Outcome:** CO5- Have knowledge regarding different thermodynamic cycles. **Experiential Learning:** 5. ApplicationofOttocycle, Dieselcycle,Dual cycle	**04 Hours**
Module -4	**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. **Course Outcome:** CO 6- Understand the concept of different types air compressors **Experiencial Learning:** 6. Single stage and multi stage air compressor	**08 Hours**
	Total	**40 Hours**

Text Book:

1. ThermodynamicsbyPKNag
2. AppliedThermodynamicsbyDSKumar,SKKataria&Sons

Reference Books:

1. EngineeringThermodynamicsbyMSRathore
2. AppliedThermodynamicsbyTDEastopPearsonEducation,5th edition
3. http://nptel.ac.in/
4. AppliedThermodynamicspaperback-1,January-2018byOnkarSingh

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

CO1	To understand the basic concepts of thermodynamics
CO2	Understand the foundation of heat and work transfer
CO3	Understandthefoundationforpowerplants, heatengines and heat pump.
CO4	Understandbasicsofmodelingof power plants andtheirassociatedtechniques
CO5	Have knowledge regarding different thermodynamic cycles.
CO6	Understand the concept of different types air compressors

Experiential Learning:

1. Energyequation (flow/non-flow process)
2. Applicationofheatengine
3. Applicationofheatpump
4. Application of first law of thermodynamics -Smallprojectsonsteampowerplant
5. ApplicationofOttocycle, Dieselcycle,Dual cycle
6. Singlestageandmultistageaircompressor

Type	Code		L-T-P	Credits	Marks
PE	BTME-T-PE-401	CAD/CAM	3-1-0	3	150

Objectives	Understandthebasicsof computeraideddesignandtheroleofcomputersin manufacturing.
Pre-Requisites	BasicknowledgeofEngineeringDrawinganddesigning.
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	Introduction: Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, storage devices. Computer Graphics: Raster scan graphics coordinate system, database structure for graphics modeling, transformation of geometry, 3D transformations, mathematics of projections, clipping, hidden surface removal. **Course Outcome:** CO1: ThestudentabletoknowabouttheCAD/CAMsoftware.	**12 Hours**
Module -2	Geometric modeling: Requirements, geometric models, geometric constructionmodels, curve representation methods, surface representation methods, modeling facilities desired. Drafting and Modeling systems: Basic geometric commands, layers, display control commands, editing, dimensioning, solid modeling. **Course Outcome:** CO2: Computergraphics,drafting,numericalcontrol,grouptechnology. **Experiencial Learning:** ❖ Makingthedifferentsolidgeometry structure	**08 Hours**
Module -3	Numerical control: NC, NC modes, NC elements, NC machine tools, structure ofCNC machine tools, features of Machining center, turning center, CNC Part Programmingfundamentals, manualpart programming methods, Computer AidedPart Programming. Computer Aided Quality Control: Terminology in quality control, the computer in QC,contact inspection methods, noncontactinspection methods-optical, noncontact inspection methodsnonoptical, computer aided testing, integration of CAQC with CAD/CAM. **Course Outcome:** CO3:CIMandcomputer aidedqualitycontrols **Experiencial Learning:**	**10 Hours**

	❖ Developing theGCodesandMCodesfortheCNC LatheOperation/CNCwoodrouter	
Module -4	Computer integrated manufacturing systems: Types of Manufacturing systems, Machine tools and related equipment, material handling systems, computer control systems, human labor in the manufacturing systems, CIMS benefits.Group Technology: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type. **Course Outcome:** CO4:Focusesontheintegrationofthesetoolsand theautomationoftheproduct developmentcycle CO5:FocusesonmachiningtheoryautomatedCNCmachining,andprocesscontrol **Experiencial Learning:** ❖ Designingandproducing ofanymachinetools/ Components	**10 Hours**
	Total	**40 Hours**

Text Book:

1. CAD/ CAMTheoryand Practice/IbrahimZeid/TMHPublishers.
2. Automation,Productionsystems&ComputerintegratedManufacturing/Groover/PearsonEducation

Reference Books:

1. CAD/CAM/CIM/RadhakrishnanandSubramanian/NewAgePublishers
2. CAD/CAM:Conceptsand Applications/Alavala/PHIPublishersComputerNumericalControlConcepts and programming / Warren S Seames / Thomson Publishers

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

CO1	ThestudentabletoknowabouttheCAD/CAMsoftware.
CO2	Computergraphics,drafting,numericalcontrol,grouptechnology.
CO3	CIMandcomputer aidedqualitycontrols
CO4	Focusesontheintegrationofthesetoolsand theautomationoftheproduct developmentcycle
CO5	FocusesonmachiningtheoryautomatedCNCmachining,andprocesscontrol

Experiential learing:

- ❖ Makingthedifferentsolidgeometry structure
- ❖ Developing theGCodesandMCodesfortheCNC LatheOperation/CNCwoodrouter
- ❖ Designingandproducing ofanymachinetools/ Components

Type	Code		L-T-P	Credits	Marks
PC	BTME-T-PC-403	**Mechanisms of Machines**	4-1-0	3	150

Objectives	The objective of this course is to familiarize the students with mechanisms, machines, kinematic analysis and force analysis of links of machines. Balancing of machine members, power transmission and breaking system. Roll of friction
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 Fundamentals:** Basic Kinematic concepts and definitions, Degrees of freedom, ElementaryMechanism:Link,joint,KinematicPair,Classificationofkinematic pairs, Kinematic chain and mechanism, Gruebler's criterion, Inversion of mechanism, Grashof criteria, Four bar linkage and the inversions, Single slider crank mechanism, Double slider crank mechanism and their inversion. Transmission angle and toggle position, Mechanical advantage. **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. **Course Outcome:** CO1: Learn the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism. **Experiential Learning:** 1.Fourbarmechanismsforsimpleapplications	**12 Hours**
Module -2	**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. **Balancing for rotating and reciprocating machines**, Flywheel, Governors: types and applications **Course Outcome:** CO2: AnalysetheforcesintheslidercrankMechanism,Analysebalancingofrotatingandrec	**10 Hours**

	iprocatingcomponentsofmachines,EstimatingthefunctionofFlywheel **Experiential Learning:** ❖ Flywheel	
Module -3	**Gear and Gear Train:** 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, Minimumnumberofteethtoavoidinterference.AnalysisofmechanismTrains:Simple Train, Compound train, Reverted train, Epicyclic train and their applications. **Cams Design:** Fundamental law of Cam, Cam Terminology, Classification of Cams and followers, Analysis of follower motions (Displacement, velocity, Acceleration and jerk) – Simple Harmonic, Uniform Velocity and Constant Acceleration & Retardation Types, Generation of Cam Profiles by Graphical Method, Introduction on Cams with specified contours. **Course Outcome:** CO3:Explainthebasicconceptsoftoothedgearingandimplementkinematicsofgeartrains **Experiential Learning:** ❖ Geartrainusing spurgear,wormandwormwheel	**10 Hours**
Module -4	**FrictionEffects**: Screwjack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis. **Brakes & Dynamometers :** Classification of brakes, Analysis of simple block, Band and internal expanding shoe brake, Braking of a vehicle. Absorption and transmission dynamometers, Prony brake, Rope brake dynamometer, belt transmission, epicyclic train, torsion dynamometer. **Course Outcome:** CO4: Explain the effect of friction on Screw jack, friction between pivot and collars, single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis. **Experiential Learning:** ❖ Screwjack ❖ brake	**10 Hours**
	Total	**42 Hours**

TEXT BOOKS:

- KinematicsandDynamicsofMachinerybyRLNorton,TataMacGraw Hill
- TheoryofMachines byS.S.Rattan,TataMacGrawHill

REFERENCE BOOKS

- TheoryofMachinesandMechanismsbyJohnJ. Uicker Jr.,GordonR.Pennockand Joseph E. Shigley, Oxford University Press
- TheoryofMachinesbyThomasBevan,CBSPublications
- Kinematicsand DynamicsofMachinerybyCharlesE.Wilsonand J.PeterSaddler,

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

CO1	Learnthebasiccomponentsofmechanisms, analyzingtheassemblywithrespecttothe displacement, velocity, and acceleration at any point in a link of a mechanism.
CO2	AnalysetheforcesintheslidercrankMechanism,Analysebalancingofrotatingand reciprocatingcomponentsofmachines,EstimatingthefunctionofFlywheel
CO3	Explainthebasicconceptsoftoothedgearingandimplementkinematicsofgeartrains
CO4	Explaintheeffect offrictiononScrewjack,frictionbetweenpivot andcollars,single, multi-plate and cone clutches, anti friction bearing, film friction, friction circle, friction axis.
CO5	ComprehendBrakes&Dynamometers

Experiential Learning:

- Fourbarmechanismsforsimpleapplications
- Flywheel
- Geartrainusing spurgear,wormandwormwheel
- Screwjack
- Brake

Type	Code		L-T-P	Credits	Marks
MC	BTMC-T-MC-401	**ENVIRONMENTAL ENGINEERING**	3-1-0	3	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 -1	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 Hours**
Module -2	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,	**12 Hours**

	carbon trading, carbon foot print National Ambient Air quality Standards, Noise standards, Vehicle emission standards	
Module -3	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 Hours**
Module -4	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 Hours**
	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		L-T-P	Credits	Marks
OO	BTCE-T-OO-401	**NPTEL**	2-0-0	2	150

Objectives	
Pre-Requisites	Knowledge of Technical Papers in Secondary Education
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		**08 Hours**
Module -2		**08 Hours**
Module -3		**06 Hours**
Module -4		**08 Hours**
Module - 5		**06 Hours**
	Total	**36 Hours**

TEXT BOOKS:

REFERENCE BOOKS

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

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

Type	Code		L-T-P	Credits	Marks
PC	BTME-P-PC-402	**BASIC MANUFACTURING PROCESSES LABORATORY**	0-0-3	2	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.

DetailedSyllabus

Experiment No.	Topics
Experiment 1	Determination of grain size, clay content, permeability and green compressive strength of Molding sand
Experiment 2	Foundry Practices
Experiment 3	Preparation of a wood pattern.
Experiment 4	Determination of strength of brazed and solder joints
Experiment 5	Practice and preparation of job in TIG/MIG welding
Experiment 6	Practice and preparation of job in sheet metal using processes like forming and deep
Experiment 7	Demonstration of different rolling mills
Experiment 8	Demonstration of Extrusion processes

CourseOutcomes: At the end ofthis course, thestudents 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.

Type	Code	Engineering MOS **LABORATORY**	L-T-P	Credits	Marks
PC	BT-ME-P-PC-401		0-0-3	2	100

Objectives	Study different types of force, friction ,center of gravity ,moment of inertia, strength of different material and stiffness of spring
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 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

Experiment no.	NAME OF THE EXPERIMENT	Hours
Experiment no. 1	Verification of Polygon Law	**3 hours**
Experiment no. 2	Determine Radius of gyration of compound Pendulum	**3 hours**
Experiment no. 3	Determine coefficient of friction of inclined plane apparatus	**3 hours**
Experiment no. 4	Determine tensile and compressive strength of different material using UTM	**3 hours**
Experiment no. 5	Determine fatigue strength of material	**3 hours**
Experiment no. 6	Determine torsional strength of material	**3 hours**
Experiment no. 7	Estimation of spring constant under tension and compression	**3 hours**
Experiment no. 8	Strain measurement using strain gauge	**3 hours**
Experiment no. 9	Determine of impact strength using IZOD	**3 hours**
Experiment no. 10	Determine hardness of material	**3 hours**
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

Type	Code		L-T-P	Credits	Marks
PC	BTME-P-PC-403	**FLUID MECHANICS AND MACHINES**	0-0-3	2	100

Objectives	Study of pressure gauge, manometers, flow measuring equipment, venturimeter, orifice meter, Bouyancy. Study of pumps, Centrifugal, Reciprocating. Study of Turbines, impact and reaction types.
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.

Detailed Syllabus

Experiment no.	NAME OF THE EXPERIMENT	Hours
Experiment no. 1	Determination of metacentric height and Application to stability of floating bodies.	**3 hours**
Experiment no. 2	Verification of Bernoulli Theorem	**3 hours**
Experiment no. 3	Determination of C_v& C_d of orifice Meter	**3 hours**
Experiment no. 4	Calibration of bourden tube pressure gauge & measurement of pressure using manometers.	**3 hours**
Experiment no. 5	Determination of Darcy's coefficient on pipe friction apparatus	**3 hours**
Experiment no. 6	Experiment on impact of Jets	**3 hours**
Experiment no. 7	Experiments on performance of Pelton Turbine	**3 hours**
Experiment no. 8	Experiments on performance of Francis Turbine	**3 hours**
Experiment no. 9	Experiments on performance of centrifugal pump	**3 hours**
Experiment no. 10	Experiments on performance of reciprocating pump	**3 hours**
Total		**30 Hours**

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

CO1	To know about bourden tube pressure gauge & measurement of pressure
CO2	To know difference in application of venturimeter & 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)

(2022-23 Admission Batch)

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	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

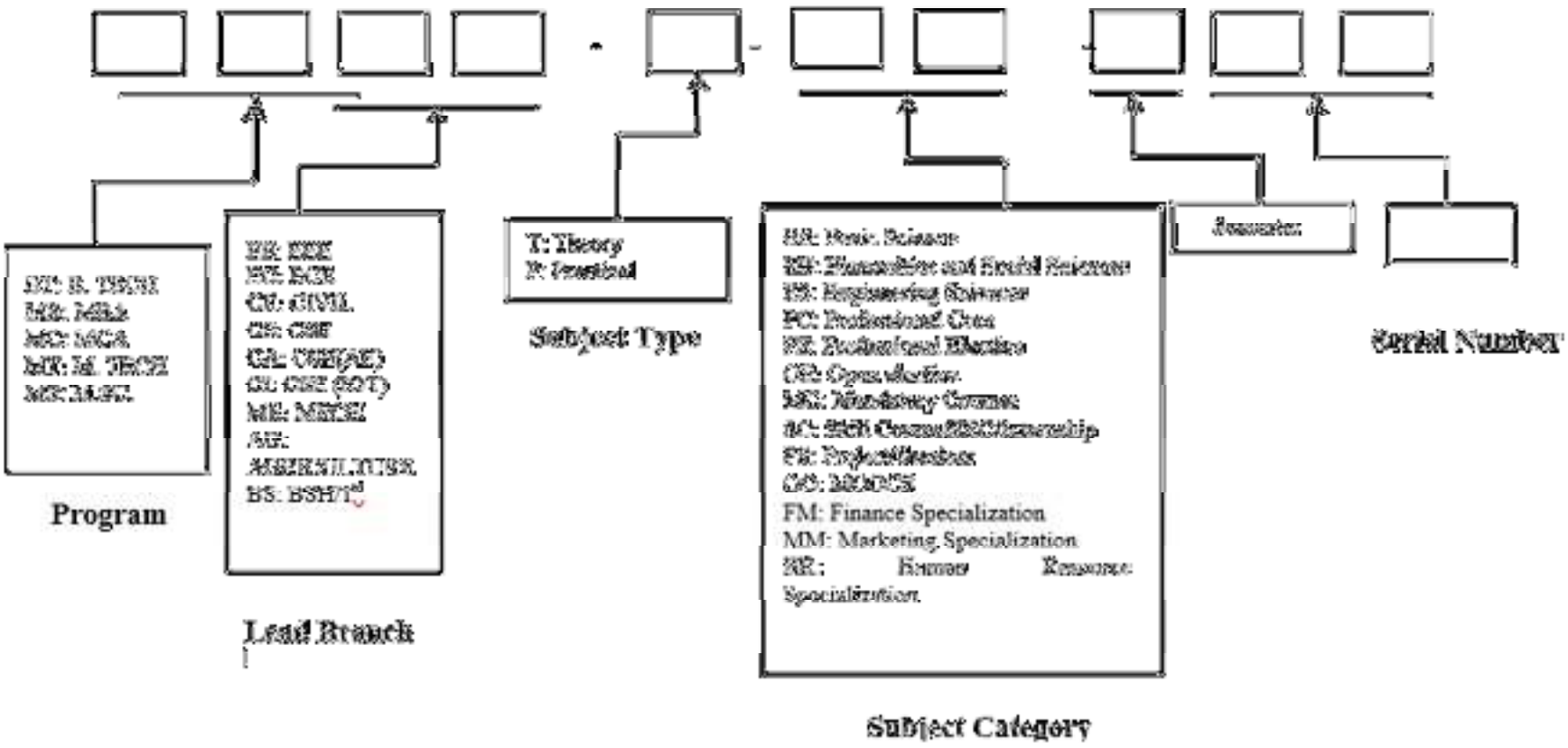
Proposed Internal Examination (B. Tech, Autonomous)					
Sl. No	**Type of Test**	**Mark**	**Frequency**	**Total Mark**	**Reduced Mark**
1	Modular Test	25	3	75	**50**
2	Online Quiz Test	10	6	60	**10**
3	Assignment	5	2	10	**10**
4	Subject Specific Project	15	1	15	**15**
5	Attendance	15	1	15	**15**
			TOTAL	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	Strength of Materials	4-0-0	3
5	PC	BTME-T PC-505	Power Plant Engineering	3-1-0	3
6	MC	BTMC-T-MC-503	Universal Human Value	4-0-0	0
7	AEC	BTSC-T-AEC-503	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	PS	BTSC-P-PS-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			NPTEL	2-0-0	3
7			Essence of Indian Knowledge Tradition - II	2-0-0	0
8	AEC	BTSC-T-AEC-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 4	0-0-2	2
Total Hours/ Credit (Practical)				9	4
Grand Total Hours/ Credit				**39**	**23**
SUMMER INTERNSHIP TRAINING for 30 Days					

3rd Year B.Tech
(Mechanical Engineering)

Contents

Third Year B.Tech

Curriculum Structure

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**	**TotalMark**	**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**	**TotalMark**
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, micrometre.				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 ofMaterials: Boresi and Schmdt,Willey

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, TataMcGraw 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
PE	BTME-T-PE-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-503		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 R Gaur, R Asthana, G P Bagaria, 2ndRevised 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-3	L-T-P	Credits	Marks
AEC	BTSC-T-AEC-503		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-502		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-501		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-503		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					
Teaching Scheme					

Detailed Syllabus:

Module	Topics	Hours
Experiment-1	Job on lathe with tapper 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
PS	BTME-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 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	BTME-P-PS-602		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.

6th Semester

Type	Code	Optimization in Engineering	L-T-P	Credits	Marks
BS	BTBS-T-BS-601		4-0-0	3	150
Objectives	The students will be able to understand:				
Pre-Requisites					
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 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	
CO2	
CO3	
CO4	
CO5	
CO6	

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					
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 DhanpatRai 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 Publiations
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

5. To understand the different types of heat exchanger

Type	Code	Essence of Indian Knowledge Tradition – II	L-T-P	Credits	Marks
			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				
Pre-Requisites					
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**

Text Books:

Reference Books:

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-4	L-T-P	Credits	Marks
AEC	BTSC-T-AEC-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 Hours**

Text Books:

1. Strength of Materials by James M Gere, Stephen P Timoshenko

2. The Theory of Machines by S S Ratan
3. Engineering Mechanics- New Age International by S 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

Course Outcome:

1. Understand: Explain the principles and significance of material testing and mix design in civil engineering projects.
2. Apply: Perform standard tests on aggregates, bitumen, and soil to evaluate their properties and suitability.
3. Analyze: Interpret test results to assess material performance under specific construction conditions.
4. Evaluate: Compare alternative materials and methods to optimize construction practices.
5. Create: Develop mix designs using the Marshall Method to meet project specifications.
6. Demonstrate: Present findings and practical insights from material testing and mix design processes effectively.