COURSE STRUCTURE

BATCH: 2019-2023

DEPARTMENT OF MECHANICAL ENGINEERING
INSTITUTE OF ENGINEERING & TECHNOLOGY

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COURSE STRUCTURE

B.TECH. (AUTOMOBILE ENGINEERING)

ABOUT THE PROGRAM

B.Tech. in Automobile Engineering is 4 years full-time graduate course which is divided into 8 semesters. This course is designed and taught primarily to impart hands-on experience to the students in the field of automobile engineering. The students are made familiar with modern technologies involved in fabrication and working of all types of automobiles and auto components. The primary focus is to provide the students with the skills for their growth in the automobile sector.

This course is for individuals who:

Those who are passionate about automobiles and are willing to devote time to gaining in-depth knowledge and skills of the modern day automobiles and technologies used therein. Also, for those who are willing to put in long hours in understanding the working and designing aspects of automobiles.

Students who are looking for:

Developing hands-on skills to work with engines, spares designs of different parts and components of automobiles and gaining expertise in the design and fabrication of automobile engineering.

Breakup of Courses

S. no.	Category	Total no. of Credits	HS	BS	ES	PC	PE	OE	PW / Seminar
1	University Core	52	6	18	28				
2	Professional Core	90	19	6		48			17
3	Professional Elective	26					26		
4	Open Elective	16						16	
		184	**25**	**24**	**28**	**48**	**26**	**16**	**17**

Breakup of Category

S. no.	Subject Area	Range	Percentage	Credits
1	Humanities & Social Sciences , Soft Skill and EPP	(5 – 10 %)	13.6	25
2	Basic Sciences	(15 – 20%)	13.0	24
3	Engineering Sciences	(15 – 20%)	15.2	28
4	Program Core	(30 – 40%)	26.1	48
5	Program Electives	(10 – 15%)	14.1	26
6	Open Electives	(5 – 10%)	8.7	16
7	Project Work / Seminars	(10 – 15%)	9.2	17
8	Non Graded Mandatory Courses	8 units	0.0	0
	Total		**100.0**	**184**

University Core

S. no	Type	Courses	L	T	P	Credits	Contact Hrs	Prerequisites
1	BS	Engineering Mathematics - I	3	1	0	4	4	
2	BS	Engineering Physics	3	1	2	5	6	
3	BS	Engineering Chemistry	3	1	2	5	6	
4	ES	Computer and Programming	4	1	2	6	7	
5	ES	Basic of Mechanical Engineering	3	1	2	5	6	
6	ES	Engineering Drawing	0	0	2	1	2	
7	ES	Applied Mechanics	3	1	2	5	6	Departmental
8	ES	CAD Lab	0	0	2	1	2	Departmental
9	ES	Electronics Engineering	3	1	2	5	6	
10	ES	Electrical Engineering	3	1	2	5	6	
11	HS	English Language Skills for Communication I	1	1	2	3	4	
12	BS	Engineering Mathematics-II	3	1	0	4	4	Engineering Mathematics - I
13	HS	English Language Skills for Communication - II	1	1	2	3	4	English Language Skills for Communication – I

BS	18
ES	28
HS	6
Total	**52**

Professional Core

S. no	Type	Courses	L	T	P	Credits	Contact Hrs	Prerequisites
1	BS	Engineering Mathematics III	3	1	0	4	4	Engineering Mathematics II
2	BS	Environmental Studies	2	0	0	2	2	
3	HS	Ethics and Values	2	0	0	2	2	
4	HS	Soft Skill I	0	0	4	2	4	
5	HS	Soft Skill II	0	0	4	2	4	Soft Skill I
6	HS	Soft Skill III	0	0	6	3	6	Soft Skill II
7	HS	Soft Skill IV	0	0	6	3	6	Soft Skill III
8	HS	EPP I	0	0	4	2	4	
9	HS	EPP II	0	0	4	2	4	EPP I
10	HS	Industrial Economics	3	0	0	3	3	
11	PC	Power Electronics and Drives	2	0	2	3	4	
12	PC	Switching Theory & Logic Design	3	0	2	4	5	
13	PC	Measurement and Metrology	2	0	2	3	4	-
14	PC	Advance Programming Technology	3	0	2	4	5	
15	PC	Fluid Machinery & System	3	0	2	4	5	
16	PC	Manufacturing Science	3	0	2	4	5	
17	PC	Strength of Material	3	1	0	4	4	Applied Mechanics
18	PC	Theory of Machines	3	0	2	3	3	Applied Mechanics
19	PC	Micro Processor & Micro Controller	3	0	0	3	0	
20	PC	Design of Machine Elements & Mechanism	3	0	2	4	5	Strength of Material
21	PC	Robotic System	3	0	2	4	5	
22	PC	FEM and MEMS	3	0	2	4	5	
23	PC	Control Systems	3	0	2	4	5	Switching Theory & Logic Design
24	PW	Mini Project I	0	0	4	2	4	
25	PW	Mini Project II	0	0	4	2	4	Mini Project I
26	PW	Industrial Training I	0	0	2	1	2	
27	PW	Industrial Training II	0	0	2	1	2	
28	PW	Minor Project	0	0	6	3	6	
29	PW	Major Project	0	0	16	8	12	Minor Project

BS	6
HS	19
PC	48
PW	17
Total	**90**

Professional Elective

S. no	Level	Courses	L	T	P	J	Credits	Contact Hrs	Prerequisites
Thermal Automotive									
1	001	Refrigeration & Air-Conditioning	3	0	0	0	3	3	Engineering Thermodynamics
2		Refrigeration & Air-Conditioning Lab	0	0	2	0	1	2	
3	001	Alternate Fuels and Energy System	3	0	0	0	3	3	
4	002	Automotive Transmission System	3	0	0	0	3	3	
5	002	Vehicle Dynamics & Structure	3	0	0	0	3	3	
6	003	Two and Three Wheeler Engine	3	0	0	0	3	3	
7	003	Gas Turbine and Jet Propulsion	3	1	0	0	4	4	Engineering Thermodynamics
8	004	Tractor and Farm Equipment	3	1	0	0	4	4	Engineering Thermodynamics
9	004	Advanced Heat Transfer	3	0	0	0	3	3	Heat Transfer & Combustion
10		Solar Energy Lab	0	0	2	0	1	2	
11		Project based Solar Energy Lab	0	0	0	8	2	8	
Fluids Automotive									
1	001	Advanced Fluid Mechanics	3	1	0	0	4	4	Fluid Mechanics
2	002	Compressible Fluid Flow	3	1	0	0	4	4	Advanced Fluid Mechanics
3	002	Automotive Pollution & Control	3	0		0	3	3	
		Engine Testing & Pollution Measurement Laboratory	0	0	2	0	1	1	
4	003	Automotive Aerodynamics	3	0	0	0	3	3	Advanced Fluid Mechanics
5		Automotive Aerodynamics Lab	0	0	2	0	1	2	
6		Project based Automotive Aerodynamics Lab	0	0	0	8	2	4	
7	003	Fundamental of Fan, Compressor & Blowers	3	0	0	0	3	3	
8	004	Computational Fluid Dynamics	3	0	0	0	4	4	Advanced Fluid Mechanics
9		CFD Lab	0	0	2	0	1	2	
10		Project based CFD Lab	0	0	0	8	2	8	
Automotive Design									
1	001	Computer Aided Design of Automotives	3	0	0	0	3	3	
2		Advanced Software Lab	0	0	2	0	1	2	
3		Project based Advanced Software Lab	0	0	0	8	2	8	
4	002	Engine Design and Development	3	0	0	0	3	3	
5	002	Finite Element Analysis	3	1	0	0	4	4	Strength of Material

6	003	Engine Tribology	3	1	0	0	4	4	Strength of Material
7	003	Vibration and Noise	3	1	0	0	4	4	Theory of Machines
8	004	Machine Tool Design	3	0	0	0	3	3	Machine Design II & Manufacturing Sc.
9		MTD Lab	0	0	2	0	1	2	
10		Project based Machine Tool Design Lab	0	0	0	8	2	8	
Automotive Manufacturing									
1	001	Computer Aided Manufacturing	3	0	0	0	3	3	Manufacturing Technology
2		CAD/CAM Lab	0	0	2	0	1	2	
3		Project based CAD/CAM Lab	0	0	0	8	2	8	
4	002	Automaterial & Component Testing	3	0	0	0	3	3	Material Engineering & Technology
5	002	Composite Materials	3	0	0	0	3	3	Material Science
6	003	Advanced Welding Technology	3	0	0	0	3	3	
7	003	Modern Manufacturing Process	3	0	0	0	3	3	Manufacturing Technology
8		Modern Manufacturing Process Lab	0	0	2	0	1	2	
9		Project based Modern Manufacturing Science Lab	0	0	0	8	2	8	
10	004	Non Destructive Testing Method	3	0	0	0	3	3	
Industrial Engineering									
1	001	Industrial Engineering	3	0	0	0	3	3	
2	001	Product Development & Design of Automotives	3	0	0	0	3	3	
3		PDD Lab	0	0	2	0	1	2	
4		Project based Product Development & Design Lab	0	0	0	8	2	8	
5	002	Operations Research	3	0	0	0	3	3	Industrial Engineering
6	002	Engine & Vehicle Evaluation	3	0	0	0	3	3	
7	003	Value Engineering	3	0	0	0	3	3	Industrial Engineering
8	004	Supply Chain Management	3	0	0	0	3	3	Industrial Engineering
9	004	Applied Ergonomics	3	0	0	0	3	3	Product Development & Design of Automotives
10		Applied Ergonomics Lab	0	0	2	0	1		
11		Project based Applied Ergonomics Lab	0	0	0	8	2	8	
Automotive Electronics									
1	001	Automotive Electronics & Instrumentation System	3	0	0	0	3	3	
		Automotive Electronics & Instrumentation Laboratory	0	0	2	0	1	2	

2	001	Navigational Aids & Guidance	3	0	0	0	3	3	
3	002	Vehicle Inspection & Maintenance	3	0	0	0	3	3	
		Vehicle Maintenance Laboratory	0	0	2	0	1	2	
4	002	Robotics & Robot Application							
5		Robotics & FMS Lab	0	0	2	0	1	2	
6		Project based Robotics Lab	0	0	0	8	2	4	
7	003	Industrial Automation & Control System	3	0	0	0	3	3	Industrial Engineering
8		Automation Lab	0	0	2	0	1	2	
9		Project based Automation Lab	0	0	0	8	2	8	
10	003	Engineering System Modeling & Simulation	3	0	0	0	3	3	Robotics & Robot Application
11	004	Micro Processor Application in Automobiles	3	0	0	0	3	3	
12	004	Robotic Application and Maintenance	3	0	0	0	3	3	

Open Elective

S. no	Type	Courses	L	T	P	J	Credits	Contact Hrs	Prerequisites
1	OE	Total Quality Management	3	1	0	0	4	4	-
2	OE	Energy Conservation & Management	3	1	0	0	4	4	-
3	OE	Smart Materials	3	1	0	0	4	4	-
4	OE	Project Management	3	1	0	0	4	4	-
5	OE	Reliability and Maintenance Engineering	3	1	0	0	4	4	-
6	OE	Mechatronics	3	1	0	0	4	4	
7	OE	Six Sigma & Applications	3	1	0	0	4	4	

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SYLLABUS
B.TECH.
(AUTOMOBILE ENGINEERING)

BMAS-0101: ENGINEERING MATHEMATICS I

Course Objectives: To make the students understand the concepts of differential calculus, differential equations and matrices by giving more emphasis to their applications in engineering.

Credits: 04 **Semester I** **L–T–P: 3–1–0**

Module No.	Contents	Teaching Hours (Approx.)
I	**Differential Calculus**: Partial differentiation, Euler's theorem for homogeneous functions, Composite functions, Total derivatives, Expansion of functions of several variables, Asymptotes and Curve Tracing (in Cartesian coordinates), Jacobian and its properties, Extrema of functions of several variables using Lagrange's multipliers.	13
II	**Matrices**: Elementary transformations, Rank by echelon form, Consistency and Solution of system of linear equations, Complex matrices, Eigen values and Eigenvectors, Cayley–Hamilton theorem & its applications. **Ordinary Differential Equations I:** Solution of Exact and Reducible to exact differential equations.	13
III	**Ordinary Differential Equations II:** Solution of nth order linear differential equations with constant coefficients, Euler-Cauchy Equations, Simultaneous differential equations, Solution of II order differential equations by method of reduction of order, Reduction to normal form, Change of independent variable and Method of variation of parameters, Applications of second order differential equations in electrical circuits and mechanical systems.	14

Learning Outcomes:

After studying these topics, the student will be able to

- Understand partial differentiation and its applications
- Trace the curves in Cartesian coordinates
- Find rank of a matrix & its applications in solving systems of linear equations
- Solve the ordinary differential equations and know their applications in engineering

Text Books:

- M. Goyal and N. P. Bali, A Text Book of Engineering Mathematics, Laxmi Publication, Delhi, 2014.
- M. K. Jain, S. R. K. Iyengar and R. K. Jain, Advanced Engineering Mathematics, Narosa Publishing House, New Delhi, 2002.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 2014.

Reference Books:

- T. M. Apostol, Calculus, Volume I , John Wiley & Sons, Inc. , USA, 1967.
- T. M. Apostol, Calculus, Volume II , Xerox Corporation, USA, 1969.
- G. B. Thomas and R. Finney, Calculus & Analytic geometry, Addison Wesley, USA, 1995.
- W. E. Boyce and R. D. Prima, Elementary Differential Equations, John Wiley & Sons, 2009.

BPH S0001: ENGINEERING PHYSICS

Objective: *The Syllabus is designed and styled especially to give B.Tech. I year students a sound base in fundamental physics as well as to give their exposure to a wide range of its utility in engineering and technology.*

Credits: 04 **Semester I** **L–T–P: 3–1–0**

Module No.	Content	Teaching Hours
I	**Interference & Diffraction:** Principle of superposition, Coherent Sources, Interference due to division of wave front- Biprism experiment and division of amplitude- Interference in thin films, Newton's rings Expt; Diffraction of light, Fresnel and Fraunhoffer diffraction, Diffraction due to single slit and N-slits (Grating). **Polarization:** Concept of polarization of light, Phenomenon of double refraction, Superposition of ordinary and extra ordinary rays: Plane, Circularly and elliptically polarized light, quarter and half wave plates, Optical activity, Fresnel's theory for optical rotation, Specific rotation, Biquartz polarimeter.	**20**
II	**Solid State Physics & Superconductivity:** Bands in solids, band formation in solids, Fermi level and Fermi energy, temperature dependence of conductivity in semiconductors, Hall effect, Temperature dependence of resistivity in superconducting materials, Meissner effect; Type I and Type II superconductors, Temperature dependence of critical field, Applications of superconductors. Introduction of nanoscience and nanotechnology with applications. **Electromagnetics & Dielectrics:** Gauss law in electrostatics, Ampere's law, Faraday law, Maxwell's equations (Integral and Differential forms), Equation of continuity, Inconsistency in Ampere's law: Displacement current, Propagation of E-M waves in free space and in conducting media, Poynting theorem and Poynting vector, Dielectric behavior of materials.	**20**
III	**Relativistic Mechanics:** Basic Concepts, Inertial & non-inertial frames, Galilean Transformations, Michelson- Morley experiment; Einstein's postulates, Lorentz transformation equations; Length contraction, Time dilation, Addition of velocities, Variation of mass with velocity, Mass energy equivalence. **Wave Mechanics & X-ray Diffraction:** Wave - particle duality, de-Broglie hypothesis, Phase and group velocities: wave packet, Heisenberg's uncertainty principle and its applications; Wave function and its normalization, Schrödinger's wave equation: time dependent and time independent wave equations, Particle in one dimensional potential box; Bragg's law, Compton's effect.	**20**

Text Books :

- *Engineering Physics by S.K. Gupta / S.L. Gupta Vol. I & II

Reference Books:

- Optics - Ajoy Ghatak (TMH)
- Fundamental of Physics - Resnick, Halliday & Walker (Wiley)
- Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
- Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
- Introduction to Electrodynamics by David J. Griffith (Prentice Hall of India)
- Solid State Physics by S.O. Pillai (New Age International Publishers)

Outcome:

- *After completing the course the B.Tech. I year students would be able to apply the subject knowledge in engineering science and technology.*
- *A student of ordinary caliber can comprehend the theoretical aspects easily without much strain and difficulty.*
- *Teaching-learning methodology of the course is such that the elementary knowledge of a student raises gradually to its complex aspects during the completion of the course program.*

BCHS0101: ENGINEERING CHEMISTRY

Objective: *The subject intends to provide understanding of the fundamental concepts of Chemistry applicable in Engineering Sciences with the emphasis on the latest technological advancements thereby preparing the students for a rewarding career in science and technology.*

Credits: 04 **Semester I/II** **L–T–P: 3–1–0**

Module No.	Content	Teaching Hours
I	**Chemical Bonding:** M.O. theory and its applications in homo & hetero diatomic molecules. Hydrogen bond, metallic bond and their applications. Semi-conductors. **Reaction intermediates** (carbocation, carbanion & free radical). Types of isomerism (optical and geometrical) chirality, elements of symmetry, diastereomers, optically active compounds, R-S configuration and E-Z geometrical isomers, conformation of ethane and *n*-butane. **Fuels**: Definition and classification of fuels. Analysis of coal and determination of calorific value by bomb calorimeter. **Synthetic petrol**: Bergius and Fischer Tropschs methods **Lubrication:** Introduction, classification, properties & uses of lubricants. **Ceramics:** Introduction, classification, scope & applications.	15
II	**Polymers:** Polymerization and its classification. Preparation, properties and uses of polymers: Thermoplastics (Polystyrene, Teflon and Nylon 66), Thermosetting polymer (Bakelite). Biodegradable polymers (PLA, poly β-hydroxy butyrate), molecular weights of polymers, natural rubber and its vulcanization, synthetic rubber (neoprene, Buna-S, Buna-N). **Water Treatment:** Introduction, hardness and its units, L-S Process, calgon process, zeolite and ion-exchange processes, reverse osmosis, treatment of municipal water, impurities in water, boiler feed water, boiler troubles and remedial measures **Functional materials:** Biomaterials, smart materials (piezoelectric, pyroelectrics & ferroelectrics) and advanced materials. **Glass:** Preparation, varieties & uses.	16
III	**Corrosion**: Introduction, consequences, types, theories of corrosion, (galvanic, pitting, stress, water line, intergranular & soil corrosion) and protection of corrosion. **Spectroscopy:** Elementary ideas and simple applications of UV, visible, infrared and NMR spectral techniques **Chemical Kinetics:** Order and molecularity of reactions, zero order, first and second order reactions. Integrated rate equations. Theories of reaction rates, factors affecting rate of reaction. pH, buffer solution (Henderson-Hasselbalch equation). **Introduction to Nanoscience & Nanotechnology:** Basic concepts of nanoscience and nanotechnology, fullerenes, graphenes, carbonnanotubes, principle and uses of SEM & TEM techniques. Applications of nanomaterials.	17

Text Book:

- Shashi Chawala **"***Theory and Practicals of Engineering Chemistry***"** 4th edition, Dhanpat Rai & Co pvt ltd.

Reference Books:

- Morrison & Boyd "*Organic Chemistry*",6th edition ,Pearson education
- I.L. Finar "*Organic Chemistry*",5th edition, Longmans Green & Co ltd.
- Y.R. Sharma "*Elementary Organic Spectroscopy: Principles and Chemical Applications*", 1st edition, S. Chand and Co. ltd.
- S.S.Dara "*Text book of Engineering Chemistry and Pollution Control*" 2nd edition, S. Chand and Co.ltd.
- Marsh G Fontana "*Corrosion Engineering*" 3rd edition, Tata McGraw hill publishing Co ltd.

- Attkins & Others **"**Inorganic Chemistry" 5th edition, Oxford university press.
- Attkins & Other**s "***Physical Chemistry*" 6th edition, Oxford University press**.**
- Puri, Sharma and Pathania "*Principles of Physical Chemistry***"** 44th edition, Vishal publishing Co. Jalandhar.
- K.J.Laidler "Chemical Kinetics" 3rd edition, Pearson education.
- Malik, Tuli and Madan "*Selected topics in Inorganic chemistry*", 7th edition, S. Chand and Co.ltd.
- T. Pradeep, "*A Textbook of Nanoscience & Nanotechnology*" Tata McGraw Hill, New Dehli, 2012.

Outcome:

- *Knowledge of Chemical Sciences for better appreciation of applications in engineering field.*
- *The students will develop thorough understanding of the fundamental concepts of Chemistry and its applications in the field of various Engineering Sciences such as Electrical, Mechanical, Environmental, Civil and Material Sciences and Technology.*
- *The student's ability to perform experiments, analyze and interpret the data of experiments will be enhanced.*
- *The students will be acquainted with recent technological advancements and thus will be better equipped for a rewarding career in science and technology.*

BCSC0001: COMPUTER PROGRAMMING

Objective: *To impart adequate knowledge on the need of problem solving techniques and develop programming skills to implements applications using the concepts of C Language. Also by learning the programming constructs they can easily switch over to any other language in future.*

Credits:05 **L-T-P-J:4-1-0-0**

Module No.	Content	Teaching Hours
I	**Generation of Programming Languages:** Low, Assembly, High and 4GL. **Language Processors:** Compiler, Interpreter, Assembler, Linker and Loader. **Algorithm:** Introduction, Features, Different Ways of stating Algorithms. **Flow Chart:** Introduction, Standard, Guidelines, Advantages and Limitations of using Flowcharts. **Basics of C:** Overview, Structure of a C program, Identifier, Keywords, Variables, Data types, Formatted Input and output. **Operators and Expression:** Assignment, Unary, Arithmetic, Relational, Logical, Bitwise, Conditional, Special operators and their precedence & Associativity. IEEE representation of data types like float & double, Lvalue and Rvalue **Type Conversion:** Type Promotion in expression, Conversion by Assignment, Truncation and Casting Arithmetic expression. **Decision and Case Control Structure:** if, if-else, nested if-else, Decisions using switch, switch versus if-else ladder, goto. **Loop Control Structure:** For loop, while loop, do-while loop, nesting of loops, break, and continue.	17
II	**Arrays:** Introduction, one dimensional and two dimensional Array- Declaration, Initialization, Address Calculation. **Operations on Arrays:** Insertion, Deletion, Linear Search & Bubble Sort. **String:** Introduction, One dimensional and two dimensional Array-Declarations, Initialization **Operations on String:** Length, Copy, Reverse, Concatenate, Compare with & without built-in functions. **Functions:** Declaration and Definition, Category of Functions, Parameter Passing Techniques – Call by Value, Passing Arrays to Functions. **Introduction to Storage Classes:** Auto, Static, Extern and Register. **Recursion:** Mechanics of Recursive Call, Implementation of Recursion, Recursion vs. Iteration. **The C Preprocessor:** Introduction, Macro Expansion and File Inclusion, Conditional	17
III	**Pointers:** Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Arrays and Pointers, Pointer and Strings, Pointer Arithmetic, Pointers to Pointers, Array of Pointers, Pointer to an Array, Two Dimensional Array and Pointers, Pointers to Functions, Dynamic Memory Allocation, void Pointer and Null Pointer. **User Defined Types:** enum, typedef, Union and Structure - Declaration, Initialization, Nested Structures, Arrays of Structures, Structure and Pointer, Passing Structure Through Function. Difference between Structures and Union. **File Handling:** Data and Information, File Concepts, File Organization, File Operations: Open, Read, and Close, Trouble in Opening a File. File Opening Modes, Working with Text Files. Random Access to Files of Records. Introduction to Command Line Arguments.	18

Text Books:

- *Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science – A Structured Programming Approach Using C", C Language Learning, 2007*

Reference Books:

- *Herbert Schildt , "C: The Complete Reference", 5th Edition, McGraw Hill Education*
- *K. N. King, "C Programming a Modern Approach", W. W. Norton, 2nd Edition, 2008.*
- *Kernighan and Ritche, "The C Programming Language", PHI, 2ndEdition, 2011.*
- *P. Dey and M. Ghosh, "Programming in C", Oxford University Press 2nd Edition, 2013.*

Outcome: *After completion of course, the student will be able to:*

- *Familiar with the concepts related to structured programming constructs*
- *Design an algorithmic solution for a given problem and as well C program for a given algorithm.*
- *Demonstrate their knowledge of, and ability to apply, programming fundamentals in different programming languages.*
- *Apply knowledge of computing and mathematics appropriate to the discipline; specifically, to include the application of mathematics, science and engineering to solve and reason about computational problems.*
- *To apply the concepts and design principles relating to: data structures, computer architecture and organization, programming languages, operating systems, and networks.*

BME G0002: APPLIED MECHANICS

Objective: *The aim of the applied mechanics is to teach the basic analytical methods that is the fundamental concepts and techniques of engineering mechanics. It describes and predicts the condition of rest or motion of solid under the action of forces. This shows the implementation of these methods in basic engineering design.*

Credits: 04 **Semester I/II** **L–T–P: 3–1–0**

Module No.	Content	Teaching Hours
I	**Introduction:** Engineering Mechanics: Idealization of Bodies, concept of Rigid Body, External Forces, moments, couples, Laws of Mechanics. **Force Systems And Equilibrium:** Concurrent forces in a plane, Parallel forces in a plane, Free Body Diagram, Equation of equilibrium and their applications to various systems of forces. **Friction:** Concepts of friction, Dry friction, Laws of friction and their applications to wedge, ladder, screw, belt-pulley system, Rolling friction.	14
II	**Distributed Forces and Moment of Inertia:** Centroid of Composite figures, Area Moment of Inertia, Polar Moment of Inertia, Parallel axis theorem, Perpendicular axis theorem, Principle Moment of Inertia, Mass Moment of Inertia of circular ring, disc, cylinder, sphere and cone about their axis of symmetry. **Beams:** Different support & load conditions, Shear Force and Bending Moment Diagrams for point load, uniformly distributed load, uniformly varying load.	12
III	**Analysis of Plane Trusses:** Engineering structures, Perfect Truss, Determination of axial forces in the members, Method of Joints, Method of Section. **Kinematics of Rigid Body:** Plain motion of rigid body, Velocity and acceleration under translation and rotational motion, Absolute motion, Relative motion. **Kinetics of Rigid Body:** Force, Mass and Acceleration, Work, Power and Energy, Impulse and Momentum, D' Alembert's Principle and dynamic equilibrium.	14

Text Books:

- "*Engineering Mechanics*" – Statics & Dynamics by Dr. A.K. Tayal, Umesh Publications, Delhi
- "*Engineering Mechanics*" – Statics Vol.I& Dynamics Vol-II by V.S. Mokashi (Tata McGraw- Hill)

Reference Books:

- "*Engineering Mechanics*" – I.H. Shames, Prentice Hall of India Pvt. Ltd., New Delhi (EEE)
- "Mechanics for Engineers" – (Statics and Dynamics) F.P. Beer & E.R. Johnston, TMH New Delhi
- "*Engineering Mechanics*" – Statics & Dynamics by J.L. Marriam& L.G. Kraig, John Wiley & Sons Ltd.

Outcome: *At the end of the course the student will be able to:*

- *Understand the representation and analysis of forces, moments, and equilibrium of particles and rigid bodies, Concept and principles of work and energy.*
- *The effect of friction and its role in engineering applications.*
- *Develop basic know how and awareness to deal with real life applications in various fields of engineering.*

BME G0001: BASIC MECHANICAL ENGINEERING

Objective: *Precise thermodynamics education is a requirement to discuss issues that one faces in thermodynamics and resulting studies in global warming, energy conversion and other energy related topics that affect sustainability of the environment in the global sense. Also introduce the students to various basic manufacturing processes carried out in various industries very commonly.*

Credits: 04 **Semester I/II** **L–T–P: 3–1–0**

Module No.	Content	Teaching Hours
I	**Fundamentals of Thermal Engineering:** Thermodynamic systems, State & properties, Thermodynamic equilibrium & processes, Heat & work, Work done for different polytrophic processes, Zeroth law of thermodynamics and its applications, First law of thermodynamics, Steady flow energy equation, Application of first law to various thermodynamic systems and its limitations.	13
II	**Second Law of Thermodynamics:** Concept of heat engine, heat pump & refrigerator, Second Law of Thermodynamics, Carnot Cycle, Carnot theorem. Clausius Inequality, Concept of entropy, Entropy change during various processes. **Introduction to Manufacturing Processes**: Mechanical properties of materials, Engineering Materials: High Carbon, Medium Carbon and Low Carbon Steel with applications.	13
III	**Casting Process:** Patterns and types of patterns and their allowances, Moulding sand and its properties, Elements of gating system**,** Casting defects. **Machining Processes:**Working principle and operations of Lathe and Drill Machine. **Fabrication processes:** Introduction and classification of welding, principle and applications of Shielded Metal Arc Welding and Gas Welding.	14

Reference Books:

- Nag P. K.: "*Engineering Thermodynamics*", TMH, and India.
- Yadav R.: "*Thermodynamics and Heat Engines*", Vol I & II (SI Edition) Central Publishing House Allahabad.
- HajraChowdhary SK and HajraChowdhary AK "*Workshop Technology*" Media Promotors& Publishers.
- Raghuwanshi RS, "*Workshop Technology*" DhanpatRai and Sons, New Delhi.
- VaWylen G.J. &Sonnlog R.E.: "*Fundamentals of classical thermodynamics*", John Wiley & Sons, Inc. NY.
- WarkWenneth: "*Thermodynamics*", McGraw Hill book Co. NY.
- Joel R.: Basic Engineering "*Thermodynamic*"s, Addison Wesley.
- Chapman WAJ, "*Workshop Technology*" Part 1-3, Viva Books Pvt. Ltd. New Delhi.

Outcome: *At the end of the course the student will be able to:*

- *Understand the basic laws of thermodynamics and their applications in engineering.*
- *Understand the processes and operations of metal joining, fabrication casting and machining with applications.*
- *Develop basic know how and awareness of various manufacturing processes.*

BEE G0001: ELECTRICAL ENGINEERING

Objective: *The objective of the course is to give a glimpse of Electrical Engineering as a discipline. Each and every household as well as industrial unit uses numerous electrical devices daily. Indeed, modern day living is unthinkable without electricity. It is imperative for the students to know how the electricity is generated, transmitted to the consumer and utilized. After going through this course, the students will be aware of the working principles of the electrical devices around them and safety precautions while handling them.*

Credits: 04 **Semester I/II** **L–T–P: 3–1–0**

Module No.	Content	Teaching Hours
I	**DC circuit analysis & Network theorems:** Fundamentals of electric circuits, Kirchhoff's laws, mesh analysis, node analysis, Thevenin theorem, maximum power transfer theorem, superposition theorem. **Steady state AC analysis:** AC fundamentals, average &rms values of different AC waveforms, phasor algebra, analysis of series AC circuits, power triangle, concept of power factor, power factor improvement.	13
II	**Three phase AC circuits:** Generation & advantages of three phase system, star & delta connection, line & phase voltage/current relations. **Magnetic circuits:** Faraday's law, Self and mutual inductance, B-H characteristics, hysteresis & eddy current losses, basics of magnetic circuit. **Single phaseTransformers: :** Constructional feature, Working Principle, EMF equation, Ideal transformer, Equivalent Circuit, Phasor diagram , Definition of voltage regulation and efficiency, Introduction to Auto-Transformer.	13
III	**Rotating Electrical Machines**: Introduction to Electromechanical Energy Conversion. DC Machine: Construction, Operating principle, Need of Starter, EMF Equation, Types of DC Motor, Torque Equation, Characteristics and applications. Induction motor: 3-phase: Construction & Principle, Need of Starter, Torque Equation, Torque-slip Characteristics. Single Phase Induction motor: Principle and Starting methods. Synchronous Motor:Operating principle and applications. **Electrical Installation and Illumination:** Introduction to distribution of electrical energy, Types of cables & switches, Electrical wiring. Fluorescent sodium vapour and mercury lamp.	14

Text Books:

- D.C. Kulshrestha, "Basic Electrical Engineering", Tata McGraw Hill.

Reference Books:

- T.K. Nagsarkar&M.S.Sukhija, "Basic Electrical Engineering", Edition 2008, Oxford University Press.
- H. Cotton, "Advanced Electrical Technology", 2nd Edition 2009, Wheeler Publishing.
- I. J. Nagarath, "Basic Electrical Engineering", 2nd Edition, Tata McGraw Hill.
- D. E. Fitzgerald & A. Grabel Higginbotham, "Basic Electrical Engineering", 5th Edition, McGraw Hill.
- Edward Hughes, "Electrical Technology", 3rd Edition, Pearson Education.

Outcome: *After completion of course, students will be able to:*

- *Understand the basic concepts of magnetic, DC & AC circuits.*
- *Explain the working principle, construction, applications of DC & AC machines.*
- *Gain basic knowledge about the switches, cables, wirings and lamps.*

BEC G0001: ELECTRONICS ENGINEERING

Objective: *The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering.*

Credits: 04 **Semester I/II** **L–T–P: 3–1–0**

Module No.	Contents	Teaching Hours
I	**Transport phenomenon in semiconductors:** Semiconductor materials; Intrinsic and Extrinsic semiconductors; Mass-action law, Drift and diffusion of charge carriers. **Junction diodes:** P-N Junction diode: construction, operation & characteristics; Zener and Avalanche breakdown mechanisms; Diode resistance and capacitance; Photo-diode and LED. **Diode applications:** Rectifiers: half wave, full wave : Centre-tapped and bridge type.; Filters; Clippers; Clampers; Voltage Multipliers; Zener diode as voltage regulator; Regulated power supply.	14
II	**Bipolar Junction Transistor (BJT):** Bipolar junction transistor: construction & operation; CB ,CE, CC configurations & their Characteristics; Operating point; Transistor as a switch; Need of biasing; Biasing methods: fixed bias, emitter bias, potential divider bias, voltage feedback bias; Bias stabilization; Stability factor; h-parameters; Small signal analysis of Single stage BJT amplifier. **Field Effect Transistor (FET):** Construction, operation & characteristics of JFET; Shockley's equation; Depletion& Enhancement type MOSFET; Biasing of JFET:-fixed bias, self-bias and voltage divider bias; Biasing of depletion type & enhancement type MOSFET.	14
III	**Digital Electronics:** Number systems; Binary Addition & Subtraction;1's and 2's complement , Subtraction using 2's complement; Boolean algebra; Logic gates; Implementation of basic gates using universal gates; Realization of Boolean functions using basic & universal gates; Canonical forms(SOP & POS); Simplification of Boolean functions using Boolean postulates & K-map up to 4 variables with don't care condition. **Operational Amplifier (Op-Amp):** Operational amplifier: Block diagram, ideal and practical Op-Amp characteristics; Inverting, non-inverting and differential configurations (open loop and closed loop); Applications of Op-Amp as buffer, adder, subtractor, integrator and differentiator.	13

Text Book:

- Robert L. Boylestad and Louis nashel sky, "*Electronic devices and circuit theory*", Pearson Education/PHI, New Delhi.

Reference Books:

- Morris Mano, "*Digital design*", Pearson Education.
- R.A. Gayakwad, "*Op-amps & linear Integrated circuits*", PHI.
- R.J. Smith and R.C. Dorf, Circuits, "*Devices and System,*" Willey, 5th edition.
- Jacob Millman and Christos C. Halkias, "*Integrated Electronics*", TMH, New Delhi.
- H.S. Kalsi; "*Electronic Instrumentation*", TMH, New Delhi.

Outcome: *After completion of course, student will be able to:*

- *Explain the theory, construction, and operation of basic electronic devices.*
- *Use the basic electronic devices*

BEL H0001: ENGLISH LANGUAGE SKILLS FOR COMMUNICATION-I

Objective: *The core objective of this course is to equip the students with the essential knowledge of basic English grammar, common vocabulary, writing strategies and reading skills thereby enable them to read, write and speak English with considerable accuracy and confidence.*

Credits: 02 **Semester: I** **L–T–P: 2–0–0**

Module No.	Contents	Teaching Hours
I	**Parts of Speech:** Noun, kinds & usage Pronoun, kinds & usage Adjectives & their degrees **Articles:** Definite and Indefinite articles **Paragraph Writing:** Small paragraphs on given topics **Vocabulary**: Words of functional usage **Text:** 'The Eyes are Not Here' by Ruskin Bond	10
II	**Verb:** Main verbs & auxiliary verbs Forms of verbs Transitive and intransitive verbs **Modal auxiliaries** **Adverb:** Usage and positioning of adverb **Text:** 'After Twenty Years' by O' Henry	8
III	**Preposition** **Tenses and Usage:** Present, past and future **Correction of Errors:** Error correction on the topics covered in all the three modules **Reading Comprehension (Unseen)** **Text**: 'What We Must Learn from the West' by Narayana Murthy	8

Recommended Reading:
English Teacher by R.K. Narayan

References:
Course Handbook (Collection of Short Stories, One Act Play & Essays)
English Grammar in Use by Raymond Murphy, IV Edition, Cambridge University Press, UK
Living English Structure by W.S. Allen, Pearson India

Outcome: *After the completion of the course students will be able to:*

- *Write grammatically correct English while expressing themselves in textual answers and paragraph writing.*
- *Identify common English errors and correct them.*
- *Read to understand, evaluate, analyze and discuss through text and reading comprehension.*
- *Communicate well with others in correct English.*

BEL H0801: ENGLISH LANGUAGE LAB-I

Objective: *The objective of this course is to provide the learners with an opportunity to practice listening and speaking skills – the two most important aspects of language learning - enabling them to speak fluently and correctly using standard pronunciation. The course also aims at giving them a platform to practice language in various social and professional settings.*

Credit: 01 **Semester: I** **L–T–P: 0–0–2**

Module No.	Contents	Teaching Hours
I	**Audio Visual Material for Listening and Speaking** The Power of English: How English became a global language Entry level recording by students Sounds of English RP (Practice with IPA) Duncan's Speech **Speaking Activities:** Introduction of the Students Practicing pronunciation (with the help of dictionary) Describing objects Picture Analysis	10
II	**Audio Visual Material for Listening and Speaking:** 'Slow Poisoning of India': A documentary on Environmental issues Video clips from 'Water Horse' 'Enterprising India': Interview of Ratan Tata & Narayan Murthy **Speaking Activities:** Discussion on environmental issues Review of 'Water Horse' Role plays on real life situations: Focus on the use of verbs and adverbs	8
III	**Audio Visual Material for Listening and Speaking** Varieties of English (Indian, American and British): video clips of these varieties Narration in Present tense: (documentary on 'Holy Ganges') Narration in Past tense: 'Robin hood- II' Future Tense: Video on use of future tense Exit level recording **Speaking Activities** Describing places/ routine Story Narration/ Describing a past event Description of future plans/goals	9

Audio-Visual Material:

Raman, Meenakshi & Sangeeta Sharma, Technical Communication CD, Oxford University Press, New Delhi.
Material available in the Language Lab.

References:

Longman Dictionary of Contemporary English, Pearson Longman, England.
Norman Lewis, Word Power Made Easy, Goyal Publications & Distributers, Delhi.
Mohan, Krishan & N.P. Singh, Speaking English Effectively, Macmillan India Ltd., New Delhi
Cambridge English Pronouncing Dictionary by Daniel Jones

Outcome: *After the completion of the course students will be able to:*

- *Listen and understand English correctly.*
- *Acquire correct pronunciation.*
- *Improve their vocabulary.*
- *Enhance speaking skills, confidence and overcome hesitation in conversing in English.*

BME G0800: ENGINEERING WORKSHOP PRACTICE LAB

Objective: *The purpose of this lab is to enable the students to have the practical skills for basic workshop practices e.g. Marking out, drilling, turning, milling and grinding. The student will also have practical exposure to various welding and joining processes along with various moulds preparation for castings in Foundry shop.*

Credits: 01 **Semester I/II** **L–T–P: 0–0–2**

Module No.	Content	Lab Hours
I	**List of Experiments** • To study the working of basic machine tools like Lathe m/c, Shaper m/c, Drilling m/c and Grinding m/c. • To perform the following operations on Centre Lathe: • Turning, Step turning and Taper turning • Facing, Grooving and Knurling • To perform the operations of Marking, Filing and Sawing on the given metallic work-piece (M.S.) as per given dimensions. • To perform the operations of drilling of making the holes on the given metallic work-piece (M.S.) by use of Drilling machine. • To perform the operations of making external and internal threads by use of Tapes and Dies. • To develop the blank dimensions for the given product using development process. • To prepare a Funnel of required dimensions using joining processes. • To prepare Lap/Butt joint by an Electric Arc welding. • To prepare Lap/Butt joint by Gas welding. • To perform different operations in Carpentry shop such as cutting, planning and chiseling on the given wooden piece. • To prepare a joint (Lap/T) by using wooden specimen/piece. • To prepare a Sand mould for solid casting with the help of given pattern. • To prepare the mould for hollow casting with the help of pattern and core. • To prepare square bolt head by upsetting process in Black Smithy shop.	36

Outcome: *On successful completion of this lab, the students will be able to:*

- *Demonstrate an understanding of and comply with workshop safety regulations.*
- *Select and perform a range of machining operations to produce a given job.*
- *Identify and use marking out tools, hand-tools, and measuring equipments and to work to prescribed tolerances. Acquire knowledge of welding, joint design and the application of welding.*

BME G0801: ENGINEERING DRAWING

Objective: *To know about different types of lines & use of different types of pencils in an Engineering Drawing. To know about different types of projection. To know projection of points, straight lines, solids etc. To know development of different types of surfaces. To know about isometric projection. To know fundamentals of AUTO-CAD. Basics of dimensioning, Lettering& representation of lines.*

Credits: 01 **Semester I/II** **L–T–P: 0–0–2**

Module No.	Content	Lab Hours
I	**Introduction:** Introduction to drawing instruments, sheet layout, types of lines and their uses, lettering, types of dimensioning, application of symbols and conventions in drawing practice, geometrical construction. Concepts of scales in drawing and their types **Theory of projections:** Introduction of projections, Orthographic & Pictorial projection, **Orthographic projection:** Projection of points, lines, planes and solids. Section of solids, **Isometric projection:** Concepts of isometric and perspective views. Conversion of pictorial views to orthographic views and vice versa. Development of surfaces & Computer Aided Drawing using Auto CAD.	24

Text Books:

- Bhatt N.D., Panchal V.M., "Elementary Engineering Drawing", Charothar Publishing, Gujarat.
- Dhawan R.K.; "A Text book of Engineering Drawing", S. Chand.

Reference Books:

- Gopalkrishna K.R.; "Engg. Graphics"; Subhash Publishers, Bangalore.
- Trymbaka Murty. S; "Computer Aided Engineering Drawing"; T.K. International Publishing House Pvt. Ltd. New Delhi.
- Luzadder Warren J., Duff John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Practice-Hall of India Pvt. Ltd, New Delhi.
- Singh Ajit, "Machine Drawing" Tata McGraw Hill, New Delhi.

Outcome: *At the end of the course the student will be able to:*

- *Use common drafting tools to construct engineering drawings and apply dimensions on engineering drawings.*
- *Create, construct and Interpret views and sectional views and projections.*
- *Create isometric and oblique sketches and identify standard features Use SI units, and standards scales to produce engineering drawings.*
- *Produce engineering drawings using computer aided drafting (CAD) system to improve visualization skills.*

BPH S0801: ENGINEERING PHYSICS LAB

Objective: *14 no. of experiments based on theoretical aspects are set in laboratory to give B.Tech Students a sound practical knowledge in fundamental and applied physics.*

Credits: 01 **Semester I/II** **L–T–P: 0–0–2**

Any twelve experiments, at least five from each group

Module No.	Content	Lab Hours
I	**Group -A** • To determine the wavelength of monochromatic light by Newton's rings. • To determine the wavelength of monochromatic light with the help of Fresnel's biprism. • To determine the specific rotation of cane sugar solution using polarimeter. • To determine the wavelength of spectral lines using plane transmission /diffraction grating. • To determine the wave length of laser light by diffraction grating method. • To verify Stefan's law by electrical method. • To determine high resistance by leakage method using digital D.C. microvoltmeter. **Group – B** • To determine the specific resistance of the material of a given wire using Carey Foster's bridge. • To study the variation of magnetic field along the axis of current carrying circular coil and then to estimate the radius of the coil. • To calibrate the given ammeter by potentiometer. • To calibrate the given voltmeter by potentiometer. • To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor. • To determine the energy band gap of a given semiconductor material. • Measurement of resistivity of semiconductor by four probe method at different temperatures and determination of the band gap.	24

Outcome:

- B.Tech. Students learn about the applications of basic-laws, principles and concepts of Engineering Physics in the various fields of science and technology.
- Practical training of a student reinforces his/her theoretical knowledge adequately and make him confident in subject.

BCH S0801: ENGINEERING CHEMISTRY LAB

Objective: *The subject intends to provide understanding of the fundamental concepts of Chemistry with practical exposure applicable in Engineering Sciences thereby preparing the students for a rewarding career in science and technology.*

Credits: 01 **Semester I/II** **L–T–P: 0–0–2**

Module No.	Content	Lab Hours
I	• To prepare and standardize the solution of NaOH (N/10) against standard solution of Oxalic acid (N/5). • To determine the percentage of available chlorine in the given sample of bleaching powder by iodometric titration using starch as an internal indicator. • To determine the constituents and amount of alkalinity in the given water sample by titrating it against standard HCl solution (N/20) using phenolphthalein and methyl orange as an internal indicator. • To determine the ferrous content in the supplied sample of iron ore by titrimetric analysis against standard potassium dichromate(N/20) solution using potassium ferricyanide $K_3[Fe(CN)_6]$ as an external indicator. • To determine chloride ion content in a given water sample by argentometric method (Mohr's method) using K_2CrO_4 as an internal indicator. • To determine the temporary, permanent and total hardness of water in a given sample of water by • titrating it against standard EDTA solution (N/20) using eriochrome black – T as an internal indicator. • To determine the viscosity of an addition polymer solution (like polystyrene) with respect to water by using Ostwald viscometer. Viscosity of water is 0.0101 poise at 20°C. • To determine the % of moisture in a given sample of coal by proximate analysis. • To determine strength of given HCl solution by titrating it against N/5 NaOH solution by using pH meter. • To determine iron concentration in the given water sample by colorimetric method by using KSCN as a color developing agent and the measurement are carried out at λ_{max} 480nm. • To determine the free CO_2 in a given sample of water. • To determine iodine value of given oil sample. • Show that the hydrolysis of an ester in presence of an acid is an example of first order reaction.	26

Outcome:

- *Knowledge of Chemical Sciences for better appreciation of applications in engineering sciences.*
- *The student's ability to perform experiments, analyze and interpret the data of experiments will be enhanced.*

BCS C0800: COMPUTER PROGRAMMING LAB

Objective: *The objective is to provide a comprehensive study of the C programming language. It stress the strengths of C, which provide students with the means of writing efficient, maintainable, and portable code.*

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Lab Hours
I, II and III	• Mapping of flow chart, Algorithm, Language • Simple C-program execution • Programs based on various operators • Programs based on Decision and case Control Structure • Programs based on Loop Control Structure • Program based on special control statement ➢ break ➢ continue • Programs based on Array Insertion, Deletion, Linear Search & Bubble Sort • Programs based on String ➢ Length, Copy, Reverse, Concatenate, Compare with & without built-in functions • Programs based on Functions. • Programs based on Storage Class. • Programs based on Recursion. • Programs based on Preprocessor. • Programs based on Pointers • Programs based on array • Programs based on string • Programs based on call by value and call by reference • Programs based on Dynamic Memory Allocation • Programs based on User Defined Data types ➢ Structure and Union ➢ Enum and Typedef • Programs based on File handling ➢ Opening a file ➢ Reading, writing and appending a file ➢ Closing file ➢ Random Access to Files of Records • Programs based on Command Line Argument.	17 17 18

Reference Books:

- *Herbert Schildt , "C: The Complete Reference", 5th Edition, McGraw Hill Education*
- *K. N. King, "C Programming a Modern Approach", W. W. Norton, 2nd Edition, 2008.*
- *Kernighan and Ritche, "The C Programming Language", PHI, 2ndEdition, 2011.*
- *P. Dey and M. Ghosh, "Programming in C", Oxford University Press 2nd Edition, 2013.*

Outcome: *On Completion of this course, students are able to:*

- *Write, compile and debug programs in C language.*
- *Use different data types in a computer program.*
- *Design programs involving decision structures, loops and functions.*
- *Understand the concepts of functions, recursion, pointers and file handling.*
- *Write, compile and debug programs in C language.*
- *Use different data types in a computer program.*
- *Design programs involving structures, union and functions.*

BEE G0800: ELECTRICAL ENGINEERING LAB

Objective: *To provide exposure to the students with hands on experience on basic Electrical & Electronics circuits.*

Credits: 01 **Semester: I/II** **L-T-P: 0-0-2**

Module	List of Experiments	Lab Hours
I,II & III	1. To verify the Thevenin's theorem (DC circuits). 2. To verify the maximum power transfer theorem (DC circuits). Also draw graph between power and load resistance. 3. To study the phenomenon of resonance in series R-L-C circuit and also draw the graph between frequency and current. 4. To determine the V-I characteristics of a semi-conductor diode. 5. To study the working of a Half-Wave & Full Wave (Bridge type) rectifier and determine the ripple factor for both cases. 6. To determine the efficiency of a single phase transformer by direct load testing. 7. To study the application of CRO i.e. (current measurement, voltage measurement and frequency measurement). 8. To study and calibrate single phase (induction type) energy meter and also compare it with digital meter. 9. To study various logic gates such as OR, AND, NOT, NAND, NOR. 10. To verify the Superposition Theorem (DC circuits).	24

Outcome: *At the end of the course students will be able*

1. *To construct basic circuits.*
2. *To construct circuits on a breadboard.*
3. *To measure the various electrical quantities(like voltage, current, frequency and power)*
4. *To measure resistance using DMM*
5. *To measure energy using single-phase energy meter.*
6. *To understand working of 1-phase transformer.*
7. *To write satisfactory laboratory reports.*

BME G0802: APPLIED MECHANICS LAB

Objective: *The Applied Mechanics Laboratory to plan to provide the students the opportunity to perform experiments and understand the application of theory covered in course on mechanics. It investigates the concepts of Newtonian (classical) mechanics through weekly hands-on experiments, emphasizing connections between theoretical principles and practical applications in engineering. In addition to furthering their understanding about the workings of the physical world, students will improve their skills at conducting experiments, obtaining reliable data, presenting numerical results, and extracting meaningful information from such numbers.*

Credits: 01 **Semester I/II** **L–T–P: 0–0–2**

Module No.	Content	Lab Hours
I	**List of Experiments** • Study of functioning of gear trains. • Deflection of simply supported beam and verification of theoretical values. • To determine the modulus of rigidity of rod with the help of torsion testing machine. • To study functioning of belt pulley systems. • To find the mechanical advantages, velocity ratio and efficiency of worm and worm wheel. • To find the coefficient of friction between the surface of a given wood slide bar and an inclined plane. • To find the coefficient of friction between belt and pulley using belt pulley system. • To find reaction at the supports of a simply supported beam with different types of loading. • To find moment of inertia of a fly wheel about the axis of rotation using electronic counter machine. • To find centre of gravity of different geometrical objects. • To find forces in members of a truss for different load conditions. • To study conversion of momentum. • To verify the law of conservation of energy. • To verify law of polygon of forces. • To verify law of parallelogram of forces. • Demonstration for centrifugal forces.	24

Outcome: *At the end of the course the student will be able to:*

- *Know the practical skills to analyze the forces, moments, and their equilibrium.*
- *Know the practical skills to analyze the effect of friction.*
- *Develop basic know how and awareness to deal with practical aspects of applied mechanics.*

BMA S0102: ENGINEERING MATHEMATICS II

Course Objectives: To make the students understand the concepts of integral calculus, convergence of infinite series, vectors and partial differential equations by giving more emphasis to their applications in engineering.

Credits: 04 **Semester II** **L–T–P: 3–1–0**

Module No.	Contents	Teaching Hours (Approx.)
I	**Convergence of Infinite Series:** Introduction, Limit u_n test, Leibnitz test, Comparison and p-series test, Cauchy's root test, Ratio test, Raabe's and Logarithmic tests, De Morgan & Bertrand's test, Special logarithmic test (without proofs). **Beta and Gamma Functions:** Transformations, Relation between Beta & Gamma functions, Duplication formula (without proof), Applications in solving definite integrals.	13
II	**Multiple Integrals:** Double and Triple integrals, Change of order of integration, Applications to area and volume, Change of variables, Dirichlet integral and its applications. **Vector Calculus I**: Introduction, Scalar and Vector point functions, Gradient, Divergence and Curl.	13
III	**Vector Calculus II**: Vector identities, Line, Surface and Volume integrals, Work done by a force, Green's theorem, Gauss' divergence theorem & Stoke's theorem (without proof). **Partial Differential Equations (PDEs)**: Introduction, I order Lagrange's linear PDEs, n^{th} order linear PDEs.	14

Learning Outcomes:

After studying these topics, the student will be able to

- Apply different tests for determining convergence of an infinite series
- Evaluate double and triple integrals and study their applications
- Find the gradient of a scalar field and divergence, curl of a vector field
- Understand various integral theorems related to line, surface and volume integrals
- Solve partial differential equations of first and higher orders

Text Books:

- M. Goyal and N. P. Bali, A Text Book of Engineering Mathematics, Laxmi Publication, Delhi, 2014.
- M. K. Jain, S. R. K. Iyengar and R. K. Jain, Advanced Engineering Mathematics, Narosa Publishing House, Delhi, 2002.
- H. Kishan, Sure Success in Convergence, Atlantic Publishers & Dist., Delhi, 2005.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 2014.

Reference Books:

- T. M. Apostol, Calculus, Volume I , John Wiley& Sons, Inc. , USA, 1967.
- T. M. Apostol, Calculus, Volume II , Xerox Corporation, USA, 1969.
- G. B. Thomas and R. Finney, Calculus & Analytic Geometry, Addison Wesley, USA, 1995.

BCSG0001: PYTHON PROGRAMMING

Objective: *This course introduces the solving of mathematical problems using Python programming using OO concepts and its connectivity with database.*

Credits: 05 **L-T-P-J:4-1-0-0**

Module No.	Content	Teaching Hours
I	Introduction to Python: Introduction and Basics; Setting up path Python Data Variables & Operators: Data Variables and its types, id() and type() functions, Coding Standards; **Control Structures:** if-else, elif, Nested if, Iteration Control structures, Break, Continue & Pass; **String Manipulation:** Accessing Strings, Basic Operations, String slices, Function and Methods. **Lists:** Introduction, Accessing list, Operations, Working with lists, Function and Methods.	14
II	**Tuple:** Introduction, accessing tuples, Operations, Working, Functions and Methods. **Dictionaries:** Introduction, accessing values in dictionaries, Working with dictionaries, Properties, Functions. **Functions:** Defining & Calling a function, Passing arguments to functions – Mutable & Immutable Data Types, Different types of arguments, Recursion, Scope of variables; **Modules and Packages:** User-defined modules and Standard Library: random, numpy, scipy, sys, Math Module, String Module, List Module, Date & Time Module, Regular Expressions: match, search, replace;	14
III	**Input-Output:** Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions. **Exception Handling:** Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions. Basics of Python for Data Analysis, Introduction to series and dataframes & Python using Pandas.	14

Text Books:

- *Paul Barry: "Head First Python "O'Reilly Media, Inc.", 2010.*

Reference Books:

- *Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.*

Outcome: *After completion of course, the student will be able to:*

- *Understand to solve problems with smaller Lines of Code using Python as compared to other programming languages*
- *Use OO concepts while programming in Python*
- *Use in-built packages defined in Python*
- *Work with Python using GUI*

BCSG0800: PYTHON PROGRAMMING LAB

Objective: *This course introduces the solving of problems using Python programming using OO concepts and its connectivity with database.*

Credits:01 **L-T-P-J:0-0-2-0**

Module No.	Content	Lab Hours
I, II and III	Programs based on the concepts of: • Building Python Modules • Obtaining user Data • Printing desired output Programs based on the concepts of: • Conditional if statements • Nested if statements • Using else if and elif Programs based on the concepts of Iteration using different kinds of loops Usage of Data Structures • Strings • Lists • Tuples • Sets • Dictionary Program based on the concepts of User-defined modules and Standard Library (random, numpy, scipy, sys, Math Module, String Module, List Module). Program based on Input Output. Program based on exception Handling. Program based on Simple Data analysis. Program based on Pandas.	26

Text Books:

- *Paul Barry: "Head First Python "O'Reilly Media, Inc.", 2010.*

Reference Books:

- *Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.*

Outcome: *By the end of the course, students will learn to:*

- *solve problems with smaller Lines of Code using Python*
- *use OO concepts while programming in Python*
- *use in-built packages defined in Python*
- *use front-end as Python Programming to connect with any back-end*

BEL H0002: ENGLISH LANGUAGE SKILLS FOR COMMUNICATION-II

Objective: *The objective of this course is to enrich the comprehension skills of the students with a focus on essential nuances of English grammar, functional vocabulary and writing skills, in this manner, enable them to read, write and speak English correctly and effectively.*

Credits: 02 **Semester: II** **L–T–P: 2–0–0**

Module No.	Contents	Teaching Hours
I	**Functional Categories:** Subject, Object, Predicate **Sentence:** Types - simple, compound and complex sentences **Conjunctions** **Parallelism** **Vocabulary**: Words of Functional Usage **Text:** 'Science and Human Life' by JBS Haldane	10
II	**Word Formation:** Inflection, derivation, blending, compounding and clipping **Concord:** Subject-verb Agreement **Non-Finites:** Gerund, infinitives, participle **Text:** 'The Last Leaf' by O' Henry	8
III	**Punctuation** **Voice:** Active & Passive **Narration:** Direct & Indirect **Correction of Errors:** Correction of Errors on the topics covered in all the three modules **Reading comprehension (Unseen)** **Text**: 'A Brief History of the Future' by Stephen Hawkins	8

Recommended Reading:
Time Machine by H.G. Wells

References:
Course Handbook (Collection of Short Stories, One Act Play & Essays)
English Grammar in Use by Raymond Murphy, IV Edition, Cambridge University Press, UK
Making Sense of English by M. A. Yadugiri, Viva Books Pvt. Ltd., New Delhi
Living English Structure by W.S. Allen, Pearson India

Outcome: *After the completion of this course, the students will be able to:*

- *Use syntactically correct and effective English while writing textual answers or while expressing themselves elsewhere.*
- *Identify common English errors and correct them in speaking and writing.*
- *Develop their reading skills as well as understand, evaluate, analyze and discuss through textual reading and other reading materials.*
- *Express themselves in various fields in an effective and impressive manner.*

BEL H0802: ENGLISH LANGUAGE LAB II

Objective: *The objective of this course is to give students exposure of listening and speaking English in various communicative contexts. The course will also provide them with an opportunity to form their opinion, develop their thinking skills, analyze their thoughts and express themselves in an effective way, honing their communicative skills in English.*

Credit: 01 **Semester: II** **L–T–P: 0–0–2**

Module No.	Content	Teaching Hours
I	**Audio Visual Material for Listening and Speaking:** TED Talk by Shashi Tharoor 'Freedom is Not Free' by Shiv Khera 'One Crime History': Animated video Group discussion: Videos on group discussion **Speaking Activities:** Process description Advertisement presentations by students Newspaper reading and discussion Group discussion practice	10
II	**Audio Visual Material for Listening and Speaking:** 'The thrilling potential of 6th sense technology' (TED) by Pranav Mistry 'India on four wheels': A BBC documentary Video clips from 'Movie 9' **Speaking Activities:** Describing concepts Discussion on problems of India Extempore	8
III	**Audio Visual Material for Listening and Speaking:** Women Empowerment: Speech by Hilary Clinton at UN council meet. 'Corporate Culture' by J. Wilkinson (TED X) on Corporate work culture Introduction to Stress Management' by Dr. LuAnn Helms Exit level recording by students **Speaking Activities:** Discussions on gender discrimination Presentations Coping with anger, stress and nervousness	9

Audio-Visual Material:

Raman, Meenakshi & Sangeeta Sharma, *Technical Communication CD,* Oxford University Press, New Delhi.
Material available in the Language Lab.

References:

Longman Dictionary of Contemporary English, Pearson Longman, England.
Norman Lewis, *Word Power Made Easy*, Goyal Publications & Distributers, Delhi.
Mohan, Krishan & N.P. Singh, *Speaking English Effectively*, Macmillan India Ltd., New Delhi
Cambridge English Pronouncing Dictionary by Daniel Jones

Outcome: *After the completion of the course students will be able to:*

- *Listen, understand and analyse a variety of speeches, documentaries and interviews.*
- *Express themselves with correct pronunciation and fluency.*
- *Use appropriate vocabulary and fluency.*
- *Enhance communication skills and personality.*
- *Participate in discussions on social and professional issues.*

BEC G0801: ELECTRONICS SIMULATION LAB

Objective: *To provide exposure to the students with hands on experience on basic Electrical & Electronics circuits.*

Credits: 01 **Semester: I/II** **L-T-P: 0-0-2**

Module	List of Experiments	Lab Hours
I,II & III	11. To verify the Thevenin's theorem (DC circuits). 12. To verify the maximum power transfer theorem (DC circuits). Also draw graph between power and load resistance. 13. To study the phenomenon of resonance in series R-L-C circuit and also draw the graph between frequency and current. 14. To determine the V-I characteristics of a semi-conductor diode. 15. To study the working of a Half-Wave & Full Wave (Bridge type) rectifier and determine the ripple factor for both cases. 16. To determine the efficiency of a single phase transformer by direct load testing. 17. To study the application of CRO i.e. (current measurement, voltage measurement and frequency measurement). 18. To study and calibrate single phase (induction type) energy meter and also compare it with digital meter. 19. To study various logic gates such as OR, AND, NOT, NAND, NOR. 20. To verify the Superposition Theorem (DC circuits).	24

Outcome: *At the end of the course students will be able*

1. *To construct basic circuits.*
2. *To construct circuits on a breadboard.*
3. *To measure the various electrical quantities (like voltage, current, frequency and power)*
4. *To measure resistance using DMM*
5. *To measure energy using single-phase energy meter.*
6. *To understand working of 1-phase transformer.*
7. *To write satisfactory laboratory reports.*