Mechanical Engineering

B.TECH | BRANCH CODE: 102 (ME) | SEMESTER 1, 2, 3 CURRICULUM

Academic Authority: Bihar Engineering University (BEU Patna) | **Branch Code:** 102 (ME)
Interactive Dashboard: beuvault.vercel.app/syllabus →

COURSE & CREDIT STRUCTURE OVERVIEW

#	Sem	Course Code	Course Title	Category	L-T-P-C
1	Sem 1	100101	Engineering Chemistry	Theory	3-0-0-3
2	Sem 1	100102	Engineering Mathematics–I	Theory	3-1-0-4
3	Sem 1	100103	Communicative English	Theory	3-0-0-3
4	Sem 1	100104	Engineering Graphics and Design	Theory	1-0-0-1
5	Sem 1	100106	Basic Electrical Engineering	Theory	3-0-0-3
6	Sem 1	100109P	Sports/Yoga/NCC/NSS	Lab	0-0-2-1
7	Sem 1	100101P	Engineering Chemistry Lab	Lab	0-0-2-1
8	Sem 1	100103P	Communicative English Lab	Lab	0-0-2-1
9	Sem 1	100104P	Engineering Graphics and Design Lab	Lab	0-0-4-2
10	Sem 1	100106P	Basic Electrical Engineering Lab	Lab	0-0-2-1
11	Sem 2	100201	Engineering Physics	Theory	3-0-0-3
12	Sem 2	100202	Engineering Mathematics–II	Theory	3-1-0-4
13	Sem 2	100203	Programming for Problem Solving	Theory	3-0-0-3
14	Sem 2	100206	Workshop Practices	Theory	2-0-0-2
15	Sem 2	100204	Elements of Mechanical Engineering	Theory	3-0-0-3
16	Sem 2	100214P	Swachh Bharat Mission	Lab	0-0-2-1
17	Sem 2	100201P	Engineering Physics Lab	Lab	0-0-2-1
18	Sem 2	100203P	Programming for Problem Solving Lab	Lab	0-0-2-1
19	Sem 2	100206P	Workshop Practices Lab	Lab	0-0-2-1
20	Sem 2	100204P	Elements of Mechanical Engineering Lab	Lab	0-0-2-1

Note: Visit **beuvault.vercel.app** → to access essential BEU college & academic tools — including interactive syllabus tracking, result analytics, UGEAC directory, and coding modules.

SEMESTER 1 — MECHANICAL ENGINEERING DETAILED SYLLABUS

100101 — Engineering Chemistry L-T-P-C: 3-0-0-3

• UNIT 1.0 - Atomic and Molecular Structure [8]

Electromagnetic radiations, Dual nature of electron and Heisenberg uncertainty Principle.
Photoelectric effect, Planck\'s theory. Principles for the combination of atomic orbitals to form a molecular diagram of molecular orbitals. Bent\'s rule, VSEPR theory (typical example) co- ordination numbers and geometries. Isomerism in transition metal compounds. Metal Carbonyls; Synthesis and Structure.

• UNIT 2.0 - Spectroscopy [6]

Principle of rotational and vibrational spectroscopy, selection rule for application in diatomic
molecules, elementary idea of electronic spectroscopy, UV-VIS spectroscopy with related to rules and its applications. Basic Principle of nuclear Magnetic resonance spectroscopy with applications.

• UNIT 3.0 -Electrochemistry and Fuels [6]

Nernst equation, EMF and electrochemical cell, the introduction of corrosion, corrosion
mechanism, types of corrosion, water line corrosion, stress corrosion, pitting corrosion, Lead acid storage cell, leclanche cell. Calorific value of fuels, proximate and ultimate analysis of coals, fuel cells, Bio fuels.

• UNIT 4.0 - Water Chemistry [8]

Hardness of water, estimation of water hardness by EDTA and Alkalinity method. Removal
of the hardness of water- soda lime process, zeolite process, Ion exchange process, Boiler problem, sludge, and scale formation, priming and foaming, Boiler corrosion, and Caustic embrittlement.

• UNIT 5.0 - Polymer and Plastics [8]

Polymerization techniques (free radical, ionic, and co-ordination mechanism)Preparation
properties, and technical application of phenol-formaldehyde resins, elastomers, synthetic rubbers (Buna-S, Buna-N, neoprene). Inorganic polymers, Silicones, adhesives, epoxy resins. the structural difference between thermoplastic and thermosetting Plastics, the Importance of commercially important thermoplastics and thermosets; Poly ethylene, Polyvinyl chloride, Polystyrene.

• UNIT 6.0 - Organic Reactions and Synthesis of A Drug Molecule [6]

Introduction to intermediate and reaction involving Substitution, addition, elimination,
oxidation-reduction. Diels Elder cyclization and epoxide ring opening reactions, synthesis of commonly used drug molecules like aspirin.

■ LABORATORY SYLLABUS: 100101P — Engineering Chemistry Lab

	Perform any 10 Experiments
Exp 1:	To estimate hardness of water by alkalinity method
Exp 2:	To estimate hardness of water by EDTA method
Exp 3:	To remove hardness of water by ion exchange method
Exp 4:	Determination of pH of a given acid solution using a standard sodium hydroxide solution
Exp 5:	Determination of surface tension and viscosity
Exp 6:	Chemical analysis of salt (Acid radical and basic radical)

Exp 7:	Adsorption of acetic acid by charcoal
Exp 8:	Test of adulteration of fat butter, sugar, turmeric powder, chilli powder and pepper
Exp 9:	Saponification/ acid value of an oil
Exp 10:	Identification of organic substances and their functional groups
Exp 11:	Potentiometric determination of redox potentials and emf
Exp 12:	Synthesis of drug/ polymer like ASPRIN/ Urea- formaldehyde resin
Exp 13:	Thin layer chromatography
Exp 14:	Analysis of flue gas by orsat apparatus

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. University Chemistry, B.H. Mahan,Pearson
• 2. Chemistry, principles and application, M.J. Sienko and R.A. Plane, McGraw Hill
• International
• 3. Fundamentals of molecular Spectroscopy, C.N. Banwell
• ,
• McGraw
• Hill
• International
• 4. Engineering Chemistry (NPTEL Web- Book), B.L. Tembe, Kamaluddin and M.S.
• Krishnan, NPTEL
• 5. Physical Chemistry, P.W. Atkins, Oxford University Press
• 6. A text book of engineering chemistry, S. Chawala, Dhanpat Rai Publication
• 7. General Chemistry Part 1, R. Sarkar, New Central Book agency

100102 — Engineering Mathematics–I

L-T-P-C: 3-1-0-4

• UNIT 1.0 Linear Algebra-I [7]

Elementary Row operations, Gauss -Jordan Method for finding the inverse of Matrix,

Complex Matrix : Hermitian , Skew Hermitian and Unitary Matrix, Vector space, Sub Spaces, Linear dependence and Independences of Vectors, Linear Span, Basis, Dimension, Extension of basis of subspace, The rank of a matrix, Row and column space, Solvability of system of linear equations.

• UNIT 2.0 Linear Algebra-II [7]

Linear Transformations, Kernel and Range of linear transformation, Matrix Representation of

a linear transformation, Rank-Nullity Theorem, Eigen Value and Eigen Vectors, Properties of Eigen vectors, Eigen Bases, Orthogonal Transformation, Similarity Transformation, Matrix Diagonalization, Cayley- Hamilton Theorem.

• UNIT 3.0 Calculus for single variable [7]

Inderminate form, L'Hospital Rule, Rolle's Theorem, Mean Value Theorem, Expansion of

function (single variable), Taylor and Maclaurin Series, Riemann Integration, Riemann Sum, Improper Integrals, Beta and Gamma function and their properties.

• UNIT 4.0 Multivariable Calculus (Differentiation) [7]

Function with two or more variable, Limit, continuity and Partial differentiation, Total

Differentiation Taylor's series and Maclaurin's series for function with two variable, Jacobian, Maxima and Minima, Method of Lagrange's multiplier.

• UNIT 5.0 Multivariable Calculus (Integration) [7]

Double Integral, change of order of integration, Triple integral, Change of Variable in a

Double and Triple Integrals, Change to polar coordinate, Change to cylindrical coordinate, Change to spherical polar coordinate, Application to area and volume using double and triple integral

• UNIT 6.0 Vector Calculus [7]

Scalar and vector fields, Gradient, Directional derivative, Divergence, Curl and their

properties, Line integral, Green's theorem in plane (without proof), Surface integral, Stoke's theorem (without proof), Volume Integral, Gauss-Divergence' theorem (without proof).

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. AICTE's Prescribed Textbook: Mathematics-I (Calculus & Linear Algebra), Reena
• Garg, Khanna Book Publishing Co. ISBN-10 9391505171
• 2. Advanced Engineering Mathematics, Chandrika Prasad & Reena Garg, Khanna Book
• Publishing Co., 2021. ISBN 10: 9386173522 / ISBN 13: 9789386173522.
• 3. Higher Engineering Mathematics, B.V. Ramana, Tata McGraw Hill New Delhi, 11th
• Reprint, 2010,ISBN-10 007063419X ISBN-13978- 0070634190.
• 4. Advanced Engineering Mathematics, Srklyengar Rk Jain,Narosa,5thEdition,ISBN-10
• 8184875606 ISBN-13978-8184875607
• 5. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley &
• Sons, 2006.

100103 — Communicative English L-T-P-C: 3-0-0-3

• UNIT 1.0 Vocabulary Building [7]

Nature of Word Formation; Root Word and Morpheme; Prefix and Suffix; Foreign

Expressions in English; Synonym and Antonym; Homophone and Homograph; Abbreviation and Acronym.

• UNIT 2.0 Basic Writing Skills [7]

Parts of Speech: Types of Words; Structures of Sentence; Kind of Sentence; Phrase and

Clause; Punctuation Marks; Capitalization; Tenses: Present, Past and Future; Voices: Active and Passive; Formation of Questions using Primary Auxiliaries, Modals and Wh-Words.

• UNIT 3.0 Common Errors in English [7]

Articles; Prepositions; Modifiers; Subject-Verb Agreement; Noun-Pronoun agreement;

Redundancies; Cliches; Spelling Error.

• UNIT 4.0 Principles of Appropriate Writi [7]

Defining: Describing, Classifying and Exemplifying; Introduction, Body, and Conclusion;

References, Quotations and Illustrations; Organizing the Paragraphs in a Document; 7Cs of the Professional Writing: Clear, Concise, Concrete, Correct, Coherent, Complete and Courteous.

• UNIT 5.0 Practices of Formal Writing [7]

Formal Letter: Cover-Letter and Application; Resume Writing; Report Writing; Minutes of

Meeting; Memorandum; Notice; Essay Writing: Personal and Impersonal; Email Writing Etiquettes; Article Writing; Writing for Current Social Media.

• UNIT 6.0 Comprehension of Written English [7]

Of Studies (Essay) by Sir Francis Bacon; The Sun Rising (Poem) by John Donne; The Last
Leaf (Story) by O Henry; Unseen/Untaught Passage.

■ LABORATORY SYLLABUS: 100103P — Communicative English Lab

Note:	Perform any 10 Experiments (Language Lab activities include Listening, Speaking, Reading & Phonetics)
Exp 1:	Listening Comprehension and Speed (Software)
Exp 2:	Reading Comprehension and Speed (Software)
Exp 3:	Pronunciation: Learning and Test (Software)
Exp 4:	Self-Introduction: Social, Academic and Professional
Exp 5:	English Typing: Microsoft Word Document (MS Word), and Microsoft Power Point Presentation (PPT)
Exp 6:	Oral Presentation
Exp 7:	Interview: Online and Offline
Exp 8:	Just A Minute Technique (JAM) and Extempore
Exp 9:	Debate
Exp 10:	Group Discussion
Exp 11:	Activities: Role Play, Peer Activities, and Group Activities
Exp 12:	Anchoring and Addressing: an Assembly, a Meeting, a Seminar, a Party

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. English language and communication skills for engineers, Sanjay Kumar,Pushp lata,
• Oxford university Press
• 2. Communicative English for Technical student, Dr. Bijay Bhadur Singh and Dr.
• Kalpana Sinha, Foundation publishing House (FPM)
• 3. Communication Skill (As per VRV syllabus 2018),Sanjay Kumar and Pushp lata,
• Oxford University Press
• 4. A course in Listening & Speaking, V. Sasi Kumar ,P. Kiranmai Dutt and Geetha
• Rajeevan, Foundation Books

100104 — Engineering Graphics and Design L-T-P-C: 1-0-0-1

• UNIT 1.0 Introduction to Engineering Drawing [7]

Principles of Engineering Graphics and Their Significance, Usage of Drawing Instruments,
Lettering, Conic Sections including the Rectangular Hyperbola (General Method Only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales Plain, Diagonal and Vernier Scales

• UNIT 2.0 Orthographic Projections [7]

Principles of Orthographic Projections - Conventions -Projections of Points and Lines
Inclined to Both Planes; Projections of Planes Inclined Planes Auxiliary Planes.

• UNIT 3.0 Projections of Regular Solids [7]

Types of Solids, Projects of Solids (Prism, pyramids, cone, and cylinder): Inclined to Both
the Planes- Auxiliary Views; Draw Simple Annotation, Dimensioning and Scale.

• UNIT 4.0 Sections and Sectional Views of Right Angular Solids [7]

Section of Solids (Prism, Cylinder, Pyramid, Cone), Auxiliary Views; Development of

Surfaces Of Right Regular Solids- Prism, Pyramid, Cylinder And Cone; Draw The Sectional Orthographic Views of Geometrical Solids, Objects From Industry And Dwellings (Foundation To Slab Only).

• UNIT 5.0 Isometric Projections [7]

Isometric Views, Compound Solids; Principles of Isometric Projection Isometric Scale,

Conventions; Isometric Views of Lines, Planes, Simple and Conversion of Isometric Views toOrthographic Views And Vice-Versa, Conventions.

• UNIT 6.0 Overview of Computer Graphics [7]

Listing the Computer Technologies that Impact on Graphical Communication, Demonstrating

Knowledge of the Theory of CAD Software [Such As: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify And Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog Boxes And Windows, Shortcut Menus (Button Bars), The Command Line (Where Applicable), The Status Bar, Different Methods of Zoom as Used in CAD, Select and Erase Objects.; Isometric Views of Lines, Planes, Simple And Compound Solids.

■ LABORATORY SYLLABUS: 100104P — Engineering Graphics and Design Lab

	Perform any 10 Experiments
Exp 1:	(Which includes dimensioning methods, different types of line, construction of different polygon, divide the line and angle in parts, use of stencil)
Exp 2:	Construction of Plane, Diagonal & Vernier Scales.
Exp 3:	Construction of Ellipses, Parabolas, and Hyperbolas using the general method.
Exp 4:	Construction of cycloid, epicycloid, hypocycloid, and involute of a circle.
Exp 5:	Projection of Points and Lines inclined to both planes.
Exp 6:	Projections of Planes (e.g., rectangular, triangular) in inclined positions.
Exp 7:	Projection of Solids (prisms,pyramids, cones, and cylinders)
Exp 8:	Drawing of Sections of Prisms, Cylinders, Pyramids, and Cones.
Exp 9:	Development of Surfaces for prisms, pyramids, cylinders, and cones.
Exp 10:	Construction of Isometric views of lines, planes, and simple solids.
Exp 11:	Introduction to CAD Software.
Exp 12:	Use of CAD software to draw basic geometric shapes, apply dimensions, and modify objects.

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Engineering Drawing, N.D. Bhatt, Charotar Publishing House, 53rd Edition, ISBN:
• 978-9380358277
• 2. A Textbook of Engineering Drawing, R.K. Dhawan, S. Chand Publishing, Revised
• Edition, ISBN: 978-8121929571
• 3. Engineering Drawing and Graphics, K. Venugopal, V. Prabhu Raja, New Age
• International Publishers, 3rd Edition, ISBN: 978-8122430120
• 4. Engineering Graphics with AutoCAD, D.M. Kulkarni, A.P. Rastogi, A.K. Sarkar, PHI
• Learning Pvt. Ltd., 1stEdition, ISBN: 978-8120337834

100106 — Basic Electrical Engineering L-T-P-C: 3-0-0-3

• UNIT 1.0 [8]

DC Circuit Analysis and Network Theorems: Concepts of Network, Active and Passive

elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements. R L and C as linear elements. Source Transformation. Kirchhoff's Law, loop and nodal methods of analysis; star – delta transformation; Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. (Simple Numerical Problems)

• UNIT 2.0 [5]

Magnetic Circuit: Magnetic circuit concepts, analogy between Electric & Magnetic circuits,

Magnetic circuits with DC and AC excitation, Magnetic leakage. B-H curve, Hysteresis and Eddy Current losses, Magnetic circuit calculations.

• UNIT 3.0 [8]

Steady State Analysis of Single-Phase AC Circuits: Sinusoidal, Square and Triangular

waveforms–average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel, and series – parallel RLC Circuits: Apparent, Active & Reactive Powers, Power factor, causes and problems of low power factor, power factor improvement. Resonance in Series and Parallel Circuits. (Simple Numerical Problems)

• UNIT 4.0 [5]

Three Phase AC Circuits: Three Phase System – its necessity and advantages, meaning of

phase sequence and star and delta connections, balanced supply and balanced load, line and phase voltage/ current relations, three phase power and its measurement. (Simple Numerical Problems)

• UNIT 5.0 [10]

Introduction to DC Machines:Principal, Operation, Construction, and types of DC machines,

e.m.f. equation of generator and torque equation of motor. Single Phase Transformer: Principle of Operation, Construction, e.m.f. equation, losses in transformer, efficiency. Three Phase Induction Motor:Principal, Operation, and Construction (Simple Numerical Problems)

• UNIT 6.0 [6]

Soldering- Soldering and desoldering techniques, breadboard wiring, general-purpose PCB

soldering/wiring. Wiring-Types of residential and commercial wiring systems, general rules and guidelines for installation, loadcalculation and sizing of wire, rating of main switch, distribution board.

■ LABORATORY SYLLABUS: 100106P — Basic Electrical Engineering Lab

	Perform all 10 Experiments
Exp 1:	Verification of Kirchhoff's laws.
Exp 2:	Verification of Superposition Theorem.
Exp 3:	Verification of Thevenin's Theorem.
Exp 4:	Verification of Norton's Theorem.
Exp 5:	Verification of Maximum Power Transfer Theorem.
Exp 6:	Measurement of power in 3 – Ø circuit by Two Watt meter method and determination of its power factor.

Exp 7:	Star to Delta and Delta to Star conversion of the three circuit.
Exp 8:	Determination of Efficiency by load test of a 1 – Ø Transformer.
Exp 9:	To study the typical BHK house wiring
Exp 10:	Study of safety precautions while working on electrical installations and necessity of earthing

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Basic Electrical Engineering, D.P.
• Kothari
• et
• al,McGraw-Hill
• Education
• 4th
• Edition,2019
• 2. Electrical and Electronic Technology Edward Hughes, 12th edition, 2016
• 3. Principles Electrical Engineering and Electronics, V.K Mehata, Rohit Mehta, S Chand
• and Company 2nd edition, 2015
• 4. Basic Electrical Engineering, J. B. Gupta, Katson Publication
• 5. A textbook of Electrical Technology B. L. Thereja, A. K. Thereja Vol. 1, 2, and 3 S
• Chand Publication

ADDITIONAL LABORATORY COURSES

100109P — Sports/Yoga/NCC/NSS (Credit: 0-0-2-1)

Course Objectives:	Fostering creativity, innovation, teamwork, and leadership among engineering undergraduates.
Pre-requisite:	Nil
Course Outcome	
Outcome 1:	Developed innovative projects: Students may have successfully developed innovative projects that demonstrate their creativity, problem-solving skills, and technical competence.
	These projects could be prototypes, models, simulations, or practical solutions to real-world problems, showcasing their ability to apply engineering concepts in a creative and innovative manner.
Outcome 2:	Improved critical thinking and problem-solving skills: Students may have honed their critical thinking and problem-solving skills through various course activities, such as brainstorming, design thinking, and project development.
	They may have learned to analyse complex problems, identify viable solutions, and make informed decisions based on technical, economic, and social considerations.
Outcome 3:	Enhanced project management and teamwork skills: Students may have gained practical experience in managing projects, including planning, scheduling, budgeting, and risk management. They may have learned how to work effectively in a team, collaborate with diverse team members, and communicate project progress and results professionally.
Outcome 4:	Increased interdisciplinary knowledge and collaboration: Students may have gained exposure to interdisciplinary concepts and collaborated with peers from different engineering disciplines.
	They may have learned to appreciate diverse perspectives, leverage interdisciplinary knowledge, and work collaboratively to develop innovative solutions that integrate multiple domains of engineering.

Outcome 5:	Cultivated a mindset of innovation and entrepreneurship: Students may have developed a mindset of innovation and entrepreneurship, recognizing the importance of creativity, adaptability, and continuous improvement in engineering practice.
	They may have learned to identify opportunities, think critically, and take risks to develop and implement innovative projects with commercial or societal potential.
List of Reports:	Any topics related to innovative project.

SEMESTER 2 — MECHANICAL ENGINEERING DETAILED SYLLABUS

100201 — Engineering Physics

L-T-P-C: 3-0-0-3

• UNIT 1.0

1. Frame of Reference [2 Hours]

Non-Inertial frame of reference, rotating coordinate system, centripetal and Coriolis acceleration and its application in weather system.

2. Oscillations [3 Hours]

Harmonic Oscillator, Damped Harmonic motion – overdamped, critically Damped and lightly damped oscillators, Force Oscillators and Resonance.

• UNIT 2.0

1. Optics [4 Hours]

Huygens's Principle, Superposition of Waves and interference of Light by wave front- splitting and amplitude-splitting; Young's double slit experiment, Michelson interferometer, Fraunhofer diffraction from single slit and circular aperture, Diffraction Grating and their resolving power

2. LASER

Einstein's theory of matter-radiations interaction, Einstein's Coefficients (A and B), Amplification by population inversion, Different types of lasers – Gas Laser, Helium-Neon Laser, Solid State Laser (Ruby, Neodymium), Semiconductor Laser.

• UNIT 3.0

1. Quantum Mechanics [5 Hours]

Compton Effect, Photoelectric Effect, Wave Particle duality, de Broglie's hypothesis, Heisenberg's Uncertainty Principle, Wave function and wave packets, phase and group velocities, Schrodinger's Wave Equation, Normalization, Expectation values, Eigenvalues and Eigenfunction.

2. Applications in One dimensions [2 Hours]

Application of Schrodinger Wave Equation for particle in one dimensional box – its wavefunction and eigenvalue of energy and momentum.

• UNIT 4.0

1. Vector Calculus [2 Hours]

Gradient, Divergence and Curl, Line, Surface and Volume integrals, Gauss's Divergence theorem and Stokes' theorem in Cartesian Coordinate.

2. Electrostatics [4 Hours]

Gauss's Law and its applications, Divergence and Curl of Electrostatic fields, Electrostatic Potential, Boundary Conditions, Poisson's and Laplace's equations, Dielectrics, Polarization, Bound Charges, Electric displacement, Boundary Conditions in dielectrics.

• UNIT 5.0

1. Magnetostatics [4 Hours]

Lorentz force, Biot-Savart and Ampere's circuital laws and their applications, Divergence and Curl of Magneto static fields, Magnetic vector potential, Force and torque on a magnetic dipole, Magnetic Materials, Magnetization, Bound currents, Boundary conditions.

2. Electrodynamics and Electromagnetic Waves

Ohm's law, Motional EMF, Faraday's Law, Lenz's law, Self and mutual inductance, Energy stored in magnetic field, Maxwell's equations in vacuum and nonconducting medium, Continuity Equation, Poynting Theorem, Wave Equations: plain electromagnetic wave in vacuum and their transverse nature and Polarization.

• UNIT 6.0

1. Introduction to Solids and Semi-Conductors [3 Hours]

Free electron theory of metal, fermi level, Bloch's theorem for particle in a periodic Potential, Kroning-Penney model and origin of energy band.

2. Electronic Materials

Metals, semiconductors and insulators, intrinsic and extrinsic semiconductors,Carrier transport, diffusion and drift, P-N junction.

■ LABORATORY SYLLABUS: 100201P — Engineering Physics Lab

	Perform any 10 Experiments
Exp 1:	Determination of the capacitance and permittivity of the given material.
Exp 2:	Determination of e/m of electron.
Exp 3:	Determination of Planck's constant and Photoelectric Work Function using Photoelectric cell.
Exp 4:	Verification of inverse square law using photocell.
Exp 5:	Determination of Wavelength of (He-Ne) LASER using Diffraction Grating Method.
Exp 6:	Calculation of Energy Band Gap of a semiconductor.
Exp 7:	Determination of Dielectric constant using resonance method.
Exp 8:	Determination of Wavelength of Sodium light by measuring the diameter of the Newton's Ring.
Exp 9:	Determination of curvature of convex surface of a lens by Newton's ring.
Exp 10:	Verification of existence of Bohr's Energy level with Frank-Hertz apparatus.
Exp 11:	Determination of the Earth's horizontal magnetic field intensity and magnetic Moment of a magnet by employing magnetometer.
Exp 12:	Verification of Faraday's Law and Lenz's Law of Electromagnetic Induction.

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, R. Eisberg R.
• Resnick, Wiley India Pvt. Ltd ISBN 978-81-265-0818-1
• 2. Theory of Vibration with Application, W.T. Thomson M. D. Dahleh, Pearson India
• ISBN 978-81-317-0482-0
• 3. Introduction to Electrodynamics, D.J. Griffiths, Pearson India, ISBN 978-93-325-
• 5044-5
• 4. Electromagnetism, I.S. Grant, W. R. Phillips, Wiley India Pvt. Ltd ISBN 978-04-719-
• 2712-9
• 5. The Feynman Lectures on Physics, R.P. Feynman R. B. Leighton, Pearson India
• ISBN 978-00-710-7458-2
• 6. Optics, Ajay Ghatak ,McGraw Hill ISBN 978-93-901-1359-0
• 7. Physics of Vibration and Waves, H. J. Pain, Wiley India Pvt. Ltd, ISBN 978-04-700-
• 1296-3
• 8. Concept of Modern Physics, Arthur Beiser, McGraw Hill ISBN 978-93-513-4185-7
• 9. Introduction to Solid State Physics, C. Kittle , Wiley India Pvt. Ltd, ISBN 978-81-
• 265-7843-6

100202 — Engineering Mathematics–II

L-T-P-C: 3-1-0-4

• UNIT 1.0 Complex Analysis – I [6]

Functions of complex variable, limit, Continuity, Differentiability, Analytic function,

Cauchy-Riemann Equations in Cartesian and polar form, harmonic function and harmonic conjugate.

• UNIT 2.0 Complex Analysis – II [8]

Line Integral, contour integrals, Cauchy theorem, Cauchy's Integral formula(without proof),

Taylors series, zero of analytic functions, singularities, Laurent's series, residue, Cauchy residue theorem(without Proof) and its applications.

• UNIT 3.0 Ordinary Differential Equations [8]

Linear differential equations of nth Order with constant coefficients, solution of

Homogeneous and Non-Homogeneous Equations, Equations with variable coefficients, Cauchy- Euler Equations, Method of Variation of Parameters.

• UNIT 4.0 Sequence and Series [6]

Introduction of Sequence and Series, Nature of series Tests of convergence of Series

Comparison test, D'Alembert ratio test, Cauchy's Root test, Raabe's test, Logarithmic test, Cauchy's condensation test.

• UNIT 5.0 Laplace Transform [8]

Laplace Transform, Existence theorem, properties of Laplace Transform, Laplace Transform

of Periodic functions, Inverse Laplace Transform, convolution theorem. Application of Laplace Transform to solve Ordinary differential equations.

• UNIT 6.0 Fourier Series [6]

Fourier Series, Fourier Series for odd and even functions, Half range sine and cosine series,

Parseval's theorem.

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Advanced Engineering Mathematics, Kreyszig Erwin, John Wiley and Sons,10th
• Edition,2020 ISBN:978-0470-45836-5
• 2. Advanced Engineering Mathematics, Dass H.K., S Chand and Company
• pvt.Ltd.,22nd Edition,2018 ISBN:978-93-5283-718-2
• 3. Higher Engineering Mathematics, Grewal B.S., Khanna Publishers,44th Edition,2023
• ISBN:9788174091154
• 4. Complex Variables (Theory and Applications), Kasana H.S., PHI,2nd Edition.2015
• ISBN:978-81-203-2641-5
• 5. A Text Book of Engineering Mathematics, Bali N.P., Goyal Manish Laxmi
• Publications,9th Edition,2014
• 6. Higher Engineering Mathematics, Ramana B.V., Tata McGraw Hill New Delhi, 11th
• Reprint, 2010, ISBN-10 007063419X ISBN-13
• 978- 0070634190
• 7. Differential Equations, Ross S.L.,Wiley Publications,3rd edition,2016 ISBN:978-81-
• 265—1537-0
• 8. Advanced Differential Equations, Raisinghania M.D., S.Chand and Company
• PVT.LTD.,18th Edition,2015 ISBN:978-81-219-0893-1
• 9. Schaum's Outlines Complex Variables, Spiegel Murray R, Lipschutz Seymour,
• Schiller J John and Spellman Dennis, MC Graw Hill Education Private Ltd.2nd
• Edition,2010 ISBN:978-0-07-008538-1

100203 — Programming for Problem Solving

L-T-P-C: 3-0-0-3

• UNIT 1.0

Introduction to Programming [6 Hours]

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

• UNIT 2.0

Operators, Conditional Branching and Loops [8 Hours]

Arithmetic expressions/arithmetic operators, relational operators, logical operators, bitwise operators and precedence. Writing and evaluation of conditionals and consequent branching, Iteration and loops.

• UNIT 3.0

Arrays and String [6 Hours]

Array declaration & initialization, bound checking arrays (1-d, 2-d), character arrays and strings.

• UNIT 4.0

Function, Recursion and Pointers [9 Hours]

Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Idea of pointers, Defining pointers, Use of Pointers in self- referential structures, idea of call by reference.

• UNIT 5.0

User defined Data Types and File handling [8 Hours]

Structure- defining, declaring, initializing; accessing structure members, processing of structure, array of structures, structures within structure, structure and function, type definition; Union— definition, declaration, accessing union members, initializing union. Introduction, file declaration, opening and closing a file, working with text and binary files, I/O operations on file, error handling,

random access to files

• UNIT 6.0

Basic Algorithms **[5 Hours]**

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

■ LABORATORY SYLLABUS: 100203P — Programming for Problem Solving Lab

	Perform any 10 Experiments
Exp 1:	Tutorial 1: Problem solving using computers: Lab1: Familiarization with programming environment
Exp 2:	Tutorial 2: Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions
Exp 3:	Tutorial 3: Branching and logical expressions: Lab 3: Problems involving if-then-else structures
Exp 4:	Tutorial 4: Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series
Exp 5:	Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation
Exp 6:	Tutorial 6: 2D arrays and Strings Lab 6: Matrix problems, String operations
Exp 7:	Tutorial 7: Functions, call by value: Lab 7: Simple functions
Exp 8:	Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Programming for solving Numerical methods problems
Exp 9:	Tutorial 10: Recursion, structure of recursive calls Lab 10: Recursive functions
Exp 10:	Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures
Exp 11:	Tutorial 12: File handling: Lab 12: File operations

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Programming in ANSI C 4th Ed,E Balagurusamy, McGraw Hill Education India
• Private Limited, ISBN-978-9339219666, 7th Edition
• 2. The C Programming Language 2e,W. Kernighan / Dennis Ritchie,Pearson Education
• India, 978-9332549449, 2nd Edition
• 3. Computer Fundamentals and Programming in C,ReemaThareja,Oxford University
• Press, ISBN- 978-9354977893, 3rd Edition

100206 — Workshop Practices L-T-P-C: 2-0-0-2

• UNIT 1.0

Sheet Metal Working **[6 Hours]**

Sheet material: GI sheets, aluminium, tin plate, copper, brass etc; Tools: steel rule, vernier callipers, micrometer, sheet metal gauge, scriber, divider, punches, chisels, hammers, snips, pliers, stakes etc.; operations: scribing, bending, shearing, punching etc; Product development: hexagonal box with cap, funnel etc.

• UNIT 2.0

Joining **[6 Hours]**

Classifications of joining processes; Brazing, Soldering, and Mechanical Joints, Arc welding, Gas welding etc.

• UNIT 3.0

Pattern Making and Foundry Practice [6 Hours]

Pattern material: wood, cast iron, brass, aluminium, waxes etc.; Types of patterns: split, single piece, match plate etc; Tools: cope, drag, core, core prints, shovel, riddle, rammer, trowel, slick, lifter, sprue pin, bellow, mallet, vent rod, furnace etc. Moulding sands: green sand, dry sand, loam sand, facing sand etc., Sand casting: Sand preparation, mould making, melting, pouring, and cleaning

• UNIT 4.0

Fitting Shop [10 Hours]

Introduction to Fitting; Fitting Tools: Files and their classification, Holding Tools, Cutting Tools, Measuring and Marking Tools, Thread Making Tools, Various Fitting Power Tools; Methods Of Filing: Cross Filling and Draw Filing, Other associated operations Marking. Sawing and Chipping; Safety and Precautions in Fitting Shop.

• UNIT 5.0

Carpentry Shop [7 Hours]

Introduction to Carpentry Shop; Types of Wood; Seasoning of Wood: Ty[es of Seasoning Methods; Defects in wood; Structure of Wood; Car[entry Tools; Measuring Tools, Marking Tools, Cutting Tools, Planning Tools, Drilling and Boring Tools, Holding Tools, Striking Tools, Auxiliary tools and materials used in Carpentry; Wood working Processes; Carpentry joints; wood Working Machines: Wood Working Lathe, Circular Saw, Thickness Planer, Band sawSafety and precautions in Carpentry Shop.

• UNIT 6.0

Smithy Shop [5 Hours]

Introduction to Smithy Sho; Forging Tools and Equipment; Forging Operations: Drawing, Upsetting, Swaging, Punching, Drifting, Fullering, Bending; Hot Working Processes: Rolling, Drop Forging, Press Forging, Hot Extrusion, Hot Drawing, Cold Working Process, Safety and Precautions in Smithy Shop.

■ LABORATORY SYLLABUS: 100206P — Workshop Practices Lab

	Perform all Experiments List of Practical
Exp 1:	Learn and apply of different fitting tools –like work holding, marking, measuring, cutting, finishing and miscellaneous. Student will also prepare the report with sketch, specifications and applications of fitting tools demonstrated.
Exp 2:	Prepare one simple and another male-female type fitting jobs as per given drawings- 2 jobs
Exp 3:	Learn and apply of different tin smithy tools. Student will also prepare the report with sketch, specifications and applications of tin smithy tools demonstrated.
Exp 4:	Learn and apply of welding equipments and making minimum one model.
Exp 5:	Learn and apply of foundry tools and making minimum one model.
Exp 6:	Learn and apply of carpentry tools and making minimum one model.
Exp 7:	Learn and apply of Sheet Metal tools and making minimum one model.
Exp 8:	Learn and apply of Lathe Tools & operations for making a job.
Exp 9:	Learn and apply the application of measuring tools.
Exp 10:	Learn and apply any casting process for making a model

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Hajra Choudhury S.K., Hajra Choudhury A.K. And Nirjhar Roy S.K., “ElementsOf
• Workshop Technology”, Vol. I 2008 And Vol. Ii 2010, Media PromotersAnd Publishers
• Private Limited, Mumbai.
• 2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering AndTechnology”, 4th
• Edition, Pearson Education India Edition, 2002.
• 3. Gowri P. Hariharan And A. Suresh Babu,”Manufacturing Technology – I”Pearson Education,
• 2008.
• 4. Roy A. Lindberg, “Processes And Materials Of Manufacture”, 4th Edition,Prentice Hall
• India, 1998.
• 5. Rao P.N., “Manufacturing Technology”, Vol. I And Vol. Ii, Tata McgrawhillHouse, 2017.

100204 — Elements of Mechanical Engineering L-T-P-C: 3-0-0-3

• UNIT 1.0 [6]

Energy Resources

Renewable or non-conventional sources of energy, their origin and various forms-solar, wind. Biogas and biomass energy, their merits & demerits, major applications-brief description Non-renewable or non-renewable or conventional sources of energy: the fossil fuel. Coal, petroleum and natural gas.

• UNIT 2.0 [4]

Review of Basic Concepts Of Thermodynamics

Thermodynamics system, properties, state, processes and cycles. Heat, work and internal energy.

• UNIT 3.0 [4]

Steam Generators

Types of boilers, water-tube and fire-tube boilers-their merits and demerits, boiler mountings and accessories-simple description.

• UNIT 4.0 [8]

Basic Concept of Refrigeration And Air Conditioning

Principles of working or vapour compression, vapour absorption and air refrigeration; principles of air conditioning systems.

• UNIT 5.0 [10]

Prime Movers

Simple steam turbine, gas-turbine, IC engines (SI and CI), their brief description and principles of working. Power Plant: principles of working of thermal, hydel and nuclear power plants, work output and efficiency.

• UNIT 6.0 [6]

Engineering Materials and Their Properties

Ferrous and non-ferrous metals: Mechanical properties e.g. strength, hardness, resilience etc. Heat Treatment of Steel: Annealing, tempering, quenching, case-hardening etc.

■ LABORATORY SYLLABUS: 100204P — Elements of Mechanical Engineering Lab

	Perform all Experiments
Exp 1:	Demonstrate & study of steam boilers and its mounting & accessories.
Exp 2:	Demonstrate & study the working of SI internal combustion Engines &its; components.
Exp 3:	To learn the mechanical properties of engineering materials.

Exp 4:	To learn the working of steam power plant.
Exp 5:	To learnt the working of vapour compression refrigeration system.
Exp 6:	To learn the working of impulse steam turbines.
Exp 7:	To study the working of gas turbines.
Exp 8:	To learn the working of reaction steam turbines
Exp 9:	To learnt the working of vapour absorption refrigeration system.
Exp 10:	Demonstrate & study the working of CI internal combustion Engines &its;

■ RECOMMENDED TEXTBOOKS & REFERENCES:

• 1. Basic Mechanical Engineering, By T J Prabhu,
• 2. Element of Mechanical engineering, J.K .Kitlur, G.D.Gokak
• 3. Basic Mechanical Engineering, By Sadhu singh,
• 4. Element of Mechanical engineering, S. N. Lal

ADDITIONAL LABORATORY COURSES

100214P — Swachh Bharat Mission (Credit: 0-0-2-1)

	0 02 1
Objectives	
Objective 1:	Understanding the importance of cleanliness and sanitation: The course could aim to create awareness about the significance of cleanliness and sanitation in maintaining personal health, environmental sustainability, and community well-being.
	It could cover topics such as waste management, sanitation practices, and the impact of poor sanitation on public health.
Objective 2:	Developing skills for effective waste management: The course could provide training on various waste management techniques, such as waste segregation, composting, recycling, and proper disposal of hazardous waste. It could also emphasize the importance of reducing waste generation and promoting sustainable waste management practices.
Objective 3:	Promoting behavioural change towards cleanliness: The course could focus on influencing positive behavioural change among individuals and communities towards cleanliness.
	It could include modules on promoting good hygiene practices, creating awareness about the harmful effects of littering and open defecation, and encouraging responsible waste disposal habits.
Objective 4:	Creating awareness about Swachh Bharat Mission initiatives: The course could provide information about the Swachh Bharat Mission initiatives and campaigns launched by the Government of India to promote cleanliness and sanitation, such as Swachh Survekshan, Swachh Bharat Abhiyan, and Clean India Campaign.
	It could also discuss the progress made, challenges faced, and future prospects of the Swachh Bharat Mission.
Objective 5:	Engaging in community participation and advocacy: The course could emphasize the importance of community participation in the Swachh Bharat Mission and provide tools and strategies for engaging with local communities to promote cleanliness and sanitation.

	It could also encourage advocacy for policy changes and innovations to address sanitation-related issues at the community, regional, and national levels.
Pre-requisite:	Nil
Course Outcome	
Outcome 1:	Increased awareness and knowledge about cleanliness and sanitation: Participants of the course may gain a deeper understanding of the importance of cleanliness and sanitation, including the impact on personal health, environmental sustainability, and community wellbeing.
	They may learn about various waste management techniques, hygiene practices, and the initiatives of the Swachh Bharat Mission.
Outcome 2:	Enhanced skills for effective waste management: Participants may acquire practical skills related to waste management, such as waste segregation, composting, recycling, and proper disposal of hazardous waste.
	They may also develop skills in reducing waste generation and promoting sustainable waste management practices in their communities or workplaces.
Outcome 3:	Positive behavioral change towards cleanliness: The course may influence participants to adopt positive behavioral changes towards cleanliness, such as avoiding littering, practicing good hygiene habits, and promoting responsible waste disposal.
	Participants may develop a sense of responsibility towards maintaining cleanliness in their surroundings and actively contribute towards creating a cleaner environment.
Outcome 4:	Increased community participation and advocacy: Participants may become actively engaged in community participation and advocacy efforts related to cleanliness and sanitation.
	They may collaborate with local communities, government bodies, and nongovernmental organizations (NGOs) to raise awareness, implement cleanliness initiatives, and advocate for policy changes or innovations to address sanitation-related issues.
Outcome 5:	Contribution towards Swachh Bharat Mission objectives: Participants may contribute towards the objectives of the Swachh Bharat Mission, such as promoting cleanliness, ensuring proper waste management, and eliminating open defecation.
	They may actively participate in Swachh Bharat Mission campaigns, initiatives, and activities, and make a positive impact on their communities and society at large.
List of Reports	
Report 1:	Any topics related to Swatch Bharat Mission

SEMESTER 3 — MECHANICAL ENGINEERING DETAILED SYLLABUS

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