Course Curriculum Structure and Syllabus
for
B. Tech Program
in
Production and Industrial Engineering
Semester I
Session: 2024-2025

Course Curriculum of B. Tech. in Production and Industrial Engineering

SEMESTER – I

Sl. No.	Course Code	Course Name	L	T	P	C
1	BSC 101	Engineering Mathematics-I	3	1	0	4
2	BSC 102	Engineering Physics	3	0	2	4
3	PCC 101	Basic Manufacturing Engineering I	3	0	0	3
4	ESC 101	Basics of Electrical and Electronics Engineering	3	0	2	4
5	ESC 102	Engineering Drawing and Computer Graphics	1	0	4	3
6	ESC 103	Workshop Practice	0	0	4	2
7	ESC 104	Design Thinking & Idea Lab	0	0	2	1
8	AU 101	Sports & Yoga or NSS/NCC (Audit)	0	0	2	0
	Total					**21**

*** Department offered a basic core course**

NOTE: Mandatory Vocational / Industrial Training (4 Weeks) for student opting for exit after first year with UG certificate

Detailed Syllabus

Course Code: BSC 101	**Category:** Basic Science Courses
Course Title: Engineering Mathematics – I	**Semester**: First
L-T-P: 3-1-0	**Credit: 4**

Engineering Mathematics – I

Unit 1

Matrices and Linear Algebra:

Elementary operations, Gauss Elimination, Rank of matrices: Echelon form, Normal form, Determinants, Consistency and solution of system of linear equations, Eigen values, Eigen vectors, Caylay-Hamilton theorem. Vector space, subspace, linearly independent and dependent of vectors. Basis and Dimensions, Rank-Nullity theorem. S: Basic properties of matrices, Elementary transformation, Determinants.

Unit 2

Differential Calculus:

Expansions of function of one variable using Taylor's and Maclaurin's series, Asymptotes, Curve tracing, Limit and continuity of two variables, Partial and Total derivatives, chain rule, Jacobian, Taylor's theorem, Maxima and minima of two variables, Method of Lagrange's multipliers. S: Higher order derivatives, Limit and continuity of two variables, Jacobian.

Unit 3

Integral Calculus:

Beta and Gamma function, Evaluation of Double integrals in Cartesian and Polar co-ordinates, Change of order of integration, Evaluation of Triple integrals in Cartesian, Spherical and Cylindrical co-ordinates, Change of Variables, Applications to Area, Volume, surface area and Center of Mass. Vector differentiation, Gradient, Divergence and Curl, Line Integrals and Arc Length Parameterization, Surface Integral, Volume Integral, Path independence, Statements and illustrations of theorems of Green, Stokes and Gauss, applications. S: Beta and Gamma function, Area, Volume, Surface area.

Textbooks:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley Eastern Ltd.

Reference Books:

1. Serge Lang, "Linear Algebra" Springer , 3rd edition
2. Gilbert Strang," Linear Algebra and its applications", Cengage Learnings RS, 4th edition
3. Howard Anton and Chris Rorres ,"Elementary Linear Algebra ",John Wiley, and sons, 10th edition
4. K. D. Joshi , "Calculus for Scientists and Engineers" , CRC Press
5. Sudhir Ghorpade and Balmohan Limaye , "A course in Calculus and Real Analysis"1st edition, Springer-Verlag, New York.

Course Code: BSC 101	**Category:** Basic Science Courses
Course Title: Engineering Physics	**Semester**: First
L-T-P: 3-0-2	**Credit:** 4

Engineering Physics

Unit 1 **(8L)**

Quantum Mechanics: Matter waves, Properties of matter waves, Physical significance of wave function. Schrödinger's time dependent and time independent equatiom, Operators, Eigen values and Eigen functions, Expectation values, Applications of Schrödinger's equation, Motion of a free particle. Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box)

Unit 2 **(7 L)**

Solid State Physics: Lattice parameters, Miller indices, inter planer distance of lattice plane, density of crystals (linear, planar and volume), Sommerfield's free electron theory. Density of states (3D), Fermi-Dirac probability function, Nearly free electron theory (E-k curve), classification of solids based on band theory

Unit 3 **(8 L)**

Semiconductor Physies: Electron and hole concentrations in semiconductors intrinsic density, intrinsic and Extrinsic conductivity, Position of Fermi level in intrinsic and extrinsic semiconductors, Law of mass action, Temperature variation of carrier concentration in extrinsic semiconductors, Electrical conduction in extrinsic semiconductor. Hall Effect.

Unit 4 **(7L)**

Laser Physics: Introduction to laser, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping). Optical resonator. Laser beam characteristics. Ruby laser, Nd-YAG Laser, He-Ne Laser, Semiconductor Laser, Engineering applications of Laser (Fiber optics, Laser material interaction)

Learning resources:

1. Introduction to quantum mechanics/ David J. Griffiths
2. A text book of Engineering physics, Avadhanulu and Kshirsagar, S. Chand Pub
3. Concepts of Modern Physics, Arthur Beiser, Tata McGraw-Hill Edition.
4. Introduction to Solid State Physics, Charles Kittel, Wiley
5. Solid State Physics, S O Pillai, New Age International Publishers
6. Solid state electronic devices. Ben G. Streetman. Sanjay Banerjee Pearson Prentice Hall , Macmillan India Ltd
7. LASERS Theory and Applications, K. Thyagarajan, A. K. Ghatak 8. Mechanical Vibrations Theory and Applications, Francis S Tse, Ivan E Morse, Rolland T. Hinkle

Course Code: BSC 102	**Category :** Basic Science Courses
Course Title: Engineering Physics Laboratory	**Semester** : First
L-T-P : 0-0-2	**Credit:** 1

Engineering Physics Laboratory

List of Experiments:

1. Frank-Hertz Experiment
2. Planck's Constant
3. To determine the wavelengths of light of a given source using diffraction grating
4. Band gap of a semiconductor by four probe method
5. Hall effect in Semiconductor
6. Magnetoresistance measurement of semiconductor
7. To determine the reverse saturation current and material constant of PN Junction
8. To determine the dielectric constant of material
9. Study of Biot-Savart’s law
10. Measurement of magnetic susceptibility by Quinke’s method

Course Code: PCC 101	**Category:** Professional Core Courses
Course Title: Basic Manufacturing Engineering I	**Semester:** First
L-T-P: 3-0-0	**Credit:** 3

Basics of Manufacturing Engineering - I

Introduction – 2L

Classification of different manufacturing processes, application areas and limitations, selection of a manufacturing process.

Introduction to Casting – 5L

Steps involved in casting, advantages, limitations and applications of casting process. Pattern types, pattern, materials color coding and storing of patterns.

Introduction to Moulding methods – 5L

Types of Mould and green sand mould, preparation of mould, equipment, moulding sand ingredients, essential requirements, sand preparation and control, testing, cores and cores making. Sand castings.

Introduction to Metal Forming Technology – 14L

Introduction to deformation; Introduction to various forming operation rolling, forging, drawing, deep drawing, bending, extrusion and punching and blanking.

Introduction to Welding– 10L

Introduction to welding, types of welding, classification of different types of welding. Introduction to various welding process and equipment.

Learning Resources:

1. Manufacturing Science by Ghosh and Mallik, East West Press Pvt. Ltd., New Delhi
2. Fundamentals of Modern Manufacturing by M. P. Groover, John Wiley and Sons, New Delhi
3. Fundamentals of Metal Forming Processes by B. L. Juneja, New Age International Ltd., New Delhi
4. Manufacturing Engineering and Technology by Kalpakjian and Schmid, Pearson Education Pvt. Ltd. New Delhi
5. Lindberg R.A., "Processes and Materials of Manufacture", Prentice-Hall of India, 1990.
6. Groover M.P., "Fundamentals of Modern Manufacturing", John Wiley & Sons 2002.
7. DeGarmo E.P., Black J.T., and Kohser R.A., "Materials and Processes in Manufacturing", Prentice-Hall of India, 1997.
8. Richard, A., Little., Welding and Welding Technology, Tata McGraw Hill, 2001.
9. Heine, R., and Rosenthal, P., Principles of Metal Casting, Tata McGraw Hill, 1985.

Course Code: ESC 101	**Category:** Engineering Science Course
Course Title: Basics of Electrical and Electronics Engg	**Semester:** First
L-T-P: 3-0-0	**Credit:** 3

Basics of Electrical and Electronics Engineering

Unit 1

DC Circuits: Electrical circuit elements (R, L, and C), voltage and current sources, Kirchhoff s laws, analysis of simple DC circuits: Superposition, Thevenin and Norton theorems, Maximum Power Transfer theorem, Star-Delta transformation

Unit 2

AC Circuits:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections, three-phase power.

Unit 3

Magnetic Circuits and Transformers: Magnetic materials, B-H curve, hysteresis loop, series and parallel magnetic circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation, and efficiency. Autotransformer and three-phase transformer connections

Unit 4

Semiconductor Diode: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche).

Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator.

Bipolar Junction Transistors: PNP and NPN structures, Principle of operation, relation between current gains in CE, CB and CC, input and output characteristics of common emitter configuration.

Unit 5

Digital System and Binary Numbers: Number System and its arithmetic Signed binary numbers, Logic simplification and combinational logic design: Binary codes, code conversion, review of Boolean algebra. **Logic Gates:** Different types of gate and truth table, adder and subtractor using logic gates. Introduction to Operational Amplifiers.

Text Books:

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
4. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.

Reference Books:

1. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education.
2. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford Higher Education.

Course Code: ESC 101	**Category:** Engineering Science course
Course Title: Basics of Electrical and Electronics Engg. Laboratory	**Semester**: First
L-T-P: 0-0-2	**Credit:** 1

Basics of Electrical and Electronics Engineering Laboratory

List of the Experiment (Any Ten)

1. Overview of the Basic Electrical Engineering Lab and safety precautions.

2.To verify Network Theorems: KCL & KVL.

3.To connect a simple DC circuit with two loops and more than one source to measure all the branch currents. (Superposition Theorems)

4.To verify Thevenin's and Norton's Theorems.

5.To verify the maximum power transfer in Electrical Network.

6.To measure voltage, current, and power in the R-L, R-C and R-L-C series circuits and observe the phase difference between voltage and current using CRO.

7.Identification and testing of PN- Junction Diode, Zener diode, **LED,** Photo Diode, Photo Transistor.

8.Measurement of Voltage and Current using Multimeter, and the Frequency and Amplitude of a signal with the help of CRO and Function Generator.

9. To study PN-Junction Diode's and Zener Diode's I-V Characteristics.

10. Assemble the Single phase Half Wave and Full Wave Bride Rectifier (only study of Waveforms).

11. Measurement & study of Input and Output Characteristics of a BJT in CE Configuration.

12. Analyze the Truth Table of Basic Digital Electronics Logic GATES

13. Verify the basic Laws of Boolean Algebra.

Course Code: ESC 102	**Category:** Engineering Science course
Course Title: Engineering Graphics and Computer Aided Engineering Graphics	**Semester**: First
L-T-P: 1-0-4	**Credit:** 3

Engineering Graphics and Computer Aided Engineering Graphics

Introduction to Engineering Drawing
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.
Lettering, Dimensioning, Scales
Plain scale, Diagonal scale and Vernier Scales.
Geometrical Construction and Curves
Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.
Projection of Points, Lines, Surfaces
Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes- Auxiliary Planes.
Projection of Regular Solids
Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).
Combination of Regular Solids, Floor Plans
Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
Isometric Projections
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
Sections and Sectional Views of Right Angular 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)
Overview of Computer Graphics, Customisation & Cad Drawing
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

Course Code: ESC 103	**Category:** Engineering Science course
Course Title: Workshop Practice	**Semester**: First
L-T-P: 0-0-4	**Credit:** 2

Workshop Practice

Detailed contents:

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. CNC machining, Additive manufacturing
3. Fitting operations & power tools
4. Electrical &Electronics
5. Carpentry
6. Plastic moulding, glass cutting
7. Metal casting
8. Welding (arc welding & gas welding), brazing

Workshop Practice:

Machine shop

Typical jobs that may be made in this practice module:

To make a pin from a mild steel rod in a lathe.

To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Fitting shop

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry

Typical jobs that may be made in this practice module:

To make wooden joints and/or a pattern or like.

Welding shop

Typical jobs that may be made in this practice module:

ARC WELDING: To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING: To join two thin mild steel plates or sheets by gas welding.

Foundry shop

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy shop

Typical jobs that may be made in this practice module:

A simple job of making a square rod from a round bar orlike.

Plastic moulding & Glass cutting Shop

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made. For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Course Code: ESC 104	**Category:** Engineering Science course
Course Title: Design Thinking & Idea Lab	**Semester**: First
L-T-P : 1-1-0	**Credit: 1**

Design Thinking & Idea Lab

Lab1: Introduction to design thinking
Lab 2: Empathy and User centred design
Lab 3: Definition of Problems
Lab 4: Ideation technique
Lab 5: Prototyping and rapid prototyping
Lab 6: Testing and Iteration
Lab 7: Industry 4.0 and Smart Manufacturing
Lab 8 and 9: AI and Innovation
Lab 10: Ethics and Innovation
Lab 11: Final Project
Lab 12: Final project presentation

Sports & Yoga or NSS/NCC: AU 01 (Audit)