Semester I

Theory/ Practical	Sl No	Course Type	Course Code	Course Name	Hours per week			Credit	Marks	
					L	T	P	C	CA	ESA
T	1.	BSC	BPY23111T	Physics	3	1	0	4	40	60
P	2.	BSC	BPY23111P	Physics Laboratory	0	0	2	1	20	30
T	3.	BSC	BMA23111T	Mathematics - I	3	1	0	4	40	60
T	4.	BSC	BBI23201T	Biology for Engineers	2	0	0	2	40	60
T	5.	ESC	BCS23101T	Programming for Problem Solving	2	1	0	3	40	60
P	6.	ESC	BCS23101P	Programming for Problem Solving Lab	0	0	2	1	20	30
T/P	7.	ESC	BCE23101P	Engineering Graphics and Design	1	0	4	3	40	60
P	8.	ESC	BME23101P	Manufacturing Practice Workshop-1	0	0	2	1	20	30
P	9.	ESC	BME23103P	Design Thinking and Idea Lab	0	0	2	1	20	30
P	10	AUC	*	NSS/NCC/ SPORTS/YOGA	0	0	2	0	00	100
				Total	**11**	**3**	**14**	**20**	**280**	**420**

BSC	PHYSICS	L	T	P	C
		3	1	0	4

Pre-requisite: Physics and Mathematics course of 12th standard.

Course Objectives: To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

Course Outcome:

After successful completion of the course, the students will be able

CO1: understand the concept of fundamental of mathematical physics and apply in solving problems.

CO 2: to apply the mathematical physics to study the dielectric properties of matter.

CO 3: understand the basics of electromagnetism by applying magnetostatics and electrostatics theory.

CO 4: to understand the concept of transverse and longitudinal wave propagation.

CO 5: to understand the geometrical optics, wave optics and lasers.

Detailed Syllabus

Module 1: Mathematical Physics	**6 hours**
Del operator, Laplacian operrtor gradient, divergenge and curl, problems related to these concepts, their physical significance (qualitative), Gauss's theorem, Stoke's Theorem	
Module 2: Electrostatics in vacuum and other dielectric media	**8 hours**
Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential, Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field	
Module 3: Magnetostatics and Electromagnetic theory	**6 hours**
Bio-Savart law, Ampere's law, Inconsistency of Amere's law, Displacement current, faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF, magnetic substances, paramagnetic, diamagnetic, ferromagnetic, Maxwell's equations (qualitative)	
Module 4:Harmonic motion, Non-dispersive transverse and longitudinal waves	**8 hours**
Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, Transverse wave on a string, the wave equation on a string, Harmonic waves, longitudinal waves and the wave equation for them	
Module 5: Optics	**8 hours**
Spherical and chromatic aberrations, Achromatism in different cases, interference of light in Newton's rings experiment, Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, , different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium)	
Total Lecture hours	**36 hours**

Text Book(s)	
	1. Introduction to Electrodynamics, D.J Griffiths, 3rd Edn., 1998, Benjamin Cummings. 2. Electricity and Magnetism, Edward M.Purcell, 1986 McGraw-Hill Education 3. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill 4. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill 5. Ian G. Main, Oscillations and waves in physics
Reference Books	
	1. The Feynman Lectures on Physics, Vol I, II,III 2. Bhattacharya & Nag, Engineering Physics **3.** O. Svelto, Principles of Lasers

BSC	PHYSICS LABORATORY	L	T	P	C
		0	0	2	1

Prerequisite : Basics of 12 standard Physics lab

Course Objective :

1) To develop the laboratory skill in handling equipments.
2) Provide the basic idea of various electromagnet theorems
3) To develop the technical skill & ideas through continuous interactions..
4) To understand the basic concepts for performing different experiment for further application

Course Outcome:

CO1: Learning basic concept of various measuring instruments
CO2: Learning the basic concept measuring various electrical components by using Digital multimeter
CO3: Understand the concept of focal length and power of lens
CO4: Understand the concept of measuring inductance of coils.
CO5: Learning the concept of resonant and anti-resonant frequency concept of LCR circuit.
C06: The course provides the basic idea focal length, refractive index of a material and diffraction of light.

List of Experiments :

1) Measured the length, breadth and diameter of particular shapes by using slide calipers and screw gauge.
2) To measure the
   a) Resistance, Capacitance and Inductance
   b) AC & DC Voltage and current by using Digital Multimeter
3) To determine the inductance of a coil by Anderson's bridge
4) To study a series LCR circuit and determine it's
   a) Resonant frequency and b) Quality factor Q
5) To study a parallel LCR circuit and determine its
   a) Anti-resonant frequency and b) Quality factor Q.
6) Measure the self inductance of a coil by Rayleig's method.
7) To determination of the power of
   a) Convex lens b) Concave lens
8) To find the radious of curvature of a Plano convex lens using Newton's ring apparatus
9) To find the refractive index of water using a convex lens and a plain mirror.
10) To find the refractive index of the material of the Prism with the help of spectrometer.

Total Lab Hours :	26 Hours

Text Books :

1) A Text Book On Practical Physics: K.G. Mazumdar & B.Ghosh
2) A Text Book On Practical Physics: Dr. Samir Kumar Ghosh
3) Bhattacharya & Nag. Engineering Physics.
4) B.Sc. Practical Physics By C.L. Arora.

BSC	MATHEMATICS-II (ODE & Complex Variables)	L	T	P	C
		3	1	0	4

Pre-requisite: Knowledge of Mathematics at Class XI & XII

Course Objectives:

1. To familiarize the prospective engineers with techniques in ordinary differential equations and complex variables
2. To provide the basic tools of mathematics for the purpose of modelling the problems and obtaining solutions.

Course Outcome:

After successful completion of the course, the students will learn

CO 1: The effective mathematical tools for the solutions of differential equations that model physical processes.

CO 2: The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Module 1:First Order Ordinary Differential Equations	**10 hours**

Exact, linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2: Ordinary Differential Equations of Higher Orders	**14 hours**

Second order linear differential equations with variable coefficients: Euler-Cauchy equations, Solution by variation of parameters; Power series solutions: Legendre's equations and Legendre polynomials, Frobenius method, Bessel's equation and Bessel's functions of the first kind and their properties.

Module 3: Complex Variable – Differentiation	**10 hours**

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 4: Complex Variable – Integration	**14 hours**

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Total Lecture hours	**48 hours**

Text Book

1. AICTE's Prescribed Textbook: Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable), Khanna Book Publishing Co.

Reference Books

1. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
2. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009
6. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005
7. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984
8. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
9. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958
10. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
11. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008
12. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

BSC	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Prerequisite: Biology in intermediate level

Course Objectives:

After studying the course, the student will be able to:

1. Understand the significance of 18th-century biological observations in driving major scientific discoveries.
2. Recognize that biological classification encompasses more than mere categorization, emphasizing morphological, biochemical, and ecological criteria.
3. Explain the concepts of dominance and recessiveness in genetic inheritance from parents to offspring.
4. Identify DNA as the genetic material, illustrating how all life shares common building blocks while exhibiting immense diversity.

Detailed Syllabus

Module:1 Introduction — **4 hours**

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module:2 Classification — **3 hours**

The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Module:3 Genetics — **3 hours**

“Genetics is to biology what Newton’s laws are to Physical Sciences” Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module:4 Biomolecules — **3 hours**

All forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric

structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	
Module:5 Enzymes	**3 hours**
Without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	
Module: 6 Information Transfer	**3 hours**
The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. DICOM Image formats, The DNA Technology (Use and Application) Regulation Bill, 2019	
Module: 7 Macromolecular Analysis	**3 hours**
How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	
Module: 8 Metabolism	**4 hours**
The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	
Module: 9 Microbiology	**4 hours**
Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	
Total hours	**30 Hours**
Text Book	
1. General Biology, Uma Devi Koduru, Khanna Book Publishing Company.	
Reference Books	
1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd	
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons	
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company	
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher	
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers	

ESC	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
		2	1	0	3

Pre-requisite: Basic computer knowledge, basic mathematics

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn the syntax and semantics of C programming language.
4. To learn the usage of structured programming approach in solving problems.
5. To understated and formulate algorithm for programming script
6. To analyze the output based on the given input variable

Course Outcome:

After successful completion of the course, the students will learn

CO1: Illustrate basic concepts of computer and C programming.

CO2: Apply the concepts of conditional and looping statements.

CO3: Demonstrate the ability to write C program using arrays, structures, pointers and files.

CO4: Develop modular programs using C language.

Detailed syllabus

Module 1:Introduction to Programming	**4 hours**

Introduction to Programming; 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/Pseudocode 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.

Module 2:Introduction to C	**3 hours**

Using Comments, Keywords, Identifiers, Tokens, Basic Data Types, Writing C Expressions using Operators, Precedence of Operators, I/O Statements in C

Module 3: Conditional Branching and Loops	**4 hours**

Conditional Branching Statements, Iterative Statements, Nested Loops, Break and Continue Statements, Goto Statements

Module 4:Arrays and Strings	**4 hours**

1-D Array-Declaration, Accessing Array Elements, Array Operations, 2-D Array-Matrix Addition, Subtraction, Multiplication, Character Arrays, Strings, String Manipulation Function.

Module 5: Functions	**4 hours**

Function Declaration/Prototype, Function Definition, Function Call, Return Statement, Passing Parameters, Scope of Variables, Storage Classes, Recursive Function. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

MODULE 6: Structure	**3 hours**

Structures, Defining Structures, Accessing Members, Array of Structures.

MODULE 7: Pointers and File handling	**2 hours**

Pointers, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, File handling

Total Lecture hours	**24 hours**
Text Book	
1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill 2. YashavantKanetkar, Let us C, BPB Publication 3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill 4. YashavantKanetkar, Understanding Pointers in C, BPB Publication	
Reference Books	
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India	

ESC	PROGRAMMING FOR PROBLEM SOLVING LABORATORY	L	T	P	C
		0	0	2	1

Pre-requisite: Basic computer knowledge, basic mathematics

Course Objectives: The students will try to learn

1. To translate given algorithms to a working and correct program.
2. To be able to correct syntax errors as reported by the compilers.
3. To be able to identify and correct logical errors encountered at run time.
4. To be able to write iterative as well as recursive programs.
5. To be able to represent data in arrays, strings and structures and manipulate them through a program.
6. To be able to declare pointers of different types and use them in defining self-referential structures.
7. To be able to create, read and write to and from simple text files.

Course Outcome:

CO1: Translate a given algorithm to C program and become familiarized with programming environments.
CO2: Build programs using modular programming and recursion.
CO3: Build programs using built-in and user defined data types for data processing.
CO4: Build programs for data processing using dynamic memory management.
CO5: Solve a computational problem through team work.
CO6: Exhibit self-learning by writing programs for solving problems in differentiation and integration by numerical methods.

List of Experiments

Lab1: Familiarization with programming environment (editors, compilation, debugging etc.) (2 hours)
Lab 2: Simple computational problems using expressions and precedence (2 hours)
Lab 3: Problems involving using if-then-else and switch statements (2 hours)
Lab 4: Iterative problems e.g., sum of series, factorial, Fibonacci series etc. (2 hours)
Lab 5: 1D, 2D Array manipulation: summation, finding odd/even in a set, string handling etc. (4 hours)
Lab 6: Matrix problems (addition, multiplication etc.), String operations (finding length, concatenation, comparing etc.) (4 hours)
Lab 7: Simple function illustrating the concepts, call by value (2 hours)
Lab 8: Recursive functions for summation, Fibonacci series, and factorial (2 hours)
Lab 9: Pointers, call by reference, passing arrays to functions, passing address of structure to function, passing array of structure to function, pointers and arrays, function pointer, dynamic allocation of block of memory and accessing the elements (4 hours)
Lab 10: File operations on text files, binary files (2 hours)

List of Equipment: Desktop Computers

Text Book(s)

1	Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2	YashavantKanetkar, Let us C, BPB Publication
3	E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4	YashavantKanetkar, Understanding Pointers in C, BPB Publication

Reference Books

1.	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

ESC	ENGINEERING GRAPHICS AND DESIGN	L	T	P	C
		1	0	4	3

Pre-requisite: Nil

Course Objectives:

1. To provide the basic knowledge about Engineering Drawing.
2. Detailed concepts are given in projections, technical drawing, dimensioning and specifications

Course Outcome:

Upon completion of this course, the student will be able to

1. To prepare themselves to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. To prepare themselves to communicate effectively
3. To prepare themselves to use the techniques, skills, and modern engineering tools necessary for engineering practice

Detailed syllabus

Module 1: Introduction to Engineering Drawing — **7 hours**

i. Principles of Engineering Graphics and their significance, usage of Drawing instruments
ii. Lettering - Single stroke letter – Vertical and inclined capital and small letter
iii. Scales – Plain, Diagonal and Vernier Scales
iv. Curves - Ellipse, parabola, hyperbola, different methods of construction of conic sections, tangents and normal to conics

Module 2: Orthographic Projections — **13 hours**

i. Principles of Orthographic Projections-Conventions
ii. Projections of Points and lines inclined to both planes
iii. **Projection of lines (First angle only):** Line parallel to one or both planes, line perpendicular to a plane, line inclined to one plane and parallel to other, line inclined to both plane.
iv. **Projections of planes (First angle only):** Plane perpendicular to one plane and parallel to other, plane perpendicular to both plane, plane inclined to one plane and perpendicular to other.
v. **Projection of solids (First angle only):** Axis perpendicular to one plane and parallel to other, axis parallel to both plane, axis inclined to one plane and parallel to other, axis inclined to both plane.

Module:3 Sections and Sectional Views of Right Angular Solids — **4 hours**

Section of solids: Section plane parallel to one plane and perpendicular to other, section plane inclined to one plane and perpendicular to other.
Development of surfaces of Right Regular Solids- Prism, Pyramid, Cylinder and Cone

Module:4 Isometric Projections — **4 hours**

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;

Module:5 Introduction of Computer Graphics	**5 hours**
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]	
Module 6: Demonstration of simple team design (Students Project as group work)	**3 hours**
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	
Total Lecture hours	**36 hours**
Text Book(s)	
1.	AICTE's Prescribed Textbook: Engineering Graphics & Design (ISBN: 978-93-91505-066)
Reference Books	
1.	Jain, Maheshwari, Gautam (2021), Engineering Graphics & Design, Khanna Book Publishing.
2.	Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing.
3.	Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson.
4.	Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
5.	Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
6.	(Corresponding set of) CAD Software Theory and User Manuals.

BME23103P	DESIGN THINKING AND IDEA LAB	L	T	P	C
		0	0	2	1

Pre-requisite: Mathematics-1, Physics-1, Engineering Graphics & Design

Course Objectives: The objectives of this course are to:

1. Learn all the skills associated with the tools and inventory associated with the IDEA Lab.
2. Learn useful mechanical and electronic fabrication processes.
3. Learn necessary skills to build useful and standalone system/ project with enclosures.
4. Learn necessary skills to create print and electronic documentation for the system/project.
5. To instill the core ideas of design thinking
6. To create, conceptualize, build and present ideas on the basis of prototypes

Course Outcome: After successful completion of this course, the students should be able to:

1. Understand various types of tools and its functions
2. Identify and solve problems using critical thinking skills and creative problem-solving techniques.
3. Use various technologies and tools to develop, implement and explore new plans testing their ideas
4. Understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices

Detailed Syllabus

Module 1: Introduction to Tools	**4 hours**

Introduction to basic hand tools - Tape measure, Vernier caliper, Hammers, Fasteners, Wrenches, Pliers, Saws, Tube cutter, Chisels, Vice and Clamps, Tapping and Threading, Adhesives. Introduction to Power tools - Power saws, Jigsaw, Angle grinder, Belt sander, Bench grinder, Rotary tools, Various types of drill bits.

Module 2: Mechanical Cutting/Joining Process	**4 hours**

Mechanical cutting processes - Basic operation in Lathe, Milling, Drilling, Grinding, Carpentry, Black Smithy operations, Wood Lathe, Basic welding, brazing and other joining techniques for assembly.

Module 3: Additive & Subtractive Manufacturing	**10 hours**

3D printing and prototyping technology, 3D printing using FDM, SLS and SLA, Basics of 3D scanning, point cloud data generation for reverse engineering, Prototyping using subtractive cutting processes. 2D and 3D Structures for prototype building using Laser cutter and CNC routers.

Module 4: PCB Design and Fabrication	**6 hours**

Familiarization to basic electronic components, Schematic design and board layout using Eagle software. Entire PCB fabrication process (printing, heat transfer, etching, drilling, component pasting, soldering, testing & verification).

Module 5: Design Thinking Approach in Stages	**6 hours**

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer needs. Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Concept Generation Methodologies, Concept Testing, Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things	
Total Lecture hours	**30 hours**
Text Book(s)	
1.	Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and distributors, 5th Edition,2002.
2.	3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
3.	Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing," Springer, 2010
4.	Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer, 2004.
5.	All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
6.	The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269
7.	Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542
8.	Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945, 978-9352131952, 978-9352133703
9.	Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633
10.	Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13: 978-1260019193.
Reference Books	
1.	The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.
2.	The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.
3.	Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978-9352137374
4.	Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586
5.	Electronic Product Design, G. Kaduskar and V.B. Baru, Wiley India.

BME23101P	MANUFACTURING PRACTICE WORKSHOP - I	L	T	P	C
		0	0	4	2

Pre-requisite: None

Course Objectives: The objectives of this course are to:

1. To impart knowledge and skill to use tools, machines, equipment, and measuring instruments.
7. To educate students of safe handling of machines and to develop the hands-on practical workshop skills.

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

1. Select tools and machinery according to the job.
2. Use hand tools in different shops for performing different operations.
3. Prepare job according to the drawing.

Module 1: Welding: **5 hours**

(a) Theoretical Instructions: Introduction to welding processes, Safety Precautions, Demonstration of different equipments, Types of welding-Gas, Arc and Resistance welding, tools used in welding, various fluxes & electrodes used in welding. Introduction of AC & DC welding and its applications.

(b) Practical Demonstrations: Demonstration of all basic tools & personal protective equipments. Demonstration of operations such as measuring, marking, punching and cutting. Demonstration of different types of joints by using arc welding, gas welding and flame brazing.

Module 2: Machine and Machine Tools **5 hours**

(a) Theoretical Instructions: Introduction of machine and machine tools, Safety Precautions, Different equipments and tools used, basic study of constructional details of lathe, drilling, milling, shaper and surface grinder. Introduction of various types of cutting tools (Nomenclature) and their material

(b) Practical Demonstrations: Demonstration on Lathe & basic operations such as drilling, facing, turning, taper turning, step turning, knurling, chamfering, threading. Demonstration of basic measuring instruments

Module 3: Metal cutting operations **5 hours**

(a) Theoretical Instructions: Demonstration of different tools and material used - different edges and angles, introduction to different attachment and accessories required in lathe, milling & shaper machine, Safety Precautions, Demonstration of basic measuring instruments used

(a) **Practical Demonstrations:** Lathe- centering, plain turning, step turning, taper turning, internal and external thread cutting, Milling- indexing, hexagonal/square headed bolt, gear cutting, Shaper- planing, slotting and grooving, Surface grinding

Module 4: Fitting **5 hours**

(a) Theoretical Instructions: Introduction to fitting work, safety precautions, Demonstration

of basic hand tools, holding devices and basic fitting operations such as measuring, marking, punching, filing, sawing, drilling, tapping and dieing. **(b) Practical Demonstrations:** Demonstration of all basic hand tools, measuring tools & equipments. Demonstration of simple operations such as marking, measuring, punching, filing, sawing, drilling, tapping and dieing.	
Module 5: Carpentry	**5 hours**
(a) Theoretical Instructions: Introduction to Carpentry, Safety Precautions, demonstration of different tools used in carpentry. Various types of joints. Brief description of wood cutting machines. **(b) Practical Demonstrations:** Demonstration & practice of different carpentry operation like marking and measuring, cutting, planning, chiseling, filing and chamfering.	
Module 6: Blacksmithy	**5 hours**
(a) Theoretical Instructions: Introduction, Safety precautions, Demonstration of basic hand tools and holding devices, Description of all forging operations such as heating, hammering, finishing, forge welding, normalizing and tempering. Comparison of hot & cold working. **(b) Practical Demonstrations:** Demonstration & practice of different smithy operations like cutting, hammering, punching, bending etc. Demonstration & practice of making a square dimension from a cylindrical bar and vice versa.	
Text Book(s)	
1.	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Media promoters and publishers private limited, Mumbai, Vol. I 2008 and Vol. II 2010.
2.	Kalpakjian S, Steven S. Schmid, "Manufacturing Engineering and Technology", Pearson Education India Edition, 4th Edition, 2002
3.	Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw-Hill House, 2017
4.	A course in Workshop Technology, Vol-I &Vol-II, B. S. Raghuwanshi, Dhanpat Rai & Co., 2015
Reference Books	
1.	Workshop Practice – Singh S., S.K. Kataria & Sons. 2003.

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