

# **Curriculum Structure & Syllabi**

(As per National Education Policy 2020)

*of*

**B. Tech.**

*in*

**Mechanical Engineering**

**(w.e.f. 2024-25)**

Vision

Mission

Program Educational Objectives

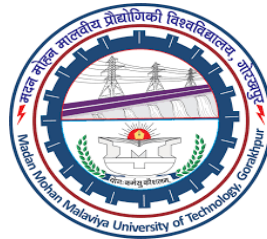
Program Outcomes

Program Specific Outcomes

Overall Credit Structure

Curriculum

Syllabus



*Offered by*

**DEPARTMENT OF MECHANICAL ENGINEERING  
MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY (MMMUT)  
GORAKHPUR-273 010, UP, INDIA  
JULY 2024**

## **B. Tech. in Mechanical Engineering**

### **Vision**

To become an Internationally Acclaimed Department of Higher Learning, Research, Innovation and Incubation in Mechanical Engineering by 2035.

### **Mission**

1. To provide quality education to the students in order to make them globally competitive Mechanical Engineers.
2. To enhance the skills of students using modern engineering tools and experimental techniques to solve real life mechanical engineering problems.
3. To make them work in groups with high level of societal, environmental and professional ethics with the self-learning attitude.
4. To establish linkages with the Industries, R&D organizations and educational institutions in India and abroad for excellence in teaching, research and innovation

### **Programme Educational Objectives (PEO)**

- PEO-1. To prepare students in the area of mechanical engineering for successful careers in industries, academia and research organizations through state-of-the-art education.
- PEO-2. To provide students with a sound foundation in science and engineering fundamentals necessary to formulate, analyze and solve mechanical engineering problems and to prepare them for research activities.
- PEO-3. To develop ability in the field of machine design, thermal engineering, manufacturing and industrial engineering so as to design and create novel products, processes and solutions for the real-life problems.
- PEO-4. To inculcate in students professional and ethical attitude, effective communication & teamwork skills, and ability to apply multidisciplinary knowledge to relate mechanical engineering problems to broader environmental and social context.
- PEO-5. To engage students in professional development through the self-learning and keep abreast with the state-of-the-art technology needed for a successful professional career.

### **Programme Outcome (POs)**

- PO-1 Apply knowledge of mathematics, science, and mechanical engineering fundamentals to solve real life problems.
- PO-2 Identify, formulate, apply engineering knowledge, and conduct research to solve real life mechanical engineering problems.

- PO-3 Ability to design a system, component, or process by applying the knowledge of Machine Design, Thermal Engineering, Manufacturing to meet desired needs within realistic constraints such as economic, environment, cultural, societal, health and safety and sustainability.
- PO-4 Ability to design and conduct experiments, as well as to analyze and interpret data and synthesis of information to reach out to solutions.
- PO-5 Select, create and apply modern engineering and IT tools, including CAD, CAM to solve complex engineering problems.
- PO-6 Apply reasoning to assess the impact of engineering solutions and practices in a global, societal, health, safety, legal and cultural context.
- PO-7 Understand the impact of engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
- PO-8 Apply ethical principle, inculcate moral values and commit to professional ethics, responsibility and norms of engineering practice.
- PO-9 Function effectively as member or leader in diverse teams and in multi-disciplinary settings.
- PO-10 Communicate effectively on complex engineering activities with engineering fraternity and society at large such as being able to understand and write effective reports, documents, presentations and give and take instructions clearly.
- PO-11 Apply knowledge and understanding of industrial engineering and management principles and function in multidisciplinary teams as a member or leader to manage projects.
- PO-12 Recognition of the need for and an ability to engage in life-long self- learning in state-of-the-art technology.

### **Programme Specific Outcome (PSOs)**

- PSO1. Graduates will be able to identify, analyze and solve engineering problems relating to mechanical systems together with allied engineering streams.
- PSO2. Graduates will learn managerial skills and interdisciplinary technologies to work effectively in a team and in a society by following ethical and environmental practices.

**SYLLABUS AND CREDIT STRUCTURE FOR B. TECH. (ME)**  
**(SESSION 2024-2025 AND ONWARDS)**  
**OVERALL CREDIT STRUCTURE FOR B.TECH. (MED)**

<b>Credit Courses</b>			
<b>Core Courses (CC)</b>		<b>Electives Courses (EC)</b>	
<b>Category</b>	<b>Min. Credits</b>	<b>Category</b>	<b>Min. Credits</b>
Basic Sciences & Maths (BSM)	20	Professional Electives (PE)/ Open Electives (OE)	36
Engineering Fundamentals (EF)	24		
Professional Skill (PS)			
Professional Core (PC)	48	Humanities & Social Science Elective (HSSE)	04
Management (M)	04		
Humanities & Social Science (HSS)	08		
Minor Project (P)	06		
Industrial Practice (IP) (In Industry)/ Major Project (MP) (In University)	10		
<b>Sub-total</b>	<b>120</b>	<b>Sub-total</b>	<b>40</b>
<b>Grand Total</b>	<b>160</b>		
<b>Non-Credit Courses</b>			
<b>One Expert Lecture</b> per semester for students (Mandatory). (BSM-1st year), (PC-2 <sup>nd</sup> Year), (T&P-3 <sup>rd</sup> Year)			<b>Non-Credit</b>
<b>Social work/Training</b> of at least 60 hours during break after first/ second semester (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).			<b>Non-Credit</b>
<b>Industrial Training</b> during the summer break after fourth semester (Mandatory).			<b>Non-Credit</b>
<b>One -week workshop</b> during the winter break after fifth semester on professional/ industry/ Social/ entrepreneurial orientation (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).			<b>Non-Credit</b>
<b>Value Added Courses (VAC) / Audit Courses (AC)</b> Two of the Value-Added Courses / Audit Courses are compulsory.			<b>Non-Credit</b>
<b>Extracurricular Activities Courses (ECA)</b> Two compulsory courses from the following S. No (ii) to (v) non-credit courses: (i) Induction Program (compulsory) (ii) Skill development (iii) Unity and Discipline (NCC or NSS) (iv) Sports, Cultural and Games (v) Personality Development			<b>Non-Credit</b>
<b>Minor Degree (MD) from any Department and Micro Specializations (MS) within the Department</b>			
<ul style="list-style-type: none"> <li>• The total number of credits for graduation will be kept to minimum 160. The additional 18-20 credits required for Minor Degree Courses.</li> <li>• Micro specializations (MS) will be run by the department in order to aligned to industry careers or higher studies</li> </ul>			Offered as a Professional Electives (PE)

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**SEMESTER WISE CREDIT STRUCTURE FOR B. TECH. (MED)**

<b>Category/Semesters</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>	<b>VII</b>	<b>VIII</b>	<b>Total</b>
Basic Sciences & Maths (BSM)	8	8	0/4	4/0					<b>20*</b>
Humanities & Social Science (HSS)	4	4							<b>08*</b>
Humanities & Social Science Elective (HSSE)					4				<b>04*</b>
Management (M)						4			<b>04*</b>
Engineering Fundamentals (EF)	4	4	8/4	0/4					<b>16*</b>
Professional Skill (PS)	4	4							<b>08*</b>
Professional Core (PC)			12	12	12	12			<b>48*</b>
Professional Electives (PE)/ Open Electives (OE)				4-8	28-32				<b>36*</b>
Minor Project (P)						0	6		<b>06*</b>
Industrial Practice (IP) (in Industry)/ Major Project (MP) (In University)								10	<b>10*</b>
<b>Total Credit</b>	<b>20*</b>	<b>20*</b>	<b>20*</b>	<b>20- 24*</b>	<b>16*- 32*</b>	<b>16*- 32*</b>	<b>6- 30*</b>	<b>10- 30*</b>	<b>160*</b>
	<b>80-84*</b>			<b>76-80*</b>					
<b>Total Courses Offered</b>	<b>05*</b>	<b>05*</b>	<b>05*</b>	<b>05*- 06*</b>	<b>04*- 08*</b>	<b>04*- 08*</b>	<b>00- 06*</b>	<b>00- 05*</b>	<b>36*</b>

*\*Minor variation is allowed as per need of the respective disciplines.*

**First Year, Semester I**

<b>S. N.</b>	<b>Category</b>	<b>Paper Code</b>	<b>Subject</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
1.	BSM	BSM-110	Engineering Mathematics-1	3	1	0	4
2.	BSM	BSM-131/181	Environmental Science and Green Chemistry	3	0	2	4
3.	EF	BEE- 110 / BEE-160	Basic Electrical Engineering	3	0	2	4
4.	PS	BME-104	Manufacturing Practice Workshop	2	0	4	4
5.	HSS	BHS- 102/152	Technical Writing and Professional Communication	2	1	2	4
			<b>Total</b>	<b>13</b>	<b>1</b>	<b>10</b>	<b>20</b>
6.	ECA-I		Induction Program	-	-	-	0

**# Group-1: CSE, IT, CH, CE; Group-2: ECE, ECE(IOT), ME, EE.**

## First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-160	Engineering Mathematics-2	3	1	0	4
2.	BSM	BSM 131/181	Engineering Physics	3	0	2	4
3.	EF	BIT-103/156	Programming in C	3	0	2	4
4.	PS	BME-157	Engineering Graphics with AutoCAD	2	0	4	4
5.	HSS	BHS-101/151	Universal Human values: understanding Harmony	3	1	0	4
			<b>Total</b>	<b>14</b>	<b>2</b>	<b>8</b>	<b>20</b>
6.	VAC/AC	BME-158	Engineering Innovation & Design	0	0	2	0
7.	ECA-II			-	-	-	<b>0</b>

### List of Value-Added Courses (VAC)/Audit Courses (AC)

S. No.	Subjects	Codes
1.	Constitution of India	AUC01
2.	Indian Culture and Heritage	AUC02
3.	Indian Architecture	AUC03
4.	Indian Festivals	AUC04
5.	Vaidic Mathematics	AUC05
6.	Astronomy	AUC06
7.	Arts of India	AUC07
8.	Intellectual Property Right	AUC08
9.	Human Rights	AUC09
10.	Logical Research	AUC10
11.	Professional Ethics	AUC11
12.	Environmental Law	AUC12
13.	Health Law	AUC13
14.	National Cadet Corps	AUC14
15.	Basics of Human Health and preventive medicines	AUC15

### List of Extra Curricular Activity (ECA) Courses

ECA-II						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/Week	Credit
1.	Open to all	ECA	Skill Development-I	ECA-151	2	0

	Branches					
2.	Open to all Branches	ECA	Unity and Discipline (NCC)-I	ECA-171	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-I	ECA-172	2	0
4.	Open to all Branches	ECA	Games & Sports-I	ECA-181	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-I	ECA-182	2	0

### SKILLS-ENHANCEMENT COURSES FOR EXIT (MECHANICAL ENGINEERING):

2-Months internship for 6-Credits **OR** Two courses mentioned below of 4 to 6 credits.

#### A. After First Year: UG Certificate (Engg.).

The candidate should pass the following two additional courses (ITI Level) **OR** any two suitable skill-based courses to qualify for **UG Certificate (Engg.)**.

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	Skill Enhancement	BME-159	Heating, Ventilation and Air Conditioning (HVAC)	2	0	2	3
2.	Skill Enhancement	BME 160	Machinist	2	0	2	3

**OR**

Equivalent skills-enhancement courses from MOOC/SWAYAM.

### SYLLABI

#### **BSM-110 Engineering Mathematics I**

**Course category** : Basic Sciences & Maths (BSM)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture : 3, Tutorial : 1 , Practical: 0

**Number of Credits** : 4

**Course Assessment methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination

**Course Objectives** : The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss, Stoke's and Green's theorem.

5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

**Topics Covered**

**UNIT-I** 9

**Differential Calculus:** Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.

**UNIT-II** 9

**Linear Algebra:** Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem, Diagonalization of matrices.

**UNIT-III** 9

**Multiple Integrals:** Double and triple integrals, change of order of integration, change of variables. Application of multiple integrals to surface area and volume. Beta and Gamma functions, Dirichlet integral.

**UNIT-IV** 9

**Vector Calculus:** Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).

**Books & References**

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,

**BSM-140/BSM-190**

**Environmental Science and Green Chemistry**

**Course category:**

Basic Sciences & Maths (BSM)

**Pre-requisite Subject:**

NIL

**Contact hours/week**

Lecture: 3, Tutorial: 0 , Practical: 2

**Number of Credits:**

4

**Course Assessment methods:**

Continuous assessment through home assignments, quizzes, minor tests, practical work, viva-voce, practical exam and major theory Examination

**Course Objectives**

Understanding the principles and concepts of Chemistry viz. Chemical Bonding, acidity and basicity, Atmospheric Chemistry & Water Chemistry, Spectroscopic analytical methods and Green Chemistry and solving industrial problems using solid foundation in Chemistry.

**Course Outcomes:**

The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To develop the concepts of basic chemistry.



2. To make the students aware of global environmental issues e.g. global warming & Greenhouse effect, Ozone depletion, pollution and its prevention and understand various aspects of atmospheric chemistry.
3. To understand the analytical and conceptual skills required for environmental chemistry research.
4. To understand water treatment for all types of uses and need to protect environment.
5. To understand the specifications of pure water and its purification techniques.
6. To develop the knowledge about Green Chemistry and Green Technology.

### **Unit 1:**

#### **Basic Chemical Concepts**

Periodic properties of elements, Ionization potential, electron affinity and electronegativity; mole concept, molarity and normality, Chemical Bonding – MO Theory, MO diagram of diatomic molecules, hydrogen bonding, electrophiles, nucleophiles, inductive effect and mesomeric effect. Reaction Mechanism. Acidity and basicity - Concept of pH.

### **Unit 2:**

#### **Atmospheric chemistry & Water Chemistry**

The atmosphere of Earth, layers of atmosphere and temperature inversion, Air pollution, Global warming and Greenhouse effect. Acid rain and Ozone layer depletion. Chemical and photochemical Smog.

Sources of water, conservation of water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Hardness of water, Softening of water by Zeolite process, Lime Soda process, Ion exchange process and Reverse osmosis.

### **Unit 3:**

#### **Spectroscopic analytical methods**

Absorbance, Transmittance and Beer-lamberts Law. Basic principles of UV-Visible spectroscopy, Fluorescence spectroscopy, Infrared spectroscopy, NMR Spectroscopy. Use of these instrumental techniques for monitoring of environmental pollution.

Environmental problems posed by the use of non-biodegradable polymers widely used in day-to-day life. Incineration as the key method for disposal of polymeric waste. Bio-degradable polymers.

### **Unit 4:**

#### **Green Chemistry**

Green Chemistry and Green Technology: New trends in Green chemistry; Green Chemistry Methodologies-Microwave heating, ultrasound technique. Green Chemical Synthesis Pathways; Green reagents, Green solvents.

### **Experiments:**

1. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
2. Determination of alkalinity in the given water sample.
3. Determination of chloride content in the given water sample by Mohr's method.
4. Determination of percentage of available chlorine in bleaching powder sample.

- Determination of iron content in the given sample using  $K_3[Fe(CN)_6]$  as an external indicator.
- Determination of Electrical conductivity/TDS of a given water sample using conductivity meter.
- Determination of dissolved Carbon Dioxide of given water sample.
- Determination of the biochemical oxygen demand of sewage influent.
- To calculate the lambda max of the given compound by using UV-Visible spectrophotometer.
- Determination of nickel / cobalt / copper solutions by UV-visible spectrometry.
- Examples of Green Synthesis /Reactions.
- Determination of Turbidity of Water
- Iodoform test
- Synthesis of a polymer Bakelite or Polyacrylic acid.

### Books & References

- A Text book of Environment and Ecology, Shashi Chawla, Tata McGraw Hill
- Environmental Studies, Raj Kumar Singh, Tata McGraw Hill
- Engineering Chemistry, Wiley India
- Engineering Chemistry, Tata McGraw Hill
- Organic Chemistry, Morrison & Boyd, 6th edition, Pearson Education
- Fundamentals of Environmental Chemistry, Manahan, Stanley E., Boca Raton: CRC Press LLC.
- Environment and Ecology, R K Khandal, Wiley India
- An Introductory Text on Green Chemistry: For Undergraduate Students, Indu Tucker Sidhwani, Rakesh K. Sharma, Wiley
- A textbook of Green Chemistry, Shankar Prasad Deo and Nayim Sepay, Techno World Publication.
- Introduction to Green Chemistry, John Andraos, Albert S. Matlack, CRC Press

### BIT-103

### PROGRAMMING IN C

**Course category** : Engineering Fundamentals (EF)

**Pre-requisite Subject** : NIL

**Contact hours/week** : Lecture: 3, Tutorial: 0, Practical:2

**Number of Credits** : 4

**Course Assessment Methods** : Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, Minor test and Major Theory Examination

**Course Objective:** Students will gain an understanding of the fundamentals of computers and programming. The objective is to prepare them for various dimensions of C Programming language.

**Course Outcomes:** The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

- Describing the basics of terminologies used in computer programming.
- Practicing C language programming by writing, compiling and debugging the code.
- Designing programs involving simple statements, conditional statements, iterative

statements, array, strings, functions, recursion and structure.

4. Discussing the dynamic memory allocations and use of the pointers.
5. Applying basic operations on files through programs.
6. Studying and implementing the codes using macros, pre-processor directives and command line arguments

## Topics Covered

### UNIT-I

9

**Basics of Computers and Programming:** Functional diagram of computer; Language Processors; Approaches to problem solving, Concept of algorithm and flow charts. **Simple Statements:** Data types; Tokens and its types; Variable declaration and initialization; User defined type declaration: type def, enum; Comments; Format specifiers; Standard I/O: taking input and displaying output; **Operators:** types, precedence and associativity; Expressions; Type conversion, Cshort-hands.

### UNIT-II

9

**Conditional Statements:** Simple if, if-else, nested if-else, else-if ladder, switch statements, nested switch, advantages of switch over nested if, restrictions on switch values. **Iterative Statements:** Concepts of entry and exit controlled loops; Uses of for, while and do while loops; Nested Loops; Printing various patterns using nested loops; Using break, continue and goto statements.

### UNIT-III

9

**Arrays:** Single-dimensional, multi-dimensional array and their applications; declaration and manipulation of arrays; strings and string handling functions. **Pointers:** Pointer and address arithmetic; dereferencing; pointers and arrays; dynamic memory allocation and de-allocation. **Functions:** Function prototype; Arguments and its types: actual, formal and default arguments; Scope of a variable; Argument passing methods; Passing pointer as the function argument; Recursion: types, advantages and disadvantages; Storage class specifies; Character test functions.

9

### UNIT-IV

**Structure:** Declaring and defining structures; Array within structure; Array of structure; Defining and using some data structures: Stack, Queue, and Linked lists. **File Handling:** Types of files; Text files and different operations on text files, opening a file, closing a file; Data structure of a file; EOF; I/O operations on files; Random access to the files. **Standard C Pre-processors & C Library:** Pre-processor, Directives, Macro, Macro substitution; Conditional Compilation; Command Line Arguments; Standard C Library.

## EXPERIMENTS

Implementing programs in following categories using programming language 'C':

1. Programs of simple statements, conditional statements, and iterative statements with the applications.
2. Programs of single and multi-dimensional arrays and their applications.
3. Programs of strings and the applications
4. Programs of pointer and the applications
5. Programs of function and the applications

6. Programs of structure and the applications
7. Codes of file handling and management
8. Codes with Pre-processor, Macro, Conditional Compilation and Command Line Arguments

### Textbooks

1. Brian W. Kernighan and Dennis M. Ritchie, "The C programming language", Pearson
2. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education
3. Yashavant Kanetkar, "Let Us C", bpb publication
4. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson
5. Herbert Schildt, "C: The Complete Reference", McGraw Hill Education

### BME 104

### Manufacturing Practice Workshop

#### Course Category

: Professional Skill (PS)

#### Pre-requisite Subject

: NIL

#### Contact Hours/Week

: Lecture: 2, Tutorial: 0, Practical: 04

#### Number of Credits

: 04

#### Course Assessment

: Continuous assessment through one Viva-voce, Practical, work/record, attendance, and Major Practical Examination

#### Method

#### Course Objective

This course introduces basic concepts of various manufacturing processes and their applications in production of complex shape and size products based on the concepts of forming, welding, casting and machining.

#### Course Outcomes

: After completion of this course the students are expected to be able to demonstrate following knowledge, skills, and attitudes

1. Understand the importance, materials, applications, and safety in different shops for the development of a product/component.
2. The knowledge of tools and processes used in carpentry and foundry shops for the development of products through the casting process.
3. The knowledge of forming process will develop skills for producing products using different tools and processes in the black smithy and sheet metal shops.
4. The knowledge and practical skill of various welding processes and their application.
5. The knowledge and practical skill of various machining processes.
6. The knowledge of non-conventional machining will develop the ability to produce various products.

### Unit I

6

**Concept of Manufacturing-** Manufacturing definition; Role of materials, processes and systems in manufacturing; Classification and brief introduction of engineering materials such as metals & alloys, Classification and brief introduction of manufacturing processes

**Unit II****6**

**Sand Casting Process of Metals-** Elements of Green Sand Mould; Pattern design and making, Method of Preparation of Green Sand Mould; Casting Defects

**Unit III****6**

**Metalworking Processes-** Classification of Metalworking Processes-brief introduction of bulk and sheet metal processes, Hot Vs Cold Working; Hot and Cold Rolling; Types of Rolling Mills, Forging, Extrusion, Drawing

**Fabrication Processes-** Classification of Welding Operations, Types of Joints & Welding Positions; Brief description of Arc, Resistance and Gas welding techniques. Brazing and Soldering

**Unit IV****6**

**Machining Processes:** Classification of machining processes & machine tools; Construction, Specification, and operations on Lathe Machine and Drilling machine

**List of Practical****1. Safety in Workshop (Demonstration)**

Safety precautions and utilization of hand tools and machines of different shops with safe working habits. Introduction to measuring equipment and gauges of different shops.

**2. Carpentry**

Study of woodwork, types of hand tools and machine. Making of one job involving wood work joint

**3. Fitting**

Study of different fits and hand tools. Making of one job involving fitting to size, male female fitting with drilling and tapping

**4. Welding**

Study of electric arc welding and gas welding, tools, types of weld joints and safety precaution during welding. Making of one joint using electric and gas welding. Students will be introduced to brazing and soldering (demonstration)

**5. Sheet Metal Work**

Study of different hand tools, machine and sheet metal joints. Making of one utility job in sheet metal

**6. Foundry**

Principles of molding, methods, core & core boxes, preparation of sand mould of given pattern and casting (demonstration)

**7. Black Smithy**

Introduction to hot working and Study of forging hand tools, furnace and machine. Making a job on hot upset forging.

**8. Machining**

Study of lathe machine, cutting tools and turning related operations. Making of one job on lathe machine including facing, step and taper turning, threading operations.

**9. Plastic Processing**

Introduction to plastics and different plastic molding techniques. Study of injection molding process with demonstration.

**10. Computer Numerical Control (CNC)**

Introduction to automation & CNC, Assembly of models of CNC, CNC wood router, engraving and exposure to part programming. Preparation of part program for simple profiles. Making a job on CNC (Demonstration).

**11. Mini Project**

Team activity – Fabrication of prototype model based on above practical.

## Text and Reference Books

1. Manufacturing Science: A. Ghosh and A.K. Mallik (East- West Press).
2. Workshop Technology Vol-I: B. S. Raghuvanshi (Dhanpat Rai and Sons)
3. Workshop Technology Vol-II: B. S. Raghuvanshi (Dhanpat Rai and Sons)

## BHS- 102/152 TECHNICAL WRITING AND PROFESSIONAL COMMUNICATION (TW&PC)

Course Category	: HSS
Prerequisite subject	: None
Number of Credits	: 4
Contact Hours/Week	: Lectures: 2, Tutorial: 1, Practical: 2
Course Assessment Methods	: Continuous assessment through One test, teacher's assessment (quiz, tutorial, assignment, attendance), and One Major Theory Examination.
Course Objectives	: The objectives of this course are to: - The course aims- <ol style="list-style-type: none"><li>1. To sensitize the students to understand the role and importance of communication for personal and professional success.</li><li>2. To enable the learners to enhance their writing skills in technological and professional echo-system.</li><li>3. To equip learners to differentiate technical writing from general writing.</li><li>4. To equip them with technical writing skills.</li><li>5. To enable learners to exhibit knowledge, skills, attitude and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.</li></ol>
Course Outcomes	: The students will be able to demonstrate the following knowledge, skills, and attitudes upon completion of the course: - <ol style="list-style-type: none"><li>1. Overcome the problems she/he shall faces in oral and written communication.</li><li>2. Acquire knowledge of and methods for using technical communication, such as reports, proposals, technical letters, etc.</li><li>3. Use and Practice compositions correctly.</li><li>4. Give presentations in different sessions and make self-appraisal.</li><li>5. Learn and understand the various facets of Communication Skills, such as (LSRW) Listening, Speaking, Reading, and writing, and identify, formulate, and solve real-life problems with a positive</li></ol>

attitude; also inculcate, the habit of learning and developing communication and soft skills.

### **Unit 1: Language and Communication**

**6**

**Language Vs communication:** Communication as coding and decoding – signs, symbols & pictograph – verbal and non-verbal symbols – Language & communication; Types of Communication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication. Thinking and Articulation, critical, creative aspects of articulation.

**Skills of Language Acquisition:** Natural Language Acquisition Skills: Listening, Speaking, Reading & Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing, Grammar & Vocabulary {LSRWGV}

**Phrase, Clause & Sentence in Professional Drafting-**Simplicity, Clarity and Conciseness of a Presentation, Differentiating between Professional and Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial, and other forms of bias in Professional Writing. Pre-writing, Drafting, and Re-writing.

### **Unit 2: Towards Technical Writing**

**6**

**Technical Paper Writing:** Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organizing References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing- Title, Keywords, Synopsis, Preface and Abstract. Drafting Research Article & Methodology.

**Thesis/Dissertation Writing:** Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory

Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections- Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

**Professional Presentation & Seminar Delivery Tools:** Designing the Presentation; Establishing the Objectives. Making Professional PowerPoint Presentations, Signaling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team & Meet etc.

### **Unit 3: Drafting Skills & Career Correspondence**

**6**

**Professional Drafting:** Letters vs. e-mails, Formal and Informal emails, Parts of e-mails, Types of e-mails, Managing tone of E-mails and business Letters, Examples of Letters and E-mail, Professional Correspondence through E-mail, Job Applications and cover Letters. Introduction to DOs (Demi- Official Letters)

**Career & Correspondence:** Developing a Professional C.V, Bio Data & Resume. Report

Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

#### **Unit 4: Professional Practices with ICT Interface**

6

**Conducting Professional Meeting:** Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Meeting Minutes.

**Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens:** Drafting E-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media. Telephone Etiquettes & Phubbing.

#### **List of Practical:**

1. Introduction to Vowel and Consonant Sounds
2. Monophthongs and Diphthongs
3. Syllable, Word Stress & Intonation
4. Harnessing Non-verbal Communication Skills in Cross-Cultural Environment for the establishment of an ideal Ecosystem to ensure Professional Success
5. Developing Speech, and Proofreading the Same
6. Argumentative Skills & Group Dynamics
7. Preparing CV, Biodata & Resume
8. Types of Interview and Interview Skills
9. GD, PI & Telephonic Interview
10. Presentation Skills, Extempore, Debate and Video Conferencing
11. Netiquettes while Writing Blogs on social media.
12. Ethical Usages of Generative AI

#### **Text / Reference Books**

1. Acharya Anita. (2012) Interview Skills- Tips & Techniques. Yking Books, Jaipur.
2. Basu, B. N., (2008) Technical Writing. PHI Learning Pvt. Ltd., New Delhi.
3. Chauhan, N. K & Singh, S. N. (2013) Formal Letters, Pankaj Publication International, New Delhi.
4. Chhabra T.N. (2018) Business Communication. Sun India Publication New Delhi.
5. Dubey Arjun et.al. (2016) Communication for Professionals. Alfa Publications, Delhi.
6. Gibaldi, Joseph (2021). The MLA Handbook for Writers of Research Papers. Ed. IX<sup>th</sup>, ModernLanguage Association of America, NY, US.
7. Gurumani, N. (2010) Scientific Thesis Writing and Paper Presentation, MJP Publishers, Chennai.
8. Hamilton Richard. (2009) Managing Writers. Penguin, India.
9. Mc Graw S. J. (2008) Basic Managerial Skills for All. Ed. 08th, Prentice Hall of India, New Delhi.
10. Murphy & Hildebrandt. (2008) Effective Business Communication. Tata McGraw Hill NewDelhi.



11. Pandey, S.P., Singh, S. N. & Kumar, Raman, (2023) Exploring Digital Humanities: Challenges & Opportunities, MacBrain Publishing House, New Delhi.

<b>BSM-160</b>	<b>Engineering Mathematics II</b>
<b>Course category</b>	: Basic Sciences & Maths (BSM)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture: 3, Tutorial: 1 , Practical: 0
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
<b>Course Objectives</b>	: The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To solve the ordinary differential equations.
2. To solve the partial differential equations using Lagrange and charpit's method.
3. To solve and understand the properties of Bessel's and Legendre's differential equation.
4. Application of partial differential equation in real life problems
5. To solve ODE and PDE with the help of Laplace transform
6. To inculcate the habit of mathematical thinking and lifelong learning.

**Topics Covered**

**UNIT-I** 9

**Ordinary Differential Equations I:** Linear differential equations with constant coefficients ( $n^{th}$  order), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

**UNIT-II** 9

**Ordinary Differential Equations II:** Series solution of second order differential equations with variable coefficient (Frobenius method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

**UNIT-III** 9

**Partial Differential equations:** Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

**UNIT-IV** 9

**Laplace Transform:** Laplace Transform, Laplace transform of derivatives and integrals. Unit step function, Laplace transform of Periodic function. Inverse Laplace transform, Convolution theorem, Applications to solve simple linear and simultaneous differential equations and Partial Differential Equations.

**Books & References**

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.
5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.

**BSM- ENGINEERING PHYSICS  
131/181**

<b>Course category</b>	: Basic Sciences and Maths (BSM)
<b>Pre-requisite Subject</b>	: Physics at 12 <sup>th</sup> Standard
<b>Contact hours/week</b>	: Lecture : 3, Tutorial : 0 , Practical: 2
<b>Number of Credits</b>	: 4
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
<b>Course Objectives</b>	: Understanding of the principles and concept of Optics, Quantum Mechanics, Fiber Optics, Electrodynamics and Physics of Advanced Materials.
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills, and attributes after completing this course. <ol style="list-style-type: none"><li>1. Understand the basics principles of Optics and its applications in Engineering and Technology.</li><li>2. Compare and understand the uses of various lasers in different fields of Engineering.</li><li>3. Know the knowledge of Optical Fibre and their applications in Photonics.</li><li>4. Understand the principles of Quantum Mechanics and their applications in Engineering and Technology.</li><li>5. Know the principles of Electrodynamics and their applications in Engineering and Technology.</li><li>6. Understand the basic properties of advanced materials and their engineering applications.</li></ol>

**UNIT-I: Optics:**

**9**

**Interference:** Interference of light, Interference in thin films, Newton's rings. Refractive index and wavelength determination.

**Diffraction:** Fresnel and Fraunhofer class of diffraction. Resultant of n-harmonic waves, single, double and N- slit diffraction, Diffraction grating, Grating spectra, Dispersive power.

**Polarization:** Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate, Polarimeter.

**Laser:** Spontaneous and stimulated emission of radiation, Population inversion, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers, and laser applications.

**UNIT-II : Quantum Mechanics and Fiber Optics:**

**9**

**Quantum Mechanics:** de Broglie waves, Davisson-Germer experiment, Concept of Phase and Group velocities, Uncertainty principle and its applications, Derivation of time independent and time dependent Schrodinger wave equations. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a particle in one dimensional infinite potential well.

**Fiber Optics:** Fundamentals of optical fiber, Acceptance angle and cone, Numerical aperture, Single and Multi-Mode Fibers, Step index and graded index fiber, Propagation Mechanism in optical fibers.

**UNIT-III: Electrodynamics:**

**9**

Scalar and Vector fields, Gradient, Divergence and curl, Concept of displacement current, Maxwell's equation in differential and integral forms, Physical significance of each equation.

Maxwell's equation in free space, Velocity of electromagnetic wave, Transverse nature of the electromagnetic wave, Poynting vector, Maxwell's equations in dielectric and conducting medium, and skin depth.

**UNIT-IV: Physics of Advanced Materials:**

**9**

Concept of energy bands in solids, Semiconducting materials, Concept of direct and indirect band gap in semiconductors, Carrier concentration and conductivity in semiconductors, Optoelectronic Materials, Superconducting Materials, Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, London Equations, BCS theory (Qualitative), Introduction of nanoscience, Nanotechnology and its applications.

**EXPERIMENTS**

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To determine the wavelength of sodium light using Newton's Ring experiment.
3. To determine the wavelength of spectral lines of white light using plane diffraction grating.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To study the variation of magnetic field along the axis of current carrying circular coil.
6. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
7. To study the energy band gap of Germanium using four probe method.
8. To determine the height of Tower by Sextant.

**Books & References**

1. Optics- Ajoy Ghatak, Tata McGraw-Hill
2. Optics- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand
3. Quantum Mechanics: Theory and Applications- Ajoy Ghatak, Tata McGraw-Hill
4. Fiber optics and laser Principles and Applications-Anuradha De, New Age International
5. Optical Fibers and its application as sensors by R. K. Shukla, New Age International.
6. Introduction to Electrodynamics by David J. Griffiths, Pearson
7. Physics of Semiconductor Devices, by S. M. Sze, Wiley
8. Concepts of Modern Physics by Arthur Beiser, Tata MCGraw Hill.
9. Introduction to Solid State Physics by C. Kittel, Wiley.
10. Engineering Physics by B. K. Pandey and S. Chaturvedi, 3e Cengage Learning Pvt. Limited, India.
11. Engineering Physics by H. K. Malik and A. Singh Tata MCGraw Hill.
12. Advanced Practical Physics Vol. I and Vol. II by D. K. Dwivedi, Victorius Publishers, New Delhi.

**BEE-110/160****Basic Electrical Engineering**

<b>Course category</b>	: Engineering Fundamentals (EF)
<i>Pre-requisite Subject</i>	: NIL
Contact hours/week	: Lecture: 3, Tutorial: 0, Practical: 2
<i>Number of Credits</i>	: 4
Course Assessment methods	: Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Minor tests and One Major Theory & Practical Examination.
<b>Course Objectives</b>	: <ol style="list-style-type: none"> <li><b>1.</b> To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context.</li> <li><b>2.</b> To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits used in electrical engineering and apply the basic concepts in Electrical engineering for multi-disciplinary tasks.</li> </ol>

**Course Outcomes:** The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
4. Classify different electrical measuring equipment's and understanding their principles.
5. Understand the basic concepts of magnetic circuits.
6. Explain construction and working principle of transformer.

**Topic Covered****UNIT I****D C Circuit Analysis and Network Theorems:****9**

Circuit Concepts: 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 laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.

**UNIT II****9****Introduction to AC Circuits:**

AC fundamentals, Analysis of single phase series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit.

Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three-phase power, and its measurement.

**UNIT III****9****Measuring Instruments:**

Fundamentals of measurement & instrumentation, Units, Dimensions and Standards. Error Analysis, types of errors & its analysis. Measuring instruments, construction and working principles of PMMC, Moving Iron and Electro-dynamometer type voltmeters & ammeters, Use of shunts and multipliers.

#### UNIT IV

9

##### **Magnetic Circuits and Transformers:**

Magnetic circuit concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.

Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.

##### **EXPERIMENTS**

1. Verification of Kirchhoff's Law.
2. Verification of Norton's Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Verification of Series R-L-C circuit.
7. Verification of Parallel R-L-C circuit.
8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
9. To perform O.C. and S.C. test of a single-phase transformer.

##### **Textbooks:**

1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

#### **BCE-151**

#### **Engineering Graphics with AutoCAD**

<b>Course category</b>	:	Professional Skill
<b>Pre-requisite Subject</b>	:	NIL
<b>Contact hours/week</b>	:	Lecture: 2, Tutorial: 0, Practical: 4
<b>Number of Credits</b>	:	4
<b>Course Assessment Methods</b>		Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Minor tests and One Major Theory & Practical Examination.
<b>Course Objective</b>	:	This course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three- dimensional objects in two-dimensional views (principal, auxiliary, sections). Dimension and annotate two-dimensional engineering drawings.

**Course Outcomes** : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. How Engineering Drawing helps to sketch the imagination?
2. Able to effectively practice the different scales for drawings.
3. Effectively analyze the geometrical shapes and to be able to draw.
4. Know about out solids and discuss about their classification.
5. How to implement the different views for a solid placed in 3d space.
6. Construction of the object from different perspective.

**Topics Covered**

**UNIT-I**

6

**Conic Sections and Orthographic Projections Introduction**

Introduction to Engineering Drawing covering, 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.

**Orthographic Projections**

Orthographic Projections covering Principles of Orthographic Projections- Conventions  
Projections of Points and lines inclined to both planes; Projections of planes inclined Planes -Auxiliary Plane

**UNIT-II**

6

**Projection of Regular Solids**

Projections of Regular Solids covering those inclined to both the Planes- Auxiliary Views

**UNIT-III**

6

**Sections and Sectional Views of Right Angular Solids**

Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

**UNIT-IV**

6

**Isometric Projections**

Isometric Projections covering, 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. Overview of computer graphics, demonstrating knowledge of the theory of CAD software.

**Text & Reference books:**

1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008
  2. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana, Pearson Education, 2008
  3. A Textbook of Engineering Drawing-Dhawan, R.K., S. Chand Publications, 2007
- Textbook on Engineering Drawing-Narayana, K.L. & P Kannaiah, Scitech Publishers, 2008

**BHS- 101/151 Universal Human Values: Understanding Harmony**

Course Category : HSS

Prerequisite subject : None

Number of Credits : 4

Contact Hours/Week : Lectures: 3, Tutorial: 1, Practical: 0

Course Assessment Methods : Continuous assessment through One test, teacher's assessment (quiz, tutorial, assignment, attendance), and One Major Theory Examination.

Course Objectives : The objectives of this course are to: -

1. Develop a holistic perspective in students based on self-exploration about themselves (human being), family, society and nature/existence.
2. Develop understanding (or developing clarity) in students about harmony in the human being, family, society and nature/existence.
3. Strengthen self-reflection in students.
4. Develop commitment and courage in students to act.

Course Outcomes : The students will be able to demonstrate the following knowledge, skills, and attitudes upon completion of the course: -

1. Ability to understand the interconnectedness of humanity and nature as well as the importance of values in interpersonal relationships.
2. Ability to recognize their role as global citizens and understand the importance of actively contributing to the betterment of society through responsible actions.
3. Ability to engage in critical reflection on their own values and beliefs, challenging assumptions and biases to foster personal growth and development.
4. Ability to appreciate and respect diversity thereby promoting communication and conflict resolution skills, promoting dialogue and understanding in resolving interpersonal and intergroup conflicts.

## **Unit 1**

**9**

Introduction to Values: origin, definition, meaning, and types of values; Values in Education System; difference between Values, Morals, and Ethics; Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and ‘Experiential Validation’ as the process for self-exploration; Continuous Happiness and Prosperity- A look at basic human aspirations; Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority; Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario; Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

## **Unit 2**

**9**

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'; Understanding the needs of Self ('I') and 'Body' - happiness and physical facility; Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer); Understanding the characteristics and activities of 'I' and harmony in 'I'; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health.

### **Unit 3**

**9**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship; Understanding the meaning of Trust; Difference between intention and competence; Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

### **Unit 4**

**9**

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature; Understanding Existence as Co-existence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence; Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics.

### **Text & Reference Books:**

1. Andrews, C. (2006). *Slow is beautiful*. New Society Publishers.
2. Gandhi, M. K. (1909). *Hind Swaraj or Indian Home Rule*. Navjeevan Trust.
3. Gandhi, M. K. (2009). *An Autobiography or The Story of My Experiments with Truth* (Mahadev Desai, Trans.). Navjeevan Mudranalay. (Original work published 1925).
4. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2010). *A Foundation Course in Human Values and Professional Ethics*. Excel Books.
5. Govindrajan, M., Senthilkumar, S., & Natarajan, M. S. (2013). *Professional Ethics and Human Values*. Prentice Hall India.
6. Kumarappa, J. C. (2017). *Economy of Permanence*. Sarva Seva Sangh Prakashan.
7. Naagarazan, R. S. (2022). *A Textbook on Professional Ethics and Human Values*. New Age International.
8. Rolland, R. (2010). *Life of Vivekanad* (4<sup>th</sup> Ed.). Advait Ashram.
9. Schumacher, E. F. (1973). *Small is beautiful. A study of Economics as if people mattered*. Blond & Briggs.
10. Suresh, J., & Raghavan, B. S. (2003). *Human Values and Professional Ethics*. S Chand.



## **BHS- 102/152 TECHNICAL WRITING AND PROFESSIONAL COMMUNICATION (TW&PC)**

Course Category	: HSS
Prerequisite subject	: None
Number of Credits	: 4
Contact Hours/Week	: Lectures: 2, Tutorial: 1, Practical: 2
Course Assessment Methods	: Continuous assessment through One test, teacher's assessment (quiz, tutorial, assignment, attendance), and One Major Theory Examination.
Course Objectives	: The objectives of this course are to: - The course aims- <ol style="list-style-type: none"><li>1. To sensitize the students to understand the role and importance of communication for personal and professional success.</li><li>2. To enable the learners to enhance their writing skills in techno-cultural and professional echo-system.</li><li>3. To equip learners to differentiate technical writing from general writing.</li><li>4. To equip them with technical writing skills.</li><li>5. To enable learners to exhibit knowledge, skills, attitude and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.</li></ol>
Course Outcomes	: The students will be able to demonstrate the following knowledge, skills, and attitudes upon completion of the course: - <ol style="list-style-type: none"><li>1. Overcome the problems she/he shall faces in oral and written communication.</li><li>2. Acquire knowledge of and methods for using technical communication, such as reports, proposals, technical letters, etc.</li><li>3. Use and Practice compositions correctly.</li><li>4. Give presentations in different sessions and make self-appraisal.</li><li>5. Learn and understand the various facets of Communication Skills, such as (LSRW) Listening, Speaking, Reading, and writing, and identify, formulate, and solve real-life problems with a positive attitude; also inculcate, the habit of learning and developing communication and soft skills.</li></ol>

### **Unit 1: Language and Communication**

**6**

**Language Vs communication:** Communication as coding and decoding – signs, symbols & pictograph – verbal and non-verbal symbols – Language & communication; Types of Communication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication. Thinking and Articulation, critical, creative aspects of articulation.

**Skills of Language Acquisition:** Natural Language Acquisition Skills: Listening, Speaking, Reading & Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing,

Grammar & Vocabulary {LSRWGV}

**Phrase, Clause & Sentence in Professional Drafting**-Simplicity, Clarity and Conciseness of a Presentation, differentiating between Professional and Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial, and other forms of bias in Professional Writing. Pre-writing, Drafting, and Re-writing.

## **Unit 2: Towards Technical Writing**

**6**

**Technical Paper Writing:** Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organizing References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing- Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing- Title, Keywords, Synopsis, Preface and Abstract. Drafting Research Article & Methodology.

**Thesis/Dissertation Writing:** Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections- Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

**Professional Presentation & Seminar Delivery Tools:** Designing the Presentation; Establishing the Objectives. Making Professional PowerPoint Presentations, Signaling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team& Meet etc.

## **Unit 3: Drafting Skills & Career Correspondence**

**6**

**Professional Drafting:** Letters vs. e-mails, Formal and Informal emails, Parts of e-mails, Types of e-mails, Managing tone of E-mails and business Letters, Examples of Letters and E-mail, Professional Correspondence through E-mail, Job Applications and cover Letters. Introduction to DOs (Demi- Official Letters)

**Career & Correspondence:** Developing a Professional C.V, Bio Data & Resume. Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

## **Unit 4: Professional Practices with ICT Interface**

**6**

**Conducting Professional Meeting:** Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Meeting Minutes.

**Introduction to Generation-Z, Cyber Identity & Professional Netiquettes for Netizens:** Drafting E-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media. Telephone Etiquettes & Phubbing.

### **List of Practical:**

1. Introduction to Vowel and Consonant Sounds
2. Monophthongs and Diphthongs
3. Syllable, Word Stress & Intonation
4. Harnessing Non-verbal Communication Skills in Cross-Cultural Environment for the establishment of an ideal Ecosystem to ensure Professional Success
5. Developing Speech, and Proofreading the Same
6. Argumentative Skills & Group Dynamics

7. Preparing CV, Biodata & Resume
8. Types of Interview and Interview Skills
9. GD, PI & Telephonic Interview
10. Presentation Skills, Extempore, Debate and Video Conferencing
11. Netiquettes while Writing Blogs on social media.
12. Ethical Usages of Generative AI

### **Text / Reference Books**

1. Acharya Anita. (2012) Interview Skills- Tips & Techniques. Yking Books, Jaipur.
2. Basu, B. N., (2008) Technical Writing. PHI Learning Pvt. Ltd, New Delhi.
3. Chauhan, N. K & Singh, S. N. (2013) Formal Letters, Pankaj Publication International, New Delhi.
4. Chhabra T.N. (2018) Business Communication. Sun India Publication New Delhi.
5. Dubey Arjun et.al. (2016) Communication for Professionals. Alfa Publications, Delhi.
6. Gibaldi, Joseph (2021). The MLA Handbook for Writers of Research Papers. Ed. IX<sup>th</sup>, Modern Language Association of America, NY, US.
7. Gurumani, N. (2010) Scientific Thesis Writing and Paper Presentation, MJP Publishers, Chennai.
8. Hamilton Richard. (2009) Managing Writers. Penguin, India.
9. Mc Graw S. J. (2008) Basic Managerial Skills for All. Ed. 08th, Prentice Hall of India, New Delhi.
10. Murphy & Hildebrandt. (2008) Effective Business Communication. Tata McGraw Hill NewDelhi.
11. Pandey, S.P., Singh, S. N. & Kumar, Raman, (2023) Exploring Digital Humanities: Challenges & Opportunities, MacBrain Publishing House, New Delhi.

### **BME - 158**

Course category:  
Pre-requisite Subject:  
Contact hours/week:  
Number of Credits:  
Course Assessment methods:

### **Engineering Innovation & Design**

Engineering Fundamental (EF)  
NIL  
Lecture: 0, Tutorial: 0, Practical: 2  
1  
Continuous assessment through attendance, practical work, record, Viva-voce

### **Course Objectives**

1. To familiarize product design process
2. To introduce the basics of design thinking
3. To bring awareness on idea generation
4. To familiarize the role of design thinking in services design

**Course Outcomes:** The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Students will be able to visualize the need for engineering for serving the society better
2. To explain the concept of design thinking for product and service development
3. To explain the fundamental concept of innovation and design thinking
4. To discuss the methods of implementing design thinking in the real world.
5. Students will be able to identify needs and be able to suggest different alternative solutions considering cost constraints.

- Students will enhance the possibility of taking up entrepreneurship activity, possibility of coming up with new ideas leading to IPR.

**UNIT-I**

Introduction Design & innovation, Who designs & develops products, Industrial & Practical examples. Projects.

**UNIT-II**

Creative thinking- Invention- innovation & inventiveness in a society.

**UNIT-III**

A Generic Development Process & Concept Development. Identifying Customer Needs, Concept Generation, Concept Selection

**UNIT-IV**

Product Architecture, Industrial Design, Intellectual Property Rights

**Textbooks**

- Product Design & Development- Karl T. Ulrich, Steven D Eppinger, McGraw Hill
- Publishers.
- Gerard Voland, Engineering by Design, Pearson,
- Human Factors in Engineering Design- Mark S sanders & Ernst J. Mc Cornick McGraw Hill
- Publishers.
- [https://ocw.mit.edu/courses/esd-051j-engineering-innovation-and-design-fall-2012/video\\_galleries/lecture-notes-and-videos/](https://ocw.mit.edu/courses/esd-051j-engineering-innovation-and-design-fall-2012/video_galleries/lecture-notes-and-videos/)
- 2012/video galleries/lecture-notes-and-videos/

<b>BME-159</b>	Heating Ventilation and Air Conditioning (HVAC)
<b>Course category</b>	: UG Certificate (Engg.)
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture: 3, Tutorial : 0 , Practical: 2
<b>Number of Credits</b>	: 3
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
<b>Course Objectives</b>	: This course is designed to provide occupational and technical information related to the safety, fundamentals of refrigeration, electrical circuits and controls, installation and service of residential hermetic units, and basic sheet metal fabrication.
<b>Course Outcomes</b>	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
	<ol style="list-style-type: none"> <li>Thorough understanding and increased knowledge of HVAC systems, including their installation, operation, maintenance and repair.</li> <li>Increased confidence and experience to troubleshoot for any issues with HVAC systems in the least time possible</li> <li>Greater skill and understanding to work with HVAC systems and ensure proper maintenance to reduce shutdowns or downtimes.</li> <li>Increased confidence and experience to guide other professionals regarding all critical aspects of HVAC systems.</li> <li>Better strategic skills and foresight to predict possible challenges and hindrances and address these in time, before they have grave impact</li> </ol>

6. Enhanced skills and capabilities to work and assume higher roles and responsibilities related to HVAC systems across any organization, thereby increasing avenues for growth and progression

## Topics Covered

### UNIT-I 9

**Introduction to HVAC:** Fundamental and scope of HVAC, Mode of heat transfer , Standards Refrigeration cycle Component of A/C, Refrigerants and types

**Classification of Air-Conditioning System:** Window Air Conditioning Systems, Split Air Conditioning Systems, Central Air Conditioning Systems, Package Air Conditioning Systems.

**Fundamental and scope of HVAC:** Air cooled system of air conditioning, Chilled water system of air conditioning, Air water system of air conditioning, Direct refrigerant system of air conditioning.

### UNIT-II 9

**Study of Psychometric:** Properties of Air (DBT, %RH, WB, DPT, enthalpy).

**Load Calculation:** Orientation of Building, To Read Latitude of Location of building, Calculation of U factor for wall, glass, Roof and Partition, Calculation of Equivalent Temp. Difference for wall, glass, Roof and Partition, Cooling and Heat Load Calculation using ASHRAE Standards, Calculation Of sensible Heat Factor, ADP and Dehumidified CFM

### UNIT-III 9

**Chilled water system:** Definition of STHE, Study about Chilled Water Systems, Types & Application of Chillers, Open loop & Closed loop system- Chilled water pipe sizing, Types of Valves & Its Connection, Valve Authority, Primary and Secondary pump system, Hydraulic Calculation for Pump Selection

Expansion Tank Sizing, Air Separator, Pump Cavitations, Pump Curves, NPSH Calculation for Pumps, Advance Psychometric Analysis, Determine Mix Air

Temperature, Calculate the Flow of Air, ESHF, Ton of Refrigeration, Design of CAV & VAV System. Components of Chilled Water system, Heat Gain Calculation, Manual Calculation, Hour analysis Program, Cooling and Heating Load calculation using Hourly Analysis Program (HAP)

### UNIT-IV 9

#### Duct Designing:

Calculation of duct sizes by Mc-Quay Duct Sizer; Equipment and Air Terminal:

Cold storage selection. Selection of Materials of Ducts, Primary and secondary pump selections, Duct material selection, Selection of cooling tower, Selection of Chillers, AHU and FCU classification and selection, Package unit selection DX unit selection Section dwg, Pipe Designing, Air terminal selection.

Pipe Designing Refrigerant Pipe sizing. Chilled water pipe sizing, Calculation of Chilled water pipe sizes by Mc-Quay pipe Sizer Software, Static Pressure Calculation: Selection of Motor HP, Selection Fan/Blower RPM.

## Books & References

1. HVAC Fundamentals Volume-1 / James E. Brumbou / Audel / 4th Edition
2. Fundamentals of HVAC Systems / Robert Mcdowall / Academic Press / 2007
3. Home Heating & Air Conditioning systems / James Kittle / MGH
4. HVAC Fundamentals / Samuel C. Sugarman / Fairmont Press / 2005.
5. Principles of Refrigeration – Dossat, Pearson 6. R&AC Handbook by ISHRAE

<b>BME-160</b>	<b>Machinist</b>
<b>Course category</b>	: UG Certificate (Engg.).
<b>Pre-requisite Subject</b>	: NIL
<b>Contact hours/week</b>	: Lecture: 2, Tutorial: 0 , Practical: 2
<b>Number of Credits</b>	: 2
<b>Course Assessment methods</b>	: Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
<b>Course Objectives</b>	: The objective of this course is to provide the student with knowledge in the areas of industrial safety, machining and machine tools as practiced in the field of Mechanical Engineering Technology
<b>Course Outcomes</b>	: Upon completion of this course, the student will demonstrate the ability to: <ul style="list-style-type: none"> <li>• Identify and remediate unsafe work practices within a shop environment.</li> <li>• Perform a variety of machining operations on both an engine lathe and vertical milling machine.</li> <li>• Apply tolerances, fits, surfaces finish requirements, and material selection to a given part or assembly.</li> <li>• Determine machine tool speeds, feeds, and depth of cuts for a variety of machining applications.</li> <li>• Understand machine code (G&amp;M code) for (CNC) machine tools.</li> </ul>

**Topics Covered**

**UNIT-I** 6

Plan & identify tools, instruments and equipment for marking and make this available for use in a timely manner. Identify hand tools for different fitting operations and make these available for use in a timely manner, Check for dimensional accuracy as per standard procedure. Plan and organize for fitting job.

Marking and Marking tools, Measuring instruments. Linear measurements - Steel rule – Marking media – Calipers – Dividers – Marking punches – Scriber – Hammer – Marking off table – Surface plate – vices – Angle plate – Try square – Combination set – Marking block – Parallel block.

**UNIT-II** 6

Precision measuring instruments: Micrometer (different types, parts, graduation, reading) – Vernier caliper – Dial Test Indicator- Bore dial gauge – Vernier height gauge – Vernier bevel protractor – Gear tooth caliper.

Hand tools: Hacksaw frame and blade – Saw setting – Files (types, uses, cut, grade, specification) – convexity of file – Pinning of file – Taps and Dies – Die nut – Chisel – Reamer

**UNIT-III** 6

Drilling: Lubricants and Cutting fluids, Maintenance, Drilling machines – types – various operations in drilling machine – Drill – Drill holding devices – work holding devices – tap drill size – Cutting speed, feed and depth of cut in drilling – Drilling defects and causes. Types of cutting fluids and purpose – Lubricants classification and properties – Lubricating system – Maintenance – Machine tool inspection

Lathe: Parts and functions – Types – Specification – Operations – Lathe accessories and attachments – Cutting speed, feed, RPM – Lathe tools and angles – Driving mechanism – Chip breaker – Taper turning methods – Taper and its types – Taper calculation – Sine bar and slip gauges – Screw thread and elements – Forms of screw threads – Lathe centre’s – Mandrel – Thread

cutting – Single and multi-start threads – Simple gear train and compound gear train – Lathe dogs  
– Driving plate – Face plate – Rests.

#### **UNIT-IV**

6

Milling: Milling machine – classification – specification – parts, functions – Application – cutter holding devices – milling cutters – cutter material – types of cutters – Nomenclature of milling cutter – Different milling operations – Up milling and down milling – Straddle milling – Gang milling – Cutting speed, feed and machining time – Dividing head types and uses – Types of indexing and calculations – Types of gears and uses – Elements of spur gear – Spur gear calculation – Selection of gear cutter – Helix and spiral elements, applications – Difference between helix and spiral – Methods of checking gear and its parts – Rack elements, application – Cam types and applications – Jigs and fixtures – Gauges material and purpose – Different types of gauges.

Grinding: Types of grinding machines – parts and functions of each types – Different grinding operations – Construction of grinding wheel – Standard marking system of grinding wheels – Glazing and loading – Dressing and truing – Cutting speed, feed and depth of cut – Shapes of grinding wheel and applications – Selection of grinding wheel – Wheel balancing – Wet grinding and dry grinding – Tool and cutter grinder attachments and their uses.

#### **List of Practical:**

1. Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy.
2. Produce components by different operations and check accuracy using appropriate measuring instruments.
3. Make different fit of components for assembling as per required tolerance observing principle of interchange ability and check for functionality.
4. Set different shaped jobs on different chuck and demonstrate conventional lathe machine operation observing standard operation practice.
5. Set different components of machine & parameters to produce taper/ angular components and ensure proper assembly of the components.
6. Set the different machining parameters and cutting tool to prepare job by performing different slotting operation.
7. Set the different machining parameters and cutters to prepare job by performing different milling operation and indexing.
8. Set the different machining parameters to produce square & “V” threaded components applying method/ technique and test for proper assembly of the components.
9. Produce components of high accuracy by different operations using grinding.
10. Read and apply engineering drawing for different application in the field of work.
11. Set different machining parameters and cutters to prepare job by different milling machine operations.
12. Set the different machining parameters and cutters to prepare components by performing different milling operations and indexing.
13. Plan and perform simple repairs, overhauling of different machines and check for functionality.

#### **Textbooks and References:**

1. Manufacturing Science: A. Ghosh and A.K. Mallik (East- West Press).
2. Workshop Technology Vol-I: B. S. Raghuvanshi (Dhanpat Rai and Sons)
3. Workshop Technology Vol-II: B. S. Raghuvanshi (Dhanpat Rai and Sons)

4. A Textbook of Workshop Technology: Manufacturing Processes
5. Mechanical Workshop Practice, John K C, PHI