

Department of Mechanical Engineering (ME)

Course name: B.Tech. (Mechanical Engineering)

First Year ME Course Structure, Syllabus & Evaluation Scheme

(Note: This Course Structure, Syllabus & Evaluation Scheme is as per New Education Policy-2020 and has been approved by the Academic Council. It has been implemented for First year students admitted in Academic Session: 2026-2027)

B.TECH-ME: IMPLEMENTED FROM SESSION 2026-2027

CURRICULUM & EVALUATION SCHEME

I SEMESTER (MECH. ENGG.)

Sr. No.	Course Type	Category	Subject Code	Course Title	L	T	P	Credits	MSE (I & II)	LAB	TA	Total	ESE	Total Marks
1	BSC	Multidisciplinary	DMA101	Mathematics-I	3	1	0	4	30	-	20	50	50	100
2	BSC	Multidisciplinary	DPH101	Physics	3	0	2	4	15	15	20	50	50	100
3	ESC	Multidisciplinary	DCS101	Programming for Problem Solving	3	1	0	4	15	15	20	50	50	100
4	ESC	Multidisciplinary	DEE101	Basic Electrical Engineering	3	0	2	4	15	15	20	50	50	100
5	SEC	Skill Enhancement	DCE101	Engineering Graphics	0	0	4	2	-	30	20	50	50	100
6	HSMC	Value Added Course	DHS101	Universal Human Values	2	0	0	2	15	15	20	50	50	100
7	HSMC	Ability Enhancement Mandatory	DHS102	English for Technical Writing	2	0	0	2	30	-	20	50	50	100
8	MC	Mandatory Course	MC101	Induction Program	0	0	0	0						-
				Total Credits				22						700

II SEMESTER (MECH. ENGG.)

Sr. No.	Course Type	Category	Subject Code	Course Title	L	T	P	Credits	MSE (I & II)	LAB	TA	Total	ESM	Total Marks
1	BSC	Multidisciplinary	DCY201	Chemistry	3	0	2	4	15	15	20	50	50	100
2	ESC	Multidisciplinary	DET201	Basic Electronics Engineering	2	1	0	3	30	-	20	50	50	100
3	ESC	Multidisciplinary	DME201	Basic Engineering Mechanics	3	1	0	4	30	-	20	50	50	100
4	ESC	Value Added Course	DCE202	Environmental Ecology and Sustainability	2	1	0	3	30	-	20	50	50	100
5	SEC	Skill Enhancement	DWS201	Digital Fabrication/ Workshop/Manufacturing Practices	0	0	4	2	-	30	20	50	50	100
6	HSMC	Ability Enhancement	DHS203	Communication Skills	2	0	2	3	15	15	20	50	50	100
7	PCC	Core	DME202	Engg Thermodynamics	3	0	0	3	15	15	20	50	50	100
8	MC	Mandatory Course	MC202	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club	0	0	0	0						-
				Total Credits				22						700

Course Content

Objective: The objective of this course is to make students learn the laboratory skills needed to design safe conduction of reactions and experiments in Chemistry. The student will acquire a foundation of Chemistry to enable them to understand and critically interpret the primary research in Chemistry.

Prerequisite: Not specified in the source syllabus.

Course Outcomes (CO):

CO1 Interpret UV-Visible and IR-Spectra.

CO2 Describe reaction rates for reactions of various orders and surface chemistry.

CO3 Understand different aspects of electrochemical processes, reversible, irreversible cells, nanochemistry and environmental chemistry.

CO4 Understand the stereochemistry of molecules and identify organic reactions on the basis of their mechanism.

CO5 Distinguish between different polymeric structures, classify polymers, and analyze the polymerization mechanism and use of polymers in different walks of life. Knowledge of conductivity of polymer, biodegradable polymers and fibre reinforced plastics. Acquire knowledge about water and treatment of municipal water and solid waste management.

CO6 To develop experimental skills to perform, monitor and manipulate the reactions.

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	1	3	2	-	2	-	-	-	3
CO2	-	-	-	3	-	-	-	-	-	-	3
CO3	3	3	1	3	2	-	2	-	-	-	3
CO4	3	3	1	3	2	-	2	-	-	-	3
CO5	3	3	1	3	2	-	2	-	-	-	3
CO6	3	3	1	3	2	-	2	-	-	-	3
Average	3	3	1.3	3	2	0.33	2	0.33	0.16	0.33	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation, put "-".

Course Syllabus:**UNIT-1**

(I) Bonding: VSEPR Theory, Valence Bond Theory, Crystal-field theory, Electronic Spectra and Ligands (strong and weak field), Phosphorescence and Fluorescence, Jablonski diagram, hydrogen bonding and their effect on physical properties, Metallic bonds, Classification and Applications of Liquid crystals, Band Theory of Solids and superconductors. (Lectures: 6-7)

(II) Spectroscopy: Basic Principles, Instrumentation and Applications of UV-Vis and IR Spectroscopy. (Lectures: 5-6)

UNIT-2

(I) Chemical Kinetics: Second order reactions. Determination of order. Fast and slow reaction. Steady state approximation. Temperature effect. Concept of Activated Complex/Transition State: Energy of activation, Potential energy surface, Theories of reaction rate: Collision and Transition State theories in terms of enzyme catalysis. (Lectures: 4-5)

(II) Surface Chemistry: Introduction, Types of adsorption. Adsorption isotherms, BET, Applications of adsorption. (Lectures: 2-3)

UNIT-3

(I) Electrochemistry: Dry and fuel cells, electrochemical cell, Solar cells, Dye sensitized cell, Photovoltaic cell. (Lectures: 3-4)

(II) Nanochemistry: Introduction, general methods of preparation, characterization and applications of nanomaterials. (Lectures: 2)

(III) Environmental Chemistry: Air and Water Pollution, analysis of gaseous effluents, oxides of Nitrogen, oxides of Sulphur and H₂S, chemical analysis of effluent liquid streams, BOD, COD, control of pollution, depletion of ozone layer. (Lectures: 5-6)

UNIT-4

(I) Stereochemistry: Stereoisomerism of organic molecules containing one & two chiral centers. Enantiomers & Diastereomers. E-Z nomenclature, R-S configuration, Atropisomerism, and Optical isomerism in Allenes, Biphenyls and Spiranes, Circular Dichroism. (Lectures: 5-6)

(II) Reaction Mechanism: Inductive, Electromeric and Mesomeric effects. Study of reaction intermediates (Carbanion, carbocation, carbene, nitrene and benzyne). Mechanism of nucleophilic and electrophilic substitution reactions. Mechanism and application of following reactions: a) Suzuki-Miyaura Cross coupling reaction; b) Fries and Photo-Fries Rearrangement; c) Wagner-Meerwein Rearrangement; d) Umpolung Reactions; e) Favorskii Rearrangement. (Lectures: 5-6)

UNIT-5

(I) Polymers: Introduction, types of polymers, Molecular mass-number and mass average molecular weight, determination of molecular mass by Osmometry, viscosity, light scattering and size exclusion chromatography, Rheological properties and uses of some common polymers. Synthetic Polymers (carbon framework, silicon framework, fluorinated polymer), Conducting and Biodegradable polymers. (Lectures: 4-5)

(II) Water Analysis: Introduction; Hardness of Water- cause, types, units, Disadvantages of using hard water for domestic and industrial purposes, Softening of hard water, Chemical analysis of Water- estimation of free chlorine, total alkalinity, hardness, Numerical based on determination of hardness. (Lectures: 4-5)

(III) Solid Waste Management: Classification, waste treatment & Disposal methods (Composting, sanitary landfilling, thermal processes, recycling and reuse). (Lectures: 4-5)

List of Experiments:

- Determination of alkalinity in given water sample: a. Sodium Carbonate & Sodium Bicarbonate; b. Sodium Carbonate & Sodium Hydroxide.
- Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
- Determination of Chloride content of water by Mohr's Method.
- Determination of Chlorine content in Bleaching powder.
- Determination of strength of supplied Ferrous Ammonium Sulphate (FAS) solution using external, internal indicators.
- Determination of viscosity of a given liquid by Ostwald's viscometer.
- Determination of surface tension of a given liquid by Stalagmometer.
- pH metric titration.
- Determination of Dissociation constant of weak acids by conductometric Titration.
- To prepare aspirin (acetyl salicylic acid) from salicylic acid.
- Synthesis of polyurethanes.
- Find the concentration of the given samples using UV-visible spectroscopy.

Reference Books:

1. Engineering Chemistry by Shashi Chawla.
2. Organic Chemistry by I. L. Finar.
3. Physical Chemistry by Puri, Sharma & Pathania.
4. Polymer Science by V. R. Gowarikar, N. V. Vishwanathan and J. Shridhar, Wiley Eastern Ltd., New Delhi.
5. Elementary Organic Spectroscopy by Y. R. Sharma.

Evaluation Scheme:

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1&2	TA	Lab	Total Sessional Marks	ESM / Total Marks
1	BSC	DCY-101/201	Chemistry	4(3-0-2)	15	20	15	50	50 / 100

Subject Code: DCE202 Subject Name: ENVIRONMENTAL ECOLOGY & SUSTAINABILITY

Credits [L-T-P]: 3[2-1-0]

Course Content

Course Objective: To introduce students to the fundamentals of environment and ecology, create awareness about environmental issues, and encourage sustainable practices using simple and practical concepts.

Course Outcomes (CO):

CO1 Explain the components of environment, their interactions, biosphere, environmental education, and impacts of developmental activities on the environment. (L2 – Understand)

CO2 Identify and explain various natural resources and appropriate methods for their conservation and sustainable utilization. (L2 – Understand)

CO3 Analyze ecosystem functions, energy flow, ecological succession, food chains, ecological pyramids, biogeochemical cycles, and biodiversity conservation. (L4 – Analyze)

CO4 Assess major types of environmental pollution and suggest suitable pollution prevention, control, and solid-waste-management measures based on the 3R principle. (L4 – Analyze)

CO5 Evaluate environmental and social issues associated with sustainable development, climate-related concerns, environmental ethics, regulatory mechanisms, and environmental impact assessment. (L5 – Evaluate)

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	-	2	3	-	-	-	1
CO2	2	2	1	-	-	2	3	-	-	-	1
CO3	3	3	-	2	-	2	3	-	-	-	1
CO4	3	3	2	2	1	3	3	2	-	1	1
CO5	2	3	1	2	-	3	3	3	1	2	2
Average	2.40	2.40	1.33	2.00	1.00	2.40	3.00	2.50	1.00	1.50	1.20

Correlation scale: 3 = High, 2 = Moderate, 1 = Low, – = No direct correlation.

Course Syllabus:

UNIT-1

Introduction to Environment (No. of Lectures - 04)

Importance of Environmental Education, Component of Environment and their interactions, Man and the Biospheres, Impact of Development on Environment.

UNIT-2

Natural Resources (No. of Lectures - 06)

Forest resources, water resources, mineral resources, land resources, energy resources (renewable and non-renewable), conservation of natural resources.

UNIT-3

Ecology (No. of Lectures - 08)

Ecology: Ecosystem, energy flow through ecosystem, ecological succession, food chain and web, ecological pyramid, Biochemical Cycles: Water cycle, carbon cycle, oxygen cycle, nitrogen cycle, phosphorus cycle, and sulphur cycle; aquatic ecosystem, Introduction to population ecology, Biodiversity.

UNIT-4

Environmental Pollution (No. of Lectures - 05)

Air pollution, water pollution, soil pollution, noise pollution, and solid waste management (3R: Reduce, Reuse, Recycle).

UNIT-5

Social Issues and Environment (No. of Lectures - 07)

From unsustainable to sustainable development, urban problems related to energy, water conservation, watershed management, environmental ethics, acid rain, Ozone layer depletion, greenhouse effect, global warming, nuclear hazards and accidents, and environmental impact assessment.

Recommended Textbooks:

1. Benny Joseph - Environmental Studies, McGraw Hill Education (India) Private Limited.
2. S.V.S. Rana - Essentials of Ecology and Environmental Science, PHI Learning.

Reference Books:

1. Suresh K. Dhameja - Environmental Science and Engineering, S K Kataria and Sons.
2. Y. Anjaneyulu – Introduction to Environmental Science, BS Publications.
3. P. Anandan & R. Kumaravelan - Environmental Science & Engineering, Scitech Publications.

Evaluation Scheme:

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1&2	TA	Lab	Total Sessional Marks	ESM / Total Marks
1	VAC	DCE-201	Environmental Ecology & Sustainability	3(2-1-0)	-	-	-	-	- / -

Course Content**Course Outcomes (CO):**

CO1 Communicate engineering graphics by doing geometric constructions and dimensioning.

CO2 Produce basic orthographic projections on projections of points and lines.

CO3 Produce orthographic projections on planes and solids.

CO4 Develop isometric drawings of simple objects using AutoCAD 3D interface.

CO5 Make conversion of Isometric Views to Orthographic Views and Vice-Versa using AutoCAD.

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	-	-	2	-	-	-	-	3	-
CO2	3	2	1	-	2	-	-	-	-	2	-
CO3	3	3	2	-	2	-	-	-	-	2	-
CO4	2	1	2	-	3	-	-	-	-	2	-
CO5	2	3	2	-	3	-	-	-	-	3	-
Average	2.4	2.0	1.75	-	2.4	1	2	-	-	2.4	-

Correlation scale: 3 = Substantial (High), 2 = Moderate (Medium), 1 = Slight (Low); If there is no correlation, put “-”.

Course Syllabus:**UNIT-1****Introduction to Computer Aided Engineering Graphics (Lectures: 4+4)**

Introduction, AutoCAD User Interface, BIS conventions, Dimensioning. Generation of points, lines, curves, polygons, dimensioning, layers, blocks. Geometrical constructions.

UNIT-2**Orthographic Projections (Lectures: 3+5)**

Projections of Points. Projections of Lines parallel and inclined to both the planes.

UNIT-3**Projections of Planes and Solids (Lectures: 3+5)**

Projections of Planes: Projections of regular planes, plane inclined to both the planes. Projections of Solids: Projections of regular solids inclined to one plane.

UNIT-4**Isometric Projections (Lectures: 3+5)**

Principles – Isometric Scale – Isometric Views. AutoCAD 3D interface. Plane Figures and Simple Solids.

UNIT-5**Transformation of Projections (Lectures: 6+2)**

Conversion of Isometric Views to Orthographic Views and Vice-Versa in AutoCAD.

Total class hours: 40 (sum of the unit-wise lecture hours given in the source syllabus).

Proposed Textbooks:

1. Engineering Drawing – N.D. Bhatt & V.M. Panchal, 48th edition, 2005, Charotar Publishing House, Gujarat.
2. Engineering Graphics for Degree by K.C. John, PHI Learning Private Limited.
3. Computer Aided Engineering Graphics by Rajashekar Patil, New Age International Pvt. Ltd.

Reference Books:

1. Computer Aided Engineering Drawing – S. Trymbaka Murthy, I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2006.

2. Engineering Graphics with AutoCAD 2020 by James D. Bethune, Pearson Publications.
3. Engineering Graphics Essentials with AutoCAD 2018 Instruction Text and Video Instruction by Kirstie Plantenberg, SDC Publications.

Web Resources:

1. <https://www.youtube.com/watch?v=iXksFTnzlM&list=PLbRMhDVUMngel6OpnNppYzfJUQHSFePQb>

Evaluation Scheme:

Since this subject has L-T-P-C as 0-0-4-2 and is a practical course, there is no requirement of centrally conducted MSE/ESE examination. The evaluation will be based on assignments / Quiz / viva-voce / practical exam at the department level.

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	Evaluation
1	Practical	DCE-101	Engineering Graphics	2(0-0-4)	Assignments / Quiz / Viva-Voce / Practical Exam at Department Level

Subject Code: DPH101

Subject Name: PHYSICS (THEORY & LAB)

Credits [L-T-P]: 4[3-0-2]

Course Content

Course Objective: The objective of the course is to provide a foundational understanding of core concepts in engineering physics and their practical applications, enabling students to analyze physical phenomena and apply scientific principles to solve engineering problems.

Course Outcomes (CO):

CO1 Understand the principle of relativity and its effect on mass, energy, and momentum. (K1 - K5)

CO2 Understand the basics of quantum mechanics and apply its principles to solve problems that occur at subatomic dimensions. (K2-K4)

CO3 Understand Maxwell's equations of electromagnetic theory and able to apply them in various systems. (K2, K4, K5)

CO4 Understand the basics of semiconducting and nanomaterials materials and their applications. (K2-K5)

CO5 Get familiar with dielectric and superconducting materials and their applications. (K1-K4)

CO6 Use various physics equipment by conducting physics experiments. (K2, K3, K6)

K1-Remember, K2-Understand, K3-Apply, K4-Analyse, K5-Evaluate, K6-Create

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3.00	3.00	-	1.00	1.00	-	3.00	1.00	2.00	-	3.00
CO2	3.00	3.00	-	2.00	-	-	3.00	1.00	2.00	-	2.00
CO3	3.00	3.00	-	3.00	-	3.00	1.00	2.00	-	3.00	
CO4	3.00	3.00	2.00	1.00	1.00	-	3.00	2.00	2.00	-	3.00
CO5	3.00	3.00	2.00	1.00	1.00	-	3.00	2.00	2.00	-	3.00
CO6	3.00	1.00	3.00	3.00	2.00	3.00	3.00	3.00	2.00	3.00	3.00

Correlation scale: 3 = Substantial (High), 2 = Moderate (Medium), 1 = Slight (Low); If there is no correlation, put “-”.

Course Syllabus:

UNIT-1

Relativistic Mechanics

Inertial and non-inertial frames of references, Michelson Morley experiment, Galilean transformation equations, Lorentz transformation equations, length contraction, time dilation and its experimental evidence, relativistic velocity addition formula, relativistic variation of mass with velocity, evidence of variation of mass with velocity, Einstein's mass-energy equivalence, examples from nuclear physics, relativistic energy-momentum relation.

UNIT-2

Quantum Mechanics

Dual nature of matter & radiation, Heisenberg's uncertainty principle and their applications, wave packet concept, Davisson-Germer experiment, postulates of quantum mechanics, physical significance of wave function, Schrodinger equation for time-independent and time-dependent cases, applications of Schrodinger wave equation for a particle in a one-dimensional box.

UNIT-3

Electromagnetic Theory

Derivation of Maxwell's equations and their physical significance, correction of Ampere's law by Maxwell, concept of displacement current, Poynting theorem, Maxwell's equations in free space & velocity of electromagnetic waves, transverse character of the wave and orthogonality of E, H and k vectors, Maxwell's equation in dielectric medium and velocity of electromagnetic wave, comparison with free space, Maxwell's equations in conducting media & solution of differential equation in this case, skin depth & its significance.

UNIT-4

Materials of Technological Importance I

Semiconducting Materials: Concept of energy bands in solids, carrier concentration and conductivity in intrinsic and extrinsic semiconductors and their temperature dependence, compound semiconductors, amorphous semiconductors. Nano Materials: Basic principles of Nanoscience and technology, classification of nanomaterials, quantum dot, quantum wire, quantum well, basics of top down and bottom-up approach.

UNIT-5

Materials of Technological Importance II

Dielectric Materials: Dielectric materials, Types of dielectric materials, concept of dielectric polarization, different types of polarizations, concept of dielectric loss, and their importance. Superconducting Materials: Resistivity of superconductors, Type – I and Type–II superconductors, Meissner effect, applications of superconducting materials.

List of Experiments:

- To determine the energy band gap of an N-type Germanium (Ge) semiconductor using four-probe method.
- Verification of Stefan's fourth power law for black body radiation and determination of temperature exponent.
- To study variation of magnetic field along axis of a current carrying coil and estimate its radius.
- Determination of specific charge (e/m) of electron.
- Determination of wavelength of spectral lines of mercury using plane transmission grating.
- Determination of wavelength of hydrogen spectral lines and calculation of Rydberg constant.
- Draw V-I characteristics of LED and determine Planck's constant.
- Study of Carey Foster's bridge: determination of resistance per unit length and comparison of two equal resistances.

Text Books:

1. Engineering Physics, R. K. Shukla, Pearson Education, Vol.-II, 2014.
2. Electrical Engineering Materials, R. K. Shukla, McGraw Hill, 1st Edition, 2012.
3. Principles of Engineering Physics, R. K. Shukla, IraBooks, 1st Edition, 2011.
4. Engineering Physics – I & II, S. K. Gupta, Krishna Prakashan Media (P) Ltd., 2014.
5. Physics for Engineers, Alok Singh, Savita Singh, Sudhir Kumar Sharma, Cambridge University Press, 1st Edition, 2026.

Reference Books:

1. Fundamental University Physics, Vol.-I: Mechanics, Marcelo Alonso, J. Finn Edwards, Addison-Wesley, 1st Edition, 1967.
2. Concepts of Modern Physics, Arthur Beiser, McGraw Hill, 6th Edition, 2003.
3. Introduction to Electrodynamics, David Griffiths, Cambridge University Press, 4th Edition, 2017.
4. Introduction to Solid State Physics, Charles Kittel, Wiley, 8th Edition, 2005.
5. Introduction to Nanotechnology, Charles P. Poole Jr., Frank J. Owens, Wiley-Interscience, 1st Edition, 2003.

Web Links:

1. <https://nptel.ac.in/courses/122101002> [IIT Bombay, Prof. D. K. Ghosh]
2. <https://nptel.ac.in/courses/122103011> [IIT Guwahati, Prof. Alike Khare, Prof. Pratima Agarwal, Prof. S. Ravi]
3. <https://nptel.ac.in/courses/115105099> [IIT Kharagpur, Prof. Amal Kumar Das]
4. <https://nptel.ac.in/courses/115101005> [IIT Bombay, Prof. D. K. Ghosh]
5. <https://nptel.ac.in/courses/115106066> [IIT Madras, Prof. S. Lakshmi Bala]

Subject Code: DCS101

Subject Name: PROGRAMMING FOR PROBLEM SOLVING (PPS)

Credits [L-T-P]: 4[3-1-0]

Course Content

Prerequisite: Not specified in the source syllabus.

Course Objectives:

The objective of this course is to develop computational thinking and problem-solving abilities among students through systematic algorithm design and programming techniques. The course enables students to analyse engineering problems, design logical solutions, and implement efficient programs using structured programming concepts.

Course Outcomes (CO):

CO1 Analyze the problem and think in terms of solution design. (K2, K3, K4)

CO2 Use the appropriate control statements of C language to solve the given problem. (K3)

CO3 Implement different Operations on arrays and use functions to solve the given problem using C. (K3, K4)

CO4 Understand pointers and designing of basic data structures like stacks, queues in C. (K2, K3, K4)

CO5 Make use of files and file operations to store and retrieve data and build simple problem-solving applications using C programming. (K2, K3, K5)

K1- Remember, K2- Understand, K3-Apply, K4-Analyse, K5- Evaluate, K6- Create

Course Articulation Matrix (CO-PO-PSO Matrix):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	-	2	-	-	-	-	-	1	2	1	2	1
CO2	3	3	2	-	2	-	-	-	-	-	1	3	3	2	1
CO3	3	3	2	-	2	-	-	-	-	-	2	3	3	2	1
CO4	3	3	3	1	2	-	-	-	-	-	2	3	3	2	2
CO5	3	3	3	1	2	-	-	2	2	1	3	3	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation, put “-”.

Course Syllabus:

UNIT-1

Introduction to computational thinking

Problem identification and analysis, Decomposition of problems, Abstraction and algorithmic thinking, Flowcharts and pseudocode, Algorithms to programs: specification, top-down development and stepwise refinement, Introduction to programming environment, use of high level programming language for the systematic development of programs. Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic.

UNIT-2

C Programming Language

Operators: Unary operators, Arithmetic & logical operators, Bit wise operators, Assignment operators and expressions, Conditional expressions, Precedence and order of evaluation. Decision Making and Iterative Problem Solving: if-else, switch, break, and continue, the comma operator, goto statement, for, while, do-while.

UNIT-3

Functions and Arrays

Functions: built-in and user-defined, function declaration, definition and function call, and parameter passing: call by value, call by reference, recursive functions, Multi-file programs. Array: Linear arrays, multidimensional arrays, passing arrays to functions, Arrays and strings.

UNIT-4

Pointers and Data Organization

Pointers: value at (*) and address of (&) operator, pointer to pointer, Dynamic Memory Allocation, calloc and malloc functions, array of pointers, function of pointers, structures and pointers. Data Organization: Introduction to Trees, Graphs, Stacks and queues, Searching techniques, Sorting techniques, Introduction to complexity awareness.

UNIT-5

File Handling

Opening and closing a data file, creating a data file, read and write functions, unformatted data files, structures for record handling, Mini-project development, Testing and validation, Introduction to collaborative programming.

Text Books:

1. Yashavant Kanetkar, Let Us C, BPB Publications.
2. Reema Thareja, Programming in C, Oxford University Press.
3. E. Balagurusamy, Programming in ANSI C, McGraw Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education.

Reference Books:

1. Byron Gottfried, Programming with C, Schaum Series, McGraw Hill.
2. Ashok N. Kamthane, Programming with ANSI and Turbo C, Pearson Education.
3. Herbert Schildt, C: The Complete Reference, McGraw Hill.
4. R.G. Dromey, How to Solve It by Computer, Pearson Education.
5. V. Rajaraman, Computer Programming in C, PHI Learning.

Online Resources:

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs53
2. <https://www.coursera.org/learn/computational-thinking-problem-solving>
3. <https://pll.harvard.edu/course/cs50-introduction-computer-science>

Evaluation Scheme:

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1	TA	Lab	Total Sessional	ESM / Total Marks
1	ESC	DCS101	Programming for Problem Solving	4(3-1-0)	30	20	-	50	50 / 100

Subject Code: DWS-201

Subject Name: WORKSHOP PRACTICE

Credits [L-T-P]: 2[0-0-4]

Course Content

Course Objective: The objective of this course is to educate and impart basic knowledge of various hand tools and equipments and their use in different shops, day to day industrial work and domestic life. Students able to understand safety precautions in the workshop. Student acquires skills of application oriented task.

Course Outcomes (CO):

CO1 Study and practice on machine tools and their operations. (K2)

CO2 Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry, black-smith and welding work. (K3)

CO3 Identify and apply suitable tools for machining processes including plain turning, step turning, taper turning, facing, thread cutting operations. (K4)

CO4 Understand and practice welding and forging operations. (K3)

CO5 Select the appropriate tools required for specific operation and the proper safety measure required to be taken while using different tools. (K2, K3)

K1 - Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 - Create

CO1

- Working principle of lathe machine.
- Parts and operations on lathe machine.
- Tool geometry of single point cutting tool.

CO2

- Study and practice of different tools used in Fitting shop, Carpentry shop and Foundry shop.
- Study and practice of different tools used in Black-smith shop, Sheet metal shop and Welding shop.

CO3

- Explanation and demonstration of various processes like plain turning and step turning.
- Explanation and demonstration of various processes like taper turning and facing.
- Explanation and demonstration of various processes like thread cutting, knurling and chamfering.

CO4

- Classification of different welding processes with the help of flow chart.
- Explanation and demonstration of forging operations.
- Safety precautions during actual forging and welding.

CO5

- Selection of proper drilling tool for drilling operation.
- Selection of proper tap for internal thread cutting operation.
- Selection of power hacksaw blade, wood cutting tools, snips, chisels etc.

CO6

- Proper demonstration of safety precautions to be taken for example leather apron, leather hand gloves, welding shield etc.
- Description of different safety tools and precautions in workshop.

1. Carpentry Shop

Practice (I): To prepare half lap corner joint from given pieces of mango wood.

Practice (II): To prepare mortise and tenon joint from given pieces of mango wood.

Instructions: Description and demonstration of different tools, joints along with advanced carpentry joints, classification and definition of timber, wood seasoning, demonstration of wood working lathe and advanced power tools used in carpentry work, safety precaution during actual working.

2. Fitting and Bench working Shop

Practice (I): To prepare male-female joint from given pieces of mild steel.

Practice (II): To prepare work piece involving marking, measuring, sawing, drilling and tapping operations.

Instructions: Classification and description of different tools used in fitting shop e.g. marking and measuring tools, holding and supporting tools, striking tools and cutting tools etc, safety precaution during actual working.

3. Black Smithy Shop

Practice (I): To prepare 'L' shape job from given piece of mild steel rod by hand forging.

Practice (II): To prepare a 'Ring' from given piece of mild steel rod by hand forging.

Instructions: Description of various forging processes done in black-smithy work e.g. upsetting, drawing down, punching, bending, fullering etc, classification and description of different tools, equipments used in black smithy shop, safety precaution during actual working.

4. Welding Shop

Practice (I): To prepare simple butt joint and lap joint by electric arc welding from given pieces of mild steel.

Practice (II): To prepare simple lap joint by oxy-acetylene gas welding and gas flame cutting practice.

Instructions: Concept of welding, classification and explanation of various types of welding with the help of flow chart, description of different tools. Equipments required for arc welding and gas welding, demonstration of various types of flames in Oxy-acetylene gas welding, setting of current and selection of electrodes along with different welding joints, safety precaution during actual working.

5. Sheet Metal Shop

Practice (I): To prepare a funnel complete with soldering from given G.I. sheet.

Practice (II): To fabricate tray / tool box or electric panel box from given G.I. sheet.

Instructions: Classification and description of different types of tools, equipments used in sheet metal work, different types of metals used in sheet metal shop e.g. Galvanized iron, mild iron, copper, aluminum etc, concept of development of surfaces along with different types of joints in sheet metal work, safety precaution during actual working.

6. Machine Shop

Practice (I): To prepare a job by plain turning, facing, step turning and chamfering operation from given mild steel rod.

Practice (II): To prepare a job by taper turning, threading, knurling operations from given mild steel rod.

Instructions: Classification of lathe machines, different parts of lathe machine, tools and equipments used, explanation and demonstration of various operations on lathe machine, tool geometry of single point cutting tool, cutting speed, feed and depth of cut in turning, safety precaution during actual working.

7. Foundry Shop

Practice (I): To prepare a mould of given pattern in Green Sand.

Practice (II): To prepare a mould with two sprue with runner and riser.

Instructions: Description and use of various foundry tools, shovel, flat rammer, hand rammer, strike off bars, vent wire, trowels, hand riddle etc. Types of various moulding sands, types of patterns, pattern materials, pattern allowances, safety precautions during actual working.

Course Articulation Matrix (CO-PO Matrix):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	1	1	1	-	-	-	-	-	1
CO2	2	-	-	1	1	1	-	-	-	-	-	1
CO3	2	-	-	1	1	1	-	-	-	-	-	1
CO4	2	-	-	1	1	1	-	-	-	-	-	1
CO5	2	-	-	1	1	1	-	-	-	-	-	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation put “-”.

Course Syllabus:**Text Books:**

1. Elements Of Workshop Technology Vol-I, by Choudhury H S K, MPP Pvt. Ltd., 2008.
2. A Course in Workshop Technology Vol I by Raghuwanshi, Dhanpat Rai & sons, 2011.
3. Workshop Practice Manual by V Kapoor, Dhanpat Rai & sons, 1998.
4. Workshop Technology: Manufacturing Processes by Khurmi & Gupta, S. Chand Publications, 2008.

Reference Books:

1. Mechanical Workshop Practice, 2/E 2nd edition, Kindle Edition, K.C. John, PHI, 2010.
2. Workshop Practice, Singh Swaran, Katson Books, 2003.
3. Workshop Practice, R.K. Rajput, 2016.
4. Workshop Practice, B.L. Juneja, Cengage Learning Publishers, 2015.

Web Links:

1. <https://sjce.ac.in/wp-content/uploads/2018/04/Workshop-Laboratory-Manual.pdf>
2. <https://nptel.ac.in/courses/112107219>

Evaluation Scheme:

Course Title	Credits (L-T-P)	MSE	TA	Lab	Total Sessional	ESM	Total Marks
Workshop Practice	2(0-0-4)	--	20	30	50	50	100

Subject Code: DET201

Subject Name: BASIC ELECTRONICS ENGINEERING

Credits [L-T-P]: 3[2-1-0]

Course Content

Course Outcomes (CO):

CO1: Explain the working principles and applications of semiconductor devices such as P-N junction diode, Zener diode, LED, photodiode, and rectifier circuits.

CO2: Describe the operation of BJT, operational amplifiers, and feedback amplifiers, and explain their basic electronic applications.

CO3: Apply number systems, Boolean algebra, logic gates, and digital building blocks to analyze simple combinational and sequential digital circuits.

CO4: Identify the basic concepts of electronic measurements, instruments, sensors, and transducers used in engineering applications.

CO5: Explain the role of modern electronic systems, including DSO, display devices, embedded systems, IoT, smart homes, electric vehicles, and consumer electronics in everyday life.

Course Articulation Matrix (CO-PO Matrix):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	2	–	–	–	–	–	–	3	2
CO2	3	2	2	1	2	–	–	1	1	1	–	3	3
CO3	3	3	2	2	2	–	–	–	1	1	–	2	3
CO4	2	2	2	3	3	1	1	–	1	1	–	3	3
CO5	2	2	2	2	3	3	2	1	2	2	2	3	3

Correlation scale: 3 = Substantial (High), 2 = Moderate (Medium), 1 = Slight (Low); – = No direct correlation.

Course Syllabus:

UNIT-1

P-N Junction Diode

Working and V-I Characteristics, Zener Diode and Voltage Regulation, half wave & Full wave rectifier, Clippers & Clampers.

UNIT-2

BJT, FET and Operational Amplifier

Introduction to BJT (Construction & Working Principle for NPN and PNP transistor), CE Configuration and Applications, DC Biasing. Introduction to JFET/MOSFET. Introduction to Operational Amplifier and its Applications as Adder, Subtractor, Inverting and Non-Inverting Amplifier.

UNIT-3

Digital Electronics

Number Systems and Base Conversion, Binary Codes (BCD and Gray Code), Logic Gates, Universal Gates, Boolean Algebra, K-map (up to 4 variables). Combinational Circuits: Half Adder, Full Adder, Multiplexer & Demultiplexer, Decoder. Sequential Circuits: Flip-Flops & Registers.

UNIT-4

Electronic Instrumentation, Sensors and Transducers

Functional Elements of Instruments, Classification & Characteristics, Types of Errors, Sources of Error, Dynamic Characteristics, Introduction to Sensors and Transducers: Temperature Sensor, Light Sensor, Proximity Sensor & LVDT.

UNIT-5

Modern Electronic Systems

Digital Storage Oscilloscope (DSO). Display Devices: LED, LCD & DSO. Electronic Devices in Daily Life, Introduction to Embedded Systems, Introduction to Internet of Things (IoT).

Text Books:

1. Boylestad, R.L. and Nashelsky, L., Electronic Devices and Circuit Theory, 12th Edition, Pearson, 2023.
2. R.P. Jain, Modern Digital Electronics, 5th Edition, McGraw Hill, 2022.
3. H.S. Kalsi, Electronic Instrumentation, 4th Edition, McGraw Hill, 2019.

Reference Books:

1. Behzad Razavi, Fundamentals of Microelectronics, 3rd Edition, Wiley, 2021.
2. A.K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., Latest Edition.
3. D. Patranabis, Sensors and Transducers, 3rd Edition, PHI Learning, 2017.
4. NPTEL Online Courses on Basic Electronics, Digital Electronics, and Electronic Instrumentation.

Assessment / Evaluation Scheme:

Assessment Component	Marks	Weightage
Mid-Semester Examination	30	30%
Continuous Assessment / Sessional	20	20%
End-Semester Examination	50	50%
Total	100	100%

Subject Code: DMA101

Subject Name: MATHEMATICS I

Credits [L-T-P]: 4[3-1-0]

Course Content

Course Objective:

The objective of this course is to educate the students about:

- the convergence of infinite series, improper integrals, and differential calculus.
- partial differentiation, multiple integrals and Beta, Gamma functions.
- vector calculus, matrices, linear algebra, and optimization techniques.

Course Outcomes (CO):

CO1: Find nth derivative, determine the expansion of functions, and find convergence of series and improper integrals. (Understand, Apply)

CO2: Find partial differentiation and evaluate area and volume using multiple integrals. (Apply, Evaluate)

CO3: Convert line integrals to surface integrals and volume integrals, determine potential functions for irrotational force fields. (Apply, Evaluate)

CO4: Solve linear system of equations and determine the eigen vectors of the matrix. (Apply, Analyze, Evaluate)

CO5: Learn concept of optimization and optimization techniques. (Apply, Analyze, Evaluate)

Course Articulation Matrix (CO-PO Matrix):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	1	–	–	–	1	1	1	2
CO2	3	3	2	2	2	1	–	–	–	1	1	1	2
CO3	3	3	2	2	2	1	–	–	–	1	1	1	2
CO4	3	3	2	2	2	1	–	–	–	1	1	1	2
CO5	3	3	2	2	2	1	–	–	–	1	1	1	2
Avg	3	3	2	2	2	1	–	–	–	1	1	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High), If there is no correlation, put “–”

Detailed Syllabus:

UNIT-I

Functions of One Real Variable (6 hours)

Successive differentiation, Leibnitz theorem, Mean value theorems, sequences and series, expansion of functions, improper integrals, and their convergence.

UNIT-II

Functions of Several Real Variables (10 hours)

Limit, Continuity, Partial differentiation, Total differential and approximations, Jacobian, Euler's theorem for expansion of functions, Beta and Gamma Functions, Multiple integrals, change of order, Change of variables, Applications to area, volume, mass, surface area etc. Dirichlet's Integral & applications.

UNIT-III

Vector Calculus (8 hours)

Point functions, differentiation, Gradient, Laplacian, Hessian, directional derivative; Divergence and Curl of a vector and their physical interpretations, Solenoidal & irrotational fields, Integration: Line, Surface and Volume integrals, Green's, Stoke's and Gauss Divergence theorems (without proof) and applications.

UNIT-IV

Matrices and Linear Algebra (10 hours)

Vector space and subspace, linear dependence, basis and dimensions, Linear transformation and its matrix representation, Elementary transformations, Echelon form, rank & nullity, consistency of linear system of equations

and their solutions, characteristic equation, Cayley Hamilton theorem, real and complex eigenvalues and eigenvectors, diagonalization, quadratic forms, complex, orthogonal, and unitary matrices, Application to Cryptography, discrete, Compartmental models, and system stability.

UNIT-V

Optimization (6 hours)

Engineering applications of optimization, statement and classification of optimization problems, Optimization techniques, single and multi-variable optimizations with no constraint, with equality and inequality constraints, Linear Programming Problems, Graphical method, and Simplex method.

Books Recommended:

1. R.K. Jain & S. R. K. Iyengar; Advanced Engineering Mathematics, Narosa Publishing House, 2002.
2. Erwin Kreyszig; Advanced Engineering Mathematics. John Wiley & Sons, 8th Edition.
3. Dennis G. Zill & Michael R. Cullen; Advanced Engineering Mathematics, Jones & Bartlett Publishers, 2nd Edition.
4. S.S. Rao; Optimization: Theory & Application, Wiley Eastern Limited.
5. T.M. Apostol, Calculus, Vol. I, 2nd ed., Wiley 1967.
6. T.M. Apostol, Calculus, Vol. II, 2nd ed., Wiley 1969.
7. Gilbert Strang, Linear Algebra & Its Applications, Nelson Engineering, 2007.
8. Calculus & Analytic Geometry, Thomas & Finney.

Subject Code: DHS102

Subject Name: ENGLISH FOR TECHNICAL WRITING

Credits: 2[2-0-0]

Course Content

Course Type: HSMC

Branches: DHS 102 – Engineering (Odd)

Semester: 1st Semester (Engineering)

Sessional Marks: 50 | End Semester Exam: 50 | Total: 100

Course Outcomes (CO):

CO1: Build and apply an effective vocabulary

CO2: Convey their ideas clearly and coherently through effective writing

CO3: Design and present professional technical documents

CO4: Organise and present ideas effectively

CO5: Apply their writing skills in practical contexts.

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	-	-	2	-
CO2	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	1	-	1	-	-	1	-	3	-
CO4	-	-	-	-	-	-	-	-	2	3	-
CO5	-	-	-	-	-	-	-	1	1	3	-
Average	-	-	1.0	-	1.0	-	-	1.0	1.5	2.8	-

UNIT I: Vocabulary Building: The concept of Word Formation. Root words from foreign languages and their use in English. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations.

UNIT II: Basic Writing Skills: Sentence Structures. Use of phrases and clauses in sentences. Importance of proper punctuation. Creating coherence. Organizing principles of paragraphs in documents. Techniques for writing precisely.

UNIT III: Designing Technical Documents: Fundamentals of Document Design, Professional Technical Formats, Free Tools for Drafting and Design.

UNIT IV: Nature and Style of sensible Writing: Describing, Defining, Classifying, providing examples or evidence, Writing introduction and conclusion.

UNIT V: Writing Practices: Comprehension, Précis Writing, Essay Writing.

Reference Books:

1. Hamp-Lyons, Liz, and Ben Heasley. Study Writing. Cambridge University Press, 2006.
2. Kumar, Kul Bhushan. Effective Communication Skills. Khanna Book Publishing, 2022.
3. Kumar, Sanjay, and PushpLata. Communication Skills. Oxford University Press, 2011.
4. Swan, Michael. Practical English Usage. Oxford University Press, 1995.
5. Wood, F. T. Remedial English Grammar. Macmillan, 2007.
6. Zinsser, William. On Writing Well. Harper Resource Book, 2001.

Subject Code: DHS101

Subject Name: UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Credits [L-T-P]: 2[2-0-0]

Course Content

Course Objective:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence.
- To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

MODULE 1 – Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

MODULE 2 – Harmony in the Human Being

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health. (6 lectures and 3 tutorials for practice session)

MODULE 3 – Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. (6 lectures and 3 tutorials for practice session)

MODULE 4 – Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

MODULE 5 – Implications of the Holistic Understanding – a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models – Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Text Book and Teachers Manual

a. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual: Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Course Outcomes (CO):

CO1: Explain the need for value education, the process of self-exploration, and the basic human aspirations of continuous happiness and prosperity.

CO2: Analyse the co-existence of the Self and the Body, distinguish between their needs, and apply the programme of self-regulation for maintaining harmony and health.

CO3: Evaluate the foundational values of trust, respect, and justice in human relationships and propose ways to establish harmony in family and society.

CO4: Describe the interconnectedness and mutual fulfilment among the four orders of nature and interpret existence as co-existence at all levels.

CO5: Apply the holistic understanding of harmony to professional ethics, technology, production systems, and management models for a value-based profession and life.

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	–	1	–	–	–	2	2	1	1	–	3
CO2	–	2	1	–	–	2	2	2	1	–	3
CO3	–	1	1	–	–	3	3	3	2	–	2
CO4	–	1	–	–	–	3	2	1	1	–	2
CO5	1	2	2	1	–	3	3	2	2	1	3
Average	0.2	1.4	0.8	0.2	0.0	2.6	2.4	1.8	1.4	0.2	2.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation, put “–”.

Subject Code: DME201 Subject Name: BASIC ENGINEERING MECHANICS

Credits [L-T-P]: 4[3-1-0]

Course Content

Prerequisite: Class XII Mathematics & Physics

Objectives: To provide the basic fundamentals of forces, moments, structural analysis, stresses and strains

Course Outcomes (CO):

CO1 Determine resultants and apply conditions of static equilibrium to plane force systems. K1, K2, K5

CO2 Analyze beam for shear force and bending moment along the span and analyze trusses structures. K1, K3, K4

CO3 Evaluate the structural properties like centroid, moment of inertia, principal moment of inertia. K1, K2, K3, K5

CO4 Evaluate stresses for one- and two-dimensional force systems. K1, K5

CO5 Assess bending and shear stresses in beams subjected to different loadings for different machine parts. K2, K3, K5

At the end of this course students should be able to:

K1- Remember, K2- Understand, K3-Apply, K4-Analyse, K5- Evaluate, K6- Create

Course Articulation Matrix (CO-PO-PSO Matrix):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	1	1	-	-	-	1	3	3	1
CO2	3	3	2	-	-	1	-	-	-	-	1	3	3	1
CO3	3	3	2	-	-	-	-	-	-	-	1	3	3	1
CO4	3	3	2	2	-	-	-	-	-	-	1	3	3	1
CO5	3	3	2	2	-	1	-	-	-	-	1	3	3	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation, put “-”.

Course Syllabus:

UNIT-1

Two-Dimensional Force Systems: Basic concepts, laws of motion, Principle of transmissibility of forces, transfer of a force to parallel position, resultant of a force system, simplest resultant of two dimensional concurrent and non-concurrent force systems, distributed force system, free body diagrams, equilibrium and equations of equilibrium, applications.

Friction: Introduction, Laws of Coulomb friction, Equilibrium of bodies involving dry-friction, belt friction, applications.

UNIT-2

Beam: Introduction, Shear force and bending moment, differential equations for equilibrium, shear force and bending moment diagrams for statically determinate beams.

Trusses: Introduction, simple truss and solution of simple truss, Method of joints and method of sections.

UNIT-3

Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes theorem, Perpendicular axes theorems, Principal moment of inertia, mass moment of inertia of circular ring, disc, cylinder, sphere and cone about their axis of symmetry.

UNIT-4

Simple Stress and Strain: Introduction, Normal and Shear stresses, Stress- Strain Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections, Strain energy. Compound stress and strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle, Theories of Failure.

UNIT-5

Pure Bending of Beams: Introduction, Simple Bending Theory, Stress in beams of different cross sections. Torsion: Introduction to Torsion of circular shaft, combined bending & torsion of solid & hollow shafts.

Text Books:

1. Engineering Mechanics by Abhijit Chanda and Debabrata Nag, Wiley India Pvt. Ltd, 2018, Kindle Edition, ISBN: 9788126570935.
2. Engineering Mechanics: Statics by J L Meriam. L G Kraige. Virginia Polytechnic Institute and State University, John Wiley & Sons, 2017. ISBN-978-8126564033.
3. Engineering Mechanics of Solids, Egor P. Popov, PHI Publications, 1990.
4. Theory of Machines and Mechanisms by J.E. Shigley, Oxford University Press, 5th Edition, 2017.
5. Engineering Thermodynamics by P K Nag, TMH Publication, 4th Edition, 2008.

Reference Books:

1. Theory of Machines and Mechanisms by Amitabha Ghosh and Asok Kumar Mallick, Affiliated East-West Press, 3rd Edition, ISBN: 9788185938936.
2. Engineering Mechanics by Timoshenko S., McGraw-Hill Education – Europe, 5th Edition, 2013.
3. Engineering Mechanics by Nelson A, McGraw Hill Education India, 1st Edition, ISBN-978-0070146143, 2017.
4. Materials and Manufacturing: An Introduction to How they Work and Why it Matters by Mark A Atwater McGraw-Hill Education, 1st Edition, ISBN: 9781260122312, 2018.

Web Links

1. <https://nptel.ac.in/courses/112106286> [IIT Madras, Prof. K. Ramesh]
2. <https://nptel.ac.in/courses/112103108> [IIT Guwahati, Prof. US Dixit]
3. <https://nptel.ac.in/courses/112103109> [IIT Guwahati, Prof. US Dixit]
4. <https://eng.utq.edu.iq/wp-content/uploads/sites/4/2019/09/engineering-mechanics-lectures.pdf> [Thi-Qar University, Prof. Haider]
5. https://www.youtube.com/watch?v=tisNUzd_f1M&t=96s [Dr. VP Singh, HBTU, Kanpur]
6. <https://www.youtube.com/watch?v=a6RNss9kBuI&t=11s> [Dr. VP Singh, HBTU, Kanpur]

Evaluation Scheme

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1&2	TA	Lab	Total Sessional Marks	ESM	Total Marks
1	ESC	DME-101 / 201	Basic Engineering Mechanics	4(3-1-0)	15+15 (30)	20	-	50	50	100

Credits [L-T-P]: 3[3-0-0]**Course Content**

Course Objectives: The objective of this course is to equip students with basics of thermodynamics for design, and analysis, of thermal aspects of the engineering processes and systems.

Prerequisite: Physics of Class XII

Course Outcome

CO1 To know and apply fundamental thermodynamic concepts, including dimensions, systems, properties, equilibrium, and temperature measurement.

CO2 Apply the first law of thermodynamics to analyze processes, work, energy, and limitations and different types of systems.

CO3 Explain the second law of thermodynamics, entropy, heat engines, efficiency, reversible and irreversible processes, and thermodynamic temperature scale.

CO4 Gain proficiency in steam properties, phase transformations, property diagrams, and analyze thermodynamic cycles.

CO5 Apply thermodynamic relations, including Maxwell relations, Clapeyron equation, and understand real gases and gas mixtures.

Course Articulation Matrix (CO-PO-PSO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	1	-	1	-	1	3	2	1
CO2	3	3	2	3	1	1	1	1	-	-	1	3	3	1
CO3	3	3	2	3	1	1	1	1	-	-	1	3	2	2
CO4	3	3	2	3	3	1	1	1	-	-	1	3	3	1
CO5	2	2	1	1	1	1	1	-	-	-	1	2	2	1

Course Syllabus:**Unit – I:**

Fundamental Concepts and Definitions: Introduction and definition of thermodynamics, Dimensions and units, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Control system boundary, control volume and control surface, Properties and state, Thermodynamic properties, Pressure and its measurement, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasistatic process, Energy and its forms, Work and heat, Gas laws, Ideal gas.

Zeroth law of thermodynamics: Zeroth law of thermodynamics, Temperature and its measurement, Temperature scales.

Unit-II

First law of thermodynamics: Thermodynamic definition of work, Thermodynamic processes, Calculation of work in various processes and sign convention, Non-flow work and flow work, Joules' experiment, First law of thermodynamics, Internal energy and enthalpy, First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Steady flow energy equation, Boilers, Condensers, Turbine, Throttling process, Pumps etc. First law analysis for closed system (non flow processes), Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer, Limitations of first law of thermodynamics, PMM-I.

Unit – III:

Second law: Devices converting heat to work, Thermal reservoir, Heat Source, Heat Sink, Heat engines, Efficiency, Devices converting work to heat, Heat pump, refrigerator, Coefficient of Performance, Reversed heat engine, Kelvin Planck statement of second law of thermodynamics, Clausius statement of second law of thermodynamics, Equivalence of two statements of second law of thermodynamics, Reversible and irreversible processes, Carnot cycle

and Carnot engine, Carnot theorem and its corollaries, thermodynamic temperature scale, PMM-II.
 Entropy: Clausius inequality, Concept of Entropy, Entropy change in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.
 Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibbs function, Availability analysis.

Unit – IV

Properties of steam and thermodynamics cycles: Pure substance, Property of steam, Triple point, Critical point, Sub-cooled liquid, Saturation states, Superheated states, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & P-V diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables & Mollier charts, Dryness factor and its measurement, processes involving steam in closed and open systems. Simple Rankine cycle, Brayton cycle.

Unit – V

Thermodynamic relations: Mathematical conditions for exact differentials. Maxwell Relations, Clapeyron Equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic & Isothermal compressibility; Real gas, Law of corresponding states, Dalton's law, Amagat's law, Property of mixture of gases. Fuels and Combustion: Combustion analysis, Heating Values and its measurement, Air requirement, Air/Fuel ratio, Standard heat of Reaction, Heat of formation.

Text Books:

1. Fundamentals of Thermodynamics by Sonntag, Van Wylen, Borgnakke, John Wiley & Sons.
2. Thermodynamics: An Engineering Approach by Cengel & Boles, McGraw Hill.
3. Engineering Thermodynamics by Onkar Singh, New Age Publishers.
4. A Textbook of Engineering Thermodynamics, R K Rajput, Laxmi Publications, 2019.

Reference Books:

1. Engineering Thermodynamics by Jones and Dugans, PHI Learning Pvt. Ltd.
2. Thermodynamics by J.P. Holman, McGraw-Hill.
3. Applications of Thermodynamics, Dr V Kadambi and Dr T R Seetharam, Wiley Publications, 2018.
4. Fundamentals of Thermodynamics by Claus Borgnakke and Richard E Sonntag, 8th edition, Wiley India Edition, 2020.

Online Learning Resources

1. (272) Engineering Thermodynamics - YouTube
2. (272) NPTEL-NOC IITM - YouTube
3. thermo.pdf (mit.edu)
4. lecture notes (iitk.ac.in)

Evaluation Scheme

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1&2	TA	Lab	Total Sessional Marks	ESM	Total Marks
1	PCC	DME-202	Engineering Thermodynamics	3(3-0-0)	15+15 (30)	20	-	50	50	100

Subject Code: DEE 101 (Tentative as provided by the EE Department)

Subject Name: BASIC ELECTRICAL ENGINEERING (Tentative as provided by the EE Department)

Credits [L-T-P]: 4[3-0-2]

Course Content

Objective

Various electrical components, connections, DC circuit analysis and basic network theorems applicable to dc network.

Single-phase AC fundamentals and its analysis.

Three-phase AC circuit connections and analysis under various load conditions.

Various measuring instruments with construction, working principle and applications.

Basic structure of power system.

Concept of magnetic circuits, magnetic coupling and losses occurred in magnetic circuit.

Construction and working of single-phase transformers.

Basic principle of electrical ac/dc machines with their construction, working principle and applications.

Course Outcomes (CO):

CO1 An exposure to common electrical components and their ratings.

CO2 Learning of electrical connections by wires of appropriate ratings.

CO3 Learning the usage of common electrical measuring instruments.

CO4 Understanding the basic characteristic of magnetic circuits and transformers.

CO5 Understanding the basic characteristic of electrical machines.

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	2	1	1	1	2
CO2	3	3	1	1	2	2	1	1	2	2	1	1
CO3	3	3	2	2	2	2	1	2	2	2	1	1
CO4	3	3	2	2	2	2	1	2	2	2	1	2
CO5	3	3	2	2	2	2	1	2	2	2	1	2
Average	3	3	1.8	1.8	2	2	1.2	1.8	1.8	1.8	1	1.6

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation, put "-".

Course Syllabus:

Module I : DC Circuit Analysis and Network Theorems: (9 hours)

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 Law; loop and nodal methods of analysis; star-delta transformation; Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. (Simple Numerical Problems)

Module II: Steady-State Analysis of Single Phase AC Circuits: (8 hours)

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

Module III: Three Phase AC Circuits: (3 hours)

Three Phase System – its necessity and advantages, meaning of phase sequence and star and delta connections, balanced supply and balanced load, line and phase voltage/current relations, three phase power and its measurement. (Simple Numerical Problems)

Measuring Instruments: (4 hours)

Types of instruments: Construction and Working Principles of PMMC and Moving Iron type Voltmeter & Ammeters, Single Phase Dynamometer Wattmeter and Induction Type Energy Meter, use of Shunts and Multipliers. (Simple Numerical Problems on Energy Meter, Shunts and Multipliers)

Module IV

Introduction To Power System: (2 hours): General layout of Electrical Power system and functions of its elements, standard transmission and distribution voltages, concept of grid.

Magnetic Circuit: (3 hours): Magnetic circuit concepts, analogy between Electric & Magnetic circuits, Magnetic circuits with DC and AC excitations, Magnetic leakage. B-H curve, Hysteresis and Eddy Current losses, Magnetic circuit calculations, mutual Coupling.

Single Phase Transformer: (3 hours): Principle of Operation, Construction, e.m.f. equation, equivalent circuit, Power losses, efficiency, introduction to auto transformer. (Simple Numerical Problems)

Module V (8 hours)

Electrical Machines: Principles of electro mechanical energy conversion.

DC Machines: Types of dc machines, e.m.f. equation of generator and torque equation of motor, characteristics and applications of dc motors. (Simple Numerical Problems)

Three Phase Induction Motor: Types, Principle of Operation, Slip–torque Characteristics, applications. (Simple Numerical Problems)

Single Phase Induction Motor: Principle of Operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of Operation of alternator and synchronous motor and their applications.

Text Books:

1. V. Del Toro, “Principles of Electrical Engineering”, Prentice Hall International.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Reference Books:

1. Edward Hughes, “Electrical Technology”, Longman.
2. T.K. Nagsarkar & M.S. Sukhija, “Basic Electrical Engineering”, Oxford University Press.
3. H. Cotton, “Advanced Electrical Technology”, Wheeler Publishing.
4. W.H. Hayt & J.E. Kennely, “Engineering Circuit Analysis”, McGraw Hill.

List of Experiments:

1. Verification of Kirchhoff’s laws.
2. Verification of (1) Superposition Theorem (2) Thevenin’s Theorem (3) Maximum Power Transfer Theorem.
3. Measurement of power and power factor in a 1– $\emptyset$ AC series inductive circuit and study improvement of power factor using capacitor.
4. Study of phenomenon of resonance in RLC series circuit and obtain the resonant frequency.
5. Measurement of power in 3– $\emptyset$ circuit by Two Wattmeter method and determination of its power factor.
6. Determination of parameter of AC 1– $\emptyset$ series RLC Circuit.
7. Determination of (1) Voltage Ratio (2) Polarity and (3) Efficiency by load test of a 1– $\emptyset$ Transformer.
8. To study speed control of DC shunt motor using (1) Armature Voltage Control (2) Field Flux Control.
9. Determination of Efficiency of a DC shunt motor by load test.
10. To study running and speed reversal of a 3– $\emptyset$ induction motor and record its speed in both directions.
11. To measure energy by a 1– $\emptyset$ energy meter and determine error.
12. Department may add any three experiments in the above list.

Evaluation Scheme

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1&2	TA	Lab	Total Sessional Marks	ESM	Total Marks
1	ESC	DEE-101	Basic Electrical Engineering	4(3-0-2)	15+15 (30)	20	15	50	50	100

Course Content

Objective: Not specified in the source syllabus.

Prerequisite: Not specified in the source syllabus.

Course Outcomes (CO):

CO1 Explain the fundamentals, processes, levels, and barriers of communication and apply effective verbal and non-verbal communication strategies.

CO2 Demonstrate proficiency in Listening, Speaking, Reading, and Writing (LSRW) skills for effective academic and professional communication.

CO3 Apply principles of vocabulary development, sentence construction, paragraph writing, comprehension, summarization, and proofreading to produce clear and accurate written communication.

CO4 Prepare professional documents such as ATS-friendly resumes/CVs, cover letters, Statements of Purpose (SOPs), and formal e-mails using appropriate digital communication etiquette.

CO5 Develop and deliver effective technical reports, abstracts, proposals, presentations, and professional communications by considering audience, purpose, context, and delivery techniques.

CO6 Demonstrate effective interpersonal and professional communication skills through group discussions, interviews, role-plays, public speaking, negotiation, networking, and responsible use of AI writing tools.

Course Articulation Matrix (CO-PO Matrix):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	2	-	-	-	-	-	2	2	3	-
CO2	1	2	-	-	-	-	-	-	2	3	-
CO3	1	3	-	-	2	-	-	2	2	3	2
CO4	1	2	-	2	3	-	-	2	2	3	3
CO5	1	2	2	2	2	-	-	2	2	3	2
CO6	1	2	2	-	3	2	1	2	2	3	2
Average	1.00	2.17	2.00	2.00	2.50	2.00	1.00	2.00	2.20	3.00	2.25

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High); If there is no correlation, put “-”.

Course Syllabus:

UNIT-1

Fundamentals of Technical Communication: Communication: Meaning, process, levels, and flows. LSRW (Listening, Speaking, Reading, Writing) framework. General and technical communication. Verbal and non-verbal communication. Communication barriers and remedies.

UNIT-2

Mechanics of Writing: Neologism and Advanced vocabulary. Principles of effective sentence and paragraph construction. Comprehension, summarization, and precise writing to distil complex technical information. Writing, editing and proofreading strategies for digital drafts.

UNIT-3

Professional Composition and Digital Correspondence: Crafting modern CVs/Resumes (ATS-friendly formatting) and Cover Letters. Statements of Purpose (SOP) for higher studies or internships. E-Mail etiquette, modern digital workspaces and asynchronous collaboration.

UNIT-4

Technical Reporting and Presentation Strategies: Technical Reports: Structure, purpose, and types. Writing abstracts and research/technical proposals. Audience and locale analysis, outlining, and organizing content. Nuances of delivery, and paralinguistic features. Negotiation and networking.

UNIT-5

Practical Communication Applications: Group dynamics and discussions, interview types and response strategies, Role-play, Public Speaking Sessions, Utilizing AI writing tools to generate and refine business documents.

Text Books:

1. Kumar, Sanjay, and Pushp Lata. Communication Skills. 2nd ed., Oxford University Press, 2015.
2. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practices. Oxford University Press, 2015.

Reference Books:

1. Mitra, Barun K. Effective Technical Communication. Oxford University Press, 2006.
2. Mohan, Krishna, and Meera Banerjee. Developing Communication Skills. Macmillan India, 2009.
3. Sharma, M. R. S. Technical Communication: Principles and Practices. Oxford University Press, 2015.
4. Sharma, R. C., and Krishna Mohan. Business Correspondence & Report Writing. Tata McGraw Hill, 2020.
5. Tuhovsky, Ian. Communication Skills: Intelligence, Presentation, Persuasion. CreateSpace Independent Pub, 2015.

List of Experiments:

Interactive practical sessions with emphasis on oral presentations/ spoken communication:

1. CALL (Computer Assisted Language Learning) Labs: IPA transcription, self-guided pronunciation checks, and accent neutralization.
2. Group Dynamics: Interactive discussions to master collaborative communication.
3. Interview Strategies: Targeted preparation and response techniques for diverse formats.
4. Presentation Skills: Adapting complex technical reports into engaging oral deliveries.
5. Conflict Resolution: Role-playing exercises to apply basic logic and reasoning.
6. Spontaneous Speaking: High-pressure practice through JAM and Extempore sessions.
7. Audio-Visual Analysis: Deconstructing effective communication strategies and TED Talks.
8. AI in Business Writing: Hands-on drafting and refining of professional documents using AI tools.

Laboratory References:

1. Arora, V. N., and Laxmi Chandra, editors. Improve Your Writing. Oxford University Press.
2. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practices. Oxford University Press.

Additional Reference Books:

1. Mitra, Barun K. Effective Technical Communication. Oxford University Press.
2. Mohan, Krishna, and Meera Banerjee. Developing Communication Skills. Macmillan India.
3. Sethi, J. A., and P. V. Dhamija. A Course in Phonetics and Spoken English. Prentice Hall of India.
4. Sharma, M. R. S. Technical Communication: Principles and Practices. Oxford University Press.
5. Sharma, R. C., and Krishna Mohan. Business Correspondence and Report Writing. Tata McGraw Hill.

Evaluation Scheme

S. No.	Course Type	Subject Code	Course title	Credits (L-T-P)	MSE 1&2	TA	Lab	Total Sessional Marks	ESM / Total Marks
1	HSMC	DHS-203	Communication Skills	3(2-0-2)	15	20	15	50	50 / 100