COURES STRUCTURE & SYLLABUS

FOR

B. TECH. MECHANICAL

SEMESTER- I & II

(CBCS 2023 COURSE AS PER NEP 2020 GUIDELINES)

Bharati Vidyapeeth
(Deemed to be University)
College of Engineering, Pune
Department of Mechanical Engineering

Vision of the Bharati Vidyapeeth (Deemed to be University) College of Engineering is:

To be a World Class Institute for Social Transformation through Dynamic Education

Missions of the Bharati Vidyapeeth (Deemed to be University) College of Engineering are:

- *To provide quality technical education with advanced equipment, qualified faculty members, and infrastructure to meet the needs of the profession & society.*
- *To provide an environment conducive to innovation, creativity, research, and entrepreneurial leadership.*
- *To practice and promote professional ethics, transparency, and accountability for the social community, economic & environmental conditions.*

Goals of the Bharati Vidyapeeth (Deemed to be University) College of Engineering are:

- *Recruiting experienced faculty.*
- *Organizing faculty development programs.*
- *Identifying socio-economically relevant areas & emerging technologies.*
- *Constant review & upgradation of curricula.*
- *Upgradation of laboratories, library & communication facilities.*
- *Collaboration with industry and research & development organizations.*
- *Sharing of knowledge, infrastructure, and resources.*
- *Training, extension, testing, and consultancy services.*
- *Promoting interdisciplinary research.*

The vision of the Mechanical Engineering Department is:

To develop high-quality Mechanical Engineers through dynamic education to meet social and global challenges.

Mission Statements of the Mechanical Engineering Department are:

- *To provide extensive theoretical and practical knowledge to the students with well-equipped laboratories and ICT tools through motivated faculty members.*
- *To inculcate aptitude for research, innovation, and entrepreneurial qualities in students.*
- *To acquaint students with ethical, social, and professional responsibilities to adapt to the demands of the working environment.*

Program Educational Objectives (PEOs) of the B. Tech. Mechanical are:

Graduates will be able,

- *To fulfill the needs of industry and society with theoretical and practical knowledge.*
- *To engage in research, innovation, lifelong learning, and continued professional development.*
- *To fulfill professional ethics and social responsibilities.*

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually based mathematics, numerical analysis, data analysis, statistics, and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas of the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior, and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability, etc., with mutual understanding and respect, and of inclusive attitudes.

PROGRAM OUTCOMES

PO1: Engineering Knowledge: *Apply knowledge of mathematics, natural science, computing, engineering fundamentals, and an engineering specialization as specified in WK1 to WK4, respectively, to develop solutions to complex engineering problems.*

PO2: Problem Analysis: *Identify, formulate, review research literature, and analyze complex engineering problems, reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)*

PO3: Design/Development of Solutions: *Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society, and environment as required. (WK5)*

PO4: Conduct Investigations of Complex Problems: *Conduct investigations of complex engineering problems using research-based knowledge, including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).*

PO5: Engineering Tool Usage: *Create, select, and apply appropriate techniques, resources, and modern engineering & IT tools, including prediction and modelling, recognizing their limitations to solve complex engineering problems. (WK2 and WK6)*

PO6: The Engineer and The World: *Analyze and evaluate societal and environmental aspects while solving complex engineering problems for their impact on sustainability with reference to economy, health, safety, legal framework, culture, and environment. (WK1, WK5, and WK7).*

PO7: Ethics: *Apply ethical principles and commit to professional ethics, human values, diversity, and inclusion; adhere to national & international laws. (WK9)*

PO8: Individual and Collaborative Team work: *Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.*

PO9: Communication: *Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations considering cultural, language, and learning differences*

PO10: Project Management and Finance: *Apply knowledge and understanding of engineering management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.*

PO11: Life-Long Learning: *Recognize the need for and have the preparation and ability for i) independent and life-long learning, ii) adaptability to new and emerging technologies, and iii) critical thinking in the broadest context of technological change. (WK8)*

Statements of Program Specific Outcomes (PSOs)

PSO1: Use the knowledge of thermal, design, manufacturing engineering, and computational sciences to solve Mechanical Engineering problems.

PSO2: Use Mechanical Engineering principles for research, innovation, and develop entrepreneurial skills.

B. Tech. (Mechanical Engineering): Semester–I (CBCS 2023 Course as per NEP 2020 Guidelines)

S. No.	Category	Course Code	Course	Teaching Scheme			Examination Scheme-Marks					Credits				
				L	P	T	ESE	IA	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	BM	BM1113101	Engineering Mathematics- I	3	-	1	60	40	-	-	-	100	3	-	1	4
2.	BP	BP1113102	Engineering Physics	3	2	-	60	40	50	-	-	150	3	1	-	4
3.	EE	EE1107103	Electrical Engineering Systems	4	2	-	60	40	25	-	-	125	4	1	-	5
4.	ES	ES1111104	Computer Aided Engineering Graphics#	4	2	-	60	40	50	-	-	150	4	1	-	5
5.	MJ	MJ1111105	Mechanical Engineering Systems	3	2	-	60	40	25	-	-	125	3	1	-	4
6.	UH	UH1113106	Universal Human Values	-	2	-	-	-	50	-	-	50	-	1	-	1
7.	SE	SE1111107	Skill-Based Course-I: Programming in C/C++	-	4	-	-	-	25	-	25	50	-	2	-	2
			Total	**17**	**14**	**1**	**300**	**200**	**225**	**-**	**25**	**750**	**17**	**7**	**1**	**25**

B. Tech. (Mechanical Engineering): Semester – II (CBCS 2023 Course as per NEP 2020 Guidelines)

S. No.	Category	Course Code	Course	Teaching Scheme			Examination Scheme-Marks					Credits				
				L	P	T	ESE	IA	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	BM	BM1113201	Engineering Mathematics- II	3	-	1	60	40	-	-	-	100	3	-	1	4
2.	BC	BC1113202	Engineering Chemistry	3	2	-	60	40	50	-	-	150	3	1	-	4
3.	ES	ES1108203	Electronics Engineering Systems	4	2	-	60	40	50	-	-	150	4	1	-	5
4.	ES	ES1102204	Engineering Mechanics	4	-	-	60	40	-	-	-	100	4	-	-	4
5.	MJ	MJ1111205	Computer-Aided Machine Drawing#	3	4	-	60	40	50	-	-	150	3	2	-	5
6.	AE	AE1113206	Communication Skills	-	2	-	-	-	50	-	-	50	-	1	-	1
7.	SE	SE1111207	Skill-Based Course-II: Workshop Technology	-	4	-	-	-	25	-	25	50	-	2	-	2
			Total	**17**	**14**	**1**	**300**	**200**	**225**	**-**	**25**	**750**	**17**	**7**	**1**	**25**

# Indicates 4 Hrs. Theory Paper during End Semester Examination

Course Codes and Definitions

Course Code	Definitions
AC	Audit Course
AE	Ability Enhancement Course
BC	Basic Chemistry Course
BM	Basic Mathematics Course
BP	Basic Physics Course
CC	Co-curricular Courses
EC	Extra-Curricular Course
EE	Electrical Engineering
ES	Engineering Science Course
ESE	End Semester Examination
GE	General Elective Course
ID	Inter-disciplinary Course
L	Lecture
MD	Multidisciplinary Course
MI	Minor Course
MJ	Major (Core) Course
O	Oral
OE	Open Elective Course
P	Practical
PC	Practical Courses
PE	Program Elective Course
RP	Research I Project Course
SE	Skill Enhancement Course
T	Tutorial
TW	Term Work
UH	Course Related to Universal Human Values
VA	Value Added Course
VE	Vocational Enhancement Course
VS	Vocational Skill Courses

Program Code:

Commencement/ Revised Year	Faculty Code (Egg. & Tech.)	Program Type (UG)	Program Number (Mech.)	Program Code
23	11	2	11	2311211

Course Code:

Type of Course	Faculty Code	Program Number	Sem/Year	Course Number	Course Code
MJ	11	11	3	01	MJ1111301

B. TECH. MECHANICAL: SEMESTER- I

Designation of Course	Engineering Mathematics-I (Common for all Branches) (Course Code: BM1113101)		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	Theory: 03
Practical:- 00 Hours/ Week	Internal Assessment	40 Marks	Tutorial: 01
Tutorial:- 01 Hours/ Week	Term Work	00 Marks	
	Oral/Practical Examination	00 Marks	00
	Total	**100 Marks**	**04**

Course Prerequisites	The students should know of Algebra of matrices and its Determinants, Maxima and Minima of single variable functions.
Course Objective	On completion of the course – 1. Fundamental theorems, concepts in Matrices, Demoivr's theorem and its applications in engineering. 2. Various techniques in Calculus, Explanation of functions, and Infinite series. 3. Partial differentiation, maxima, minima, and their applications in engineering.
Course Outcomes	On completion of the course, students will be able to 1. Determine the rank of a matrix and apply appropriate methods to solve systems of linear equations. 2. Apply De Moivre's theorem and hyperbolic functions to analyze and solve engineering problems. 3. Use Leibniz's rule to derive and compute the nth derivative of a given function. 4. Analyze the convergence and divergence of infinite series using appropriate tests. 5. Compute partial derivatives and evaluate total derivatives for functions of multiple variables. 6. Evaluate and interpret the maxima and minima of functions involving two variables.

Unit I	**Matrices**	**(06 Hrs.)**
Rank, Normal form, System of Linear Equations, Linear Dependence, and Independence, Linear and Orthogonal Transformations, Eigenvalues, Eigen Vectors, Cayley – Hamilton Theorem.		
Unit II	**Complex Numbers and Applications**	**(06 Hrs.)**
Definition, Cartesian, Polar, and Exponential Forms, Argand's Diagram, De'Moivre's theorem and its application to find roots of algebraic equations, Hyperbolic Functions, Logarithm of Complex Numbers, Separation into Real and Imaginary parts, Application to problems in Engineering.		
Unit III	**Differential Calculus**	**(06 Hrs.)**
Successive Differentiation, nth Derivatives of Standard Functions, Leibnitz's Theorem, Expansion of Functions: Taylor's Series and Maclaurin's Series		
Unit IV	**Differential Calculus**	**(06 Hrs.)**

Indeterminate Forms, L'Hospital's Rule, Evaluation of Limits. Infinite Series: Infinite Sequences, Infinite Series, Alternating Series, Tests for Convergence, Absolute and Conditional Convergence, Power series, Range of Convergence

Unit V	**Partial Differentiation and Applications**	**(06 Hrs.)**
Partial Derivatives, Euler's Theorem on Homogeneous Functions, Implicit Functions, Total Derivatives, Change of Independent Variables, Errors and Approximations.		
Unit VI	**Jacobian**	**(06 Hrs.)**
Jacobians and their applications, Chain Rule, Functional Dependence. Maxima and Minima: Maxima and Minima of Functions of two variables, Lagrange's method of undetermined multipliers.		

PBL: Project-Based Learning (Topics)

1 Echelon form
2 Normal forms
3 Linear and orthogonal transformation
4 Eigen values and eigen vectors
5 Argand diagram
6 De Moivre's theorem
7 Hyperbolic and logarithmic functions
8 Leibnitz theorem
9 Taylor's theorem
10 L'Hospital's rule
11 Tests for convergence
12 Euler's theorem for homogeneous functions
13 Total derivative
14 Maxima and minima for two-variable functions
15 Langrage undetermined multipliers

Reference Books

1. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune),7th Edition, 1988, Reprint 2010
2. Higher Engineering Mathematics by B.S. Grewal (Khanna Publication, Delhi), 42nd Edition, 2012
3. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill), Edition, 2008
4. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 8th Edition, 1999, Reprint 2010
5. Advanced Engineering Mathematics, 7e, by Peter O'Neil (Thomson Learning), Edition 2007
6. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education), 2nd, Edition, 2002

Unit Test –

Unit Test - I	Unit I, II, III

Designation of Course	Engineering Physics (Common for all Branches) (Course Code: BP1113102)		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	03
Practical:- 02 Hours/ Week	Internal Assessment	40 Marks	
Tutorial:- 00 Hours/ Week	Term Work	50 Marks	00
	Oral/Practical Examination	00 Marks	01
	Total	**150 Marks**	**04**

Course Prerequisites	Students are expected to have a basic understanding of physics and calculus.
Course Objective	To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense, with a view to laying the foundation for engineers.
Course Outcomes	On completion of the course, students will be able to 1. Analyze the motion and behavior of charged particles and apply this knowledge to the design and development of modern instruments such as electron microscopes. 2. Evaluate the challenges in architectural acoustics and propose suitable remedies, and utilize ultrasonic techniques for non-destructive testing in industrial applications. 3. Apply the principles of quantum mechanics to interpret micro-level physical phenomena and explain their implications in solid-state physics. 4. Explain the wave nature of light and apply optical methods to measure physical parameters such as stress, pressure, and dimensions. 5. Apply the fundamental principles of lasers and fiber optics to analyze and implement engineering applications involving communication and sensing systems. *6.* Describe the properties of solids and relate them to their engineering applications in materials and devices.

Unit I	**Modern Physics**	**(06 Hrs.)**
Motion of a charged particle in electric and magnetic fields, Electrostatic and Magnetostatic focusing, Electron microscopy, interaction of electron beam with the material, Wavelength and resolution, transmission electron microscope (TEM), scanning electron microscope (SEM), Separation of isotopes by Bainbridge mass spectrograph, cathode ray tube (CRT), CRT in cathode ray oscilloscope (CRO).		
Unit II	**Architectural Acoustics**	**(06 Hrs.)**
Elementary acoustics, Reverberation and reverberation time, Sabine's formula (without Derivation), Intensity level, Sound intensity level, Loudness, Sound absorption, Sound absorption coefficient, different types of noise and their remedies, basic requirement for acoustically good hall, factors affecting the architectural acoustics and their remedies, introduction to ultrasonics, Production of ultrasonics by magneto-striction and piezoelectric methods, applications (thickness measurement, flaw detection).		
Unit III	**Quantum mechanics**	**(06 Hrs.)**
Dual nature of matter, concept of wave packet, group and phase velocity, and relation between them, physical significance of wave function, Schrodinger's time-dependent and time-independent wave equation, Application of Schrodinger's time-independent wave equation to the problems of Particle in a rigid box, concept of tunnelling at potential barrier (no derivation-only conceptual discussion).		

Unit IV	Optics – I (Interference and Diffraction)	(06 Hrs.)
INTERFERENCE: Interference due to thin film of uniform thickness and non-uniform thickness, engineering applications of interference (optical flatness, non-reflecting coatings). DIFFRACTION: Diffraction at a single slit (Geometrical method), Conditions for maximum and Minimum, Diffraction at a circular aperture (Result only), Plane diffraction grating, Conditions for principal maxima and minima.		
Unit V	**Optics – II (Polarization and Lasers)**	**(06 Hrs.)**
POLARISATION: Introduction, Double refraction and Huygen's theory, Positive and negative crystals, Nicol prism. LASERS: Lasers introduction, Characteristics of Lasers, Working principle and components of He-Ne Laser, Nd -YAG Laser, Semiconductor diode Laser, Applications in the field of optical fiber (Principle, Acceptance angle and acceptance cone, Numerical aperture, Types of optical fibers, Fiber optic communication).		
Unit VI	**Solid State Physics**	**(06 Hrs.)**
Origin of band gap, Energy bands in solids, Fermi-Dirac probability function and position of Fermi level in intrinsic semi-conductors (with derivation) and in extrinsic semi-conductors, Formation and band structure of p-n junction, Hall effect and Hall coefficient. Introduction of nanoparticles, properties of nanoparticles (Optical, electrical, Magnetic, structural, and mechanical), synthesis of nanoparticles (Physical and chemical), and quantum dots – wide band semiconductors, direct/indirect band gap semiconductors.		

PBL: Project-Based Learning (topics)

1. Tesla Coil
2. Thin film interference in film formation of colors
3. Li-Fi- a wireless data transfer system using light
4. Need for a medium for the propagation of sound waves
5. Possible effects of electromagnetic fields (EMF) on human health
6. Design and simulation of an automatic solar-powered time-regulated water pumping
7. Solar technology: an alternative source of energy for national development. 8 Measurement and effect of environmental noise in the college
9. Electronic eye (Laser Security) as an auto-switch/security system
10. Electric power generation by road
11. Design and construction of a distance measuring instrument using a laser
12. Design and construction of remote-control devices – electronic bell, Fan, etc
13. Absorption coefficient of sound-absorbing materials
14. Velocity determination of O-ray and E-ray in double refracting materials
15. Velocity determination of O-ray and E-ray in double-refracting materials
16. The design and construction of the hearing aid device
17. Study of the Quantum Confinement Effect
18. Wind turbines - a source of electricity
19. Measurement of gravitational constant 'g'

Practical (Any Eight of the Following)

1. Determination of radius of plano-convex lens/wavelength of light/Flatness testing by Newton's rings
2. Determination of the wavelength of light using a diffraction grating
3. Determination of frequency of AC voltage by CRO.
4. Determination of refractive index for O-ray and E-ray

5. Determination of divergence of a laser beam
6. Particle size by semiconductor laser
7. Determination of the wavelength of a laser by a diffraction grating
8. To study the Hall effect and determine the Hall voltage
9. Calculation of conductivity by the four-probe method
10. Study of solar cell characteristics and calculation of fill factor
11. Determination of the band gap of a semiconductor
12. Synthesis of metal oxide nanoparticles (ZnO/ZnS/silver/Gold)
13. Measurement of average SPL across spherical wavefront and behavior with the distance
14. Determination of the velocity of sound in a liquid by an ultrasonic interferometer
15. Study of the B-H curve of a sample.
16. Determination of Plank's constant.

Textbooks

1. A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar, and TVS Arun Murthy, S. Chand Publishing (2018)
2. Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publishing Co Pvt Ltd (2015)
3. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan, and S. Rai Choudhury, McGraw-Hill Education (2017)

Reference Books

1. Fundamentals of Physics, Jearl Walker, David Halliday, and Robert Resnick, John Wiley and Sons (2013)
2. Optics, Francis Jenkins and Harvey White, Tata McGraw-Hill (2017)
3. Principles of Physics, John W. Jewett, Cengage Publishing (2013)
4. Introduction to Solid State Physics, C. Kittel, Wiley and Sons (2004)
5. Principles of Solid-State Physics, H. V. Keer, New Age International (1993)
6. Laser and Non-Linear Optics, B. B. Laud, New Age International Private Limited (2011)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing Company(2014)
8. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan, New Age International Pvt. Ltd. (1997)

Unit Test –

Unit Test - I	Unit I, II, III

Designation of Course	**Electrical Engineering Systems (Course Code: ES1107103)**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical: - 02 Hours/ Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Practical Examination	00 Marks	00
	Total	**125 Marks**	**05**

Course Perquisites	Students should have basic knowledge of Physics, Chemistry, and Mathematics.
Course Objectives	1. The course introduces fundamental concepts of DC and AC Circuits, Electrical Measurement, Transformers, Induction Machines, DC Machines, Basics of power transmission, distribution & safety measures.
Course Outcomes	On completion of the course, students will be able to: 1. Apply basic electrical laws and network theorems to analyze and solve electrical networks. 2. Analyze single-phase and three-phase AC circuits and demonstrate the operation of switchgear and electrical measuring instruments. 3. Explain the principles of magnetic and electromagnetic circuits and evaluate their performance in the operation of transformers. 4. Examine the construction and working of AC motors and apply appropriate control techniques for various mechanical engineering applications. 5. Illustrate the characteristics of DC motors and implement suitable control methods for mechanical engineering applications. *6.* Describe the structure and operation of electrical power transmission and distribution systems and apply safety standards and regulations in their usage.

Course Contents

Unit-I	**DC Circuit Analysis and Network Theorems**	**(08 Hrs.)**
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 (simple numerical problems).		
Unit-II	**AC Circuits and Switch Gear, Electrical Measurement**	**(08 Hrs.)**

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation of AC quantities, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, and RLC combinations (series and parallel), series and parallel resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Measuring Instruments: Power measurement in three-phase circuits. Electrical instruments such as a wattmeter, energy meter, ton tester, megger, and power analyzer.

Switch Gear: Introduction to LT Switchgear, NO and NC Contacts, Contactors, relay, timers, use in control panel, applications in interlocking and protection, symbols.

Unit-III	Magnetic Circuit and Electromagnetic Induction	(08 Hrs.)

Magnetic Circuit: flux, flux density, field strength, 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.

Electromagnetic Induction: Faraday's law of EMI induced emf, Lenz's law, self-inductance, coefficient of self-inductance (L), mutual inductance, coefficient of mutual inductance (M), self-induced emf and mutually induced emf, coefficient of coupling, inductance in series, types of inductors, their application, and energy stored in the magnetic field.

Transformers: Single phase and three phase: Working principle, Construction, Types, applications.

Unit-IV	Induction Machines	(08 Hrs.)

Three Phase Induction Motor: construction, types, rotating magnetic field, principle of operation, slip, frequency of rotor current, rotor emf, rotor current, expression for torque, conditions for maximum torque, torque slip characteristics, starting torque in squirrel cage and slip ring motors, effect of change in supply voltage on torque, slip and speed, relation between full load torque and maximum torque, power stages in induction motor, vector diagram and equivalent circuit, no load and block rotor test, speed control of 3 phase motor, starting methods for 3 phase induction motor, circle diagram, construction and calculation.

Single Phase Motor: construction, double revolving field theory, starting methods & types of single-phase motor, equivalent circuit.

Servomotor: construction, types, working, characteristics, application in automation and robotics.

Unit-V	DC Machines	(08 Hrs.)

DC Generator: construction, emf equation of DC generator, methods of excitation, losses, condition for maximum efficiency, armature reaction, interpoles and compensating winding, commutation, methods of improving commutation, characteristics of separately excited and self-excited DC generator.

DC Motor: Working principle, voltage equation, condition for maximum power, torque developed, operating characteristics of DC motor, starting: 3-point and 4-point starter, speed control methods, Swinburne's and brake test of DC shunt motor. Soft-starting of DC motors.

Unit-VI	Basic of Power transmission and distribution, Safety Measures	(08 Hrs.)

Basic of Power transmission and distribution: classification of transmission lines, transmission line parameters, ABCD constants, voltage regulation, Ferranti effect, efficiency of transmission line. 3-phase 3-wire and 3-phase 4-wire distribution systems, feeders, distributors, main lines, and comparison of various distribution systems, including load power factor improvement techniques.

Safety Measures: Safety measures in the electrical system, safety rules, basic principles of earthing, and types of earthing.

List of Assignments:

The students will be given a total of **twelve** assignments (Two assignments on each Unit, respectively).

1. DC Circuit Analysis
2. Network Theorems
3. AC Circuits and Switch Gear
4. Electrical Measurement
5. Single-Phase Transformer
6. Three-Phase Transformer
7. 3 Phase induction motor
8. Single-phase motor
9. DC Generator
10. DC Motor
11. Power transmission and distribution
12. Safety Measures

List of Experiments:

Note: Term work shall consist of a Minimum of **Eight** Experiments from the following list.

List of Practicals to be performed in the laboratory:

1. Plotting B-H characteristics for a material
2. Verification of Kirchhoff's Laws
3. Verification of the Superposition Theorem
4. Verification of Thevenin's Theorem
5. Verification of Maximum Power Transfer Theorem
6. Study of R-L series, R-C series, R-L-C series circuit
7. Time response of the R-L series and the R-C series circuit
8. Verification of voltage and current relationships in star and delta-connected 3-phase networks
9. Single lamp controlled by two different switches (staircase)
10. Two lamps controlled independently from two different switches (parallel)
11. Series-connected lamps
12. Study of Electricity bill(Industrial / commercial)
13. Direct loading tests on a single-phase transformer
14. Mini project based on the contents of the syllabus.

Text Books

1. Basic Electrical Engineering - D. P. Kothari, J Nagarath (TMC)

Reference Books

2. Electrical Technology - Edward Huges (Pearson)
3. Electrical power system technology - S. W. Fordo, D. R. Patric (Prentice Hall)
4. Principles of Electronics-Dr. H. M. Rai (Satya Prakashan)
5. Electronic Devices and Circuit Theory- R. L. Boylestad and L. Nashelsky (PHI)
6. Electrical, Electronics Measurements and Instruments - (Satya Prakashan)

Project-Based Learning

Following is the list of topics for project-based learning (Not Limited to) based on the syllabus contents:

1. To develop a practical kit for the verification of Thevenin's theorem.

2. To develop a practical kit for the verification of the Superposition theorem.
3. To develop a practical kit for the verification of the Maximum power transfer theorem
4. To develop a practical kit for the verification of Norton's theorem.
5. To develop a practical kit for the study of the R-L-C Series circuit.
6. To develop a practical kit for the study of the R-L-C parallel circuit.
7. To develop a practical kit for the study of voltage and current relationships in a star-star-connected network.
8. To develop a practical kit to understand voltage and current relationships in a delta-delta-delta-connected network.
9. To develop a demonstration model of a single-phase transformer for practical application.
10. Case study on transformer operation and testing by using professional software.
11. To develop a demonstration model of a Smart Energy meter using GSM
12. To develop a demonstration model of Safety measures in the electrical system.
13. Case studies on – Learning Industrial Safety through films/Videos
14. Case studies on – Learning industrial Safety through posters/charts

Unit Tests

Unit Test-I	Unit I, II, III

Designation of Course	**Computer Aided Engineering Graphics (Course Code: ES1111104)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory :- 04 Hrs./ Week	End Semester Examination	60 Marks	04
Practical:- 02 Hrs./Week	Unit Test	40 Marks	
	Term Work	50 Marks	01
	Practical Examination	00 Marks	00
	Total	**150 Marks**	**05**

Course Prerequisites	Basics of Mathematics at Secondary School Level
Course Objectives	To provide knowledge about o Fundamentals of engineering drawing and curves o Isometric views and projection o Projections of points, lines, planes & solids o Use of CAD tools.
Course Outcomes	On completion of the course, students will be able to: 1. Interpret various dimensioning methods and construct standard engineering curves. 2. Construct orthographic projections of objects using the first-angle method of projection. 3. Develop sectional orthographic projections of simple engineering components. 4. Generate isometric views from the given orthographic projections. 5. Construct projections of points, lines, planes, and solids in different orientations. 6. Develop the lateral surfaces of simple solids for sheet metal applications.

Course Contents

Unit 1	**Lines and Dimensioning in Engineering Drawing and Engineering Curves**	**(08 Hrs.)**

Fundamentals of CAD and Engineering Curves

Introduction to Engineering Drawing, Types of lines and Dimensioning, Layout and size of drawing sheets, Scales.

Engineering Curves-Ellipse drawing by Directrix Focus Method, Arc of Circle Method, Concentric Circle Method, Involutes of a circle, Cycloid, Archimedean Spiral, Helix on cone, and Cylinder. Fundamentals of Computer Aided Drafting (CAD) and its applications, Various software for Computer Aided Graphics/Drafting. AutoCAD initial settings and AutoCAD commands

Unit 2	**Orthographic Projections**	**(08 Hrs.)**

Basic principles of orthographic projection (First and Third angle method). Orthographic projection of objects by the first-angle projection method only. Procedure for preparing scaled drawing, sectional views, types of cutting planes and their representation, and hatching of sections.

Unit 3	**Sectional Orthographic Projections**	**(08 Hrs.)**

Types of Sections, Sectional Orthographic Projection.

Unit 4	**Isometric Projections**	**(08 Hrs.)**

Isometric view, Isometric scale to draw Isometric projection, non-isometric lines, and construction of an isometric view from given orthographic views, and to construct an isometric view.

Unit 5	Projections of Points, Lines, Planes, and Solids	(08 Hrs.)

Projections of points, projections of lines, lines inclined to one reference plane, and lines inclined to both reference planes. (Lines in First Quadrant Only). Projection of the prism, pyramid, cone, and cylinder by the rotation method.

Unit 6	Development of Lateral Surfaces	(08 Hrs.)

Development of the lateral surfaces of solids like prisms, pyramids, cylinders, and cones.

Project-Based Learning

1 To obtain industrial drawings to identify the types of lines, dimensioning methods, and methods of projection.
2 To develop the model/charts based on engineering curves.
3 To prepare a model/chart for the identification of engineering curves in nature for industrial, societal, etc. applications.
4 To demonstrate different methods of orthographic projection.
5 To demonstrate the projection of Points.
6 To demonstrate the projection of Lines.
7 To demonstrate the projection of Planes.
8 To demonstrate the projection of Solids.
9 To demonstrate developments of surfaces for solids.
10 To demonstrate the industrial application of the development of surfaces
11 To demonstrate the Isometric projection method through a model of a cube.

Assignments: Minimum five problems on each unit in A3 A3-sized drawing Book

Term Work shall consist of **seven** A2-size (594 mm × 420 mm) sheets by hand and AutoCAD.

1. Types of lines, Dimensioning practice, 1st and 3rd angle methods symbol.
2. Engineering Curves
3. Orthographic Projections
4. Isometric views
5. Projections of Lines and Planes
6. Projection of Solids
7. Development of Lateral Surfaces

Textbooks/Reference books

1. "Elementary Engineering Drawing", N.D. Bhatt, Charotar Publishing House, Anand, India.
2. "Textbook on Engineering Drawing", K. L. Narayana & P. Kannaiah, Scitech Publications, Chennai.
3. "Fundamentals of Engineering Drawing", Warren J. Luzzader, Prentice Hall of India, New Delhi
4. "Engineering Drawing and Graphics", Venugopal K., New Age International Publishers.
5. M. B. Shah and B. C. Rana, "Engineering Drawing", 1st Ed, Pearson Education, 2005.
6. P. S. Gill, "Engineering Drawing (Geometrical Drawing)", 10 Edition, S. K. Kataria and Sons,2005.

Unit Tests

Unit Test - I	Unit I, II, III

Designation of Course	**Mechanical Engineering Systems (Course Code: MJ1111105)**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 03 Hour/ Week	End Semester Examination	60 Marks	03
Practical: -02 Hours/Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Practical Examination	00 Marks	00
	Total	**125 Marks**	**04**

Course Prerequisites	Higher Secondary Physics
Course Objective	To teach students about 1. Introduction to Systems in Thermal Engineering 2. Introduction to Systems in Design Engineering 3. Introduction to Systems in Manufacturing Engineering
Course Outcomes	On completion of the course, students will be able to: 1. Explain the working principles and performance characteristics of various power-producing and power-absorbing devices used in engineering applications. 2. Classify and compare different renewable and non-renewable energy systems based on their working principles, efficiencies, and environmental impacts. 3. Analyze the kinematic and dynamic behavior of mechanisms and machine elements used for motion and force transmission. 4. Evaluate the performance of power transmission systems such as belts, gears, and chains, and select suitable systems for engineering applications. 5. Demonstrate the working principles and apply the fundamentals of machine tools and manufacturing processes in product development. 6. Illustrate the basic concepts, configurations, and applications of robotics, and analyze their role in automation and manufacturing.

Course Contents

Unit-I	**Power Producing and Absorbing Systems**	**(06 Hrs.)**

Power Producing Systems: I.C. Engines- Basic nomenclature, Classification, S.I. and C.I. Engines, Two-stroke and four-stroke engines. Boilers- classification, water tube and fire tube boilers. Steam Turbines: Classification, simple Impulse, and reaction turbines. Water Turbines: Classification, Impulse, and Reaction Turbines. Gas Turbines: classification, open and closed gas turbines. Construction, working, and applications of all these devices.

Power Absorbing Systems: Compressors; Classification, Rotary, reciprocating air compressors, Blower, Pumps: Classification, Rotary, reciprocating pumps, Household refrigerator and window air conditioner.

Unit-II	**Renewable and Non-Renewable Energy Systems**	**(06 Hrs.)**

Renewable energy systems: Solar- P-V Cells, collectors- Flat plate, Parabolic, Trough collector, Heliostat. Wind- Classification of wind Turbines, Horizontal and vertical axis. Biomass gasification, Biogas Plant, Geothermal, Tidal, micro-hydro plant.

Non-renewable energy systems: Thermal power plant, hydroelectric power plant, Nuclear power plant, Gas Turbine plant, I.C. engine power Plant,

Unit-III	Introduction to Mechanisms of Machines	(06 Hrs.)
Kinematic link, Kinematic pair, Types of constrained motions, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach criterion, Grubler's criterion. Four-bar chain and its inversions, Grashof's law, Slider crank chain and its inversions, Double slider crank chain and its inversions. Geneva Mechanisms, Ratchet and Paul Mechanisms		
Unit-IV	**Power Transmitting Devices**	**(06 Hrs.)**
Kinematic link, Kinematic pair, Types of constrained motions, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach criterion, Grubler's criterion. Four-bar chain and its inversions, Grashof's law, Slider crank chain and its inversions, Double slider crank chain and its inversions. Geneva Mechanisms, Ratchet and Paul Mechanisms		
Unit-V	**Power Transmitting Devices**	**(06 Hrs.)**
Demonstration of: Lathe machine, Centre lathe, wood working lathe, Drilling machine, types of drilling machine, milling machine, Power saw. Grinding machine, cylindrical grinder, and surface grinder. NC machine, CNC machine.		
Unit-VI	**Introduction to Robotics**	**(06 Hrs.)**
History of robotics, Definition of robotics and robot, laws of robotics and classification of robot, application of robot, robot anatomy, Degree of freedom, Degree of mobility, Kinematics, joints, work envelope, pay load, reach, speed, acceleration, accuracy, precision, repeatability, Mounting, Footprint, cycle time, Components of robots such as sensor, power conversion unit, Actuators, Manipulators, Controllers, Base, and user interface, Future of robotics.		

Term work: Term work shall consist of the following experiments.

1. Study and demonstration of low-pressure boilers.
2. Study and demonstration of IC Engines.
3. Study and demonstration of Refrigeration and Air Conditioning.
4. Study and demonstration of Pumps and Compressors.
5. Study and demonstration of turbines.
6. Study and demonstration of Inversions of 4-bar, Single and Double Slider Crank Mechanisms.
7. Study and demonstration of power transmitting elements.
8. Study and demonstration of operations on the center lathe.
9. Study and demonstration of operations on the drilling machine.
10. Study and demonstration of robot anatomy.
11. Mini Project on Contents of Syllabus.

Assignment

1. Assignment on power-producing and absorbing devices
2. Assignment on renewable and non-renewable energy
3. Assignment on the mechanism of machines
4. Assignment on Power Transmitting Devices
5. Assignment on Machine Tools
6. Assignment on Robotics

Textbooks

1. A Textbook of Production Engineering, P.C. Sharma, S. Chand Publication, New Delhi, 2nd edition, 8th Edition (2014).
2. A Textbook of Manufacturing Technology: Manufacturing Processes, R. K. Rajput, Laxmi Publications (P) Ltd, 2nd Edition 2015

3. R.S. Khurmi and J K Gupta, Textbook of Thermal Engineering, S Chand publications.

Reference Books

1. V. Ganeshan, Internal Combustion Engine, Tata McGraw-Hill Publication, 4th Edition (2012).
2. R. K. Rajput, Thermal Engineering, Laxmi Publications
3. Ambekar A.G. Mechanisms and Machine Theory, Prentice-Hall of India, Eastern Economy Edition (2007)
4. S.S. Ratan, Theory of Machines, Tata McGraw-Hill, 4th Edition
5. Introduction to robotics, S. K. Shah. McGraw-Hill, 2nd Edition Project-Based Learning

Following is the list of topics for project-based learning (Not Limited to) based on the syllabus contents:

1. To prepare a chart of comparison among the specifications of various models of two-wheeler available.
2. To develop a demonstration model of a low-cost household refrigerator
3. To develop a demonstration model of a low-cost air conditioner
4. To develop a demonstration model of a Biogas plant
5. To develop a demonstration model of a geothermal power plant
6. To develop a demonstration model of a wind power plant
7. To develop a demonstration model of a solar energy plant
8. To develop a demonstration model of the Whitworth quick return mechanism
9. To develop a demonstration model of a single slider crank chain mechanism with its inversion
10. To develop a demonstration model of the Ratchet and Pawl mechanism
11. To develop a demonstration model of a mini conveyor using a Geneva mechanism

Unit Test

Unit Test-I	Unit- I, II, III

Designation of Course	Universal Human Values (Common for all Branches) (Course Code: UH1113106)		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 00 Hours/ Week	End Semester Examination	00 Marks	00
Practical:- 02 Hours/ Week	Internal Assessment	00 Marks	
Tutorial:- 00 Hours/ Week	Term Work	50 Marks	
	Oral/Practical Examination	00 Marks	01
	Total	**50 Marks**	**01**

Course Prerequisites	During the Induction Program, students would get an initial exposure to human values through Universal Human Values. This exposure is to be augmented by this compulsory full-semester foundation course.
Course Objective	Development of a holistic perspective based on self-exploration about themselves (human being), family, society, and nature/existence. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence. Strengthening of self-reflection. Development of commitment and courage to act
Course Outcomes	On completion of the course, students will be able to 1. Identify and reflect upon one's own thoughts, emotions, and actions to develop greater self-awareness and sensitivity towards the family, society, and natural environment. 2. Differentiate and analyze the relationship between the self and the body, recognizing their distinct needs and means of fulfillment for a balanced and holistic lifestyle. 3. Demonstrate and practice responsible human conduct through ethical, harmonious, and compassionate relationships, consistent with the values of human nature. 4. Interpret and appreciate the dimensions of harmony within society and develop a sensitive and inclusive attitude towards social well-being. 5. Explain and illustrate the cyclical processes and interdependence in nature, recognizing the role of human participation in maintaining ecological balance. 6. Integrate and apply the principles of value-based living to real-life situations for sustainable personal, social, and professional development.

Unit I	**Introductions, Aspirations, and Concerns**	**(04 Hrs.)**
Getting to know each other, Self-exploration, Individual academic, career Expectations of family, peers, society, and nation, fixing one's goals, Basic human aspirations, Need for a holistic perspective, Role of UHV		
Unit II	**Self-Management, Health**	**(04 Hrs.)**
Self-confidence, peer pressure, time management, anger, stress, Personality development, self-improvement, improvement Harmony in the human being. Health issues, healthy diet, healthy lifestyle, Hostel life, Harmony of the self and Body, Mental and physical health		
Unit III	**Relationships**	**(04 Hrs.)**

Home sickness, gratitude towards parents, teachers, and others Ragging and interaction. Competition and cooperation Peer pressure. Harmony in relationship Feelings of trust, respect, gratitude, glory, love.		
Unit IV	**Society**	**(04 Hrs.)**
Participation in society. Harmony in society: Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust), and existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.		
Unit V	**Natural Environment**	**(04 Hrs.)**
Participation in nature, Harmony in nature/existence, Understanding the harmony in Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature		
Unit VI	**Self-evaluation Strategy**	**(04 Hrs.)**
Strategy for transition from the present state to Universal Human Order: a. At the level of the individual, as socially and ecologically responsible engineers, technologists, and managers. At the level of society, as mutually enriching institutions and organizations review the role of education, need for a holistic perspective.		

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

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

Designation of Course	**Programming in C/C++ (Course Code: ES1111107)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory: - 00 Hours/ Week	End Semester Examination	00	00
Practical: - 04 Hours/ Week	Internal Assessment	00	
Tutorial: - 00 Hours/ Week	Term Work	25 Marks	00
	Oral/Practical Examination	25 Marks	02
	Total	**50 Marks**	**02**

Course Prerequisites	Basic Mathematics
Course Objective	The goal of the course is for students to develop techniques for problem-solving using a programming language.
Course Outcomes	On completion of the course, students will be able to: 1. Explain the basic concepts of C++ programming and develop simple programs using them. 2. Utilize various operators in C++ to perform arithmetic, relational, and logical operations in programs. 3. Apply conditional control structures to implement decision-making logic in C++ programs. 4. Construct programs using iterative control structures (loops) to perform repetitive computational tasks. 5. Develop and implement user-defined functions and recursive algorithms to improve program modularity and efficiency. 6. Design and use one-dimensional arrays in C++ to store and manipulate data effectively.

Course Contents

Unit-I	**Introduction to C++**	(08 Hrs.)
Introduction to C, C++; Object-oriented programming; Programming Fundamentals; Data and Data Types		
Unit-II	**Operators in C++**	(08 Hrs.)
Declarations in C++; Operators in C++; Introduction to classes and objects, and strings		
Unit-III	**Conditional Statements**	(08 Hrs.)
Relational and logical operators; If statements; Switch Statements		
Unit-IV	**Loops**	(08 Hrs.)
Loops in C++; For loop; While loop; Do while loop; Jump statement		
Unit-V	**Functions**	(08 Hrs.)
Functions, basic formats; Recursion, Overloaded functions; Local, Global, and Static Variables		
Unit-VI	**Arrays**	(08 Hrs.)
Arrays Fundamentals; Arrays and Functions; Character Arrays		

Term Work

Term work shall consist of programs (not limited to) listed below, based on the syllabus.

1. C++ "Hello, World!" Program
2. C++ Program to Print Number Entered by User
3. C++ Program to Add Two Numbers
4. Increment ++ and Decrement -- Operator Overloading in C++ Programming
5. C++ Program to Find Quotient and Remainder
6. C++ Program to Find the Size of int, float, double, and char in Your System
7. C++ Program to Swap Two Numbers
8. C++ Program to Find the ASCII Value of a Character
9. C++ Program to Multiply Two Numbers
10. C++ Program to Check Whether a Number is Even or Odd
11. C++ Program to Check Whether a Character is a Vowel or a Consonant.
12. C++ Program to Find the Largest Number Among Three Numbers
13. C++ Program to Find All Roots of a Quadratic Equation
14. C++ Program to Calculate the Sum of Natural Numbers
15. C++ Program to Check Leap Year
16. C++ Program to Find Factorial
17. C++ Program to Generate Multiplication Table
18. C++ Program to Display Fibonacci Series
19. C++ Program to Find GCD
20. C++ Program to Find LCM
21. C++ Program to Reverse a Number
22. C++ Program to Calculate the Power of a Number
23. C++ Program to Check Whether a Number is a Palindrome or Not
24. C++ Program to Check Whether a Number is Prime or Not
25. C++ Program to Display Prime Numbers Between Two Intervals
26. C++ Program to Check Armstrong Number
27. C++ Program to Display Armstrong Numbers Between Two Intervals
28. C++ Program to Display Factors of a Number
29. C++ Programs to Create Pyramid and Pattern
30. C++ Program to Make a Simple Calculator to Add, Subtract, Multiply, or Divide Using switch...case
31. C++ Program to Display Prime Numbers Between Two Intervals Using Functions
32. C++ Program to Check Prime Numbers by Creating a Function
33. C++ Program to Check Whether a Number Can Be Express as a Sum of Two Prime Numbers
34. C++ program to find the Sum of Natural Numbers using Recursion
35. C++ program to calculate Factorial of a Number Using Recursion
36. C++ Program to Find G.C.D Using Recursion
37. C++ Program to Convert Binary Number to Decimal and vice-versa
38. C++ Program to Convert Octal Number to Decimal and vice-versa
39. C++ Program to Convert Binary Number to Octal and vice-versa
40. C++ program to Reverse a Sentence Using Recursion
41. C++ Program to Calculate Power Using Recursion

42. C++ Program to Calculate the Average of Numbers Using Arrays
43. C++ Program to Find the Largest Element of an Array
44. C++ Program to Calculate Standard Deviation

Text Books

1. "Let Us C++", Kanetkar Yashavant, BPB Publications

Reference Books

1. “C++ Programming Today”, Barbara Johnston, Prentice Hall of India, New Delhi.
2. “C++ how to program”, Paul Deitel and Henry Deitel, Prentice Hall of India, New Delhi.
3. "Accelerated C++: Practical Programming by Example", Andrew Koenig and Barbara E. Moo, Addison-Wesley Publications
4. "C++: The Complete Reference", Herbert Schildt, McGraw-Hill Publications.
5. "C++ Primer"; Barbara E. Moo, Josée Lajoie, and Stanley B. Lippman; Addison-Wesley Professional
6. "Programming: Principles and Practice Using C++", Bjarne Stroustrup, Addison-Wesley Professional

B. TECH. MECHANICAL: SEMESTER- II

Designation of Course	**Engineering Mathematics-II (Common for all Branches) (Course Code: BM1113201)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	Theory: 03 Tutorial: 01
Practical: - 00 Hours/ Week	Internal Assessment	40 Marks	
Tutorial: - 01 Hours/ Week	Term Work	00 Marks	00
	Oral/Practical Examination	00 Marks	00
	Total	**100 Marks**	**04**

Course Prerequisites	The students should know differential calculus.
Course Objective	On completion of the course – 1. Fundamental theorems, concepts in Matrices, De Moivre's theorem, and its applications in engineering. 2. Various techniques in Calculus, Explanation of functions, and Infinite series. 3. Partial differentiation, maxima, minima, and their applications in engineering
Course Outcomes	On completion of the course, students will be able to: 1. Formulate and solve differential equations using various analytical and numerical methods for engineering applications. 2. Apply fundamental laws of mechanics and heat transfer to analyze simple harmonic motion and one-dimensional heat conduction problems. 3. Evaluate integrals and develop Fourier series representations for periodic functions. 4. Compute integrals involving error functions and apply them to engineering and scientific problems. 5. Determine the position and orientation of lines and planes in three-dimensional geometry using analytical methods. 6. Solve and interpret problems involving double and triple integrations with applications in area and volume calculations.

Unit I: Differential Equation of First Order and First Degree: (06 Hrs.)

Definition, Order and Degree of DE, Formation of DE, Solutions of Variable Separable DE, Exact DE, Linear DE, and reducible to these types

Unit II: Applications of Differential Equations: (06 Hrs.)

Applications of DE to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, Motion under Gravity, Rectilinear Motion, Simple Harmonic Motion,– Dimensional Conduction of Heat

Unit III: Fourier Series: (06 Hrs,)

Definition, Dirichlet's conditions, Fourier Series and Half Range Fourier Series, Harmonic Analysis

Unit IV: Integral Calculus: (06 Hrs,)

Reduction formulae, Beta and Gamma functions, Differentiation under the Integral Sign, Error functions

Unit V. Solid Geometry: (06 Hrs,)

Cartesian, Spherical Polar, and Cylindrical Coordinate Systems, Sphere, Cone, and Cylinder

Unit VI: Multiple Integrals and their Application: (06 Hrs,)

Double and Triple Integrations, Applications to Area, Volume, Mean, and Root Mean Square Values

PBL: Project-Based Learning (Topics)

1. Formation of a differential equation
2. Exact Differential Equation
3. Linear differential equation
4. Newton's law of cooling
5. Newton's second law of motion
6. Fourier's law
7. Kirchhoff's voltage law
8. Fourier series
9. Harmonic analysis
10. Gamma and beta function
11. Reduction formulae
12. Locating position in three-dimensional space
13. Multiple integrals applications
14. Error function
15. Differentiation under the integral sign

Textbooks

1. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune),7th Edition, 1988, Reprint 2010.

Reference Books

1. Higher Engineering Mathematics by B.S. Grewal (Khanna Publication, Delhi), 42nd Edition, 2012
2. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill), Edition, 2008
3. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 8th Edition, 1999, Reprint 2010
4. Advanced Engineering Mathematics, 7e, by Peter V.O'Neil (Thomson Learning), Edition 2007
5. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education), 2nd, Edition, 2002

Unit Test –

Unit Test - I	Unit I, II, III

Designation of Course	Engineering Chemistry (Common for all Branches) (Course Code: BC1111202)		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory:-03Hours/ Week	End Semester Examination	60 Marks	03
Practical:-02Hours/week	Internal Assessment	40 Marks	
Tutorial:-00 Hours/week	Term Work	50 Marks	00
	Oral/Practical Examination	00 Marks	01
	Total	**150 Marks**	**04**

Course Prerequisites	The student should have Basic knowledge of chemistry. Basic knowledge of electrochemistry and chemistry of materials. Introductory knowledge of polymers.
Course Objective	The student should acquire the knowledge of 1. To develop interest among the students regarding chemistry and its applications in engineering. 2. To develop confidence among students about chemistry and how the knowledge of chemistry is applied in the technological field. 3. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the Engineering field
Course Outcomes	On completion of the course, students will be able to: 1. Explain the different methods of analysis of water and environmental pollutants and discuss the significance of green chemistry in sustainable development. 2. Classify various types of fuels and apply their characteristics in suitable engineering applications. 3. Analyze the causes and effects of corrosion and recommend appropriate methods for its prevention and control. 4. Apply the concepts of polymers to study and evaluate the properties of advanced engineering materials. 5. Apply fundamental principles of chemistry to interpret the chemical properties and processes of materials at the nanoscale. 6. Illustrate the importance of instrumental analysis techniques and their applications in solving engineering problems.

Unit I: Water Technology & Green Chemistry (6 Hrs.)

Introduction, sources and impurities in water, Hardness of water, types, and determination of hardness using EDTA titration, softening of hard water by ion-exchange process. Numerical problems on the hardness of water. Major environmental pollutants, Basic principles of green chemistry. Atom economy, Synthesis of adipic acid, Industrial applications of green chemistry, Numerical problems on Atom economy.

Unit II: Electrochemical energy and solar energy (6 Hrs.)

Fuels: Introduction, Definition, importance of fuels, calorific value, types, fluidized bed Catalytic cracking, knocking (Petrol engine), mechanism and its ill effects, biodiesel, power alcohol, octane, and cetane number. Solar Energy: Introduction, construction, working, and applications of the photovoltaic cell.

Unit III: Corrosion technology and its control (6 Hrs.)

Introduction, Electrochemical theory of corrosion, Types of corrosion, Differential metal and differential aeration (pitting and water line), caustic embrittlement. Factors affecting the rate of corrosion, Corrosion control: Cathodic protection, sacrificial anode and impressed current methods, Metal coatings, Galvanization and tinning, Anodizing, Anodizing of aluminium, Organic coatings: Paint and varnishes. Metal finishing: Introduction, Technological importance. Principles of electroplating. Electroplating of chromium. Electroless plating: Introduction, electroless plating of nickel & copper on PCB with applications

Unit IV: Engineering Materials and Technology (6 Hrs.)

Polymers: Introduction, classification, Synthesis and applications of Polyurethane, polycarbonates, Conducting Polymers: Synthesis & Mechanism of conduction in poly aniline. Composites: Introduction, constitution, classification. Types: fiberglass, hybrid, and reinforced Composites with applications.

Unit V: Nano materials (6 Hrs.)

Introduction, size-dependent properties (Surface area, Electrical, Optical, Catalytic, and Thermal properties). Synthesis of nano materials: Top down and bottom-up approaches, Synthesis by Sol-gel, precipitation and chemical vapor deposition, Nano scale materials: Fullerenes, Carbon nano tubes and graphenes – properties and applications.

Unit VI: Instrumental methods of analysis (6 Hrs.)

Introduction, Theory, Instrumentation, and Applications of Colorimetry, pH Metry, Conductometry. Introduction to spectroscopy, principles and applications of UV/Vis. Spectroscopy

PBL: Project-Based Learning (Topics)

1. Comparison of Hardness, Alkalinity, Dissolved oxygen, Chlorides, and COD of water from two different sources
2. Removal of industrial pollutants from wastewater by adsorption on activated charcoal
3. Preparation of biofuels from two natural sources
4. Two synthetic approaches for the production of H2 as a clean fuel
5. Prevention of corrosion by metal coupling
6. Construction of biosensors in engineering applications
7. Design and simulation of automatic solar photovoltaic panels as a renewable energy source.
8. Synthesis of Conjugated Polymers and Molecules Using Sugar Reagents and Solventless Reactions. OR Composite materials and their properties, applications, and types

9. To study the mechanism of lubrication
10. Electroplating- study on how different metals can be used and the practical applications
11. Prepare Ag- Ag-nanoparticles by using the sol-gel method. Preparation of Ag nanoparticles from two natural sources
12. With the help of green chemistry principles, prepare any organic dye by using the Traditional and Green pathway.
13. Prepare epoxy resins by using suitable metho
14. Measurement and effect of waste disposal from laboratories in the college

Practical (Any Eight of the Following)

1. Determination of the Hardness of the water sample by the EDTA method
2. To determine the strength of an acid by pH–metric Titration
3. Measuring the strength of an acid by conductometric titration
4. Measurement of Surface tension of a given liquid by the Stalgmometer.
5. To determine the alkalinity water sample.
6. Estimation of the given amount of copper in the given solution by colorimetry
7. Synthesis of conducting polyaniline from aniline by oxidative polymerization
8. Determination of iron content in the given solution by Mohr's method
9. To determine the strength of a given acid solution by titrating it against a base solution using an indicator
10. Determination of reaction rate, order, and molecularity of hydrolysis of ethyl acetate
11. Verification of Beer-Lambert's Law.
12. Determination of Viscosity of Liquids by Ostwald's Viscometer
13. Determination Of Chloride Content Of Water By Argentometry
14. Estimation of copper from brass by iodometry
15. To study the setup of Daniel's cell.

Text Books

1. Engineering Chemistry, Jain P.C. & Jain Monica, Dhanpat Rai & Sons, Delhi (1992)
2. Engineering Chemistry, O. G. Palanna, Tata McGraw-Hill Publication, New Delhi
3. A textbook of Engineering Chemistry, S. S. Dara, McGraw-Hill Publication, New Delhi

Reference Books

1. Engineering Chemistry- Fundamentals and applications, Shikha Agarwal, Cambridge Publishers (2015)
2. Polymer Science and Technology (2nd Edition), P. Ghosh, Tata McGraw-Hill, (2008)
3. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch, Cengage Learning (2017)
4. Polymers: Chemistry & Physics of Modern Materials (2^{nd} edition) J. M. G. Cowie, Blackie, Academic & Professional (1994)
5. Integrated design and operation of water treatment facilities, Kawamura, Susumu. John Wiley & Sons (2000)

Unit Test –

Unit Test - I	**Unit I, II, III**

Designation of Course	Electronics Engineering Systems (Course Code: ES1107203)		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory:- 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical:- 02 Hours/ Week	Internal Assessment	40 Marks	
	Term Work	50 Marks	00
	Practical Examination	00 Marks	01
	Total	**150 Marks**	**05**

Course Prerequisites:-	Students should have the basic knowledge of Electrical Engineering
Course Objectives:-	1. To provide an overview of electronics engineering that serves as the foundation of advanced studies in mechanical engineering. 2. This course provides a comprehensive idea about the working principle 3. Operation and characteristics of electronic devices, transducers, digital electronics, and communication systems.
Course Outcomes:-	On completion of the course, students will be able to– 1. Explain the operating principles and characteristics of basic electronic devices and linear integrated circuits. 2. Apply the fundamental concepts of digital electronics to design and analyze simple digital circuits. 3. Analyze various signal conditioning methods and demonstrate their practical applications in measurement systems. 4. Differentiate between analog and digital communication systems and illustrate their working principles and applications. 5. Describe the working of transducers and data acquisition systems and apply them for measurement and control applications. 6. Explain the architecture and operation of microprocessors and microcontrollers and develop simple applications using them.

Course Contents

Unit-I	**Electronic Devices and Linear ICs**	**(08 Hrs.)**
Rectifiers: Half-wave, Full-wave wave and Bridge rectifiers - capacitor filter-wave forms-ripple factor regulation characteristics. Special semiconductor devices: FET, SCR. LED, MOSFET, DIAC, TRIAC, relays, VI characteristics – applications		
Unit-II	**Digital Electronics**	**(08 Hrs.)**
Number system – Binary, Decimal, Octal, Hexadecimal, Digital Signal, Combinational and sequential logic circuits, clock signal, Boolean Algebra and Logic gates, Arithmetic Operations, Multiplexers, Demultiplexers, Encoders, Decoders, Flip-flop, Registers, Counters. Integrated circuits & logic families: – Logic levels, noise immunity, fan out, propagation delay, TTL logic family, CMOS logic family, comparison with TTL family		
Unit-III	**Signal Conditioning**	**(08 Hrs.)**
Operational amplifiers, Inverting, non-inverting, voltage follower, summing, subtractor, Instrumentation,555 timer-operating modes: monostable, a stable multivibrator, Analog to Digital & Digital to Analog Converters		
Unit-IV	**Communication Systems**	**(08 Hrs.)**

Analog Communication & Digital Communication: Block diagram of a basic communication system, Frequency spectrum, need for modulation, Methods of modulation- Principles of AM, FM, Pulse analog & pulse digital modulation, AM/FM transmitters & receivers, satellite communication–Radar system, data transmission and MODEM, Mobile communication systems: cellular concept, simple block diagram of GSM system		
Unit-V	**Transducers and Data Acquisition Systems**	**(08 Hrs.)**
Basic requirements of transducers, classification of transducers, passive transducers: Resistive, capacitive, inductive, LVDT, potentiometric strain gauge, thermistor, hall effect, proximity sensors. Active transducers: Piezoelectric, photoelectric, and thermocouple. Static characteristics of the transducer, selection of the transducer. Block diagram of data acquisition systems and their applications.		
Unit-VI	**Microprocessor & Microcontroller**	**(08 Hrs.)**
Overview of generic microprocessor, architecture & functional block diagram, comparison of Microprocessor& microcontroller. 8051 Architecture, ports, registers, timers/counters. Serial communications interrupts. Interfacing relay, stepper motor, LCD Display, Keyboard, ADC.		

Term Work:

Term work shall consist of a Minimum of Eight **Experiments.**

1. To study and plot the regulation characteristics of the wave and the full wave rectifier.
2. To study of characteristics of SCR.
3. To study of characteristics of TRIAC
4. To study basic logic gates: AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR.
5. Implementation of Boolean functions using logic gates.
6. To study Operational Amplifiers (Op-amps).
7. Study of Amplitude Modulation and Demodulation
8. Study of Frequency Modulation and Demodulation
9. To study characteristics of LVDT for displacement measurement.
10. To study Microprocessor &Microcontroller

Assignment:

Assignment based on each unit.

Text Books:

1. K.P. Ramchandran, G.K. Vijayaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Wiley Publication,2008
2. W. Bolton, Mechatronics - A Multidisciplinary Approach, 4th Edition, Prentice Hall, 2009.
3. Dr. D. S. Kumar, Mechanical Measurement & Control, Metropolitan Book Co. Pvt. Ltd., New Delhi,2007
4. M.D. Singh and J. G. Joshi, Mechatronics, 3rd Edition, Prentice Hall, New Delhi, 2009.
5. Mottershed Allen, Electronic Devices &Circuits, PHI
6. R. P. Jain, Modern Digital Electronics, M Graw

Reference Books

1. Thomas L. Floyd, Electronic Devices, Pearson Education (Sixth edition)
2. Millman & Halkis, Electronic Devices & Circuits, PHI
3. Malvino Leach, Digital Principles & Applications, McGraw-Hill
4. Millman & Halkis, Integrated Electronics, MGH

Project-Based Learning:

Following is the list of topics for project-based learning (Not Limited to) based on the syllabus contents:

To develop a demonstration model on;

1. Potential Divider and Variable DC bias circuit. DC lighting circuit.
2. Automatic LED Emergency Light.
3. Flashing LED.
4. Dancing Light.
5. Voltage regulator using a Zener diode.
6. Cascode amplifier using FET.
7. JFET as an analog switch.
8. FET used as a Multiplexer.
9. JFET acts as a current limiter.
10. LDR& Transistor-based Light Detector.
11. LDR Based Smart Electronic Candle.
12. Smart Bulb Holder using LDR.
13. MOC3021 Opto-coupler as a solenoid/valve control.
14. Light controller switch using a phototransistor.

Unit Test -

Unit Test-I	Unit- I, II, III

Designation of Course	Engineering Mechanics (Course Code: ES1107204)		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical:- 00 Hours/ Week	Internal Assessment	40 Marks	
	Term Work	00 Marks	00
	Practical Examination	00 Marks	00
	Total	**100 Marks**	**04**

Course Prerequisites:-	1. Engineering Physics 2. Engineering mathematics
Course Objective	1. To study different types of forces in a plane. 2. To study the Centroid and moment of inertia 3. To study friction in machines 4. To study the Kinetics of linear and circular motion 5. To study the basics of civil engineering
Course Outcomes:-	On completion of the course, students will be able to– 1. Apply the concepts of force and equilibrium to analyze 2D and 3D systems using free body diagrams. 2. Determine the centroid and moment of inertia for various geometrical shapes and composite sections. 3. Explain the concept of friction and calculate the forces required to overcome friction in different engineering applications. 4. Analyze the motion of bodies using the principles of force and acceleration, work and energy, and impulse and momentum. 5. Evaluate the motion of bodies under centripetal and centrifugal forces and interpret their effects in engineering systems. **6.** Identify different civil engineering materials, building components, and foundation techniques, and explain their functional significance in construction.

Course Content

Unit-I	**Resultant and Equilibrium**	**(08 Hrs.)**
Types and Resolution of forces, Moment and Couple, Free Body Diagram, Types of Supports, Classification and Resultant of a force system in a Plane - Analytical and Graphical approach. Equilibrant, Conditions of Equilibrium, Equilibrium of a force system in a Plane, Force and Couple system about a point, Virtual work.		
Unit-II	**Centroid, Moment of Inertia, and Friction**	**(08 Hrs.)**
Centroid of line and plane areas, Moment of Inertia of plane areas, parallel and perpendicular axis theorem, radius of gyration, and least moment of inertia. Introduction to frictional force, preliminary concepts, and laws of friction. Introduction to machines, Relation between Mechanical advantage, Velocity ratio, and efficiency, Reversible and non-reversible Machines. Simple lifting machines and their velocity ratio, gear train.		
Unit-III	**Analysis of Trusses, Frames, and Cables**	**(08 Hrs.)**
Two force members: Introduction to trusses, types of trusses, perfect and redundant trusses, Analysis of plane trusses by method of joint and method of section, cables subjected to point loads. Multi-force member: plane frame.		

Unit-IV	Kinematics of particles and rigid bodies	(08 Hrs.)
Rectilinear motion, velocity, and acceleration in terms of the rectangular coordinate system, Motion along plane curve path, tangential and normal components of acceleration, motion curves (a-t, v-t, s-t), Projectile motion, Rigid body- Introduction to general plane motion.		

Unit -V	Kinetics of Particle	(08 Hrs.)
Force and acceleration, introduction to basic concepts, D'Alembert's principle, equation of dynamic equilibrium, Newton's second law of motion. Work energy principle and law of conservation of energy, impulse and momentum, law of conservation of momentum, Impact and collision.		

Unit-VI	Structural Materials and Foundations	(06 Hrs.)
Types of structures based on loading, material, and configuration; structural materials: concrete, construction steel, bricks, flooring material and tiles, paints, plywood, glass, and aluminium. **Foundations-** Function of foundation, concept of bearing capacity and its estimation, types of foundation and their suitability, causes of failure of foundation.		

List of Assignments

Numerical and/or theory questions on the following topics from previous year question papers of GATE/ESE Mechanical Engg. Examinations.

1. Resultant and equilibrium of forces
2. Centroid & Moment of Inertia
3. Friction
4. Trusses, frames, and cables
5. Kinematics of particles
6. Kinematics of a rigid body
7. Kinetics of particle
8. Structural materials and foundations

Text Books

1. "Engineering Mechanics", Bhavikatti S.S. and Rajashekarappa K. G., New Age International (P) Ltd.
2. "Engineering Mechanics (Statics and Dynamics)", Tayal A.K., Umesh Publication.
3. "Engineering Mechanics-I and II (Statics and Dynamics)", Mokashi V.S., Tata McGraw-Hill Publication.

Reference Books

1. "Engineering Mechanics (Statics and Dynamics)", Hibbeler R. C., McGraw-Hill.
2. "Vector Mechanics for Engineers-Vol.-I and Vol.-II (Statics and Dynamics)", Beer F.P. and Johnston E.R., Tata McGraw-Hill Publication.
3. "Engineering Mechanics (Statics and Dynamics)", Shames I.H., Prentice Hall of India (P) Ltd.
4. "Engineering Mechanics (Statics and Dynamics)", Singer F.L., Harper and Row Publication
5. "Engineering Mechanics (Statics and Dynamics)", Meriam J.L. and Kraige L.G., John Wiley and Sons Publication.
6. "Engineering Mechanics (Statics and Dynamics)", Timoshenko S.P. and Young D.H., McGraw-Hill Publication.

Project-Based Learning

Following is the list of topics for project-based learning (Not Limited to) based on the syllabus contents:

1. To prepare a demonstration model for various types of beams.
2. To prepare a demonstration model for various types of support.
3. To prepare a chart for various types of force systems with suitable real-life examples.
4. Case study on various situations where Varignon's theorem is used.

5. To prepare a demonstration model or to prepare a chart on the equilibrium system of forces of various engineering applications.
6. To prepare a chart on different types of trusses with various members.
7. To prepare a demonstration model of any one type of truss.
8. To prepare a demonstration model of the basic geometrical figures and locate the centroid of each.
9. To prepare a demonstration model of the I and T section and locate its centroid.
10. To prepare a chart for the parallel axis and perpendicular axis theorem with a suitable example.
11. To prepare a chart on types of friction in various field conditions.
12. To prepare a chart on the application of friction.
13. To prepare a chart on motion curves.
14. To prepare a chart related to the lifting machine and relevant industrial applications.
15. To develop an Excel sheet for projectile motion (at least three problems).
16. To develop an Excel sheet for the work energy principle (at least three problems).
17. To prepare a chart on work energy and impulse-momentum principle with a suitable example.
18. Case study on different structural materials and comparison of their mechanical properties.
19. To prepare a demonstration of different types of foundations.

Unit Tests

Unit Test-I	Unit I, II, III

Designation of Course	Computer-Aided Machine Drawing (Course Code: MJ1111205)		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 03 Hours/ Week	End Semester Examination	60 Marks	03
Practical: - 04 Hours/Week	Internal Assessment	40 Marks	
	Term Work	50 Marks	00
	Practical Examination	00 Marks	02
	Total	**150 Marks**	**05**

Course Prerequisites	1. Fundamentals of Mathematics 2. Mechanical Engineering systems 3. Computer-Aided Drafting and Visualization
Course Objectives	1. To make the students understand and interpret drawings of machine components. 2. To prepare assembly drawings both manually and using standard CAD packages 3. To familiarize the students with Indian Standards on drawing practices and standard components
Course Outcomes	The students will be able to 1. Explain the fundamentals of machine drawing and interpret the conventional representation of machine elements as per standard drawing practices. 2. Apply the principles of Geometric Dimensioning and Tolerancing (GD&T) in the preparation of accurate and standardized machine drawings. 3. Prepare and develop detailed assembly drawings of mechanical components from the given part drawings. 4. Generate and illustrate detailed part drawings using the information provided in assembly drawings.

Course Contents

Unit-I	**Fundamentals of Machine Drawing and Conventional Representation**	**(10 Hrs.)**
Introduction to Machine Drawing and its importance, Code of Practice for Engineering Drawing, BIS specifications – Materials, Welding Joint and symbols, riveted joints, pipe joints, keys, and screwed fasteners. Conventional Representation of dimensioning and sectioning, breaks in pipes and shafts, Screw Threads, springs, gears, foundation bolts, Common features, and machine components.		
Unit-II	**Geometric Dimensioning and Tolerancing (GD&T)**	**(10 Hrs.)**
Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, types of fits with symbols and applications, Geometrical Tolerances on drawings. Standards followed in the industry, Interpretation of given symbols on drawing. **Characteristics of Surface Roughness**- Machining Symbols, Indications of surface roughness and its characteristics, Symbols for directions of lay.		
Unit-III	**Details to Assembly Drawing**	**(14 Hrs.)**

Classification of Drawings- Machine drawing, Production Drawing, Part Drawing, Assembly drawing, Drawings for catalogues and instruction manuals, patent drawings, Drawing Standards, Introduction to unit assembly drawing, steps involved in preparing assembly drawing from details and vice-versa, Blueprint Readings.

Preparation of Assembly Drawings: Universal and Oldham's Couplings, Foot-Step Bearings, Lathe Tool Post, Machine Vice, Pipe Vice, Screw Jack, Single Tool post, Square tool post, Clapper block, Revolving Centre, C-Clamp.

Unit-IV	Assembly to Details Drawing and Production Drawing	(14 Hrs.)

Types of Production Drawings- Detail or Part Drawings, Working Assembly Drawings, Detailed Drawings, and Manufacturing Methods.

Preparation of Detail or Part Drawings: Plummer Block or Pedestal Bearings, Lathe Tail Stock, Drilling Jig, Piston and Connecting Rod, Gland and Stuffing Box Assembly, Gate valve, Globe valve, Non-Return Valve, and Steam Stop Valve.

Term Work

1. Three A2-sized sheets of **Details to assembly** drawing using AutoCAD.
2. Three A2-size sheets of **Assembly drawings to detail** drawings using AutoCAD.

Assignments

Minimum **Five** Questions based on each unit in A2 size Sheets

Textbook

1. R.K. Dhavan, "A Textbook of Machine Drawing", S Chand Publication, New Delhi.
2. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

References

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers,2013
2. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata McGraw-Hill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

Project-Based Learning:

Following is the list of topics for project-based learning (Not Limited to) based on the syllabus contents:

1. To develop a chart to represent different types of nuts and bolts conventionally, along with an industrial real-life application.
2. To develop a chart to represent different types of springs conventionally, along with an industrial real-life application.
3. To develop a chart to represent different types of welded and riveted joints conventionally, along with industrial real-life applications.
4. To develop a chart to represent different types of gears conventionally long in industrial real-life
5. To develop a chart to represent different types of bearings conventionally, along with an

industrial real-life application.

6. To develop a chart to represent different types of foundation bolt conventionally, along with an industrial real-life application.
7. To collect different types of nuts and bolts available in the market, and to identify their specifications and applications.
8. To obtain industrial drawings to identify the limits, fits, and tolerances.
9. To demonstrate geometrical tolerances for different industrial/real-life applications.
10. To prepare assembly and detail drawings of a given machine tool component.
11. To prepare assembly and detail drawing of a given IC engine component.

Unit Tests

Unit Test-I	Unit I, II, III

Designation of Course	**Communication Skills (Common for all Branches) (Course Code: AE1113206)**		
Teaching Scheme:	**Examination Scheme:**		**Credits Allotted**
Theory: - 00 Hours/ Week	End Semester Examination	00 Marks	00
Practical: - 02 Hours/ Week	Internal Assessment	00 Marks	
Tutorial: - 00 Hours/ Week	Term Work	50 Marks	00
	Oral/Practical Examination	00 Marks	01
	Total	50 Marks	01

Course Prerequisites	Students should have knowledge of Basic English grammar. Students should have basic information about the sound system of the English language.
Course Objective	The course objective of Communication Skills puts the following class teaching objectives, considering English Language skills as a wheel rolling aspect in today's world, the focus is on honing the skills such as LSRW and presentation skills. It also puts emphasis on technical and professional writing skills. Honing the presentation skills among students through appropriate activities will help them in their business ventures.
Course Outcomes	On completion of the course, students will be able to 1. Construct grammatically correct and meaningful sentences in English and apply them effectively in spoken and written business communication. 2. Apply the knowledge of English phonetics to achieve accurate pronunciation in professional communication. 3. Develop and use enhanced vocabulary to communicate ideas effectively in various business contexts. 4. Explain the process and principles of communication and apply them appropriately in business situations. 5. Demonstrate effective writing techniques and composing business documents suited to specific contexts and purposes. 6. Design and deliver impactful business presentations through structured content, clarity, and confident delivery.

Course Content

Unit-I	**English grammar**	**(04 Hrs.)**
Application of Basic Grammar: Articles, Prepositions, Tenses, Subject-verb agreement, Use of phrases & Clauses in sentences, Common errors		
Unit-II	**Phonetics/study of sounds in English**	**(04 Hrs.)**
Introduction to phonetics, study of speech organs, study of phonetic script, transcriptions of words, articulation of different sounds in English, reducing MTI, stress, and intonation		
Unit-III	**Vocabulary Enrichment**	**(04 Hrs.)**
Ways of word formation, Foreign phrases, One word substitutions, Synonyms & antonyms, Words often confused, Indian English words, Usage of idioms & phrases. GRAS-PT formula		

Unit-IV	Communication Skills	(04 Hrs.)
Introduction, forms and function of communication process, non-verbal codes in communication, Importance of listening skills, Listening V/s hearing, Types of listening, Barriers to communication and listening, Importance of LSRW skills in communication		

Unit -V	Technical Writing Skills	(04 Hrs.)
The mechanics and principles of written communication, Technical Communication, Need and Importance, technical report writing, email writing, notice, agenda, and minutes of meeting writing. Use of technology in technical writing		
Unit-VI	**Presentation skills**	**(04 Hrs.)**
Designing an effective presentation, understanding the theme, developing the content and layout of the presentation, use of tone and language, and using technological tools for effective presentation		

Reference Books:

1. Business Communication by Meenakshi Raman, Prakash Singh, published by Oxford University Press, second edition,
2. Spoken English- A manual of Speech and Phonetics by R. K. Bansal, J. B. Harrison, published by Orient Blackswan
3. Technical Communication by Meenakshi Raman, Sangeeta Sharma, published by Oxford University Press
4. Developing Communication Skills by Krishna Mohan, Meera Banerji, published by Macmillan India Pvt Ltd

Recommended web-links for enhancing English language and business communication

- http://www.bbc.co.uk/worldservice/learningenglish
- http://www.englishlearner.com/tests/test.html
- http://www.hodu.com/default.html
- http://www.communicationskills.co.in/index.html

Designation of Course	Workshop Technology (Course Code: SE1111207)		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 00 Hours/Week	End Semester Examination	00 Marks	00
Practical: -04 hours/Week	Internal Assessment	00 Marks	00
	Term Work	25 Marks	00
	Oral/Practical Examination	25 Marks	02
	Total	**50 Marks**	02

Course Prerequisites	Students should have basic knowledge of hand tools used in day-to-day life.
Course Objectives	The student should 1. To acquire knowledge of basic manufacturing processes. 2. To identify tools, work materials, and measuring instruments useful for sheet metal, welding, carpentry, blacksmithing, and lathe machines.
Course Outcomes	The students should be able to 1. Describe the basic manufacturing processes and operations used in carpentry work. 2. Select and use appropriate tools and equipment for performing specific manufacturing operations effectively. 3. Explain the principles of welding and perform basic welding operations on given jobs. 4. Compare different resistance welding processes and identify their suitable applications in fabrication. 5. Identify and operate various marking, cutting, and holding tools, as well as machines used in sheet metal work. 6. Explain the importance of blacksmithy processes and carry out basic forging operations on metal workpieces.

Course Contents

Unit-I	**Carpentry Shop**	**(08 Hrs.)**
Introduction to woodworking, Study of tools and Operations, and carpentry joints, Simple exercise using a jack plane. Preparing a half lap corner joint, mortise and Tenon joints, a Simple exercise on a wood woodworking lathe. Safety practices and general guidelines.		
Unit-II	**Welding Shop**	**(16 Hrs.)**
Electric arc welding, Study of tools and Operations, Edge preparations, Types of welding joints, Exercises for making various joints. Safety practices and general guidelines. Study of various equipment of Gas welding, Arc welding, and Soldering processes. Study and demonstration of TIG Welding, MIG Welding, and Spot-Welding Machine.		
Unit-III	**Sheet Metal Operations**	**(12 Hrs.)**
Introduction to machines in the sheet metal Industry: shearing machine, bending machine, circular profile cutting machines. Different types of sheet metal folds. Rivets and their different parts, selection of rivet heads, types of rivets, and their uses. Punching, blanking, shearing, bending, and piercing. Punch & Die tolerance and clearance. Introduction to Dies: Simple dies, compound dies, progressive dies. Types of presses.		
Unit-IV	**Black Smithy**	**(08 Hrs.)**
Study of tools & operations, simple exercises based on smithy operations such as upsetting, bending, etc.		
Unit-V	**Turning**	**(04 Hrs.)**

Study and demonstration of the lathe machine, specifications, parts, Accessories, and operations.

Term Work:

The Termwork shall consist of a Minimum of Eight Experiments.

1. Prepare the job of carpentry work using various Joints.
2. Explain the various welding processes and prepare the job with the Arc Welding Process.
3. Explain the various resistance welding processes and prepare the job with the Resistance welding Process.
4. Explanations and demonstrations on TIG or MIG Welding Process.
5. Practical demonstration on the shearing machine, bending machine, and circular profile cutting machines used in sheet metal operations.
6. Practical demonstration on Punching, blanking, shearing, bending, and piercing.
7. Practical demonstration on blacksmithing work and prepare a job by using blacksmithing work.
8. Practical demonstration on the lathe machine and prepare a simple job of turning.
9. Industrial visit to the manufacturing unit to observe the above various operations.

Text Books

1. O. P. Khanna, A Textbook of Welding Technology, Dhanpat Rai and Sons
2. Md. Ibrahim Khan, Welding Science and Technology, New Age International (P) Ltd.
3. Chapman W.A.J. "Workshop Technology "volume I, II.III, ELBS.

Reference Books

1. P. N. Rao, Manufacturing Technology- Vol I, McGraw-Hill Education, 9 India Pvt.
2. HajraChoudhary S.K., Bose S.K. "Elements of Workshop Technology" Volume I, II
3. Richard Little, "Welding and Welding Technology," Pearson Education, second Edition.

Rules and Regulations

B. Tech. – (All branches)

(I) Theory

(A) Theory Examination

Theory examination consists of: (i) End semester examination (ESE), and (ii) Internal assessment (IA).

(i) ESE is of 60 marks for theory courses.

(ii) The existing internal assessment system, totaling 40 marks, currently utilizes two components: a Unit Test and Project-Based Learning (PBL), each allocated 20 marks. To further enhance the teaching-learning experience, the following additional innovative assessment tools will be incorporated into the current framework. These additions are intended to improve the assessment of student learning outcomes and ensure thorough syllabus coverage through engaging and effective methods.

a) Poster presentation

b) Quiz

c) Case study

d) Presentation/Seminar

e) Open-book test

f) Assignment

g) MCQ

h) Modelling

i) Group discussion

j) Role play

k) Term paper/Review paper

Note

1. Each semester shall include two Internal Assessments: Internal Assessment–I and Internal Assessment–II.
2. Internal Assessment–I will be based on Units I, II, and III, while Internal Assessment–II will cover Units IV, V, and VI.
3. It is mandatory to categorize the courses within each discipline into appropriate groups based on their nature. For each group, a set of 2 to 4 suitable assessment tools shall be identified and used for evaluation.
4. The Course Coordinator shall prepare a unit-wise plan for conducting the Internal Assessments using the selected tools and submit it to the Head of the Department before the commencement of the academic term. A maximum of 2–3 tools may be selected for each course.
5. The Course Coordinator is also responsible for maintaining proper documentation of the Internal Assessments and shall submit the same to the Head of the Department at the end of the semester, if

Required.

6. All Internal Assessments must be designed, conducted, and evaluated in alignment with the appropriate levels of Bloom's Taxonomy.

(B) Standard of Passing

(i) There is a separate passing of 40% of 60 marks, i.e., 24 marks, for ESE for a given course.

(ii) There is a separate passing of 40% of 40 marks, i.e., 16, for IA for a given course.

(iii) A candidate who fails at ESE in a given course has to reappear only at ESE as a backlog candidate and clear the head of passing. Similarly, a candidate who fails at IA in a given course has to reappear only at IA as a backlog candidate and clear the head of passing

(II) Practical

(A) Practical Examination

Practical examination consists of: (i) Term work, and (ii) Practical/Oral examination for a given course.

(i) Term work (TW): TW marks are as mentioned in the curriculum structure.

(ii) Practical/Oral (PR/OR): PR/OR marks are as mentioned in the curriculum structure.

(B) Conduction of practical/oral examination

(i) A candidate will be permitted to appear for the practical/oral examination only if he/she submit the term work of a given course.

(ii) Practical/oral examination shall be conducted in the presence of internal and external examiners appointed by the university.

(C) Standard of Passing

(i) A candidate shall pass both heads TW and PR/OR separately with a minimum of 40% of the total marks of the respective head.

(III) MOOC and Social Activity Course

(i) If a student completes one MOOC during a program, he/ she will earn an additional TWO credits, subject to submission of the certificate of completion of the respective course. A student must complete at least two MOOCs to obtain a degree in a given discipline. Students shall register for MOOCs which are offered by any one of the following agencies:

(a) SWAYAM: www.swayam.gov.in

(b) NPTEL: www.onlinecourse.nptel.ac.in

(c) Course Era: www.coursera.org

(d) edX online learning: www.edx.org

(e) MIT Open Course ware : www.ocw.mit.edu

(f) Udemy : www.udemy.com

(g) Spoken tutorial: www.spoken-tutorial.org

(ii) If a student completes a social activity, he/she will earn an additional TWO credits, subject to submission of the certificate of completion of the respective course/ activity from the relevant authorities. A student must complete at least one social activity to obtain a degree in a given discipline.

(iii) The additional credits for MOOC and Social Activity will be given only after verification of the authentic document by the Head of the Department, and a separate mark sheet will be submitted by the Head of the Department along with the course examiner.

(IV) Value Added Course (VAC) and Indian Knowledge System (IKS) Course

(i) The VAC and IKS courses are mandatory and must be passed by students during the designated semester to earn two credits.

(ii) These courses have an internal assessment worth 100 marks, which is distributed as follows: (a) three assignments, each worth 20 marks, and (b) two case studies, presentations, or quizzes, each worth 20 marks. Faculty members have the flexibility to choose between conducting two case studies, two presentations, two quizzes, or any combination thereof.

(V) Minor Program

(i) A student shall receive a MINOR degree when he/she acquires an additional 20 credits in a given specialization defined by the UG programs offered at the institute.

(ii) The theory and practical/oral components for a given course are mentioned in the curriculum structure. The theory and examination for a given course are mentioned in Sections I and II.

(iii) The grade point, grade letter, and equivalent marks system for the MINOR Program is mentioned in Section V.

(iv) The MINOR DEGREE Program is OPTIONAL. The interested students may opt MINOR program.

(v) A student shall complete the MINOR program before his/her graduation.

(VI) A. T. K. T

(i) A student who is granted a term for B. Tech. Semester I, III, V, VII will be allowed to keep the term for his/her B. Tech. Semester-II, IV, VI, VIII examination, respectively, even if he/she appears and fails or does not appear at B. Tech. Semester I, III, V, VII examinations respectively.

(ii) A student shall be allowed to keep the term for the B. Tech. Semester-III course if he/she has a backlog of any number of Heads of passing at B. Tech. Semester I & II taken together.

(iii) A student shall be allowed to keep the term for the B. Tech. Semester-V of the respective course if he/she has no backlog of B. Tech. Semester I & II, and he/she has a backlog of any number of Heads of passing at B. Tech. Semester-III & IV taken together.

(iv) A student shall be allowed to keep the term for the B. Tech. Semester VII of the respective course if he/she has no backlog of B. Tech. Semester I, II, III, IV, and he/she has a backlog of any number of Heads of passing at B. Tech. Semester V & VI taken together.

(VII) Grade Point, Grade Letter, and Equivalent Marks

The student must obtain a minimum Grade Point of 5.0 (40% marks) in ESE and also in combined ESE + IA. A student who fails in ESE of a course has to reappear only in ESE as a backlog student and clear that hurdle of passing.

Award of the Class for the Degree considering CGPA: A student who has completed the minimum credits specified for the Program shall be declared to have passed in the program. The CGPA will be computed for every year of all the courses of that year. The grade will be awarded according to the CGPA of every year.

Range of CGPA	Final Grade	Performance Descriptor	Equivalent range of Marks (%)
9.50 ≤ CGPA ≤10.00	O	Outstanding	80 ≤ Marks ≤ 100
9.00 ≤ CGPA ≤ 9.49	A+	Excellent	70 < Marks <80
8.00 ≤ CGPA ≤ 8.99	A	Very Good	60 < Marks < 70
7.00 ≤ CGPA ≤ 7.99	B+	Good	55 < Marks < 60
6.00 ≤ CGPA ≤ 6.99	B	Average	50 < Marks < 55
5.00 ≤ CGPA ≤ 5.99	C	Satisfactory	40 ≤ Marks < 50
CGPA below 5.00	F	Fail	Marks Below 40

NOTE:

Amendment in Internal assessment tools:

From the A.Y. 2025-26, the Internal Assessment for B.Tech. Sem. I will be as per the above guidelines.