COURES STRUCTURE & SYLLBUS

FOR

B. TECH. ROBOTICS AND AUTOMATION

SEMESTER- I & II

(CBCS 2023 COURSE AS PER NEP 2020 GUIDELINES)

Bharati Vidyapeeth
(Deemed to be University)
College of Engineering, Pune
Department of Robotics and Automation 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 needs of profession & society.*
- *To provide an environment conducive to innovation, creativity, research and entrepreneurial leadership.*
- *To practice and promote professional ethics, transparency and accountability for 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 &up gradation of curricula.*
- *Up gradation of laboratories, library & communication facilities.*
- *Collaboration with industry and research & development organizations.*
- *Sharing of knowledge, infra-structure and resources.*
- *Training, extension, testing and consultancy services.*
- *Promoting interdisciplinary research.*

Vision of the Robotics and Automation Engineering Department is:

To develop, high quality Robotics & Automation Engineers through dynamic education to meet social and global challenges.

Mission Statements of the Robotics and Automation 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 working environment.*

Program Educational Objectives (PEOs) of the B. Tech. Robotics and Automation are:

Graduates will be able,

- *To fulfill need 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.*

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. ***Engineering knowledge****: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.*
2. ***Problem analysis****: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.*
3. ***Design/development of solutions****: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.*
4. ***Conduct investigations of complex problems****: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*
5. ***Modern tool usage****: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.*
6. ***The engineer and society****: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.*
7. ***Environment and sustainability****: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.*
8. ***Ethics****: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.*
9. ***Individual and team work****: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.*
10. ***Communication****: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.*

11. ***Project management and finance****: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.*
12. ***Life-long learning****: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.*

Statements of Programme Specific Outcomes (PSOs)

PSO1: *Apply the knowledge of Robotics, design, manufacturing, Automation engineering and computational sciences to solve Robotics & Automation Engineering problems.*

PSO2: *Apply Robotics & Automation Engineering principles for research, innovation and develop entrepreneurial skills.*

PSO3: *Apply concepts of Robotics & Automation engineering to asses' societal, environmental, health and safety issues with professional ethics.*

B. Tech. (Robotics & Automation 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	MJ1111104	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-I	SE1112107	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. (Robotics & Automation 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	MJ1112205	Fundamentals of Robotics	4	2	-	60	40	50	-	-	150	4	1	-	5
6.	AE	AE1113206	Communication Skills	-	2	-	-	-	50	-	-	50	-	1	-	1
7.	SE-II	SE1111207	Workshop Technology	-	4	-	-	-	25	-	25	50	-	2	-	2
			Total	**18**	**12**	**1**	**300**	**200**	**225**	**-**	**25**	**750**	**18**	**6**	**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
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

B. TECH. ROBOTICS AND AUTOMATION: 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 have knowledge 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 its applications in engineering.
Course Outcomes	After completion of the course students will be able to 1. Understand rank of matrix and apply it to solve system of linear equations. 2. Understand DeMoiver's theorem, hyperbolic functions and apply it in engineering problems. 3. Understand Leibnitz's rule and apply it to find n^{th} derivative of a function. 4. Understand fundamental concepts of convergence, divergence of infinite series and its tests. 5. Understand the concept of partial differentiation and apply it to find total derivative. 6. Evaluate the maxima and minima of any two variables functions.

Unit I: Matrices **(06 Hrs)**

Rank, Normal form, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Eigen values, 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.

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), 42th 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 V.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
Unit Test - II	Unit IV, V, VI

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 lay foundation for the engineers.
Course Outcomes	After completion of the course students will be able to 1. Analyze the properties of charged particles to develop modern instruments such as electron microscopy. 2. Understand the problems associated with architectural acoustics and give their remedies and use ultrasonic as a tool in industry for non- destructive testing. 3. Apply quantum physics problems to micro level phenomena and solid-state physics. 4. Understand the wave nature of light and apply it to measure stress, pressure, and dimension etc. 5. Apply the principles of lasers and fiber optics for applications in the field of engineering. 6. Remember properties of solid matter and connect to applications in the field of engineering.

Unit I: Modern Physics (6 Hrs)

Motion of a charged particle in electric and magnetic fields, Electrostatic and Magneto-static 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 (6Hrs)

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 (6hrs)

Dual nature of matter, concept of wave packet, group and phase velocity and relation between them, physical significance of wave function, Schrodinger's time dependant 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) (6 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 (Polarisation and Lasers) (6 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 optical fiber (Principle, Acceptance angle and acceptance cone, Numerical aperture, Types of optical fibers, Fiber optic communication).

Unit VI. Solid State Physics (6Hrs)

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.

Introductions of nanoparticles, properties of nanoparticles (Optical, electrical, Magnetic, structural, mechanical), synthesis of nanoparticles (Physical and chemical), quantum dots – wide band semiconductors, direct/indirect band gap semiconductors.

Practical (Any Eight of the Following)

1. Determination of radius of plano-convex lens/wavelength of light/Flatness testing by Newton'srings
2. Determination of wavelength of light using 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 wavelength of laser by diffraction grating
8. To study Hall effect and determine the Hall voltage
9. Calculation of conductivity by four probe method
10. Study of solar cell characteristics and calculation of fill factor
11. Determination of band gap of semiconductor
12. Synthesis of metal oxide nanoparticles (ZnO/ZnS/silver/Gold)
13. Measurement of average SPL across spherical wavefront and behaviour with the distance
14. Determination of velocity of sound in liquid by ultrasonic interferometer
15. Study of 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
Unit Test - II	Unit IV, V, VI

Designation of Course	**Electrical Engineering Systems (Course Code: EE1107103)**		
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	1. **Understand** and **apply** knowledge of Basic laws and network theorems to solve electrical networks. 2. **Understand** and **apply** knowledge of AC Circuits, Switch gear and electrical measuring instruments. 3. **Understand** and **apply** fundamental concept of magnetic and electromagnetic circuits for operation of Transformers. 4. **Understand** AC motors, its control techniques for various mechanical engineering applications. 5. **Understand** DC motors, its control techniques for various mechanical engineering applications. 6. **Understand** working of Transmission, Distribution of power use of safety rules.

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, 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 wattmeter, energy meter, tong-tester, megger and power analyzer.
Switch Gear: Introduction to LT Switchgear, NO and NC Contacts, Contactors, relay, timers, use in control panel, application 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: Faradays 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 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 system, feeders, distributors, main lines, comparison of various distribution systems, load power factor improvement techniques.

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

ListofAssignments:

The students will be given total **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

Listof Experiments:

Note: Term work shall consist of Minimum **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 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 R-L series and 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 single phase transformer
14. Mini-project based on contents of 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 (SatyaPrakashan)
5. Electronic Devices and Circuit Theory- R. L. Boylestad and L. Nashelsky (PHI)
6. Electrical, Electronics Measurements and Instruments - (SatyaPrakashan)

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 verification of Thevenin's theorem.
2. To develop practical kit for verification of Superposition theorem.
3. To develop practical kit for verification of Maximum power transfer theorem
4. To develop practical kit for verification of Norton's theorem.
5. To develop a practical kit for study of R-L-C Series circuit.
6. To develop practical kit for study of R-L-C parallel circuit.
7. To develop practical kit for study of voltage and current relationships in star connected network.
8. To develop practical kit to understand voltage and current relationships in delta connected network.
9. To develop a demonstration model of 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 Smart Energy meter using GSM
12. To develop a demonstration model of Safety measures in 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
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Computer Aided Engineering Graphics (Course Code: MJ1111104)**		
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	The students must be able to 1. Understand dimensioning methods and drawing of engineering curves. 2. Draw orthographic projections using 1st angle method of projection. 3. Draw sectional orthographic projections. 4. Draw Isometric views from given orthographic projections. 5. Draw projection of points, lines and planes and solids. 6. Draw development of lateral surfaces of solids.

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 and 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's for Computer Aided Graphics/Drafting. AutoCAD initial setting and AutoCAD commands		
Unit 2	**Orthographic Projections**	**(08 Hrs.)**
Basic principles of orthographic projection (First and Third angle method). Orthographic projection of objects by first angle projection method only. Procedure for preparing scaled drawing, sectional views and types of cutting planes and their representation, 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 isometric view from given orthographic views and to construct 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, lines inclined to both reference planes. (Lines in First Quadrant Only). Projection of prism, pyramid, cone and cylinder by 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 method of projection.
2 To develop the model/charts based on engineering curves.
3 To prepare model/chart for identification of engineering curves in nature for industrial, societal, etc. application.
4 To demonstrate different methods of orthographic projection.
5 To demonstrate projection of Points.
6 To demonstrate projection of Lines.
7 To demonstrate projection of Planes.
8 To demonstrate projection of Solids.
9 To demonstrate developments of surfaces for solids.
10 To demonstrate industrial application of development of surfaces such as steam carrying pipes, Ducts of air conditioning systems, etc.
11 To demonstrate Isometric projection method through model of a cube.

Assignments: Minimum five problems on each unit in A3 size Drawing Book

Term Work shall consist of **seven** A_2 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. "Text Book 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
Unit Test - II	Unit IV, V, VI

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	Students should 1. **Understand** the fundamentals of power producing and absorbing devices. 2. **Understand** the fundamental concepts of renewable and non-renewable energy systems. 3. **Understand** the fundamentals of mechanism of machines 4. **Understand** the fundamentals of power transmitting devices. 5. **Understand** the fundamentals of machine tools and manufacturing processes. 6. **Understand** the fundamentals of robotics and its applications.

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 strike 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 turbine. 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-hydel 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, Grashoff'slaw, 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.)
Types of Belts and belt drives, Chain drive, rope drive, Types of gears, Types of Couplings, Types of friction clutch, Power transmission shafts, axles, keys, types of Keys, Sliding Contact and Rolling Contact Bearing, Bush and ball bearings, Types of brakes.		
Unit-V	**Introduction to Machine Tools**	**(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 center lathe.
9. Study and demonstration of operations on 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 mechanism of machines
4. Assignment on Power Transmitting Devices
5. Assignment on Machine Tools
6. Assignment on Robotics

Text Books

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 Editi

Project Based Learning

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

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

Unit Test

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

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	After completion of the course students will be able to 1. Create more awareness of themselves, and their surroundings (family, society, nature); 2. Understand the Human being is coexisting with self and body and able to recognize its different needs and fulfillment 3. Develop more responsible life with human relationships, while keeping in mind the human nature 4. Understand to imbibe sensitive approach towards society and understand the dimensions of harmony in the society 5. Understand the recycle structure of the nature and able to recognize the participation 6. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Unit I: Introductions, Aspirations and Concerns (4Hrs)

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 (4Hrs)

Self-confidence, peer pressure, time management, anger, stress Personality development,Self-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 **(4Hrs)**

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 **(4 Hrs)**

Participation in society. Harmony in the society Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals .Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family

Unit V: Natural Environment **(4 Hrs)**

Participation in nature Harmony in nature/existence Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature

Unit VI. Self-evaluation Strategy **(4 Hrs)**

Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers. At the level of society: as mutually enriching institutions and organizations review 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 - PanditSunderlal 9. 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: ES1112107)**		
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 that students should develop techniques for problem solving using a programming language.
Course Outcomes	Students should 1. **Understand** basics of C++ and **apply** that knowledge to write simple programs. 2. **Understand** the uses of operators and **apply** them in writing programs. 3. **Understand** the concept of conditional statements **apply** them in writing programs. 4. **Understand** the concepts of loops in C++ **apply** them in writing programs. 5. **Understand** the concepts of user defined functions, recursion and **apply** them in writing programs. 6. **Understand** the concept of one-dimensional arrays and **apply** them in writing programs

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 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 Size of int, float, double and char in Your System
7. C++ Program to Swap Two Numbers
8. C++ Program to Find ASCII Value of a Character
9. C++ Program to Multiply two Numbers
10. C++ Program to Check Whether Number is Even or Odd
11. C++ Program to Check Whether a character is Vowel or Consonant.
12. C++ Program to Find Largest Number Among Three Numbers
13. C++ Program to Find All Roots of a Quadratic Equation
14. C++ Program to Calculate 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 Power of a Number
23. C++ Program to Check Whether a Number is 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 Number 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 Number By Creating a Function
33. C++ Program to Check Whether a Number can be Express as Sum of Two Prime Numbers
34. C++ program to Find 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 Average of Numbers Using Arrays

43. C++ Program to Find Largest Element of an Array

44. C++ Program to Calculate Standard DeviationText 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. ROBOTICS AND AUTOMATION

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 have knowledge of differential calculus
Course Objective	On completion of the course – 1. Fundamental theorems, concepts in Matrices, Demoivre's theorem and its applications in engineering. 2. Various techniques in Calculus, Explanation of functions and Infinite series. 3. Partial differentiation, maxima, minima and its applications in engineering
Course Outcomes	After completion of the course students will be able to 1. Solve differential equations by different methods. 2. Apply different laws to solve Simple Harmonic Motion, One–Dimensional Conduction of Heat. 3. Solve integral calculus and Fourier series. 4. Solve integral calculus with error functions. 5. Determine position in solid geometry 6. Solve multiple integration problems.

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, Kirchoff‟s Law of Electrical Circuits, Motion under Gravity, Rectilinear Motion, Simple Harmonic Motion, One– 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 Base Learning (Topics)

1. Formation of 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 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), 42th 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
Unit Test - II	Unit IV, V, VI

Designation of Course	**Engineering Chemistry (Common for all Branches) (Course Code:)**		
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 the interest among the students regarding chemistry and their applications in engineering. 2. To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field. 3. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the Engineering field
Course Outcomes	After completion of the course students will be able to 1. Understand the different methods of analysis of water, differentenvironmental pollutants and importance of green chemistry 2. Understand the importance of fuels and apply it for various engineering applications. 3. Explain the drawbacks of corrosion and different methods of elimination of corrosion 4. Apply the concept of polymer to study advanced materials. 5. Apply the basic concept of chemistry to explain the chemical properties and processes of materials of nanoscale 6. Understand the instrumental analysis helpful for various engineering applications

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

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 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 (6Hrs)

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 andapplications of photovoltaic cell.

Unit III: Corrosion technology and it's control (6hrs)

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. Electro less plating: Introduction, electro less 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: fiber glass, hybrid and reinforced Composites with applications.

Unit V: Nano materials (6Hrs)

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 vapour deposition, Nano scale materials: Fullerenes, Carbon nano tubes and graphenes – properties and applications.

Unit VI: Instrumental methods of analysis (6Hrs)

Introduction, Theory, Instrumentation and applications of colorimetry, pHmetry, conductometry Introduction to spectroscopy, principles and applications of UV/Vis. Spectroscopy

PBL: Project Base 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 bio sensor in engineering applications
7. Design and simulation of automatic solar - photo voltaic panels as renewable energy source.

8. Synthesis of Conjugated Polymers and Molecules Using Sugar Reagents and Solventless Reactions. OR Composite materials and it properties, applications and types
9. To study mechanism of lubrication
10. Electroplating- study on how different metals can be used and the practical applications
11. Prepare Ag- nanoparticles by using sol-gel method

12. Preparation of Ag nanoparticle from two natural sources
13. With the help of green chemistry principles, prepare any organic dye by using Traditional and Green pathway.
14. Prepare epoxy resins by using suitable metho
15. Measurement and effect of waste disposal from laboratories in the college

Practical (Any Eight of the Following)

1. Determination of Hardness of water sample by EDTA method
2. To determine strength of acid by pH – metric Titration
3. To measure the strength of acid by conductometric titration
4. Measurement of Surface tension of a given liquid by Stalgmometer.
5. To determine 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 given acid solution by titrating it against base solution using 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 set up of Daniel 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 (2nd 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**
Unit Test - II	**Unit IV, V, VI**

Designation of Course	**Electronics Engineering Systems (Course Code: ES1108203)**		
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 overview of electronics engineering that serve the foundation of advanced studies in the area of mechanical engineering. 2. This course provides comprehensive idea about 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. **Understand** the basic electronics devices and linear ICs 2. **Understand and apply** the concepts of digital electronics. 3. **Understand** the methods of signal conditioning and its applications. 4. **Understand** concepts of Analog Communication & Digital communication 5. **Understand** the concept of transducer and data acquisition system with its application. 6. **Understand** the concept of Microprocessor & Microcontroller and its applications.

Course Contents

Unit-I	**Electronic Devices and Linear ICs**	**(08 Hrs.)**
Rectifiers: Half wave, Full 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, Hela decimal, 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: mono-stable, astable-multivibrator, Analog to Digital & Digital to Analog Convertors		
Unit-IV	**Communication Systems**	**(08 Hrs.)**

Analog Communication & Digital communication: Block diagram of a basic communication system, Frequency spectrum, need for modulation, Methods of modulations- Principles of AM, FM, Pulse analog &pulsedigitalmodulation,AM/FMtransmitters&receivers,satellitecommunication–Radarsystem, 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 requirement of transducers, classification of transducers, passive transducers: Resistive, capacitive, inductive, LVDT, potentiometric strain gauge, thermistor, hall effect, proximity sensors. Active transducers:Piezoelectric,photoelectric&thermocouple.Staticcharacteristicsoftransducer,selectionoftransducer. Block diagram of data acquisition systems and its applications.		
Unit-VI	**Microprocessor & Microcontroller**	**(08 Hrs.)**
Overview of generic microprocessor, architecture & functional block diagram, comparison of Microprocessor& microcontroller. 8051 Architecture, ports, resisters, timers/counters. Serial communications interrupts. Interfacing of relay, stepper motor, LCD Display, Keyboard,ADC.		

Term Work:

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

1. To study and plot regulation characteristics of half wave and 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 of Microprocessor &Microcontroller

Assignment:

Assignment based on each unit.

Text Books:

1. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey 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, Mc Graw 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 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& Transistors 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 photo-transistor.

Unit Test -

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Engineering Mechanics (Course Code: ES1022204)**		
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 Centroid and moment of inertia 3. To study friction in machines 4. To study Kinetics of linear and circular motion 5. To study basics of civil engineering
Course Outcomes:-	The students should be able to 1. **Understand** the concept of force and **apply** it along with the concept of equilibrium in 2D and 3D system with the help of free body diagram. 2. **Understand** the significance of centroid and moment of inertia **3. Understand** the concept of friction and estimate required force to overcome friction**.** 4. **Analyze** body in motion using force and acceleration, work energy, impulse momentum principles 5. **Analyze** body in motion using centripetal and centrifugal force principles 6. **Understand** the basic concept of civil material, building component and foundation techniques.

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, least moment of inertia. Introduction to frictional force, preliminary concepts, 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 body**	**(08 Hrs.)**

Rectilinear motion, velocity and acceleration in terms of rectangular coordinate system, Motion along plane curve path, tangential and normal component 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 its suitability, causes of failure of foundation.		

List of Assignments

Numerical and/or theory questions on 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 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., McMillan Publication.
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 demonstration model for various types of beams.

2. To prepare demonstration model for various types supports.
3. To prepare chart for various types of force system with suitable real-life examples.
4. Case study on various situations where varignon's theorem is used.
5. To prepare demonstration model or to prepare a chart on equilibrium system of forces of various engineering applications.
6. To prepare chart on different types for trusses with showing various members.
7. To prepare demonstration model of any one type of truss.
8. To prepare demonstration model of the basic geometrical figures and locate the centroid of them.
9. To prepare demonstration model of the I and T section and locate the centroid of them.
10. To prepare chart for parallel axis and perpendicular axis theorem with suitable example.
11. To prepare chart on types of friction in various field conditions.
12. To prepare chart on application of friction.
13. To prepare chart on motion curves.
14. To prepare chart related to lifting machine and relevant industrial applications.
15. To development of excel sheet for projectile motion (at least three problems).
16. To development of excel sheet for work energy principle (at least three problems).
17. To prepare chart on work energy and Impulse momentum principle with suitable example.
18. Case study on different structural materials and comparison of its mechanical properties.
19. To prepare demonstration model of different types of foundations.

Unit Tests

Unit Test-I	Unit-I, II, III
Unit Test-II	Unit-IV, V, VI

Designation of Course	Fundamentals of Robotics (Course Code: MJ1112205)		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hour/ Week	End Semester Examination	60 Marks	04
Practical:- 02 hours/Week	Internal Assessment	40 Marks	
	Term Work	50 Marks	01
	Total	**150 Marks**	**05**

Course Prerequisites: -	The student should have 1. Basic knowledge of higher secondary Physics 2. Basic knowledge of Mathematics
Course Objective: -	The student should acquire the knowledge of 1. The concepts of Robotic system, its components and Configurations. 2. Robot Grippers, Drive systems and Robotics sensors. 3. Application of robots in various fields.
Course Outcomes: -	The student should be able to 1. **Understand** the basic components and configurations of robots. 2. **Understand** different types of grippers and **apply** them based on applications. 3. **Understand** the robot drive systems. 4. **Understand** the fundamentals of sensors and **apply** them based on application. 5. **Understand** the robot control systems. 6. **Understand** the applications of robots in various fields.

Course Contents

Unit-I	**Introduction to Robotics**	**(08 Hrs.)**
History of robots, Classification of robots, Present status and future trends. Basic components of Robotic system. Robot Joints, Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom.Basic Configuration of Robots.		
Unit-II	**Robot Grippers**	**(08 Hrs.)**
Introduction to End effectors. Consideration in selection of gripper, Types of grippers, Mechanical Grippers, Hooks and Scoops, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers. Specifications of robot. Selection based on the Application.		
Unit-III	**Robotics Drives Systems**	**(08 Hrs.)**
Introduction, Functions of drive systems, Hydraulic actuators- Linear Hydraulic actuators and Rotary Hydraulic actuators. Pneumatic Actuators- Linear Pneumatic actuators and Rotary Pneumatic actuators. Electric Actuators - D.C. Motor, Brushless D.C. Motors, A.C. Servomotors, Stepper Motors.		
Unit-IV	**Robotics Sensors**	**(08 Hrs.)**
Sensors in robot – Introduction, Classification, Internal and external sensors**,** Touch sensors, Tactile sensor, Proximity sensors, Robotic vision sensor, Pressure sensors. Position sensors & Velocity sensors, acceleration sensors, sound sensors, Force or Torque sensors.		
Unit-V	**Robot Control system.**	**(08 Hrs.)**
Robot controls - Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Feedback devices, Encoder, Resolver, LVDT, Motion Interpolations, Control architecture- position, path velocity and force control systems.		
Unit-VI	**Applications of Robots**	**(08 Hrs.)**

Robot applications: Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, and robot for under water applications. Material handling, Robotics and Automation for Industry 4.0.

Term work:

Term work shall consist of any eight experiments from the following list:

1. To study an introduction to basic components of Robot.
2. To study an introduction to Robot configuration
3. To study the different types of mechanism of robot manipulator.
4. To study and demonstrations of various robotics sensors.
5. To study and demonstrations of Hydraulic actuators.
6. To study and demonstrations of Pneumatic actuators.
7. To study and demonstrations of Electric actuators.
8. Two Case Studies of Applications:
    a. Introduction and general considerations in robot applications.
    b. Case study I: Robot application for Welding.
    c. Case study II: Robot application for Spray painting.
9. Mini project is based on above syllabus.

Assignment

Assignments questions based on following topic

1. Classification, configuration and characteristics of robot.
2. Robot grippers and their types.
3. Drive systems used in Robots.
4. Sensors used in Robots.
5. Robot control systems.
6. Applications of Robots.

Text Books

1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, “Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.
2. Craig. J. J. “Introduction to Robotics- mechanics and control”, Addison- Wesley, 1999.

Reference Books

1. S.R. Deb, “Robotics Technology and flexible automation”, Tata McGraw-Hill Education., 2009.
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated Approach", PHI Learning. 2009.
3. Francis N. Nagy, Andras Siegler, "Engineering foundation of Robotics", Prentice Hall Inc., 1987.
4. P.A. Janaki Raman, "Robotics and Image Processing an Introduction", Tata McGraw Hill Publishing Company Ltd., 1995.
5. Carl D. Crane and Joseph Duffy, "Kinematic Analysis of Robot manipulators", Cambridge University press, 2008.
6. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., “Robotics control, sensing, vision and intelligence”, McGraw Hill Book co, 1987
7. Ray Asfahl. C., “Robots and Manufacturing Automation”, John Wiley & Sons Inc.,1985

Project Based Learning

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

1. 2D models of basic components of robotic system
2. 2D models of different configuration of robots and its application
3. Working model and application of mechanical gripper

4. Working model and application of magnetic l gripper
5. Working model and application of adhesive gripper
6. Working model and application of expandable ladder gripper
7. Working model of robotic drive system using pipe and syringe
    a. Linear actuator, b. Rotary actuator
8. Selection of electric actuators with respect to its specification and application.
9. Detail description and working model of touch sensor.
10. Detail description and working model of tactile sensor.
11. Detail description and working model of proximity sensor.
12. Detail description and working model of pressure sensor.
13. Detail description and working model of sound sensor.
14. Detail description and working model of temperature sensor.
15. Detail description and working model of torque sensor.
16. Detail description and working model of accelerometer.

Unit Test

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

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 of sound system of 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, this will help them in their business ventures.
Course Outcomes	After completion of the course students will be able to 1. Understand and construct the error free sentences of English language and do implementation of it in the spoken and written business communication. 2. Understand and apply the sounds of English language for correct pronunciation. 3. Understand and develop the ability to enhance sound vocabulary for effective communication. 4. Understand communication process and principles to do applications in business communication. 5. Understand the techniques of writing skills and apply them in appropriate context and domain. 6. Create effective business presentation and do effective implementation of it through activities

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 sound 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, minutes of meeting writing. Use of technology in technical writing		
Unit-VI	**Presentation skills**	**(04 Hrs.)**
Designing effective presentation, understanding theme, developing content and layout of presentation, use of tone and language, 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 material and measuring instruments useful for sheet metal, welding, carpentry, blacksmith, lathe machine.
Course Outcomes	The students should be able to 1. Understand the basic Manufacturing Processes used in the carpentry. 2. Understand various tools and apply suitable tools for suitable operations. 3. Understand the importance of welding and apply to make the job. 4. Understand the various resistance welding processes. 5. Understand the knowledge of marking, cutting, holding tools and machines used in sheet metal industry. 6. Understand the importance of black smithy works and apply to make the job

Course Contents

Unit-I	**Carpentry Shop**	**(08 Hrs.)**
Introduction to wood working, Study of tools and Operations and carpentry joints, Simple exercise using jack plain. To prepare half lap corner joint, mortise and Tennon joints, Simple exercise on wood working 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 making of various joints. safety practices and general guidelines. Study of various equipment's 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 sheet metal Industry: shearing machine, bending machine, circular profile cutting machines. Different types of sheet metal folds. Rivets and its different parts, selection of rivet heads, types of rivets and its 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 lathe machine, specifications, parts, Accessories, and operations.		

Term Work: List of Experiments

List of Experiments-

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

Text Books

1. O.P.Khanna , A Text Book of Welding Technilogy, DhanpatRai 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" Pearsons Education second Edition.

Rules regarding ATKT, Continuous Assessment and award of Class

(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) IA is of 40 marks. Out of 40 marks, 20 marks will be for Unit Tests and 20 marks will be for Project Based Learning for a given course. Two Unit Tests, each of 20 marks, will be conducted. Average of marks obtained in these two unit tests will be considered as UT marks. Roll numbers allotted to the students shall be the examination numbers for the conduction of unit tests.

(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 student who fails at ESE in a given course has to reappear only at ESE as a backlog student and clear the head of passing. Similarly, a student who fails at IA in a given course has to reappear only at IA as a backlog student 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 based on term work.

(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 student will be permitted to appear for practical/oral examination only if he/she submits term work of a given course.

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

(B) Standard of Passing

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

(III) MOOC and Social Activity Course

(i) If a student completes one MOOC during a programme, he/ she will earn additional TWO credits, subjected to submission of the certificate of completion of the respective course. It is mandatory for a

student to complete atleast two MOOC to obtain degree in a given discipline. Students shall register to MOOCs which are offered by any one 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 social activity, he/she will earn additional TWO credits, subjected to submission of the certificate of completion of the respective course/ activity from the relevant authorities. It is mandatory for a student to complete atleast one social activities to obtain degree in a given discipline.

(iv) 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) A. T. K. T

(i) A student who is granted term for B. Tech. Semester-I, III, V, VII will be allowed to keep 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 examination respectively.

(ii) A student shall be allowed to keep 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 term for the B. Tech. Semester-V of 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 term for the B. Tech. Semester- VII of 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.

(V) Minor Programme

(i) A students shall receive a MINOR degree when he/she acquire additional 20 credits in a given specialization defined by respective UG programme.

(ii) The MINOR DEGREE programme is OPTIONAL. The interested students may opt MINOR programme.

(iii) A student must complete the MINOR program prior to graduation.

(VI) 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 to ESE as a backlog student and clear that head of passing.

Award of the Class for the Degree considering CGPA: A student who has completed the minimum credits specified for the programme shall be declared to be passed in the programme. The CGPA will be computed 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

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