SYLLABUS

FOR

I and II semester B.E.

(Common to All Branches of Engineering)

2021 - 2022

Sree Siddaganga Education Society®

Siddaganga Institute of Technology

(An Autonomous Institution affiliated to V.T.U., Belagavi, Approved by AICTE, New Delhi Accredited by NAAC with 'A' Grade and ISO 9001:2015 Certified)

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PRINCIPAL

SIDDAGANGA INSTITUTE OF TECHNOLOGY

TUMAKURU – 572 103, KARNATAKA

SCHEME OF TEACHING AND EXAMINATION FOR 160 CREDITS SCHEME

(EFFECTIVE FROM THE ACADEMIC YEAR 2021-22)

I Semester

Sl. No.	Course and Course Code		Course Title	Teaching Dept.	Teaching hrs/week				Examination				Credits	
					Lecture	Tutorial	Practical/ Drawing	Self Study Component	Duration in hrs.	SEE Marks	CIE Marks	Total Marks	Che. Cycle	Phy. Cycle
					L	T	P	S						
1	BSC	NMAT1	Engineering Mathematics - I	Maths	3	2	--		3	50	50	100	**4.0**	**4.0**
2	BSC	NCHE	Engineering Chemistry	Chemistry	3	--	--		3	50	50	100	**3.0**	
		NPHY	Engineering Physics	Physics	3	--	--		3	50	50	100		**3.0**
3	ESC	NCPPS	C Programming for Problem Solving	CSE	2	2	--		3	50	50	100	**3.0**	
		NCAED	Computer Aided Engineering Drawing	ME	2	--	2		3	50	50	100		**3.0**
4	ESC	NBEC	Basic Electronics	ECE	3	--	--		3	50	50	100	**3.0**	
		NBEL	Basic Electrical Engineering	EEE	2	2	--		3	50	50	100		**3.0**
5	ESC	NEM	Engineering Mechanics	CV	2	2	--		3	50	50	100	**3.0**	
		NEME	Elements of Mechanical Engineering	ME	3	--	--		3	50	50	100		**3.0**
6	BSC	NCHEL	Engineering Chemistry Lab	Chemistry	--	--	02		3	50	50	100	**1.0**	
		NPHYL	Engineering Physics Lab	Physics	--	--	02		3	50	50	100		**1.0**
7	ESC	NCPL	Computer Programming Lab	CSE	--	--	02		3	50	50	100	**1.0**	
		NBELL	Basic Electrical Engineering Lab	EEE	--	--	02		3	50	50	100		**1.0**
8	HSMC	TE1	Technical English-I	T&P	--	--	02		3	50	50	100	**1.0**	**1.0**
9	AEC	PDL	Personality Development & Leadership	T&P	1	--	--		3	50	50	100	**1.0**	
		ISDL	Ideation and Skill Development Lab	ME	--	--	02		3	50	50	100		**1.0**
10	AAP		AICTE Activity Points	40 hours of community Service to be documented and produced for the examination										
Total													**20.0**	**20.0**

Note: *1) All the students have to compulsorily undergo three weeks Induction Programme before the commencement of regular classes.*

2) Credit for each subject is decided based on: 1 hour of lecture is 1credit, 1 hour of tutorial is 0.5 credit, and 1 hour of practical is 0.5 credit.

BSC – Basic Science Course ESC – Engineering Science Course HSMC – Humanities and Social Science& Management Course

AEC – Ability Enhancement Course Examination for AICTE Activity Points will be conducted in 8th Semester

SCHEME OF TEACHING AND EXAMINATION FOR 160 CREDITS SCHEME

(EFFECTIVE FROM THE ACADEMIC YEAR 2021-22)

II Semester

Sl. No.	Course and Course Code		Course Title	Teaching Dept.	Teaching hrs/week				Examination				Credits	
					Lecture	Tutorial	Practical/ Drawing	Self Study Component	Duration in hrs.	SEE Marks	CIE Marks	Total Marks	Phy. Cycle	Che. Cycle
					L	T	P	S						
1	BSC	NMAT2	Engineering Mathematics – II	Maths	3	2	--		3	50	50	100	**4.0**	**4.0**
2	BSC	NPHY	Engineering Physics	Physics	3	--	--		3	50	50	100	**3.0**	
		NCHE	Engineering Chemistry	Chemistry	3	--	--		3	50	50	100		**3.0**
3	ESC	NCAED	Computer Aided Engineering Drawing	ME	2	-	2		3	50	50	100	**3.0**	
		NCPPS	C Programming for Problem Solving	CSE	2	2	--		3	50	50	100		**3.0**
4	ESC	NBEL	Basic Electrical Engineering	EEE	2	2	--		3	50	50	100	**3.0**	
		NBEC	Basic Electronics	ECE	3	--	--		3	50	50	100		**3.0**
5	ESC	NEME	Elements of Mechanical Engineering	ME	3	--	--		3	50	50	100	**3.0**	
		NEM	Engineering Mechanics	CV	2	2	--		3	50	50	100		**3.0**
6	BSC	NPHYL	Engineering Physics Lab	Physics	--	--	02		3	50	50	100	**1.0**	
		NCHEL	Engineering Chemistry Lab	Chemistry	--	--	02		3	50	50	100		**1.0**
7	ESC	NBELL	Basic Electrical Engineering Lab	EEE	--	--	02		3	50	50	100	**1.0**	
		NCPL	Computer Programming Lab	CSE	--	--	02		3	50	50	100		**1.0**
8	HSMC	TE2	Technical English-II	T&P	--	--	02		3	50	50	100	**1.0**	**1.0**
9	AEC	ISDL	Ideation and Skill Development Lab	ME	--	--	02		3	50	50	100	**1.0**	
		PDL	Personality Development& Leadership	T&P	1	--	--		3	50	50	100		**1.0**
10	AAP		AICTE Activity Points	40 hours of community Service to be documented and produced for the examination										
Total													**20.0**	**20.0**

Note: *1) All the students have to compulsorily undergo three weeks Induction Programme before the commencement of regular classes.*

2) Credit for each subject is decided based on: 1 hour of lecture is 1credit, 1 hour of tutorial is 0.5 credit, and 1 hour of practical is 0.5 credit.

BSC – Basic Science Course ESC – Engineering Science Course HSMC – Humanities and Social Science& Management Course

AEC – Ability Enhancement Course Examination for AICTE Activity Points will be conducted in 8th Semester

ENGINEERING MATHEMATICS - I

Contact Hours/ Week	: 3 (L)+2(T)	Credits	: 4.0
Total Lecture Hours	: 39	CIE Marks	: 50
Total Tutorial Hours	: 26	SEE Marks	: 50
Sub. Code	: NMAT1		

Prerequisites : Basics in differential calculus, Integral calculus and vectors.

Course Learning Objectives :

1. This course will enable students to apply the basic tools of differential and integral calculus, differential equations and become skilled for solving problems in science and engineering.

Course objectives :

This course will enable students to:

1. Known the behavior of the polar curve and its application.
2. Handle the indeterminate form; determine the extremities of functions of two variables.
3. Learn how the vectors govern the physical models.
4. Understand the behavior of the infinite series.
5. Known how the real word problems governed by the first order differential equations.

UNIT - I

DIFFERENTIAL CALCULUS - I

Polar curves: angle between the radius vector and tangent, angle of intersection of polar curves. Pedal equation for polar curves. Curvature and radius of curvature -Cartesian and pedal forms. (Without proof) **(8+5) hrs.**

UNIT - II

DIFFERENTIAL CALCULUS - II

Indeterminate forms L' Hospital Rule (without proof), Partial differentiation: Partial derivatives, Total derivatives-differentiation of composite functions. Maxima and minima for a function two variables, Method of Lagrange's Multipliers with one subsidiary condition - Applications of maxima and minima with illustrative examples. **(8+5) hrs.**

UNIT – III

VECTOR CALCULUS

Vector Differentiation: scalar and vector fields, Gradient, directional derivative, divergence, curl-physical interpretation; solenoidal and irrotational vector fields-illustrative problems. **(8+5) hrs.**

UNIT - IV

INFINITE SERIES

Convergence and divergence of infinite series-p-series test, comparison test, Cauchy's root test and D'Alembert's ratio test, Raabe's test (without proof)-Illustrative examples. Taylor's and Maclaurin's series expansions for one variable (statement only). **(8+5) hrs.**

UNIT - V

DIFFERENTIAL EQUATIONS - I

Solution of first order and first degree differential equations: Linear differential equations and Bernoulli's equation. Exact differential equations. Applications: Orthogonal trajectories (Cartesian form), Newton's law of cooling, flow of electricity, law of decay and growth. **(7+6) hrs.**

TEXT BOOKS :

1. Erwin Kreyzig, "Advanced Engineering Mathematics", 10th edition, Wiley Publications, 2016. ISBN: 978-81-265-0827-3
2. B. S. Grewal, Higher Engineering Mathematics, 43rd edition, Khanna Publications, 2015. ISBN: 978-81-7409-195-5

REFERENCE BOOKS :

1. Maurice D. Weir, Joel R. Hass and George B. Thomas, "Thomas' calculus**:** Early Transcendentals", 12th edition, Pearson Education, 2016. ISBN: 978--07802-426-9
2. Ramana. B.V, **"**Higher Engineering Mathematics"**,** 11th edition**,** Tata-McGraw Hill, 2010. 2010.ISBN: 0-07-053516-7
3. C. Ray Wylie, Louis. C. Barrett "Advanced Engineering Mathematics", 6th edition, Tata-McGraw Hill, 2005. ISBN: 0-07-072206-4

4. Louis A. Pipes and Lawrence R. Harvill, “Applied Mathematics for Engineers and Physicists”, 3rd edition, McGraw Hill, 2014. ISBN: 978-0486779515

5. Peter V. O’Neil, “Advanced Engineering Mathematics”, 7th edition, CENGAGE Learning India Pvt. Ltd. Publishers, 2012. ISBN: 978- 81-315-0310-2

Course Outcomes :

On successful completion of this course, students will be able to :

CO1 : Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of the curve.

CO2 : Learn the notation of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and applications.

CO3 : Illustrate the applications of multivariate calculus to understand the characteristics of vector field.

CO4 : Describe the convergence and divergence of infinite series and understand how a function of single variable can be expanded as a Taylor’s series

CO5 : Apply the analytical methods to solve first order and first degree differential equations and solve some Engineering problems.

ENGINEERING MATHEMATICS - II

Contact Hours/ Week	: 3 (L)+2(T)	Credits :	4.0
Total Lecture Hours	: 39	CIE Marks :	50
Total Tutorial Hours	: 26	SEE Marks :	50
Sub. Code	: NMAT2		

Prerequisites : Basics in differential calculus, Integral calculus and vectors.

Course Learning Objectives :

1. This course will facilitate the students with concrete foundation of ordinary differential equations, Laplace transforms, Integral calculus and vector integration enabling them to acquire the knowledge of these mathematical tools

Course objectives :

This course will enable students to:

1. Solve second and higher order differential equations.
2. Find the Laplace transform of the function f (t).
3. Find the Inverse Laplace transform of the function F(s).
4. Solve the integral by using standard integrals (Beta and Gamma) and multiple Integrals.
5. Apply the knowledge of numerical methods in the models of various physical and Engineering phenomena.

UNIT - I

LINEAR DIFFERENTIAL EQUATIONS

Solution of second and higher order equations with constant coefficients by inverse differential operator method, method of variation of parameters, solution of Cauchy's and Legendre's Linear differential equations. Engineering applications: oscillation of simple pendulum and spring, LCR circuits.

(8+5) hrs.

UNIT - II

LAPLACE TRANSFORM

Definition, Transforms of elementary functions, properties of Laplace Transform, Laplace Transform of $t^n f(t)$, $\frac{1}{t} f(t)$, derivatives and Integrals. Laplace Transform of Periodic functions, unit step function. **(8+5) hrs.**

UNIT - III

INVERSE LAPLACE TRANSFORM

Inverse Laplace Transform, Convolution theorem (without proof) and problems. Applications –Solution of Linear differential equations using Laplace Transform. **(8+5) hrs.**

UNIT - IV

INTEGRAL CALCULUS

Reduction formulae for the integrals of $sin^n x,\ cos^n x,\ sin^m x\ cos^n x$, and evaluation of these integrals with standard limits-problems. **Beta and Gamma functions**: Definition, relation between Beta and Gamma functions and simple problems.

Multiple integrals - Evaluation of double and triple Integrals, evaluation of Double integrals- change of order of integration, Jacobians and change of variables. Applications to find area and volume. **(8+5) hrs.**

UNIT - V

ELEMENTARY NUMERICAL METHODS

Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae (All formulae without proof). Solution of polynomial and transcendental equations - Newton-Raphson method (only formula) – Illustrative examples. **(7+6) hrs.**

TEXT BOOKS :

1. Erwin Kreyzig, "Advanced Engineering Mathematics", 10th edition, Wiley Publications, 2016. ISBN: 978-81-265-0827-3
2. B. S. Grewal, Higher Engineering Mathematics, 43rd edition, Khanna Publications, 2015. ISBN: 978-81-7409-195-5

REFERENCE BOOKS :

1. Maurice D. Weir, Joel R. Hass and George B. Thomas, "Thomas' calculus**:** Early Transcendentals", 12th edition, Pearson Education, 2016. ISBN: 978--07802-426-9
2. Ramana .B.V, **"**Higher Engineering Mathematics"**,** 11th edition**,** Tata-McGraw Hill. 2010. ISBN: 0-07-053516-7
3. C. Ray Wylie, Louis. C. Barrett "Advanced Engineering Mathematics", 6th edition, Tata-McGraw Hill 2005. ISBN: 0-07-072206-4
4. Louis A. Pipes and Lawrence R. Harvill, "Applied Mathematics for Engineers and Physicists", 3rd edition, McGraw Hill, 2014. ISBN: 978-0486779515
5. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th edition, CENGAGE Learning India Pvt. Ltd. Publishers, 2012. ISBN: 978- 81-315-0310-2

Course Outcomes :

On successful completion of this course, students will be able to :

CO1 : Explain various physical models through higher order differential equations and solve such linear ordinary differential equations.

CO2 : Understand the concept of Laplace transform and obtain Laplace transform of periodic functions and unit step functions.

CO3 : Apply the concept of Laplace transform in solving Linear Differential equations.

CO4 : Apply the concept of change of order of integration and change of variables to evaluate multiple integrals and their usage in computing the area and volume.

CO5 : Apply the Numerical methods to solve Algebraic and transcendental equations and find the polynomials by finite difference method.

ENGINEERING PHYSICS

Contact Hours/ Week	: 3 (L)	Credits :	3.0
Total Lecture Hours	: 39	CIE Marks :	50
Sub. Code	: NPHY	SEE Marks :	50

Course Overview :

Engineering Physics deals with the study of combined disciplines of Physics, Engineering and Mathematics. It is devoted in creating and optimizing engineering solutions through enhanced understanding and integrated applications of scientific, mathematical and engineering principles. It is cross functional and bridges the gap between theoretical science and engineering. It provides thorough groundings in applied physics for the selected topics such as elasticity, lasers & optical fibers, quantum mechanics, electrical conductivity in metals, dielectric materials, semiconductor physics and shock waves.

Course Objective :

This Course will enable students to

1. Understand the relation between different moduli of elasticity, theory and experimental method for the determination of Young's modulus by single cantilever and rigidity modulus by torsional pendulum.
2. Comprehend theoretical background of laser, the working of **He-Ne laser** and applications of laser. Also, study the nature of propagation of light in optical fiber, reasons for the fiber loss and optical fiber application in Point to point optical communication.
3. Realize the wave particle dualism, Heisenberg's uncertainty principle and its significance, mathematical formulation of Schrodinger equation and its applications, quantum mechanical tunneling effect.
4. Understand the electrical properties of metals based on classical and quantum free electron theory and dielectric properties solids.
5. Get the concept of band formation in solids and Halle effect. Also, students will go through the concept of shock waves and realize the generation of shock waves in the laboratory and calibration of shock tube.

UNIT - 1

ELASTIC PROPERTIES OF MATERIALS

Review of Stress and strain, Hooke's law, different types of elastic moduli, Poisson's ratio (α : longitudinal strain per unit stress, β: lateral strain per unit stress). Relation between elastic constants (Y, K, n and σ). Theoretical and

practical limits of Poisson's ratio. Bending of beams, bending moment of a beam**(qualitative, no derivation)** and its application in I– shaped girders, Cantilever loaded at the free end - expression for Young's modulus. Experimental determination of Young's modulus of the material of the beam by single cantilever method. Torsional pendulum - expression for rigidity modulus. Experimental determination of the rigidity modulus of wire. Numerical problems. **8 hrs.**

UNIT - 2

LASERS AND OPTICAL FIBERS

Lasers: Concept of induced absorption, spontaneous emission and stimulated emission. Expression for energy density in terms of Einstein's coefficients and discussions. Requisites of lasers. Conditions for laser action. Construction and working of He-Ne laser, applications of laser: welding and measurement of pollutants in atmosphere.

Optical fibers : Working principle, structure of optical fiber, expression for numerical aperture,classification of fibers, fiber loss and mechanisms for fiber loss**(qualitative).** Block diagram and discussion of point-point optical communication, advantages and disadvantages ,Numerical problems.

8 hrs.

UNIT - 3

QUANTUM MECHANICS

Introduction to quantum mechanics, wave-particle duality, Concept of phase and group velocities**(qualitative)**. Heisenberg's uncertainty principle: statement, equations, explanation and significance. Wave function, its significance and properties. Schrödinger's wave equation: Setting up of time independent Schrödinger's wave equation. Applications: Free particle, Particle in a potential well of infinite height. Finite potential barrier and tunneling effect, Numerical problems. **8 hrs.**

UNIT - 4

MATERIAL SCIENCE

Electrical conductivity of metals: Review of free electron theory of metals. Quantum free electron theory of metals –assumptions, drift velocity, relaxation

time, collision time, electrical conductivity in terms of collision time and mobility of electrons (no derivation), Fermi energy, Fermi velocity, Fermi temperature. Relation between Fermi energy and resistivity of the metal. Experimental determination of Fermi energy of copper by four point probe method. Fermi factor-dependency of Fermi factor on temperature and energy of the electron in the metal, Numerical problems.

Dielectric materials: Polar and non-polar dielectrics, polarization, dielectric susceptibility, dielectric constant, dielectric polarisability. Types of polarization in dielectric materials (qualitative), Expression for internal fields in a solid, Clausius-Mossotti equation.Mention of solid, liquid and gaseous dielectrics with examples. Applications of dielectric materials: in capacitor, in transformer. Numerical problems. **8 hrs.**

UNIT - 5

SEMICONDUCTOR PHYSICS AND SHOCK WAVES

Semiconductor physics: Classification of solids based on the formation of bands due to splitting of energy levels at equilibrium inter-nuclear distance: metal (Na & Mg), insulator(diamond) and semiconductor (Si).Expression for electrical conductivity for intrinsic and extrinsic semiconductor. Hall Effect, Expression for Hall coefficient, Applications of Hall effect, Numerical problems.

Shock waves: Mach number, distinctions between –acoustic, ultrasonic, subsonic, transonic and supersonic waves. Shock waves - characteristics and applications. Methods of producing shock waves- Reddy shock tube and its characterization by experimental technique. Numerical problems. **7 hrs.**

TEXT BOOKS :

1. S. O. Pillai, Solid State Physics, 8th edition, New age International Publishers, New Delhi, 2018.
2. R. K. Gaur and S. L. Gupta, Engineering Physics, Dhanpath Rai and Sons, New Delhi, 2016.

REFERENCE BOOKS :

1. Hitendra K. Singh and A. K. Singh, Engineering Physics, Tata McGraw Hill, New Delhi. 2010

2. Marikani, Engineering Physics, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi., 2014.
3. Arthur Beiser, Concepts of Modern Physics, 6th edition, Tata McGraw Hill publishing company Ltd., New Delhi, 1998.
4. M. N. Avadhanulu and P. G. Kshirsagar, Engineering Physics, S. Chand & Company Ltd., New Delhi. 2008
5. K. Ghatak and Thyagarajan, Optical Electronics, Cambridge University Press (UK), 1989.
6. Chintoo S Kumar, K. Takayama and K P J Reddy, Shock Waves Made Simple, Wiley India Pvt. Ltd. New Delhi, 2014.

Course Outcomes :

Upon completion of this course, students will be able to :

CO1 : Apply the knowledge of theory of elasticity to find Young's modulus and rigidity modulus of the materials experimentally.

CO2 : Elucidate the working of He-Ne laser, types of optical fibers, reasons for the fiber loss and their applications in engineering.

CO3 : Comprehend the wave particle dualism, significance of Heisenberg's uncertainty principle, mathematical formulation of Schrodinger equation and its applications.

CO4 : Analyze the material properties such as electrical properties of metals based on classical and quantum free electron theory, dielectric and semiconducting properties solids. Also, students are able to demonstrate determination of type semiconductor by Hall effect, the generation of shock waves in the laboratory and calibration of shock tube.

CO5 : Identify and apply the appropriate analytic, numerical and other mathematical tools necessary to solve Physics and engineering problems.

ENGINEERING PHYSICS LABORATORY

Contact Hours/ Week	: 2 (P)	Credits :	1.0
Total Hrs	: 26	CIE Marks :	50
Sub. Code	: NPHYL	SEE Marks :	50

Course Objective :

The objective of this course is to make the students to co-relate experimental knowledge with theory of Physics in the topics such as optics, quantum mechanics, material properties and shock waves. The perfectness in the experimental skills will bring more confidence, intellectual communication and ability to impart practical knowledge in real time solution of engineering studies.

List of experiments

1. Rigidity modulus by Torsional pendulum
2. Determination of Young's modulus of steel/composite material
3. Wavelength of laser light by diffraction method.
4. Determination of numerical aperture and fiber loss.
5. Determination of Planck's constant
6. Verification of Stefan's law
7. Interference at an air wedge
8. Fermi energy of copper wire by four point probe method
9. Determination of dielectric constant by charging and discharging method
10. I-V characteristics of Zener diode
11. Band gap of semiconductor (Thermistor)
12. Reddy Shock tube calibration.

***Note** : All the twelve experiments are to be conducted.*

Course Outcomes :

After completing the course, the students will be able to :

CO1 : Record the data with precision using different measuring devices and meters.

CO2 : Apply the knowledge of theory of elasticity to determine elastic moduli using cantilever and torsion pendulum methods.

CO3 : Apply the concept of diffraction, interference and reflection of light to find thickness of the object (paper), wavelength of laser, numerical aperture and fiber loss.

CO4 : Find the Fermi energy, energy gap and dielectric constant of the materials.

CO5 : Formulate simple circuits to verify Stefan's law, I-V characteristics of a diode and Planck's constant and determine the Mach number & speed of shockwaves generated by the Reddy shock tube.

ENGINEERING CHEMISTRY

Contact Hours/ Week	: 3 (L)	Credits :	3.0
Total Lecture Hours	: 39	CIE Marks :	50
Sub. Code	: NCHE	SEE Marks :	50

Course Objective :

The objectives of this course are to make students to learn:

- The basic concepts of electrochemistry, electrode potentials that are essential to determine the battery voltage, rate of corrosion and working of analytical instruments.
- The use of analytical instruments for chemical analysis.
- The working principle and construction of various batteries and their applications.
- The mechanism of corrosion, factors affecting the rate of corrosion and corrosion control methods.
- The effect of various variables in phase transformations of materials and their correlation to the properties of materials.
- The polymers required for daily usage, their synthesis, properties, applications and polymers used in advanced engineering applications such as polymer composites, nano polymer composites and conducting polymers.
- The determination of water quality using various tests.
- The different types of nano materials, production, their characterization and applications.

UNIT - I

ELECTRODE POTENTIAL, CELLS AND APPLICATIONS

Introduction to electrode potential. Electrochemical cells: Classification - Electrolytic cells and galvanic cells with examples. Single electrode potential - Definition, origin, notations and sign conventions. Derivation of Nernst equation for single electrode potential and effect of temperature & concentration on single electrode potential. Standard electrode potential - Definition. Construction and working of a galvanic cell (e.g, Daniel cell). E.M.F of a cell – Definition, notation and sign conventions. Concentration cells – Definition, construction, working and derivation of a EMF. Electrodes: Types of electrodes: Reference electrodes – construction and working of calomel electrode & Ag-AgCl electrode. Numerical problems on E, E^{o} and EMF of cells and concentration cells. Glass electrode (Ion-selective electrode) :

Definition, construction and working of glass electrode. Determination of pH using glass electrode. **8 hrs.**

UNIT - II

INSTRUMENTAL METHODS OF ANALYSIS

Introduction. Types of analysis : Qualitative and quantitative – Classical and instrumental methods of analysis. Advantages of instrumental methods of analysis over physical and chemical methods. Electro optical methods: Colorimetry – Principle, statement and derivation of Lambert's law, Beer's law, Beer-Lambert's law, instrumentation, advantages and applications. Numerical problems. Electrochemical methods : Potentiometry – Principle, instrumentation, advantages and applications. Types of potentiometric titrations – Neutralization (acid-base) and redox titrations. Conductometry - Principle, instrumentation, advantages and applications. Applications of conductometric titrations - strong acid against a strong base, strong acid against a weak base, weak acid against a strong base, weak acid against a weak base and mixture of acids (strong acid + weak acid) against a strong base. **5 hrs.**

BATTERY TECHNOLOGY

Batteries – Basic concepts, components and operation of a battery. Classification of batteries – Primary, secondary and reserve batteries. Battery characteristics. Classical batteries – construction, working and applications of Lead-acid, Ni-Cd and Zinc-Ag_2O battery. Modern batteries- construction, working and applications of Zn-air, Nickel-Metal hydride and Lithium batteries - Li-MnO_2 and Lithium-ion battery. Introduction to eco-friendly batteries.

4 hrs.

UNIT - III

CORROSION SCIENCE

Metallic corrosion – Definition, corrosion interrelated problems and Electrochemical theory of corrosion. Types of corrosion - Differential metal corrosion, differential aeration corrosion (waterline corrosion and

pitting corrosion) and stress corrosion. Factors affecting the rate of corrosion – Primary and secondary factors. Numerical problems on corrosion rate. Corrosion control methods – anodizing, phosphating, galvanizing, tinning and corrosion inhibitors–anodic and cathodic. Corrosion control by cathodic protection. **4 hrs.**

PHASE EQUILIBRIA

The phase rule – Statement and explanation of the terms involved in the phase rule with examples. Application of phase rule to one component system – Water system and two component system - Pb-Ag system. Desilverization of lead. **3 hrs.**

UNIT - IV

HIGH POLYMERS

Definition, classification – Based on occurrence, method of preparation, structure (linear, branched and crosslinked), effect of heat on polymer. Definition, classification – Based on occurrence, methods of preparation, structure (linear, branched and cross linked) and effect of heat on polymer (thermoplastic and thermosetting polymers). Polymerization - Definition, types – addition and condensation with examples. Techniques of polymerization - bulk, solution, suspension and emulsion polymerization. Mechanism of polymerization - free radical mechanism (ethylene as an example). Weight average and number average molecular weight – Definition and numerical problems. Glass transition temperature (Tg) – Definition, factors affecting Tg and significance of Tg. Synthesis, properties and applications of Teflon (PTFE), PMMA, polyurethanes, and phenol-formaldehyde. Elastomers – definition, examples, synthesis and applications of butyl rubber and Buna-S. Advanced materials - Conducting polymers - Definition, mechanism of conduction in polyacetylene; Polymer composites – Definition and advantages. Synthesis and applications of Polyaramides (Kevlar). Polymer nanocomposites - definition, properties and applications. **8 hrs.**

UNIT - V

WATER TECHNOLOGY

Introduction - Impurities present in water. Chemical analysis of water: Determination of (i) Total hardness of water using EDTA (ii) Chloride by Mohrs method (iii) Dissolved Oxygen by Winkler's method (iv) Chemical

Oxygen Demand (COD) and Biological Oxygen Demand (BOD). Numerical problems on COD. Water softening by Reverse osmosis (RO) - Principle and process. **4 hrs.**

NANO MATERIALS

Definition and types of nano materials - Carbon based materials, metal based materials, dendrimers and composites. Production of nanomaterials – top down and bottom up process. Synthesis of Nano metal oxides - Nano ZnO by combustion method and Nano TiO_2 by hydrothermal method. Carbon nano-tubes: Definition, types - SWCT and MWCT and synthesis of carbon nanotubes by arc discharge method. Techniques used in characterization of nanomaterials – FTIR, XRD, SEM and TEM (No description of techniques).

3 hrs.

TEXT BOOKS :

1. Engineering Chemistry - A Textbook of Chemistry for Engineers, Suba Ramesh and others. Wiley India, First Edition. 2011.

REFERENCE BOOKS :

(Electrode potential, cells and applications)

1. Elements of Physical Chemistry, Samuel Glasstone and David Lewis, The Macmillan Press Limited, Reprint: 1976.
2. Physical Chemistry, Walter J Moore, Longmans Green and Co. Ltd., 1966.

(Instrumental methods of analysis)

3. Instrumental analysis, Douglas A Skoog, F. James Holler and Stanley R. Crouch, Cengage Learning India Pvt. Ltd., 2010.
4. Instrumental Methods of Analysis. H. H. Willard, L.L. Merritt and J.A. Dean and F.A. Settle, CBS Publishers, 7th Edition, 1988.

(Battery Technology)

5. Industrial electro chemistry, Derek Pletcher and Frank C. Walsh, Blackie academic and Professional, 1993.
6. Chemical and Electrochemical Energy Systems, R. Narayan, B. Viswanathan, University Press (India) Ltd., 1998.

(Corrosion science)

7. Corrosion Engineering, M.G. Fontana, McGraw Hill Publications, New York, 1987.
8. Industrial electro chemistry, Derek Pletcher and Frank C. Walsh, Blackie Academic and Professional, 1993.

(Phase Equilibria)

9. A Text book for engineers, Wiley India Pvt. Ltd., First edition 2011.

(High Polymers)

10. Text Book of Polymer Science, F.W. Billmeyer, Wiley Inter science publications, 1994.
11. Polymer science, V.R. Gowriker, N. V. Viswanathan, Jayadev Sreeshar, New Age International (P) Ltd., 1996.
12. Nanocomposite science and technology – P.M. Ajayan, L.S. Schadler, P.V. Braun, Wiley, New York.

(**Water Technology**)

13. A text book of Environmental Chemistry and pollution and pollution control - S. S. Dara, D.D. Mishra, S Chand, 2012.
14. Chemistry for Engineering Students - B. S. Jai Prakash, R. Venugopal, Shivakumaraiah, Pushpa Iyengar.

(Chemistry of Nano materials)

15. Hand book of nanotechnology, Bharath Bhushan, Spinger-Verlag Berlin Heidelberg New York, 2004.
16. Structure and properties of solid state materials, B. Viswanathan, Narosa publications, 2009.

Course Outcomes :

On successful completion of this course, students will be able to:

CO1 : Determine the electrode potential of newly constructed electrodes, calculate the voltage of galvanic cells and determination of pH of water and other liquid samples.

CO2 : Apply the knowledge of colorimetry, potentiometry and conductometry in chemical analysis and carryout estimation of metals and other pollutants in industrial effluents samples. Develop new materials for construction of batteries to improve their performance.

CO3 : Protect the metals/alloys from undergoing corrosion by adopting suitable corrosion control methods. Identify the change of phases on variation of pressure, temperature and composition and correlate the changes in micro structure to the properties and mechanical applications.

CO4 : Develop new polymers and polymer composites which find applications in the field of engineering.

CO5 : Gain awareness of water quality parameters and their determination. Acquire knowledge about different types of nano materials, methods of synthesis of nano metal oxides and carbon nano tubes.

ENGINEERING CHEMISTRY LABORATORY

Contact Hours/ Week	: 2 (P)	Credits :	1.0
Total Hrs.	: 26	CIE Marks :	50
Sub. Code	: NCHEL	SEE Marks :	50

Course Objectives :

This course will make students to learn :

- The use of pH meter/Potentiometer for determination of pH/pK_a of solutions and interpret it for the health effects of drinking soft-drinks.
- The usage of Colorimeter for the estimation of metals in alloys.
- The use of conductivity meter for the determination of conductance in solutions/electrolytes.
- The use of Spectrophotometer for the determination of absorption maxima in dye solutions.
- The volumetric analysis and use of these techniques for the estimation of metals, water quality and extent of pollution.

PART - A

Instrumental Methods of Analysis :

1. Determination of pK_a of a weak acid using pH meter and its application in the determination of pK_a of soft drinks.
2. Potentiometric titration - Estimation of iron in stainless steel using standard $K_2Cr_2O_7$ solution.
3. Colorimetric determination of copper from the sample prepared from printed circuit board.
4. Determination iron in the given sample of industrial rods by colorimetric method using potassium thiocyanate.
5. Estimation of HCl using standard NaOH conductometrically (Using direct reading conductivity bridge) and its graphical interpretation in origin software.
6. Identification of λ_{max} of a dye solution using a spectrophotometer.

PART - B

Titrimetric Estimations :

1. **Analysis of industrial waste water sample – Redox Titration -** Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
2. **Complexometry -** Determination of total hardness of a sample of drinking water using standard EDTA solution.
3. **Redox titration -** Determination of iron in the given TMT (Thermo Mechanically Treated) bars (External indicator method) using standard potassium dichromate solution.
4. **Redox titration -** Determination of amount of manganese dioxide present in austenitic manganese steel using standard potassium permanganate solution.
5. **Complexometry -** Determination of CaO in cement by rapid EDTA method.
6. **Acid base titration -** Determination of alkalinity of given water sample.

Demonstration :

Synthesis of nano ZnO by combustion method and confirmation by FTIR spectroscopic analysis

REFERENCE :

1. Arthur I. Vogel, Quantitative Inorganic Analysis and Elementary Instrumental Analysis, ELBS, Longmann Group, 5th Edition, 1989.

Course Outcomes :

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

CO1 : Determine the electrode potential of newly constructed electrodes; calculate the voltage of galvanic cell and batteries and determination of pH of water and other liquid samples. Also, estimate the amount of metal(s) in effluents.

CO2 : Determine the metals/ pollutants in water and alloys using colorimeter.

CO3 : Measure the conductance of solutions / electrolytes which in turn can be used for the determination its characteristics.

CO4 : Identify the λ_{max} of dye solution and predict the complimentary colours.

CO5 : Use the knowledge of volumetric analysis for estimation of metals, materials and pollutants in water and industrial effluents samples.

C PROGRAMMING FOR PROBLEM SOLVING

Contact Hours/ Week	: 2(L) + 2(T)	Credits :	3.0
Total Lecture Hours	: 26	CIE Marks :	50
Total Tutorial Hours	: 26	SEE Marks :	50
Sub. Code	: NCPPS		

Course Objective :

- ***Design*** solutions to *simple engineering problem* by applying the basic programming principles of C language and basic mathematical knowledge.
- **Choose** a suitable C-construct to develop C code for a given problem.
- **Recognize** the bugs in the C program.
- **Apply** the C-language syntax rules to correct the bugs in the C program.
- **Develop** simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.

UNIT – I

Introduction to Computing: Components of a Computer, Concept of Hardware and Software, Art of programming through Algorithms and Flowcharts.

Overview of C: Importance of C, Basic Structure of C Programs, Programming Style, Executing a C Program.

Constants, Variables, and Data Types: Introduction, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables.

Managing Input and Output Operations: Reading a Character, Writing a Character, Formatted Input, Formatted Output.

Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity. **(7+5) hrs.**

UNIT - II

Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, the if.....else Statement, Nesting of if....else Statements, The else if Ladder, The Switch statement, the goto statement.

Decision Making and Looping: The while Statement, The do Statement, the for Statement, Jumps in Loops. **(5+6) hrs.**

UNIT - III

Array: One-Dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Searching - Linear search, Binary search, Sorting - Bubble sort, Selection sort.

Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays, Example programs – Matrix Multiplication, Transpose of a matrix. **(5+5) hrs.**

UNIT - IV

Character Arrays and Strings: Declaring and Initializing String Variables, Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, String-handling Functions (strlen(), strcpy(), strcmp(), strcat(), strrev(), strncpy(), strncmp(), strncat(), strstr(), strchr(), strrchr()), Example Programs (with and without using built-in string functions), Table of Strings.

Pointers: Introduction, Declaring Pointer Variables, Initialization of Pointer variables, Accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and 1-D Arrays. **(5+5) hrs.**

UNIT - V

User-defined Functions: Need for User-defined functions, Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments but no Return values, Arguments with Return Values, No Arguments but Returns a Value, Nesting of functions, Passing Arrays to Functions, Passing Strings to functions.

Recursion- Factorial of an integer, X^n, Finding n^{th} Fibonacci numbers.

(4+5) hrs.

TEXT BOOKS :

1. E. Balaguruswamy, Programming in ANSI C, 8th Edition, Tata McGraw-Hill Publications

REFERENCE BOOKS :

1	Yashwant Kanetkar	Let us C, 6th Edition , BPB publication
2	Kerningham and Dennis Ritchie	The C programming language (ANSI C version), 2nd Edition, PHI India
3	Jeri R Hanly, Elliot B Koffman	Problem solving and program design in C, Pearson Education

Course Outcomes :

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

CO1 : ***Illustrate*** and ***explain*** the basic computer concepts and programming principles of C language.

CO2 : ***Develop*** C programs to solve simple mathematical and decision making problems.

CO3 : ***Develop*** C programs to solve simple engineering problems using looping constructs.

CO4 : ***Develop*** C programs to demonstrate the applications of derived data types such as arrays, pointers, strings and functions.

COMPUTER PROGRAMMING LABORATORY

Contact Hours/ Week	: 2 (P)	Credits :	1.0
Total Hrs.	: 26	CIE Marks :	50
Sub. Code	: NCPL	SEE Marks :	50

Course Objectives :

This course will enable students to

- Understand the basic principles of C programming language.
- Develop C programming skills.
- Develop debugging skills using Code Blocks IDE.

Instructions :

CIE : 50 Marks

- Students are assessed every week for 35 marks.

  (This includes Observation and Record writing, Analysis and Modifications, Program execution and Viva (10 + 05 + 10 + 10 = 35)).

- Two tests are conducted for 15 marks each.

SEE : 50 Marks

- Students are allowed to pick one program from the lot.
- Write up + Analysis + Program Execution+ Viva: 10 + 10 + 20 + 10 = 50
- Change of program is allowed only once and evaluation is done for 80% marks.

Conduction :

The laboratory programs should be executed on CodeBlocks IDE using GCC Compiler.

LABORATORY PROGRAMS

1. a. Develop a C Program to find the roots of quadratic equation for non-zero co-efficients using if-else ladder construct.

1. b. Develop a C Program to conduct Binary search for a key element over an array of *n* integer elements. Report success or failure with appropriate messages.

2. a. Develop a C Program to implement a simple calculator to perform addition, subtraction, multiplication and division operations using switch construct. Display appropriate messages for invalid operator and divide by zero error.

2. b. Develop a C program to read *n* elements into an integer array and sort the array using Bubble sort technique. Print the input array and the resultant array with suitable messages.

3. a. Develop a C Program to generate the Prime numbers between the ranges *m* & *n* using nested for loop construct. Also, print the number of prime numbers generated.

3. b. Develop a recursive C function to find the factorial of a number, *n*!, defined by fact(*n*)=1, if *n*=0. Otherwise fact(*n*)=*n**fact(*n*-1). Using this function, develop a C program to compute the Binomial coefficient *n*C*r*. Perform input validation as well.

4. a. Develop a C Program to find the GCD & LCM of two integers using Euclid's algorithm.

4. b. Develop a C program to find the smallest and largest elements in an array using pointers and then swap these elements and display the resultant array.

5. a. Develop a C program to find the Sine of an angle for the given *n* terms using the series

$\text{Sin}(x) = x - x^3/3! + x^5/5! - \ldots\ldots\ldots$ *n* terms.

5. b. Develop a C program to read two matrices ***A*** (***m*** **x** ***n***) and ***B*** (***p*** **x** ***q***) and compute the product of the two matrices. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only. Program must check the compatibility of orders of the matrices for multiplication. Report appropriate message in case of incompatibility.

6. a. Develop a C program to find the sum of all the elements of an integer array using pointers.

6. b. Develop a C program to accept a matrix of order *m* x *n*. Implement the following functions:

i) Find the sum of each row

ii) Find the sum of each column

iii) The sum should be printed in main function only.

7. a. Develop a C program to count the vowels & consonants in a given string.

7. b. Develop a C program to perform the following operations using functions:

i) Read *n* elements into an array

ii) Print the contents of an array

iii) Sort an array of *n* elements using Selection sort technique

Course Outcomes :

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

CO1 : **Develop**, **Debug** and **Execute** programs to **demonstrate** decision making and looping constructs in C.

CO2 : **Develop, Debug** and **Execute** programs to **demonstrate** the applications of arrays in C.

CO3 : **Develop, Debug** and **Execute** programs to **demonstrate** the applications of functions in C.

CO4 : **Develop, Debug** and **Execute** programs to **demonstrate** the basic concepts of pointers in C.

ENGINEERING MECHANICS

Contact Hours/Week	: 2 (L) + 2 (T)	Credits	: 3.0
Total Hours	: 26 + 26 = 52	CIE Marks	: 50
Subject Code	: NEM	SEE Marks	: 50

Course Objectives :

The objectives of the course are to:

1. Learn Fundamentals of mechanics, equation of static equilibrium of particles and rigid bodies, draw and label free body diagrams, and determine equivalent force systems.
2. Obtain centroid and second moment of planar bodies/ laminas and sections.
3. Understand the effect of friction on equilibrium of bodies.
4. Develop the concepts of energy and power.
5. Develop skills to use the basic principles of mechanics in engineering applications.

UNIT - I

Fundamentals of Mechanics, Basic idealization- particle, continuum and rigid body, laws of mechanics, force and its characteristics, classification of force system, concept of free body diagram, Principle of Transmissibility.

Resultant of coplanar concurrent force system, law of parallelogram of forces, triangle law of forces, polygon law of forces, and problems related to determination of the resultant.

Equilibrium of coplanar concurrent force system, Conditions of equilibrium, Lami's theorem and problems related to equilibrium of concurrent force system. Illustrative problems specific to engineering applications.

6L + 6T hrs.

UNIT - II

Resultant of coplanar non-concurrent force system: Concept of moment, couple, equivalent force and couple system, Varignon's theorem, analysis of resultant of the system.

Equilibrium of coplanar non-concurrent force system: Types of loads, Types of supports, types of beams. Determination of support reaction for beams subjected to different types of loads (Concentrated loads, UDL, UVL,

pure moment and their combinations), introduction to the concepts of determinacy and indeterminacy in components subjected to forces/loads.

6L + 6T hrs.

UNIT - III

Distributed forces on a plane figure: Centroid, center of gravity, differences between center of gravity, center of mass , axis of symmetry, axis of reference, centroid of elementary geometrical shapes(no derivation), locating the centroid of composite figures, illustrative problems involving plane laminas /cross sections of engineering interest.

Moment of inertia : Introduction – importance in structural designs, second moment of an area or moment of inertia of elementary shapes(no derivation), radius of gyration, transfer formula, polar moment of inertia, MI about arbitrary axis of standard laminas. MI of plane laminas of standard shapes- MI of composite sections, product of Inertia, Illustrative problems of practical significance. **5L + 6T hrs.**

UNIT - IV

Friction: Introduction, Limiting Friction and Impending motion, Coulomb's laws of dry friction, coefficients of Friction, angle of friction, determination of coefficient of friction (Angle of Repose), cone of friction, application of friction, problems on horizontal plane, inclined plane, (impending motion of connected bodies and relative motion), and ladder friction. Illustrative problems of engineering interest. **5L + 4T hrs.**

UNIT - V

Virtual work: Work done on a particle, concepts of zero work, work done by internal forces, work done in stretching a spring, concept of stiffness, work done on a rigid body, virtual displacement, virtual work, illustrative problems on virtual work. **4L + 4T hrs.**

TEXT BOOKS :

1. **J L Merrium, L G Kraige, and J N Bolten**, Engineering Mechanics – Statics, 8th edition, John Wiley Publications, 2016.

   ISBN: 978-1-119-04467-3 (units 1 to 4).

2. **A Nelson**, Engineering Mechanics: Statics and Dynamics, Tata McGraw Hill Publications, 2009.

   ISBN: 978-0-07-014614-3 (unit 5).

3. **Engineering Mechanics Tutorial Series playlist available at**: https://www.youtube.com/watch?v=F96jGAE5BII&list=PLZ83ehWf497xHAbC2tcN48Awr6S5HUeQI

Course Outcomes :

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

CO1 : Identify system of forces and to solve complex engineering problems by applying principles of engineering, science, and mathematics.

CO2 : Apply equations of statics to analyze non concurrent force system and to determine support reactions and internal forces in a system.

CO3 : Locate centroid of a given planar section and be able to use concepts of moment of inertia to decide on the orientation of the section to obtain maximum resistance to rotation and be able to develop robust sections by economic use of available material.

CO4 : Recognize the advantages and liabilities of friction for a given real world problem and be able to apply concepts of friction in situations where it holds the things in place.

CO5 : Use principles of kinetics and virtual work to analyze the equilibrium and be able to find internal forces in connected systems with more than one member that form a mechanism.

BASIC ELECTRONICS

Contact Hours/ Week	: 3 (L)	Credits :	3.0
Total Lecture Hours	: 39	CIE Marks :	50
Sub. Code	: NBEC	SEE Marks :	50

Course Objectives: The objectives of this course are :

- Apply Boolean laws to simplify logical expressions.
- Emphasize on the behavior of PN junction devices, their characteristics, their applications.
- Illustrate the functionality of transistors & to develop its applications.
- Describe the operations of OPAMP & build its applications.
- Introduce basic principles of communication.

UNIT - I

DIGITAL FUNDAMENTALS

Binary addition and subtraction using 1's and 2's complement method, Review of logic gates, NAND as universal gate (as OR, AND & NOT), Boolean Algebra, DeMorgan's theorems, Simplification and realization of Boolean expressions using basic gates and NAND gates, Half adder, Full adder and Parallel adder. **8 hrs.**

UNIT - II

SEMICONDUCTOR DIODE AND ITS APPLICATIONS

Review of PN–junction, Zener diode: Working, VI characteristics.

Basic building blocks of a regulated DC power supply: Full wave rectifier, Capacitor filter (qualitative analysis), Zener regulator. **8 hrs.**

UNIT - III

TRANSISTORS AND THEIR APPLICATIONS

Review of Bipolar junction transistor, CE configurations and characteristics, BJT as an amplifier, Fixed bias and voltage divider bias (approximate analysis), DC load line and operating point, Single stage RC coupled amplifier and its frequency response.

N-channel enhancement type MOSFET, Construction and drain characteristics. **9 hrs.**

UNIT - IV

OPERATIONAL AMPLIFIER

Block diagram of an Operational amplifier, Characteristics of an ideal operational amplifier, Concept of virtual ground, Inverting and non-inverting amplifier, Voltage follower, Adder, Subtractor, Integrator and differentiator.

7 hrs.

UNIT - V

OSCILLATORS AND COMMUNICATION SYSTEM

Concept of feedback, Types of feedback, Barkhausen criteria for oscillations, RC phase-shift oscillator and Wein's bridge oscillator.

Block diagram of communication system, Need for modulation, Definition of modulation, Amplitude modulation: Definition and waveforms, Expression for AM, Modulation index, Frequency spectrum.

Frequency Modulation: Definition and waveforms (Qualitative analysis), Modulation index, Comparison of AM and FM. **7 hrs.**

TEXTBOOKS :

1. Robert L. Boylestad, Louis Nashelsky "ElectronicDevices and Circuit Theory" PHI Publication, 11th Edition, 2012.
2. Donald D. Givone "Digital Principles and Design" TMH Publication, 2003.
3. George Kennedy "Electronic Communication System", TMH Publication, 5th Edition, 2015.

Course Outcomes:

On successful completion of the course, students will be able to:

CO1 : Apply the knowledge of engineering fundamentals to analyze and design digital circuits.

CO2 : Apply the knowledge of mathematics and engineering fundamentals to design dc power supply.

CO3 : Identify and analyze various biasing circuits of a transistor amplifier.

CO4 : Apply the knowledge of engineering fundamentals to analyze the operation of an op-amp and design op-amp for various applications.

CO5 : Identify and analyze the different modulation techniques.

BASIC ELECTRICAL ENGINEERING

Contact Hours/Week	: 2 (L) + 2 (T)	Credits	: 3.0
Total Lecture Hours	: 26 + 26 = 52	CIE Marks	: 50
Sub. Code	: NBEL	SEE Marks	: 50

Course Objectives :

1. Basic concepts, basic laws & application of basic laws to analyze D.C. circuits, maximum power transfer theorem and time domain analysis of first order RL and RC circuits.
2. Voltage-current relation & power equations in R L C circuits and analysis of series and parallel A.C. circuits.
3. Generation of three phase voltages, relation between phase & line values in star and delta connected circuits, principle of operation, types of losses and efficiency of transformer.
4. Construction and principle of operation of D.C. motor, types of motors, speed control of separately excited D.C. motor.
5. Construction and working principle of three phase Induction motor & single-phase induction motor. Speed control of three phase induction motor and solar cell and solar photo voltaic system, DC-DC converter, Fuse and MCB.

UNIT - I

D.C. CIRCUITS

Kirchhoff's Laws, analysis of series, parallel and series-parallel circuits excited by independent voltage sources, Power and Energy. Maximum power transfer theorem, Time domain analysis of first order RL and RC circuits.

A.C. FUNDAMENTALS

Definition and numerical values of average value, root mean square value, form factor and peak factor of sinusoidally varying voltage and current, phasor representation of alternating quantities. **5+5 hrs.**

UNIT - II

A.C. CIRCUITS

Analysis with phasor diagram of circuits with R, L, C, R-L, RC, R-L-C for series and parallel configurations. Concept of real power, reactive power, apparent power and power factor. **6+6 hrs.**

UNIT - III

SINGLE PHASE TRANSFORMERS

Necessity of transformer, Construction, Principle of operation of transformer, transformer on No load and load condition, Emf equation, losses, variation in losses with respect to load and efficiency. Three-phase balanced circuits, voltage and current relations in star and delta connections, three-phase power. **5+5 hrs.**

UNIT - IV

D.C. MACHINES

Construction of D.C. machines. Principle of operation of DC motor, Back EMF, Torque equation, separately excited DC motor – Torque-speed characteristics, speed control of separately excited DC motor.

THREE PHASE INDUCTION MOTORS

Generation of rotating magnetic field, Construction and working of a three-phase induction motor, Slip and its significance. Starter for three-phase induction motor. **6+6 hrs.**

UNIT - V

SINGLE PHASE INDUCTION MOTOR:

Construction, working principle, types, Applications.

Study of standalone SPV systems, introduction to solar cell, DC-DC converter and inverter (Block diagram).

ELEMENTARY DISCUSSION ON CIRCUIT PROTECTIVE DEVICES

Fuse and Miniature Circuit Breaker (MCB's). **4+4 hrs.**

TEXTBOOK:

1. D.C. Kulshreshtha "Basic Electrical Engineering", TMH, Revised First Edition, 2017

REFERENCE BOOKS:

1. E.Hughes: Electrical Technology, Intl. Student Twelfth edition, AWL Press, 2016.
2. Rajendra Prasad “Fundamentals of Electrical Engineering “Prentice Hall of India Pvt. Ltd-2005.

Course Outcomes:

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

CO1 : Apply the basic laws of electrical engineering for the solution of D.C. electric circuits excited by independent voltage sources.

CO2 : Solve the R, L, C, R-L, R-C and R-L-C Series and Parallel AC circuits and determine the relation between phase and line values of voltage and current in three phase circuits.

CO3 : Calculate the losses, efficiency of a single phase transformer.

CO4 : Explain the working principle of D.C. machine and speed control of separately excited D.C. motor.

CO5 : Explain the construction and working principle of three phase and single phase induction motor, speed control of three phase introduction motor, solar photo voltaic system, DC-DC converter and protective devices.

BASIC ELECTRICAL ENGINEERING LAB

Contact Hours/Week	: 2 (P)	Credits	: 1.0
Total Lecture Hours	: 26	CIE Marks	: 50
Sub. Code	: NBELL	SEE Marks	: 50

Orientation class for an exposure to :

- Resistors, capacitors and inductors, types of wires, measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope, transformer, DC motor, synchronous generator, three phase induction motor etc.
- Basic safety precautions while dealing with electricity.

LIST OF EXPERIMENTS :

1. Verification of R-L, R-C & RLC circuit
2. Operation of a Single phase transformer
3. Three phase start/delta circuits & establish relationship between voltage & current.
4. Study the Characteristics of DC shunt motor
5. Study the Characteristics of three phase Induction Motor
6. PCB design to control the lamp operation from two positions & three positions
7. Hands on training to control speed & direction of rotation of stepper motor using Arduino processor.
8. Photo sensors/temperature sensors based solar tracking system.

Course Outcomes :

CO 1 : Verify RL, RC,RLC. Verify the voltage and current relationship in 3-phase star and delta connected circuits and to design the PCB to control the lamp from two and three points experimentally.

CO 2 : Conduct load test on 1-phase transformer, DC shunt motor and 3-phase induction motor to obtain, the speed-load characteristic.

CO 3 : Conduct the speed control & direction of rotation of stepper motor using Arduino processor. Use Photo sensors/temperature sensors to determine the efficiency of solar tracking system.

COMPUTER AIDED ENGINEERING DRAWING

Contact Hours/ Week	: 2 (L) + 2 (P)	Credits :	3.0
Total Hours	: 26 L + 26 P	CIE Marks :	50
Sub. Code	: NCAED	SEE Marks :	50

Course Objectives :

1. To expose the students to standards and conventions followed in preparation of engineering drawings.
2. To make them understand the concepts of orthographic projections, Development of surfaces and isometric projections.
3. Develop the ability of conveying the engineering information through drawings.
4. To make them understand the relevance of engineering drawings to different engineering domains.
5. To expose them to Computer aided drafting packages and generation of computer assisted drawings.

UNIT - I

INTRODUCTION TO COMPUTER AIDED SKETCHING

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly- lines, square, rectangle, polygons, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, inclination and perpendicularity.

Dimensioning, line conventions, material conventions and lettering.

ORTHOGRAPHIC PROJECTIONS OF POINTS, STRAIGHT LINES

Introduction, Orthographic projection, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of straight lines (located in First quadrant/First angle only), True and apparent lengths, True and apparent inclinations to reference planes, Simple application problems on Lines (No midpoint problems). **12 hrs.**

UNIT - II

PROJECTIONS OF PLANE SURFACES

Introduction, Orthographic projections of regular plane Surfaces – triangle, square, rectangle, pentagon, hexagon and circle in simple positions inclined to both the planes, planes in different positions by change of position method only. (No problems on punched plates, composite plates, Lamina resting on VP). **8 hrs.**

UNIT - III

PROJECTIONS OF SOLIDS

Introduction, Classification of Solids, Projections of prisms, pyramids, cylinders and cones with axis inclined to both the planes, Solids in different positions by change of position method only.(No problems on octahedrons, freely suspended solids, Solid resting on VP). **12 hrs.**

UNIT - IV

DEVELOPMENT OF LATERAL SURFACES OF SOLIDS

Introduction to section planes and sectional views, Development of lateral surfaces of right regular prisms, cylinders, pyramids, cones and their frustums resting with base on HP only, Simple application problems. **10 hrs.**

UNIT - V

ISOMETRIC PROJECTION

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres. Isometric view of combination of two simple solids. **10 hrs.**

TEXTBOOKS:

1. Engineering Graphics – K.R. Gopalakrishna, 32nd Edition, 2005-Subhash Publishers Bangalore.
2. Engineering Drawing – N.D. Bhatt & V.M. Panchal, 48th Edition, 2005 - Charotar Publishing House, Gujarat.

REFERENCE BOOKS:

1. Computer Aided Engineering Drawing – S. Trymbaka Murthy, – I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd Revised Edition-2006.
2. Computer Aided Engineering Drawing- by Dr. M H Annaiah, Dr. C N Chandrappa and Dr. B Sudheer Premkumar, Fifth Edition, New Age International Publishers.

Course Outcomes:

After undergoing the course student will be able to:

CO1 : Draw orthographic projections of Lines and Planes according to the definition of the problem.

CO2 : Draw orthographic projections of solids both in conventional way and using modern engineering tool.

CO3 : Develop the lateral surfaces of solids, draw isometric projection of combination of solids both in conventional way and using modern engineering tool.

SEMESTER END EXAMINATION QUESTION PAPER PATTERN :

A maximum of **THREE** questions will be set as per the following pattern and the student has to answer all the questions.

Particulars	Marks Allotted
First question from Unit 1 or Unit 2	10
Second question from Unit 3	20
Third question from Unit 4 or Unit 5	20
Total	50

SCHEME OF EVALUATION :

Question No.	Solution on drawing sheet	Computer display and printout	Total Marks
1	10	--	10
2	10	10	20
3	10	10	20
		TOTAL	**50**

ELEMENTS OF MECHANICAL ENGINEERING

Contact Hours/ Week	: 3 (L)	Credits :	3.0
Total Hrs.	: 39	CIE Marks :	50
Sub. Code	: NEME	SEE Marks :	50

Course Objectives :

- Students to learn availability of various energy resources and applications of thermal engineering.
- To introduce the students to the field of mechanical engineering through an exposition of various prime movers.
- Students will be introduced to fundamentals of design though power transmission elements.
- Students will be exposed to various conventional and modern manufacturing processes and fundamentals of system design.

UNIT - I

ENERGY, FORMATION OF STEAM

Energy : Forms of energy, sources and classification of energy sources,Non-conventional energy sources (Solar Energy, Wind Energy, Tidal Energy).

Formation of steam : Formation of steam, Types of steam, Steam properties - specific volume, enthalpy and internal energy, Simple numerical problems.

Refrigeration : Principle of refrigeration, Unit of refrigeration, working principle of Vapour compression refrigeration and vapour absorption refrigeration, List of commonly used refrigerants. **(4+3+2 Hrs.) 9 Hrs.**

UNIT - II

TURBINES, I C ENGINES, EV & HYBRID VEHICLES

Steam turbines - Classification, Principle of operation of impulse and reaction steam turbine

Water turbines - Classification, principle of operation of Pelton wheel, Francis turbine

Internal Combustion Engines : Construction of IC engine parts, 2 stroke Petrol and 4 stroke Petrol and Diesel engine. Simple problems on IP, BP, FP.

Introduction to Electric vehicle & Hybrid Vehicles, Working concept of electric vehicle **(1+2+4+2 Hrs.) 9 Hrs.**

UNIT - III

POWER TRANSMISSION

Belt drives : Types of belt drives, Stepped cone pulley, Velocity ratio in belt drives, Slip and Creep in belts drives.

Gear Drives : Types of gears- Spur, Helical, Spiral, Bevel, Worm gears, Rackand Pinion, and Velocity ratio in Gears.

Gear Trains : Types of Gear trains, Working of Simple gear train, Compound gear train, Simple numerical problems on gear trains. **(3 +2+2 Hrs.) 7 Hrs.**

UNIT - IV

MACHINE TOOLS

Lathe : Principle of Working, Construction of Centre Lathe, classification of lathe, Specification of lathe, Lathe operations – Turning, Facing, Knurling, Thread cutting, Taper Turning by Tailstock offset Method.

Drilling : Principle of working, classification of drilling machine, Construction and Working of Bench drilling machine. And its operations, Drilling, Boring, Reaming, Tapping, Countersinking, Counter-boring and Spot facing.

Milling : Principle of working, classification of milling machines, Construction and working of horizontal milling machine. Milling operations - Slot milling, Form milling, Angular milling, Gang milling **(3 +2+2 Hrs.) 7 Hrs.**

UNIT - V

JOINING PROCESS, MECHATRONICS AND ADDITIVE MANUFACTURING (3D PRINTING)

Joining Processes : Welding- Principle of welding, Types of welding -Arc welding, Gas welding, Working of Arc and Gas Welding, Brief description of Soldering and Brazing.

Introduction to Mechatronics : Systems of Mechatronics, advantages and disadvantages, Measurement Systems and Control Systems - Open loop control system and close loop control system (with simple block diagrams).

Introduction to CNC Machine : Advantages and disadvantages CNC, CNC system configuration.

Introduction to Additive Manufacturing : Classification and any one concept of Additive Manufacturing (3D printing by Stereo lithography process). **(3+2+1+1 Hrs.) 7 Hrs.**

TEXTBOOK :

1	K.R. Gopalkrishna	Elements of Mechanical Engineering, Subash Publications

REFERENCE BOOKS :

1	Choudhary S H K	Elements of Workshop Technology Vol. 1 and 2, Media Promoters, Mumbai
2	Dr. A.S. Ravindra	Elements of Mechanical Engineering. Best publications.
3	S. Trymbaka Murthy	Elements of Mechanical Engineering, Vikas Publishing House

Course Outcomes :

After undergoing this course, the students will be able to:

CO1 : Distinguish various energy sources, Classify and explain the working of refrigeration systems and describe the process of formation of steam.

CO2 : Describe the working of turbines, IC engines, Electric & Hybrid vehicle.

CO3 : Analyze and describe various power transmission systems for engineering application.

CO4 : Describe the working of various machine tools and its operations for engineering applications.

CO5 : Enumerate various welding processes, mechanical control systems and advanced manufacturing processes for various engineering applications.

TECHNICAL ENGLISH - 1

Subject Code	: TE1	Credits	: 1.0
Total Hours	: 26	CIE Marks	: 50
Methodology :	Blended Learning – (Instructor lead with work sheets, activities and Lab sessions)	SEE Marks	: 50
		Exam Duration	: 3 Hours

COURSE OBJECTIVES

- Enable students to use clear and coherent English to express their thoughts and ideas effectively.
- Accurately understand and interpret texts and a variety of reading material in the form of books, business context articles and reports.
- Expose students to wide variety of venues of English writing and comprehension through effective lab sessions.
- Enable students to present information and ideas using the professional presentation format and communicate effectively during job interviews.
- Enable student to Lead and participate in group discussions, present information and ideas using the professional presentation format and use body language and apply key soft skills required for confident speaking ability appropriately.

UNIT - 1

FOUNDATION GRAMMAR & VOCABULARY — **9 Hrs.**

- Nouns and Pronouns
- Determiners and Articles
- Verbs
- Subject-Verb Agreement
- Pronoun- Antecedent Agreement
- Prepositions

UNIT - 2

READING THEORY — **2 Hrs.**

- Scanning and reading for gist
- Developing business vocabulary
- Understanding text structure

UNIT - 3

READING PRACTICAL	**4 Hrs.**

- Understanding text-structure
- Reading for gist
- Developing strong business vocabulary
- To strengthen feet in proof reading which helps in making written test error free
- Understanding sentence structure and error identification

UNIT - 4

SPEAKING THEORY	**2 Hrs.**

- Giving personal information
- Talking about present circumstances
- About past experiences
- About future plans
- About expressing opinions
- About speculating

UNIT - 5

SPEAKING PRACTICAL	**9 Hrs.**

- Organizing a larger unit of discourse
- Giving information and expressing and justifying opinions
- Turn-taking (initiating and responding appropriately)
- Negotiating
- Collaborating
- Exchanging information
- Agreeing and/or disagreeing
- Suggesting
- Comparing and contrasting
- Decision-making

ASSESSMENTS

In addition to in-class assessments that are part of the syllabus to test students on key areas, internal and external assessments will focus on testing the students on the different modules:

- Reading Ability (Reading Comprehension)
- Speaking Skills (Extempore/Mock Discussion)

REFERENCES

- Word Power Made Easy by Normal Lewis (Goyal Publishers & Distributors, 2012)
- 'Business Communication Today' by Court land L Bovee and John Thill (Pearson, 14th Edition)
- 'Oxford Guide to Plain English' by Martin Cutts (Oxford, 5th Edition

Course Outcomes :

On successful completion of the course, students will be able to:

CO1 : Students will strengthen their foundational language skills and heighten their awareness of correct usage of English grammar in writing and speaking.

CO2 : Students will review the use of grammatical forms of English in specific contexts, which include: class activities, homework assignments, reading of texts and papers.

CO3 : Students understand text structure and the gist of a particular piece of text/paper/book/journal and strengthen proof reading.

CO4 : Students will become self-confident individuals by mastering negotiation skills, effective communication skills and decision-making skills.

CO5 : Students will become self-confident individuals by mastering negotiation skills, effective communication skills and decision-making skills.

TECHNICAL ENGLISH - 2

Subject Code	: TE2	Credits	: 1.0
Total Hours	: 26	CIE Marks	: 50
Methodology :	Blended Learning – (Instructor lead with work sheets, activities and Lab sessions)	SEE Marks	: 50
		Exam Duration	: 3 Hours

COURSE OBJECTIVES

- Use clear and coherent English to express ideas and share information.
- Enable students to accurately understand and interpret lectures and discussions and a variety of reading material in the form of books, business context articles and reports.
- Expose students to wide variety of environments where listening and assimilation of knowledge is key.
- Write formal letters, e-mail messages and reports as per workplace requirements.
- Expose students to wide variety of venues of English communication through effective lab sessions.

UNIT - 1	
FOUNDATION GRAMMAR & VOCABULARY	**9 Hrs.**
• Classification of Sentences • Adjectives and Adverbs • Conjunctions and Interjections • Vocabulary building and writing exercise • Tenses • Punctuations	
UNIT - 2	
LISTENING THEORY	**2 Hrs.**
• Retrieving factual information • Listening to specific information	

UNIT - 3

LISTENING PRACTICAL	4 Hrs.

- Enhance the ability to identify the topic, context, function, etc.
- Following the main points and retrieving specific points.

UNIT - 4

WRITING THEORY	2 Hrs.

- Learning minutes of giving instructions
- Explaining a development
- Asking for comments
- Requesting information
- Agreeing to requests
- Session aims at developing sentence structure and word order knowledge
- Session covers basic memo/note/email writing etiquette

UNIT - 5

WRITING PRACTICAL	9 Hrs.

- Correspondence of explaining
- Apologizing
- Reassuring
- Complaining
- Report describing
- Summarizing
- Proposal Describing
- Proposal summarizing
- Proposal recommending
- Proposal persuading
- Development of report and proposal writing skills
- Enhancement of basic writing skills
- Learning minutes of email and letter writing
- Enhancing the email writing skills

ASSESSMENTS

In addition to in-class assessments that are part of the syllabus to test students on key areas, internal and external assessments will focus on testing the students on the different modules:

- Listening Skills (Listening Comprehension)
- Writing Ability (Writing note, email, reports/proposals)

REFERENCES

- Word Power Made Easy by Normal Lewis (Goyal Publishers & Distributors, 2012)
- 'Business Communication Today' by Court land L Bovee and John Thill (Pearson, 14th Edition)
- 'Oxford Guide to Plain English' by Martin Cutts (Oxford, 5th Edition

Course Outcomes :

On successful completion of the course, students will be able to:

CO1 : Students will heighten their awareness of correct usage of English grammar in writing and speaking.

CO2 : The students will acquire necessary listening skills in order to follow and comprehend discourse such as lectures, conversations, interviews, and discussions.

CO3 : Enhance the ability to identify the topic, context, function and the ability to follow the main points and retrieving specific points.

CO4 : Write formal letters, e-mail messages and reports as per workplace requirements.

CO5 : Students will understand how to write academic papers, essays and summaries using the process approach.

PERSONALITY DEVELOPMENT AND LEADERSHIP

Contact Hours/ Week	: 1 (L)	Credits :	1.0
Total Hrs.	: 15	CIE Marks :	50
Sub. Code	: PDL	SEE Marks :	50

Course Objectives :

- To introduce the concept of personality and develop insight into the development of healthy personality.
- To introduce the concept of attitudes, time and stress management.
- To introduce the basic concept of Leadership.

UNIT - I

PERSONALITY

Introduction about self and personality. Defining the concept of personality and personality related terms. An overview of approaches to the study of Personality. Assessment of Personality - Self-report measures, Projective techniques and Behavioural Analysis. **5 Hrs.**

UNIT - II

ATTITUDE, TIME AND STRESS MANAGEMENT

Define attitude, Nature and Components of attitude, attitude formation and attitude change, relationship between attitude-behaviour.

Time as a resource, identify important time wasters& techniques for better time management.

Introduction to stress, causes of stress, results of stress & managing stress.

5 Hrs.

UNIT - III

LEADERSHIP

Leadership – Definition of a leader, leadership traits, leadership styles and characteristics of a good leader. **5 Hrs.**

RECOMMEDNED BOOKS :

The study material prepared by the department of Training & Development, Siddaganga Institute of Technology, Tumkur.

REFERENCE BOOKS :

1. Andrew Dubrin, Principles of Leadership, Cengage Learning, 7th Edition, 2015.
2. Dr. B. Ratan Reddy, Team Development & Leadership, Jaico Publishing, Edition, 2005.
3. Jon R Katzenbach & Douglas K Smith, The Wisdom of Teams, Harper Business, 2006.
4. Hersey Paul & Kenneth Blanchard, Management of Organizational Behaviour, Pearson Higher Education, 10th Edition, 2012.
5. Gary Yukl, Leadership in Organizations, Pearson Education, 8th Edition, 2017.
6. Richard L Daft, Leadership, Cengage Learning, 6th Edition, 2017.
7. Craig Watson, Dynamics of Leadership, Jaico Publishing, 2001.
8. Stephen Robbins, Organizational Behaviour, Pearson Education, 16th Edition, 2017.
9. Fred Luthans, Organizational Behaviour, Mc-Graw Hill Education, 12th Edition, 2011.
10. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
11. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi. Tata McGraw-Hill 1988.

Course Outcomes :

After the course students will be able

CO1 : To define the concept of self and personality and to know how to develop a healthy personality.

CO2 : To comprehend the concept of Attitude, Time and Stress Management.

CO3 : To define the concept of Leadership.

IDEATION & SKILL DEVELOPMENT LAB

Contact Hours/ Week	: 2 (P)	Credits :	1.0
		CIE Marks :	50
Sub. Code	: ISDL	SEE Marks :	50

Course Objectives :

- The course aims at making the students to understand the state-of-art in manufacturing domain and make them industry ready by preparing physical models through the use of latest tools such as 3D printing, laser cutting and engraving, and CNC wood routers.

UNIT - I

3D – PRINTING :

Design and developing the model using solid works software.

Generating the Program using 3D software – Solid works or any other open source.

Design of 3 models (minimum) & printing procedure, printing. **6 Hrs.**

UNIT - II

LASER CUTTING, LASER ENGRAVING & SHEET METAL WORK :

Generating the Program using Inkscape / any other software.

Models with Laser Cutting & Engraving.

Models on sheet metal work (Cylinder, Rectangular box). **6 Hrs.**

UNIT - III

CNC WOOD ROUTER & ARC WELDING :

Design & Development of Wooden models using CNC Wood router.

Generating the Program using Free CAD / any other Software to Design & develop of Wooden Models. **6 Hrs**.

Preparation of 2 arc welding models. **2 Hrs.**

UNIT - IV

One Product Development using above techniques / procedures. 6 Hrs.

SCHEME OF EXAMINATION :

Sl. No.	SEE Scheme	Marks
1	One 3D model/wood turning by wood router/ Laser cutting and Engraving	20
2	One welding or Sheet Metal Model	20
3	Viva	10
	Total	**50**

Course Outcomes :

After completing this course, the student will be able to:

CO1 : Develop 3D printed model using modeling and 3D printing software.

CO2 : Perform laser cutting and engraving for a given application and also, develop models using sheet metal operations.

CO3 : Develop wooden models using CNC wood router and perform joining operations by welding.

INDUCTION PROGRAM (3 WEEKS)

Purpose of the *Induction Program* is to help new students to adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self exploration.

The term *induction* is generally used to describe the whole process whereby the incumbents adjust to or acclimatize to their new roles and environment. In other words, it is a well planned event to educate the new entrants about the environment in a particular institution, and connect them with the people in it.

Induction Program engages with the new students as soon as they come into the institution; regular classes start only after that. At the start of the induction, the incumbents learn about the institutional policies, processes, practices, culture and values, and their mentor groups are formed. Then the different activities start, including those which are daily.

List of activities:

- Physical Activity
- Creative Arts and Culture
- Mentoring & Universal Human Values
- Familiarization with College, Dept./Branch
- Literary Activity
- Proficiency Modules
- Lectures & Workshops by Eminent People
- Visits in Local Area
- Extra-Curricular Activities in College
- Feedback and Report on the Program

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. These are included under Proficiency Modules.

There will be a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

AICTE ACTIVITY POINTS
(300 hrs. for the entire programme)

Apart from technical knowledge and skills to be successful as professionals, students should have excellent soft skills, leadership qualities and team spirit. They should have entrepreneurial capabilities and societal commitment. In order to match these multifarious requirements, AICTE has created a unique mechanism of awarding Activity Points over and above the academic grades.

Following suggestive activities as Long Term Goals may be carried out by students in teams:

- Prepare and implement plan to create local job opportunities.
- Prepare and implement plan to improve education quality in village.
- Prepare an actionable DPR for doubling the village Income.
- Developing Sustainable Water Management System.
- Prepare and Improve a plan to improve health parameters of villagers.
- Developing and implementing of Low-Cost Sanitation facilities.
- Prepare and implement plan to promote Local Tourism through Innovative Approaches.
- Implement/Develop Technology solutions which will improve quality of life.
- Prepare and implement solution for energy conservation.
- Prepare and implement plan to develop skills of village youth and provide employment.
- Develop localized techniques for reduction in construction Cost.
- Prepare and implement plan of sustainable growth of village.
- Setting of Information imparting club for women leading to contribution in social and economic issues.
- Developing and managing efficient garbage disposable system.
- Contribution to any national level initiative of Government of India. For example Digital India/ Skill India/ Swachh Bharat Internship etc.

A student has to earn 100 points (75 points for lateral entry students).

The activities can be spread over entire duration of the programme and it will be reflected in the student's 8^{th} semester Grade Card. It shall not be

considered for computation of SGPA/CGPA and for vertical progression. The total duration of the activities for entire programme is 400 hours for regular students and 300 hours for lateral entry students.

AICTE Activity Points Implementation and Monitoring Committee has been constituted under the Chairmanship of Principal and NSS Coordinator as convener, and Dean Academic, Dean Student Welfare, Chief Warden, NCC Coordinator and Two Senior Professors as members. This Committee shall arrange for logistics and material support wherever necessary and review the progress at the end of each Semester.

Procedure:

1. Students can take-up listed activities individually or in a group.
2. Proctors shall monitor the progress of students' work.
3. They can work on daily basis/ weekends/ or in one shot, continuously for 300 hours to earn 100 points. The schedule is at the convenience of group of students.
4. For every **FOUR** hours of work students will get **ONE** Activity Point.
5. Students shall submit a report and photographs related to activities carried out to the proctor
6. Students shall maintain a “Activity Logbook”
7. Students shall register to "Activity Points" during VIII Semester
8. The work done by students will be reviewed by Department Seminar Evaluation Committee during VIII Semester.
9. Break-up of CIE marks for activity points:

Evaluation by the Proctor	50 marks
Evaluation by DSEC	
(i) Report	20 marks
(ii) Presentation	20 marks
(iii) Outcome	10 marks
Total	**100 marks**

10. No SEE for Activity Points.
11. Students will be awarded either NP or P grade based on their performance.
12. Students will be awarded degree only on earning P grade in the Activity Points.

PROGRAM OUTCOMES

Engineering Graduates will be able to:

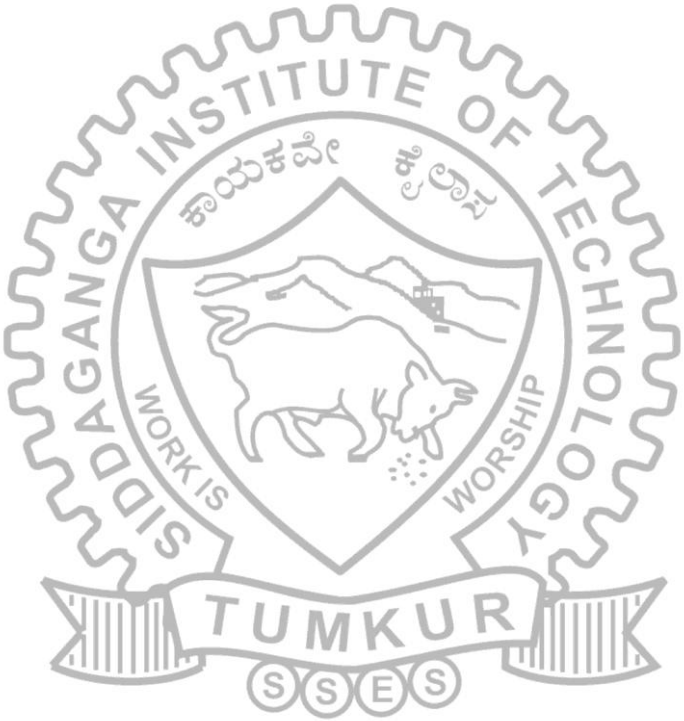
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching 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.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