VIT Vidyalankar Institute of Technology
Accredited A+ by NAAC

Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Biomedical Engineering

First Year Scheme & Syllabus

(As per AICTE guidelines, with effect from Academic Year 2022-23)

Preamble

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated, and taken forward in a systematic manner. Therefore, autonomy for Vidyalankar Institute of Technology is not merely a transition from pre-cooked syllabi to self-designed curriculum. Autonomy curriculum of the Institute offers required academic flexibility with emphasis on industry requirements and market trends, employability and problem-solving approach which leads to improving competency level of learners with diverse strengths. In line with this, the curriculum framework designed is **Choice-Based Credit and Grading System (CBCGS)**. Number of credits for each category of courses learnt by learners, internships and projects is finalized considering the scope of study and the ability that a learner should gain through the programme. The overall credits and approach of curriculum proposed is in line with AICTE model curriculum.

The curriculum comprises courses from various categories like basic sciences, humanities and social sciences, engineering sciences, general education and branch specific courses including professional electives and open electives. The curriculum has core courses of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. These courses are completed by third year of the engineering programme that enables learners to prepare for higher education during their final year. Professional elective courses, that begins from third year of programme, offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a salient feature of this curricula ensuring employability. Open Elective courses cover multi-disciplinary, special skill development, project management and similar knowledge that make learner capable to work in industrial environment.

For holistic development of learners, apart from technical courses, Humanities and Social Science courses develop the required soft-skills and attitude amongst learners. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking, Wellness - Body, Mind & Spirit, Indian Traditional Knowledge System under General Education category. These general education courses aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses. In addition to this, the curriculum is augmented with Life Enrichment audit courses for knowledge inspiring experience.

Additionally, curriculum provides add-on minor/honours degree that involves field/ domain study. Learner can avail this degree by completing requirement of additional 15 credits. Thus, the academic plan of VIT envisages a shift from summative to formative and competency-based learning system which will enhance learner's ability towards higher education, employability and entrepreneurship.

Chairman, Board of Studies
Department of Biomedical Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

First Year B. Tech. Biomedical Engineering **Semester: I**

Course Structure and Evaluation Scheme

Sr. No.	Course			Head of Learning	Credits	Evaluation Scheme (Marks)			Total marks (Passing@40% of total marks)
	Code	Nature	Name			ISA	MSE	ESE	
1	HS01	C	Effective Communication	Theory	02	15	20	40	075
		T	Effective Communication	Practical	1	25	-	25	050
2	BS02	C	Engineering Mathematics-I	Theory	3	20	30	50	100
3	BS15	C	Engineering Physics	Theory	2	15	20	40	075
		T	Engineering Physics	Practical	1	25	-	25	050
4	CE18	C	Structured Programming	Theory	2	15	20	40	075
		T	Structured Programming	Practical	1	25	-	25	050
5	ES04	C	Basic Electrical Engineering	Theory	2	15	20	40	075
		T	Basic Electrical Engineering	Practical	1	25	-	25	050
6	ES02	C	Engineering Mechanics	Theory	2	15	20	40	075
		T	Engineering Mechanics	Practical	1	25	-	25	050
7	GEXX*	E	Any GE course from GE04 onwards	As per course	2	25	-	50	075
Total Credits					**20**	**-**	**-**	**-**	**-**

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE=End Semester Examination
C=Compulsory, T=Tandem, E=Elective, A=Audit

*** Refer to Appendix A for the list of General Education (GE) courses. GE01, GE02 and GE03 are mandatory and will be offered by the department as per program scheme. A subset of courses from GE04 to GE10 shall be offered against GEXX* (Sr. No. 7). However, the subset will depend on the GE courses made available by the institute for that semester.**

First Year B. Tech. Biomedical Engineering **Semester: II**

Course Structure and Evaluation Scheme

Sr. No.	Course			Head of Learning	Credits	Evaluation Scheme (Marks)			Total marks (Passing@40% of total marks)
	Code	Nature	Name			ISA	MSE	ESE	
1	HS02	C	Professional Skills	Theory	2	15	20	40	075
		T	Professional Skills	Practical	1	25	-	25	050
2	BS04	C	Engineering Mathematics-II	Theory	3	20	30	50	100
3	BS16	C	Engineering Chemistry	Theory	2	15	20	40	075
		T	Engineering Chemistry	Practical	1	25	-	25	050
4	ES01	C	Engineering Graphics	Theory	2	15	20	40	075
		T	Engineering Graphics	Practical	1	25	-	25	050
5	CE20	C	Object-Oriented Programming	Theory	2	15	20	40	075
		T	Object-Oriented Programming	Practical	1	25	-	25	050
6	GE01	C	Design Thinking	Theory	2	15	20	40	075
		T	Design Thinking	Practical	1	50	-	-	050
7	GEXX*	E	Any GE course from GE04 onwards	As per course	2	25	-	50	075
Total Credits					**20**	**-**	**-**	**-**	**-**

ISA=In Semester Assessment, MSE=Mid Semester Examination, ESE=End Semester Examination
C=Compulsory, T=Tandem, E=Elective, A=Audit

*** Refer to Appendix A for the list of General Education (GE) courses. GE01, GE02 and GE03 are mandatory and will be offered by the department as per program scheme. A subset of courses from GE04 to GE10 shall be offered against GEXX* (serial number 7). However, the subset will depend on the GE courses made available by the institute for that semester.**

Detailed Syllabus of First Year Semester-I

Course Name: Effective Communication

Course Code: HS01

Category: Humanities, Social Sciences and Management Courses

Preamble:

This course introduces learners to the basics of Effective Communication and English language usage which will equip them with the requisite skillset for higher studies and placements. It considers the important foundational aspects of communication skills and English proficiency required for the workplace. It acquaints the learners with modern communication tools and the basics of public speaking before an audience.

Pre-requisites:

Basic English usage

Course Objectives:

- To enable learners to gain understanding of the cyclic process, methods, channels, and barriers of communication.
- To facilitate learners in developing the skills of active listening, impactful public speaking, reading strategies, and effective writing.
- To create awareness of strengthening English proficiency for competitive exam preparation and the art of comprehension and summarization.
- To introduce strategies for creating effective presentations using modern ICT enabled tools.

Course Outcomes:

Learner will be able to:
CO1: Use verbal/non-verbal cues at social and workplace situations by learning the basics of communication skills.
CO2: Employ listening strategies to become effective listeners and powerful speakers for speaking at social, academic and business situations.
CO3: Improved verbal aptitude to be equipped for competitive examinations and placements.
CO4: Make effective presentations and present before an audience with confidence.
CO5: Use reading strategies for faster comprehension, summarization and evaluation of texts.
CO6: Develop awareness of contemporary digital tools of communication.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of Communication	Concept, Elements and Cycle of Communication Methods of Communication (Verbal and Nonverbal) Objectives and Channels of Communication (Formal and Informal) Barriers to Communication: Physical, Mechanical, Psychological, Semantic, Socio-cultural, Cross-cultural	10
2	Listening & Speaking	Techniques to improve Listening, Listening exercises Speech writing and delivery Different types of Speeches & Tips on Public Speaking	6
3	English Usage	Vocabulary Building (Etymology, Synonyms, Antonyms, One Word Substitutes) useful for TOEFL, GRE Grammar Proficiency Tests (Articles, Prepositions, Tenses, Punctuation) Identifying Common Errors in Writing Grammar Checkers and Sentence Correction Tools	4
4	Presentation Skills	Introduction to Presentation Skills Creating Presentations-Content Delivering Presentations before an audience Using Presentation Software-Modern Presentation Tools	4
5	Comprehension & Summarization	Comprehension & Reading Strategies Graphic Organizers (Mind Maps, Flow Charts, Tree Diagrams etc.) Summarization of technical passages within specified word limit	2
6	Communication Strategies for Virtual Age	Digital Content Creation Infographics, ICT Tools Social and Popular Media	4
Total			**30**

Suggested list of Practicals:

1. Ice Breakers/Introduction/Aptitude Test/English Proficiency Test
2. Extempore Speech Practice Session
3. Prepared Speech

4. Group Presentations on current and relevant topics
5. Situational Dialogue Writing and Delivery
6. Skits/Role play on Methods of Communication and Barriers of Communication
7. English Usage Practice on Grammar and Vocabulary
8. Virtual Lab

Suggested list of Assignments:

1. Written Assignment on Fundamentals of Communication (Individual)
2. Listening Activities and Exercises (Individual)
3. Aptitude test on Vocabulary and Grammar (Language Lab) (Individual)
4. Presentation on domain related topics (Group)
5. Comprehension & Summarization of technical passages
6. Digital Content Creation using ICT Tools

Suggested List of Value-Added Home Assignments:

1. https://www.udemy.com/course/professional-communication-and-business-writing**/** Udemy
2. https://www.udemy.com/courses/business/communications/ Udemy

Suggested Online Courses:

1. Courses on Communication offered by Udemy
2. Business English for Non-Native Speakers Offered by The Hong Kong University of Science and Technology
   https://www.coursera.org/Specializations/Business English for Non-Native Speakers

3. English Communication Skills offered by University of Washington

   https://www.coursera.org/specializations/Business English Communication Skill
4. https://www.udemy.com/share/101wx6/Public Relations: Media Communication Crisis
5. https://www.udemy.com/share/101BkA/Basic English Grammar and Structures

Reference Books:

1. Raman Meenakshi and Sangeeta Raman, "Communication Skills", OUP, 2016.
2. Kumar Sanjay and Pushp Lata, "Communication Skills", OUP, 2011.
3. Murphy Herta, "Effective Business Communication", McGraw Hill, 2017.
4. Kitty O Locker, "Business Communication- Building Critical Skills", McGraw Hill, 2013.
5. Lehman, Dufrene, Sinha, "BCOM" Cengage Learning, 2020.
6. K. Alex, "Soft Skills", S.Chand and Company, 2014.
7. Stanton Nicky, "Mastering Communication", Palgrave Master Series, 2009.
8. Alan Pease, "Body Language", Manjul Publications, 2014.
9. A. Kaul, "Effective Business Communication", Prentice Hall of India, 2015
10. Monippally, "Business Communication Strategies", Tata McGraw Hill, 2001.

Course Name: Engineering Mathematics-I

Course Code: BS02

Category: Basic Science

Preamble:

The objective of the course is to develop the basic Mathematical skills of engineering learners that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many fields of engineering and technology. learners impart knowledge of De-Moivre's Theorem, Hyperbolic Functions, and Logarithm of Complex Numbers. The course clarifies the concept of Partial Differentiation and its applications. The course will enable learners to learn basics of Successive Differentiation, Matrices, system of linear equations, Expansions of function and Transcendental Equations.

Pre-requisites:

Basics of Complex Numbers and Differentiation

Course Objective:

- To recall and remember basics of Complex, Successive differentiation and transcendental equations
- To apply methods to solve engineering problems.
- To solve and evaluate the problems using Complex, Successive differentiation and transcendental equations
- To analyze problems based on System of Linear Equations

Course Outcomes:

Learner will be able to:

CO1: Illustrate the basic concepts of Complex Numbers and solve problems involving different forms and properties of Complex Numbers.
CO2.: Apply the knowledge of complex numbers to solve problems in Hyperbolic Functions and Logarithmic function.
CO3: Illustrate the basic principles of Partial Differentiation, Homogeneous functions, and Composite functions.
CO4: Illustrate basic principles of Maxima and Minima and Successive Differentiation.
CO5: Apply principles of basic operations of Matrices, Rank, and echelon form of matrices to solve simultaneous equations.
CO6: Illustrate the concept of Transcendental Equations, linear algebraic equations, and Expansions of functions..

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100
Practical	-	-	-	-

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Complex Numbers	Statement of D'Moivre's Theorem. Expansion of sinn θ, cosnθ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ, Powers and Roots of complex numbers.	7
2	Hyperbolic Function and Logarithm of Complex Numbers	Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of Functions. Logarithmic functions, Separation of real andImaginary parts of Logarithmic Functions.	7
3	Partial Differentiation and Applications	Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function. Euler's Theorem on Homogeneous functions with two independent variables (with proof). Deductions from Euler's Theorem. Maxima and Minima of a function of two independent variables, Jacobians of two and three variables	8
4	Successive Differentiation & Expansion of Functions	Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and problems. Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series (Statement only).Expansion of sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x), log(1+x)	8
5	Matrices	Rank of a Matrix using Echelon forms, reduction to normal form and PAQ form. System of homogeneous and non–homogeneous equations, their consistency and solutions.	8

Module No.	Module Name	Content	No. of Hours
6	Numerical Solutions of Transcendental Equations and linear algebraic equations,	Solution of Transcendental Equations: Solution by Newton Raphson method and Regula – Falsi method. Solution of system of linear algebraic equations, by Gauss Jacobi Iteration Method, Gauss Seidal Iteration Method.	7
Total			**45**

Text Books:

1. Ramana B.V.,"Higher Engineering Mathematics",12th edition, Tata MCGraw Hill,2017

Reference Books:

1. Dr. B.S. Greswal ,"Higher Engineering Mathematics",9th Edition, Khanna Publication,2012
2. Erwin Kreysziq,"Advanced Engineering Mathematics",9th Edition,Wiley Eastern limited ,2012
3. Srimanta Pal and Subidh C. Bhunia ,"Advanced Engineering Mathematics", UK Edition, Oxford Press,2015
4. H.K. Das," Advanced Engineering Mathematics",17th Edition,S,chand,2008
5. Howard Anton and Christ Rorres "Elementary Linear Algebra with Applications",5th edition,John Wiley 2012

Course Name: Engineering Physics

Course Code: BS15

Category: Basic Science

Preamble:

Most of the engineering branches are being off spring of basic sciences where physics is playing a pivotal role in concept and understanding the foundation of core engineering branches. Physics prepares students to apply physics to tackle 21st century engineering challenges, and to apply engineering to address 21st century questions in physics.

The course will develop the student awareness in semiconductor devices and quantum Physics The student will develop an informed appreciation of the paradigm shift already in evidence in technologies behind modern services and products. He will possess basic physics knowledge to pursue simulation and modelling of the semiconductor systems.

Pre-requisites:

12th Std. Physics, Basic Mathematics

Course Objective:

- Identify and understand the fundamental physical principals underlying engineering devices and processes— a prerequisite to become successful engineers.
- To provide inclusive knowledge of fundamental physical principles encouraging engineering students to venture into the research field.
- To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.
- To give exposure to the topics of fundamental physics in semiconductor and Laser.

Course Outcomes:

Learner will be able to:

CO1: Identify various crystallographic planes and understand crystal defects.
CO2: Understand the band theory of solids and the carrier concentration in solids
CO3: Analyze the charge distribution and charge transport processes in semiconductors
CO4: Apply the knowledge of Fermi level in semiconductors and applications of semiconductors in electronic devices
CO5: Compare the properties of engineering materials for their current and futuristic frontier applications
CO6: Illustrate the working principle of various lasers and quantum processes

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Crystallography	Bravais Lattice, Lattice Characteristics, Miller - Indices, Planes and Directions, Interplanar spacing. Real crystals and crystal defects.	5
02	Semiconductor Physics	Band theory of solids, Classification of semiconductors. Fermi-Dirac statistics, carrier concentration in semiconductors. Concept of Fermi energy level, its position and variation with temperature and impurity concentration.	5
03	Semiconductor Conductivity	Intrinsic carrier density, mobility, and conductivity. Carrier diffusion, drift, and resistance. Electrical conduction in extrinsic semiconductor.,Diffusion length and mean lifetime. Hall Effect.	5
04	Semiconductor Devices	Physics of p-n junctions. Fermi level - in equilibrium, in forward and in reverse bias. Band bending in forward and reverse bias junction Introduction to two terminal devices – Rectifier diode, LED, Zener diode, PIN diode, Solar Cell, Schottky diode etc.	5
05	Engineering Materials and Applications	Liquid crystals: Nematic, Smectic and cholesteric phases, Liquid crystal display. Multiferroics: Type I & Type II multiferroics and applications. Magnetoresistive Oxides: Magnetoresistance, GMR and CMR materials. Introduction to spintronics.	4
06	Lasers	Radiation Matter Interactions, Einstein's coefficients. Basics of Laser- Population inversion, Pumping, Optical Resonator, Metastable state etc. Laser Beam Characteristics. Laser Systems - Ruby laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser. Engineering applications of Laser.	4

Module No.	Module Name	Module Contents	No. of Hours
07	Introduction to Quantum Physics	De Broglie hypothesis of matter waves; properties of matter waves. Physical interpretation of wave function Introduction to Schrodinger's equations	2
Total			**30**

Suggested List of Practicals:

1. Half Wave Rectifier
2. Full Wave Rectifier
3. Electric Motor
4. Transformer
5. Transistor as a switch
6. Transistor in CB and CE mode
7. Energy Band of a Semiconductor
8. Hall Effect
9. Light Emitting Diode
10. Solar Cell
11. Zener Diode
12. PN-junction diode
13. Wavelength of LASER using grating
14. Divergence of LASER beam
15. Grove depth of CD using LASER

Suggested Online Courses:

1. Physics of silicon solar cells Offered by École Polytechnique.
   https://www.coursera.org/learn/physics-silicon-solar-cells
2. Semiconductor Physics Offered by University of Colorado Boulder
   https://www.coursera.org/learn/semiconductor-physics

Text Books:

1. John Wiley ,S.M. Sze Physics of Semiconductor Devices,
2. Prentice Hall India, B. Streetman, and S. Banerjee, Solid State Electronics,
3. Narosa 2008 R.P. Feynman, "The Feynman Lectures on Physics (Vol. 1-3)",
4. Pearson Education 2013-I.S. Tyagi, "Principles of Quantum Mechanics",
5. D.J. Griffiths," Introduction to Quantum Mechanics"
6. R Shankar, second edition Principles of Quantum Mechanics,

Reference Books / Articles

1. http://dsc.discovery.com/tv-shows/curiosity/topics/10-ways-quantum-physics-will-change-world.htm
2. http://dsc.discovery.com/tv-shows/curiosity/topics/10-real-world-applications-of-quantum-mechanics.htm
3. Leonard I. Schiff, "Quantum Mechanics", McGraw Hill/ Asia, Edition 3

Course Name: Structured Programming

Course Code: ES04

Category: Engineering Science

Preamble:

To provide exposure to problem-solving by developing an algorithm, flowchart and implement the logic using C programming language.

Course Objectives:

1. The course aims to provide exposure to problem solving through programming
2. It aims to train students the basic concepts of C programming language
3. The course involves a lab component to give students hands on experience with the concepts
4. It aims to provide exposure to handling data through files

Course Outcomes:

Learner will be able to:

CO1: Understand the fundamentals of a programming language.
CO2: Apply the control structures for code optimization and hence improving efficiency.
CO3: Decompose a problem and solve it using modular programming.
CO4: Demonstrate the use of derived and user derived data types for collection and processing of data.
CO5: Understand the concept of pointers and files to solve the problems related to dynamic and persistent data.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of C	Character Set, Identifiers and Keywords, Data Types, Constants and Variables Operators, Math Library Functions, Expressions, Pre-processor Directives	4
2	Input and Output	Unformatted and Formatted I/0 Function scanf( ) Function printf( ) Concept of Field width, Precision and Flags Basic Programs Based on Computation	2
3	Control Structures	Conditional Branching - if, if-else statement, nested if-else, and switch-case statement. Looping – for loop, while and do-while loop, nested loops Unconditional Branching – break and continue statement	6
4	Functions	Introduction of Functions Declaration and definition of a Function Calling a Function and passing arguments to a Function Concept of Global and Local Variables Storage Classes –Auto , Extern , Static, Register Recursion	6
5	Arrays, Strings and Structures	Array-Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. String- Basic of String, Array of String , Functions in string. h Structure- Declaration, Initialization, Nested structure, Operation on structures, Array of Structure.	6
6	Pointers and Files	Pointer: Pointer Variables, Reference and Dereference Operators, void Pointer, Call by Reference, Pointer Arithmetic, Pointer to Pointer, Pointers and Array, Passing Arrays to Function, Array of Pointers and Dynamic Memory Allocation. Files: Types of File, File operation- Opening, Closing, Creating, Reading, Processing File.	6
Total			**30**

Suggested List of Practicals:

Learners are expected to perform minimum 12 practicals based on the following suggested topics.

Sr. No.	Suggested Topic(s)	Number of Experiments
1	Computation Based Programs	1

Sr. No.	Suggested Topic(s)	Number of Experiments
2	Programs using if .. else and nested if .. else	2
3	Programs using switch case	2
4	Programs using for loop	3
5	Programs using while loop	2
6	Programs on Functions	2
7	Programs on Recursion	2
8	Programs using 1D and 2D Arrays	3
9	Programs using Strings	2
10	Programs on Structures	2
11	Programs using Call by Reference	1
12	Programs using Dynamic Memory Allocation	1
13	Programs on Files	2

Text Books:

1. K. R. Venugopal and Sudeep Prasad, "Mastering C", Tata McGraw Hill.
2. Behrouz Forouzan "A Computer Science –Structure Programming Approaches using C", Cengage Learning.
3. Byron S. Gottfried, Schaum's outlines "Programming with C"- Tata McGraw Hill.

Reference Books:

1. M. G. Venkateshmurthy," Programming Techniques through C", Pearson Publication.
2. E. Balaguruswamy, "Programming in ANSI C ", Tata McGraw- Hill Education.
3. Pradeep Day and Manas Gosh "Programming in C", Oxford University Press
4. Yashwant Kanetkar "Let Us C", BPB Publication

Course Name: Basic Electrical Engineering

Course Code: ES08

Category: Engineering Sciences

Preamble:

This course introduces learners to basic techniques for electrical circuit analysis.

Pre-requisites:

1. Current Electricity, Electromagnetic Induction, Electromagnetism.
2. Complex numbers and Matrices

Course Objectives:

- To enable learners to gain understanding of the D.C circuit analysis and different network theorem
- To facilitate learners in developing the skills analysing single and three phase AC circuits.
- To create awareness of single-phase transformer working.
- To introduce electrical machines applications.

Course Outcomes:

Learner will be able to

1. Evaluate DC circuits using different network theorems.
2. Evaluate 1-Φ circuit and 3-Φ AC circuits.
3. Illustrate the constructional features and operation of 1-Φ transformer.
4. Understand different types of DC and AC motors.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	DC Circuits (Only Independent Sources)	Kirchhoff's Laws, Ideal and practical voltage and current Sources, Source Transformation, Star-Delta / Delta-Star Transformations, Mesh and Nodal Analysis, Superposition Theorem Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.	10
2	AC Circuits	AC Circuits: Generation of alternating voltage, basic definitions, average and R.M.S. values, phasor and phase difference, sums on phasors. Single-phase ac series and parallel circuits consisting of R, L, C, RL, RC, RLC combinations, definitions -real, reactive and apparent power, admittance (Y), Series and parallel resonance, Q factor	8
3	Three Phase AC circuits	Generation of Three-Phase Voltages, voltage & current relationships in Star and Delta Connections, Power Measurement	3
4	Single Phase Transformer	Working principle, EMF equation, Transformer losses, Comparison between Actual (practical) and ideal transformer, Performance parameters, Phasor diagram	5
5	Motors and applications	DC motors, AC motors, Servo motors, Stepper motors, BLDC and their applications.	4
Total			**30**

Suggested List of Practicals:

1. To measure output voltage across load resistor/current through load resistor and verify the result using Mesh and Nodal analysis.
2. To verify of Superposition Theorem.
3. To verify Thevenin's Theorem.
4. To verify Norton's Theorem.
5. To verify Maximum Power Transfer Theorem.
6. To find the resistance and inductance of a coil connected in series with a pure resistance
7. To find resonance conditions in a R-L-C series resonance circuit
8. To measure relationship between phase and line, currents and voltages in three phase system (star & delta)
9. To measure Power and phase in three phase system by two wattmeter method.
10. To find the equivalent circuit parameters by conducting OC and SC test on single phase transformer

Text Books:

1. V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
3. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
4. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
5. M. Naidu,S. Kamakshaiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004
6. B.R Patil "Basic Electrical Engineering" Oxford Higher Education, Revised Second Edition, 2018

Reference Books:

1. B.L.Theraja “Electrical Engineering “ Vol-I and II.
2. S.N.Singh, “Basic Electrical Engineering” PHI , 2011Book

Course Name: Engineering Mechanics

Course Code: ES02

Category: Engineering Science

Preamble:

To improve the skill sets to understand forces and motions associated with particles and rigid bodies. This course also imparts and inculcate students to understand force system and its effects.

Pre-requisites:

Basic Mathematics and Physics

Course Outcomes:

Learner will be able to:

CO1: Ability to understand and analyse forces, force systems and equilibrium.
CO2: Understand and verify law of Moments.
CO3: Determine the centroid of plane lamina.
CO4: Evaluate co-efficient of friction between the different surfaces in contact.
CO5: Understand and apply basic concepts of Kinematics of particles and kinematics of rigid bodies.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module name	Content	No. of Hours
1	System of Coplanar Forces	Introduction to Force and Force systems (Concurrent, Parallel and General coplanar force system), resolution composition and resultant of force systems. Principle of transmissibility of a force, Moment of force about a point, Couples, Varignon's Theorem. Force couple system.	6
2	Centroid	First moment of Area, Centroid of Regular composite plane Laminas	4
3	Equilibrium	Equilibrium of rigid beams: Free body diagrams. Conditions of equilibrium. Types of supports & types of loads. Determination of supports reactions for different types of loads on the beams.	5
4	Friction	Coefficient of static and dynamic friction, Laws of friction, Angle of Friction, Angle of Repose. Concept of Cone of friction. Equilibrium of bodies on horizontal & inclined plane.	4
5	Kinematics of Particle	Uniformly accelerated motion along straight line, motion under gravity, Projectile Motion.	7
6	Kinematics of Rigid Bodies	Introduction to different types of motion a Rigid body performs viz. Translation, Rotation and General Plane motion. Concept of Instantaneous Centre of rotation (ICR) for the finding velocity. Locating ICR for multiple link mechanism. Velocity analysis of rigid body using ICR.	4
Total			**30**

Suggested List of Practicals:

1. Verification of principle of moment /Bell crank Lever- By using simulation software
2. Determination of support reactions of simply supported beam -By using simulation software
3. Determination of coefficient of friction using inclined plane method - By using simulation software
4. Projectile Motion - By using simulation software
5. Verification of Law of Polygon of coplanar Forces- By using simulation software
6. Determine the Centroid of plane lamina - By using simulation software

Text Books:

1. A K Tayal, "Engineering Mechanics", 14th edition, Umesh Publication, 2010
2. K L Kumar, "Engineering Mechanics", 3rd edition, Tata McGraw-Hill, 2011
3. R. S. Khurmi, "Engineering Mechanics", 21st edition, S. Chand Publication, 2018

Reference Books:

1. R. C. Hibbeler, "Engineering Mechanics", 14th edition, Pearson Publication, 2020
2. Beer & Johnston, "Engineering Mechanics", 12th edition, Tata McGraw-Hill Education, 2019
3. F. L. Singer, "Engineering Mechanics", 2nd edition, Harper& Raw Publication, 1975
4. W. G. McLean & E. W. Nelson, "Engineering Mechanics", 12th edition, Tata McGraw- Hill Education, 2020
5. J. L. Meriam and L. G. Kraige, "Engineering Mechanics (Statics)", 7th edition, Wiley Books, 2011

Detailed Syllabus of First Year Semester-II

Course Name: Professional Skills

Course Code: HS02

Category: Humanities, Social Sciences and Management Courses

Preamble:

The course will groom learners in the areas of developing professional etiquettes, building digital profiles, imbibing workplace ethics, and organizational behavior. This course will also be an essential guide in building business communication and soft skills concepts.

Pre-requisites:

Effective Communication

Course Objectives:

- To introduce the concepts of the job application process and digital profile building.
- To create awareness of professional etiquettes and corporate culture in tune with 21st Century soft skills.
- To enable learners to enrich their personality through self-awareness and SWOT analysis and understand various interpersonal skills required for the workplace.
- To build the foundations of professional ethics and corporate social responsibility among learners.

Course Outcomes:

Learner will be able to:
CO1: Apply the traits of a suitable candidate for a job/higher education, upon being trained in the techniques of holding a group discussion, facing interviews and writing resume.
CO2: Acquire basic proficiency in building a digital profile by demonstrating an awareness of professional and ethical responsibilities.
CO3: Understand the nuances of professional etiquettes and professionalism.
CO4: Enrich their personality through SWOT analysis, identify their personality traits and learning styles
CO5: Develop interpersonal skills to build effective professional relations.
CO6: Demonstrate awareness of contemporary issues, knowledge of ethical responsibilities and CSR.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Employment Skills	Job Application & Resume Writing Group Discussion Interview Skills Digital Profile Building (ePortfolio, LinkedIn)	10
2	Professional Etiquettes	Corporate Grooming and Workplace Etiquette Telephone Etiquette Netiquettes Digital Footprints, Social Media, Personal Profile Privacy	4
3	Interpersonal Skills	Assertiveness, Negotiation Leadership, Team Building Problem Solving, Decision Making Cultural and Emotional Intelligence	6
4	Ethics	Introduction to Ethics Plagiarism and Online Plagiarism Checker Patents Trademark and Copyrights and GI – Geographical Indicators Professional Ethics Corporate Social Responsibility (CSR) Information Confidentiality	4
5	Personality Enrichment	SWOT Analysis and JOHARI window Developing Positive Attitude Personality Types and Learning Styles Vision and Goal Setting Stress Management and Time Management	4
6	21st Century Skills	Creative Thinking Critical Thinking Collaboration and Communication	2
Total			**30**

Suggested list of Practicals:

1. Icebreakers – Introducing others
2. GD Practice Session
3. Final GD
4. Digital Profiling

5. Role Play on Professional Etiquettes
6. Personality Enrichment
7. Seminar on Interpersonal Skills
8. Case Studies on Ethics

Suggested list of Assignments:

1. Draft a Cover Letter and a Resume in response to a job vacancy advertisement (Individual)
2. Role plays and documentation on Professional Etiquettes (Group)
3. Role Play and documentation on Interpersonal Skills (Group)
4. Analysis of case studies on Ethics (Individual)
5. SWOT Analysis (Individual)
6. Assignment on 21st Century Skills Group)

Suggested list of Online Courses:

1. LinkedIn Mastery: Creating an awesome profile - https://www.udemy.com/course/linkedin-mastery-creating-an-awesome-profile/
2. Soft Skills: The 11 Essential Career Soft Skills - https://www.udemy.com/course/soft-skills-the-11-essential-career-soft-skills/
3. Understanding Personality Types at Work - https://www.udemy.com/course/understanding-personality-types-at-work/
4. Speak English Professionally: In Person, Online & On the Phone - https://www.coursera.org/learn/speak-english-professionally
5. How to Write a Resume (Project Centered Course) https://www.coursera.org/learn/how-to-write-a-resume
6. Interviewing and Resume Writing in English Specialization https://www.coursera.org/specializations/english-interview-resume
7. Build Your Professional ePortfolio in English - https://www.coursera.org/learn/eportfolio-english

Reference Books:

1. Wallace and Masters, "Personal Development for Life and Work", Thomson Learning, 2021.
2. Dr. K.Alex, "Soft Skills", S. Chand and company, 2014.
3. Robbins Stephens, "Organizational Behaviour", Pearson Education, 2016.
4. Dorch, Patricia, "What Are Soft Skills?", Executive Dress Publisher, NewYork, 2013.
5. Francis Peter, "Soft Skills and Professional Communication", Tata McGraw Hill, 2019.
6. Kitty O Locker, "Business Communication- Building Critical Skills", McGraw Hill, Sixth Edition.
7. Chaturvedi and Chaturvedi, "Business Communication - Concepts Cases and Applications", Pearson, 2021.
8. Jones, "How to Speak Fluently", Indian Publishing House, 2021.

Course Name: Engineering Mathematics-II

Course Code: BS04

Category: Basic Science

Preamble:

The objective of the course is to develop the basic Mathematical skills of engineering learners that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many fields of engineering and technology, impart fundamental knowledge of Differential Equations of First Order, Higher Order, Special functions like Beta and Gamma Function, Double and Triple Integration, DUIS, Rectification, Numerical solutions of Differential Equations and Numerical Integration.

Pre-requisites:

Fundamentals of Integration and Differential Equations.

Course Objective:

- To recall and remember basics of differential equations, integral Calculus
- To apply methods to solve engineering problems.
- To solve and evaluate the problems using Multiple Integration, Numerical Integration.
- To analyze problems based on Numerical Methods for solving differential Equations

Course Outcomes:

Learner will be able to:

CO1: Illustrate the concept of Exact Differential equation and solution of various types of First Order First Degree Differential Equations.

CO2: Illustrate the concept of Complementary Function and Particular Integral and solution of Linear Differential Equations with constant coefficients.

CO3: Illustrate the concepts of Beta, Gamma function and DUIS .

CO4: Illustrate the concept of Double Integral in Cartesian and Polar form, change the order of Integration, Evaluate Double Integral over a given region.

CO5: Illustrate the concept of changing to polar coordinates in double integrals. Application of double integrals to compute Area, Evaluation of Triple Integration.

CO6: Illustrate the concept of Numerical solution of Ordinary Differential Equation, and Numerical integration using various methods.

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Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100
Practical	-	-	-	-

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Differential Equations of FirstOrder and First Degree	Exact differential Equations, Equations reducible to exact form by using integrating factors. Linear differential equations (Review), equation reducible to linear form, Bernoulli's equation	7
2	Linear Differential Equations with Constant Coefficients andVariable Coefficients of Higher Order	Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax}, $\sin(ax+b)$, $\cos(ax+b)$, x^m, $m\ is\ positive\ integer$, $e^{ax}V$, $x.V\ or\ X$. Method of variation of parameters	8
3	Beta and GammaFunction and Differentiation under Integral Sign	Beta and Gamma functions and its properties. Differentiation under integral sign with constant limits of integration.	7
4	Multiple Integration-1	Double integration-definition, Evaluation of Double Integrals. (Cartesian & Polar), Evaluation of double integrals by changing the order of integration. Evaluation of integrals over the given region. (Cartesian & Polar)	8
5	Multiple Integration-2	Evaluation of double integrals by changing to polar coordinates. Application of double integrals to compute Area, Triple integration definition and evaluation (Cartesian, cylindrical and spherical polar coordinates).	8
6	Numerical solution of ordinary differential equations of firstorder and firstdegree, andNumerical Integration	Numerical solution of ordinary differential equation using Euler's method and Runge-Kutta fourth order method Numerical integration-by Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th rule .	7
Total			**45**

Text Books:

1. Ramana B.V.,"Higher Engineering Mathematics",12th edition, Tata MCGraw Hill,2017

Reference Books:

1. Dr. B.S. Greswal, "Higher Engineering Mathematics",9th Edition,Khanna Publication,2012
2. Erwin Kreysziq ,"Advanced Engineering Mathematics",9th Edition,Wiley Eastern limited ,2012
3. Srimanta Pal and Subidh C. Bhunia ,"Advanced Enginering Mathematics", UK Edition, Oxford Press,2015
4. H.K. Das," Advanced Engineering Mathematics",17th Edition, S. Chand,2008
5. Howard Anton and Christ Rorres "Elementary Linear Algebra with Applications",5th Edition, John Wiley 2012

Course Name: Engineering Chemistry

Course Code: BS16

Category: Basic Science

Preamble:

This course imparts learners sound knowledge on the fundamentals of chemistry which can be applied in various courses and projects taken in Electronics and Computer Science, Electronics and Telecommunication and Biomedical Engineering.

Pre-requisites:

Basic Chemistry

Course Objectives:

1. The contents of this course will aid in quantification and understand the applications of several concepts in Chemistry.
2. To appreciate the need for and importance of engineering chemistry for industrial and domestic use.
3. To gain the knowledge on existing and future upcoming materials used in device fabrication.
4. To impart knowledge of green chemical technology and its applications.
5. To enhance the thinking capabilities in line with the modern trends in engineering and technology.

Course Outcomes:

Learner will be able to:

CO1: Interpret properties, synthesis, and uses of important materials in various engineering applications.
CO2: Apply the fundamentals of electrochemistry in prevention & control measures related to corrosion of structures and devices.
CO3: Rationalise different types of batteries and their real-life engineering applications.
CO4: Analyse different spectroscopic techniques and study fundamentals of electromagnetic spectrum.
CO5: Associate Green Chemistry principles in product development knowledge.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Polymer Chemistry	Introduction to Polymer, Properties of Polymers- Molecular weight, numerical problems on molecular weight, Glass transition temperature Methods of polymerization, Synthesis, Properties and Uses of commercially important polymers, Study of Speciality polymers like Conducting polymers, Liquid Crystal Polymer etc., Applications of Polymers	6
2	Electrochemistry and Corrosion	Electrochemistry- Basics, Types of electrochemical cells, Electrochemical series and Galvanic series, Nernst equation, Numerical problems, Construction & Application of various electrodes Corrosion- Chemical and Electrochemical corrosion, Mechanism, Types- Differential aeration, Galvanic, Stress, Intergranular, Microbial, Soil corrosion etc., Prevention and control Measures, Case studies like- Corrosion in human body implants & Corrosion in electronic gadgets	6
3	Energy Storage systems	Fundamentals of Energy storage, primary cells and secondary cells, Types of Batteries, Construction and application of Li-Ion battery Fuel cells- principle, components of fuel cell, types of fuel cell, applications, advantages and disadvantages, hydrogen production and hydrogen storage system Numerical problems	4
4	Chemistry of Semiconductors	Silicon & Germanium - Physical and chemical properties, Isotopes, Chemistry of compounds like GaAs, GaP, InP. InGaAs, ZrO, HfO and applications in industry	3
5	Engineering Materials	Nanomaterials: Introduction, Graphene, Fullerenes, Carbon nanotubes, Electronic and Mechanical properties, Synthesis of CNT, Role of nano materials in electronics, Photonics, MEMS, Energy Nano-bio application Composite Materials: Types, properties, and industrial applications Shape Memory alloys: Principle, properties, super elasticity- One way and two-way shape memory effect, Austenite and martensite transformations, applications	5

Module No.	Module Name	Content	No. of Hours
		Smart Materials: Self-Assembled Nanostructures - Energy Harvesting Materials, Intelligent Materials – Magneto strictive Materials	
6	Spectroscopic techniques	Fundamentals of Spectroscopy, Electromagnetic spectrum, Different Forms of Spectroscopy, Beer-Lambert's law-Numerical problems, Techniques, Instrumentation and applications in Medicines and electronics	4
7	Green Chemistry	12 Principles of Green Chemistry & application in green computing & Green Electronics, Numerical problems	2
Total			**30**

Suggested List of Practicals:

1. To determine free acid pH of different solutions using pH meter
2. To determine the Wavelength of Maximum Absorbance using colorimeter.
3. To determine metal ion concentration using colorimeter.
4. To determine Molecular weight of polymers by Oswald Viscometer.
5. To synthesize UF, PF, Nylon 66.
6. To synthesize biodegradable polymer.
7. To determine Viscosity of oil by Redwood Viscometer
8. To separate pigments using paper chromatography.
9. To determine total, temporary, and permanent hardness of water sample by EDTA method.
10. To construct the battery and measure potential difference across two terminals
11. To identify the materials and learn their properties
12. To set up a galvanic cell
13. To set up an electrolytic cell and carry out electroplating
14. To carry out etching of the Printed Circuit Board (PCB)
15. To synthesize a nanomaterial and study its characterization
16. To detect the adulteration in given milk sample
17. Virtual experiment on Nanomaterial using open-source tool- www.nanohub.org
18. Virtual experiments using open-source tool - https://vlab.amrita.edu

Text Books:

1. Shashi Chawla, "A Textbook of Engineering Chemistry", Dhanpat Rai & Co. (PVT.) LTD., New Delhi (2004).
2. S. S. Dara, "Engineering Chemistry", Chand & Co, New Delhi (2006)
3. Jain and Jain, "Engineering Chemistry", Dhanpat Rai & Co (PVT.) LTD, New Delhi (2006).

Reference Books:

1. B.R. Puri and L.R. Sharma, "Principles of Physical Chemistry", 45th Edition, Vishal Publishing Co. 2012.
2. Peter Atkins, Physical Chemistry, XI th ed, Oxford, United Kingdom, Oxford University Press, 2017
3. Green Chemistry: A textbook- V. K. Ahluwalia, Alpha Science International
4. Concise Inorganic Chemistry – J. D. Lee

5. V.R.Gowariker, "Polymer Science", New Age International Publication
6. S.K.Kulkarni, "Introduction to Nanotechnology"
7. Fundamentals of Molecular Spectroscopy (4th edition)- C. N. Banwell, Elaine M. McCash, Tata McGraw Hill.
8. Elementary Organic Spectroscopy- Y.R. Sharma, S. Chand and Co.
9. William D. Callister, Materials Science and Engineering: An Introduction, Wiley
10. Mel Schwartz, Smart Materials, CRC Press New York, 2009
11. Dimitris C. Lagoudas, Shape Memory Alloys, Springer, New York, 2008
12. Micky Rakotondrabe, Smart Materials- Based Actuators at Micro/Nano-Scale, Springer

Course Name: Engineering Graphics

Course Code: ES01

Category: Engineering Science

Preamble:

To improve the visualization skills of the students, with imparting the student's ability to read a drawing. This course also imparts and inculcate students to understand the theory of projection.

Pre-requisites: Basic Geometry

Course Outcomes:

Learner will be able to:

CO1: Understand conventional method and usage of CAD software.
CO2: Apply the basic principles of projections and visualization to communicate ideas graphically.
CO3: Construct the drawing of curves, points, straight lines, and planes using concept of projections.
CO4: Interpret the three-dimensional pictorial objects and represent in two-dimensional views.
CO5: Construct three dimensional shapes from two dimensional views using the concept of projections.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	**ISA**	**MSE**	**ESE**	**Total**
Theory	15	20	40	75
Practical	25	-	25	50

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Engineering Graphics and CAD	Introduction and importance of engineering graphics. Introduction of different types of the quadrants, method of projection, lines and dimensioning. Drawing instruments and their usage. Introduction Computer Aided Design and Drafting (CADD or CAD) software and operations, menu system and toolbars.	3
2	Engineering Curve	Basic construction of cycloid, involutes, and helix of cylinder.	4
3	Projection of points, lines	Projections of lines, inclined to both the reference planes HP and VP as per the first angle projection method.	4
4	Projection of Planes	Projection of rectangular, triangular, square, pentagonal, hexagonal, and circular planes, inclined to both the reference planes HP and VP as per the first angle projection method.	4
5	Orthographic Projections	Drawing orthographic views from pictorial projections. Sectional orthographic Projections of a simple machine part as per the first angle projection method. - By drafting in the sketchbook as well as on CAD software. CAD Drawing: Applying dimensions to objects, applying annotations to drawings, setting up and use of layers, changing of the line properties, Printing setup and procedure. Different CAD Tools and usage- Draw tools, modify tools, properties, copy selection, dimensioning and editing (text height and arrow size).	9
6	Isometric Views	Drawing Isometric views from given views of simple blocks with plane, cylindrical surfaces, and circular holes. - By drafting in the sketchbook as well as on CAD software CAD Drawing: Switching to isometric drafting mode, switch /change to different ISO planes, ISO circles on different ISO planes, Different CAD Tools and usage- Draw tools, Modify tools, Properties of line.	6
Total			**30**

Suggested List of Practicals:

Learners are expected to perform minimum 12 practicals based on the following suggested topics, using Computer Aided Design (CAD) tool.

Sr. No.	Suggested Topic(s)	Number of Practicals
1	Orthographic Projection (Without Section)	4
2	Orthographic Projection (with section)	4
3	Isometric Views	4
4	Problem Based Learning (PBL) on AutoCAD	2

Text Books:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", 53rd Edition, Charotar Publishing House Pvt. Ltd., 2014
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing",50th edition, Charotar Publishing House Pvt. Ltd. 2014
3. Dhananjay A Jolhe, "Engineering Drawing" 1st edition, Tata McGraw Hill, 2017

Reference Books:

1. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies): Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi, 2012
2. "Learning AutoCAD", Autodesk Official Training Guide, 2009

Course Name: Object Oriented Programming

Course Code: ES05

Category: Engineering Science

Preamble:

The course aims to advance learners knowledge in problem solving and programming principles for real world applications through object-oriented programming using Java language. The course emphasizes data abstraction and object-oriented programming design through the implementation of classes, objects and related concept like Inheritance, Polymorphism, Exception Handling, Multithreading and Applets.

Course Objectives:

1. The course aims to provide exposure to problem solving through object oriented programming
2. It aims to train students the basic concepts of Java programming language
3. The course involves a lab component to give students hands on experience with OOP concepts
4. It aims to provide exposure to develop a web based application

Course Outcomes:

Learner will be able to:

CO1: Apply fundamental Programming Constructs.
CO2: Illustrate the concept of packages, classes, and objects.
CO3: Elaborate the concept of strings, arrays, and vectors.
CO4: Implement the concept of inheritance and interfaces.
CO5: Implement the notion of exception handling and multithreading.
CO6: Develop webI based applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Practical	25	-	25	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Java	Features of Java, Platform Independence – Byte Code, JVM, JRE. Data Types Operators, Control Structures, Static Data, Static Function, 1D Array and 2D Array	5
2	Object Oriented Programming	Classes and Objects, Instance Variables, Constructors Object Passing Methods Method Overloading, Array of Objects	4
3	Inheritance	Concept and Types Constructors in Inheritance Method Overriding and Dynamic Method Dispatch, abstract and final keyword Interfaces – Concept and Significance Wrapper Classes – String, StringBuffer, Vector	8
4	Exception Handling	Concept of Exception, Types –Checked and Unchecked Use of throws keyword. try-catch-finally keywords. Throwing Exception manually User Defined Exceptions	5
5	Multithreaded Programming	Creating Thread – Different Methods Using Thread Methods, Thread Exceptions, Priorities Life Cycle of Thread Synchronization	5
6	Packages and Applets	Inbuilt Package, Importing Packages User Defined Packages, Naming Packages, Advantages of Packages Applet Basics, Applet Life Cycle Applet Drawing Methods,	5
		Total	**30**

Suggested List of Practicals:

Learners are expected to perform minimum 12 practicals based on the following suggested topics.

Sr. No.	Suggested Topic(s)	Number of Practicals
1	Programs on Basic programming constructs like branching and looping	2
2	Program on accepting input through keyboard	2
3	Programs on class and objects	2
4	Program on method and constructor overloading.	2
5	Program on Packages	1
6	Program on 2D arrays, strings functions.	2

Sr. No.	Suggested Topic(s)	Number of Practicals
7	Program on String Buffer and Vectors.	2
8	Program on types of Inheritance.	1
9	Program on Multiple Inheritance.	1
10	Program on abstract class and abstract methods.	1
11	Program using super and final keyword.	1
12	Program on Exception handling.	2
13	Program on user defined exception.	2
14	Program on Multithreading.	3
15	Program on Graphics class.	2
16	Program on applet class.	2

Text Books:

1. Herbert Schildt "JAVA: The Complete Reference", Oracle Press
2. Sachin Malhotra and Saurabh Chaudhary, "Programming in JAVA", Oxford University Press

Reference Books:

1. Ivor Horton "Beginning JAVA", Wiley, India
2. Dietal and Dietal "Java: How to program", Prentice Hall
3. Stevan Jolzner" JAVA Programming- Black Book", Dreamtech Press
4. Demics "Learn to Master Java Programming script", Staredu Solutions.

Detailed Syllabus of General Education Courses

Course Name: Design Thinking

Course Code: GE01

Category: General Education

Preamble

Design thinking is a powerful tool for rethinking and revitalizing strategy—and for driving organizational performance. By placing customers' needs at the center of a product, service, process, or business model, you can reframe strategic challenges and develop more effective solutions. Drawing on right-brained creativity and left-brained analytics, the course on design thinking enables you to broaden your strategic perspective, find novel opportunities for innovation, and keep your business moving forward

Pre-requisites:

NIL

Course Objectives:

- To provide knowledge on the concepts of Design Thinking
- To impart knowledge on the phases of Design Thinking
- To apply Design Thinking concepts

Course Outcomes:

Learner will be able to:

1. Understand the concepts of design thinking approaches
2. Create design thinking teams and conduct design thinking sessions
3. Apply both critical thinking and design thinking in parallel to solve problems
4. Apply design concept to their daily work

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
2	2	2	1

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075
Tutorial	50	-	-	050

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Design Thinking Overview	What is different about design thinking, Design thinking skills, Design thinking mindset, Principles of Design thinking	2
2	General Approaches to Design Thinking	The basics of Design thinking, Design thinking frameworks, Design thinking team, Design thinking workshops and meeting – Characteristics and types	4
3	Design Thinking approach in stages	Apply design thinking framework, emphasize with customers/users, Define the problem, Ideate, Prototype, Test solution.	7
4	Design Thinking Techniques	Listening and emphasizing techniques – Engagement, Observation, showing empathy, Define and ideation techniques – Unpacking, Personas, Pattern recognition and connecting the dots, Prototype, and testing techniques – Types of prototypes, forms of testing in design thinking,	7
5	General Design Thinking Practices	Use of diagrams and maps in design thinking – empathy map, affinity diagram, mind map, journey map. Story telling techniques – Improvisation, scenarios, K-scripts	8
6	Adopt and Adapt Design thinking	Cautions and pitfalls – assumptions, pitfalls and cautions in design thinking workgroups, Best practises	2
Total			**30**

Reference Books:

1. Tim Brown "Change by Design - How Design Thinking Transforms Organisations and Inspires Innovations "
2. Larry J.Leifer, Michael Lewerick, and Patrick "The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods"

Course Name: Indian Constitution

Course Code: GE06

Category: General Education

Preamble:

This course introduces learners to the framework that demarcates fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens.

Pre-requisites:

NIL

Course Objective:

- To Understand what a constitution is and why it is necessary
- To Understand how constitution embodies certain ideals
- To understand the importance of fundamental rights as well as fundamental duties.
- To understand functioning of parliament

Course Outcomes:

Learner will be able to:

CO1: learner will be able to understand constitution principles
CO2: learner will be able to co-relate with political system
CO3: learner will be able to pursue the values of civic life
CO4: learner will be able to exercise their rights and duties

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075
Practical	-	-	-	-

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction	Historical background of constitution, Philosophy of constitution	3
		Citizenship at the commencement of the Constitution, Rights of citizenship of certain persons of Indian origin residing outside India, Persons voluntarily acquiring citizenship of a foreign State not to be citizens, Continuance of the rights of citizenship, Fundamental Duties	4
3	Fundamental Rights	Definition, Laws inconsistent with or in derogation of the fundamental rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Core issues (Uniform civil code, Article 370, Reservation)	4
4	Directive Principles of State Policy	Definition, Certain principles of policy to be followed by the State, Equal justice and free legal aid, Organisation of village panchayat, Right to work, to education and 10 public assistance in certain cases, Provision for just and humane conditions of work and maternity relief, Living wage, etc., for workers, Participation of worker; in management of industries, Uniform civil code for the citizens, Provision for free and compulsory education for children, Promotion of educational and economic interests of Scheduled Castes, Scheduled Tribes and other weaker sections, Protection and improvement of environment and safeguarding of forests and wild life, Protection of monuments and places and objects of national importance, Separation of judiciary from executive, Promotion of international peace and security	4
5	The Parliament	Constitution of Parliament, Composition of the Council of States, Composition of the House of the People, Duration of Houses of Parliament, Rights of Ministers and Attorney-General as respects Houses, Law making procedure, Amendment process and language	4
6	Judiciary	Establishment and Constitution of Supreme Court, High Courts for States, Subordinate Courts, Working of quasi – judicial bodies	4
7	Elections	Superintendence, direction and control of elections to be vested in an Election Commission, Power of Parliament.to make provision with respect to elections to Legislatures, Power of Legislature of a Slate to make provision with respect to elections to such Legislature Bar to interference by Couns in electoral matters	4
8	Landmark cases	Nanavati case, Shah Bano, Keshvanand Bharti, Vishakha Case etc	3
Total			**30**

Suggested Online Courses:

1. Constitutional Studies
   https://onlinecourses.nptel.ac.in/noc20_lw03/preview
2. Constitution of India
   https://www.udemy.com/course/constitution-of-india/

Reference Books:

1. D.C. Gupta – Indian Government and Politics
2. D.D. Basu – Introduction to the Constitution of India
3. P. M. Bakshi - The Constitution of India
4. M. V. Pylee - Constitutional History of India

Course Name: Universal Human Values

Course Code: GE07

Category: General Education

Preamble:

The present education system has become largely skill-based. The prime emphasis is on science and technology. However, science and technology can only help to provide the means to achieve what is considered valuable in terms of facilities. Value Education is a crucial missing link in the present education system. Because of this deficiency, most of our efforts may prove to be counterproductive and serious crises at the individual, societal and environmental level are manifesting.
Values and skill complement each other. Values mean importance or participation and skills mean qualities, training, and capabilities. To fulfil our aspirations both values and skills are necessary. When we identify and set the right goals and produce in right direction, this is known as value domain, the domain of wisdom. Basically we must know what really is useful to achieve human happiness, the happiness to all and for all the time.
And when we learn and practices to actualize this goal to develop the techniques to make this happen in real life, in various dimensions of human Endeavour, this is known as domain of skills. Hence, there is an essential bonding between values and skills for the success of any human endeavour.
For a happy and successful life it is important to know, explore, verify and practice universal human values, professional ethics.

Course Objectives:

- To help the student to see the need for developing a holistic perspective of life.
- To sensitize the student about the scope of life – individual, family, society and nature/existence.
- Strengthening self-reflection.
- To develop more confidence and commitment to understand, learn and act accordingly.

Course Outcomes:

Learner will be able to:

CO1: Learner will become more aware of themselves and their surroundings.
CO2: Learners will be more responsible in life and will able to handle critical problems.
CO3: Learners will develop better critical ability.
CO4: Learners will be more sensible towards commitment.
CO5: Learner will be able to apply human values in day to day life.
CO6: Learner will become a responsible citizen..

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075
Practical	-	-	-	-

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Value Education	Need for Value Education, Basic Guidelines for Value Education, The Content of Value Education,The Process of Value Education, Starting to observe inside What is Self-exploration? What is its Purpose? Content of Self-exploration, Process of Self-exploration Natural Acceptance, What is the State today? What is the way out? What do we need to do?	5
2	The Basic Human Aspirations Continuous Happiness and Prosperity	Continuous Happiness and Prosperity Our Basic Aspirations Exploring Happiness and Prosperity A Look at the Prevailing Notions of Happiness and Prosperity, Some Possible Questions/Confusions Basic Requirements for Fulfilment of Human Aspirations What is our State today?, Why are we in this State? - Living with Wrong Assumptions, What is the Solution? The Need for Right Understanding Our Program: Understand and Live in Harmony at all Levels of Living , Our State today Our Natural Acceptance for Harmony at all Levels of our Living , Human and Animal Consciousness	5
3	Understanding the Human Being as Co-existence of Self ('I') and Body	Human Being is more than just the Body Understanding Myself as Co-existence of the Self and the Body ,Understanding Needs of the Self and Needs of the Body, Understanding the Activities in the Self and the Activities in the Body, Understanding the Self (I) as the Conscious Entity, the Body as the Material Entity Exercise on distinguishing Needs of the Self ('I') and Body Exercise on Distinguishing Activities of the Self (I) and Body Understanding the Body as an Instrument of 'I' (I' being the Seer, Doer and Enjoyer)	5

Module No.	Module Name	Content	No. of Hours
		Why should I study Myself?, Getting to know the Activities in the Self (I) How are the Activities in T Related! The Activities in 'I' are Continuous Effects of the Problem.... What then is the Solution? Result of Realization and Understanding Living with Definiteness Our Body A Self-organized Unit Harmony of T with the Body: Sanyama and Svasthya What is our State today? What is the way out? Understanding and Living with Sayama Correct Appraisal of our physical needs	
4	Harmony in the Family, Society,Nature-Understanding Values in Human Relationships	Family as the Basic Unit of Human Interaction, Harmony in the Family.Justice (Nyaya),What is the State today? Values in Human Relationships,Trust (Visvasa) Respect (Sammana) The Basis for Respect Assumed Bases for Respect Today The Problems due to Differentiation Difference between Attention' and 'Respect' What is the way out? Affection (Sneha) Care (Mamand) Guidance (Vatsalya) Reverence (Shraddha) Glory (Gaurava) Gratitude (Kritagayta) Love (Prema) Harmony from Family to World Family: Undivided Society Extending Relationship from Family to Society Identification of the Comprehensive Human Goal Where are we today? Programs Needed to Achieve the Comprehensive Human Goal: The Five Dimensions of Human Endeavour Education-Right Living (Siksha Sanskara) Health-Self-regulation (Svasthya-Sanyama) Justice-Preservation (Nyaya-Suraksha) Production-Work (Utpadana-Karya) Exchange-Storage (Vinimaya-Kosa) What is our State today? Harmony from Family Order to World Family Order: Universal Human Order The Four Orders in Nature Interconnectedness and Mutual Fulfilment (Parasparta aur Paraspara Purakata) Recyclability and Self-regulation in Nature Undertanding the Four Orders Things (Vastu) Activity (Kriya) Innateness (Dharana) Natural Characteristic (Sabha) ,Basic Activity,Conformance Human Beings-our State today	5

Module No.	Module Name	Content	No. of Hours
		What is way out	
5	Implications of the Right Understanding	Values in Different Dimensions of Human Living Universal Values naturally emerging from the Right Understanding Definitiveness of Ethical Human Conduct Identification of Snama leading to Svatantrata and Swarajya Development of Human Consciousness Implications of Value-based Living Identification of Comprehensive Human Goal Vision for the Holistic Alternative Basis for Humanistic Education and Humanistic Constitution Universal Human Order and its Implications	5
6	Professional Ethics Journey towards the Holistic Alternative	Profession-In the Light of Comprehensive Human Goal Ensuring Competence in Professional Ethics- The current Scenario Inherent Contradictions and Dilemmas and their Resolution Appreciating the Need for Self-Exploration Facilitating the Understanding of Harmony at various Levels Steps for Evolution at the Individual Level Steps for Transition at the Level of Family Society and Profession Promoting Mass Awareness and moving towards Humanistic Education Evolving Holistic Models of Living Amending Policies, Programs and Social Systems in tune with Comprehensive Human Goal Is the Transition too Difficult? Concluding Remarks	5
Total			**30**

Reference Books:

1. A Foundation course in Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria Excel books.

Course Name: Indian Traditional Knowledge System

Course Code: GE08

Category: General Education

Preamble:

India has a vast tradition of Sanskrit texts dealing with various scientific thoughts. Number of treatises on the topics like Agriculture, Animal Husbandry, Chemistry, Astronomy, Mathematics, Botany, etc. focus on the development of thoughts in the concerned area.

This course aims at introducing a student with various treatises on physical as well as social sciences and their contribution to modern branches of sciences. Taking into consideration the vast scope of these sciences, major treatises will be introduced in the course thereby making a student to ponder over the ancient knowledge systems of India.

Pre-requisites:

NIL

Course Outcomes:

- To facilitate the learners with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system.
- It aims at imparting basic principles of thought process, reasoning and inference

Course Outcomes:

Learner will be able to:

CO1: Understand and the rich history of Indian knowledge system
CO2: Understand the different areas of contribution from India.
CO3: Apply the different principals of traditional knowledge in modern systems.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Evaluation Scheme:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	50	075
Practical	-	-	-	-

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Review of Scientific Literature in Sanskrit	References of sciences/scientific knowledge through different textual sources etc.	6
2	Chemistry and Mathematics	Various treatises on Chemistry, Use of chemistry in medicines, Metallurgy, Use of chemistry for occult practices, Mathematical concepts through Shulbasutras, Development of different mathematical branches and treatises based on that, Development of astronomy, etc.	15
3	Dietetics	Study of different texts based on culinary art Nalapakadarpana, Bhojanakutuhalam, Supashastra, Modes of preservation of food, Dietary guidelines through branches of Ayurveda, Food and diseases, etc.	5
4	Agriculture, Astronomy, and Zoology	Study of krishisuktas, Krishiparashara, Brihatsamhita, Types of crops, Manures, Types of land- devamatruka, nadimatruka, Indian Astronomy, Use of animals in warfare, Animal husbandry, Animals for medicines, etc.	4
Total			**30**

Reference Books:

1. Nirmal Trikha "Scientific Knowledge in Sanskrit Literature"
2. S. Balachandra Rao "Indian Astronomy: An Introduction"
3. B. Seal "Ancient Indian Sciences"
4. Melissa Stewert "Science in Ancient India (Science of the Past)"
5. India's Contribution to World Culture – SudheerBirodkar
6. Ancient India – R. C. Majumdar
7. Ancient Indian Sciences – Swami ChidatmanJee Maharaj
8. Nalini sadhale, H. V. Balkundi and Y.L.Nene "KrishiParashara – Agriculture by Parashara " Asian Agri-History Foundation
9. Stella Kramrisch "The Art of India through the Ages"
10. K.Krishna Murthy "Early Indian Secular Architecture"
11. Raman Sukumar "The Asian Elephant: Ecology and Management" Cambridge University Press

Appendix-A

List of courses under General Education Courses

Sr. No.	Course Code	Course Title	Hours Per Week			Credits	Preferred Semester
			Lecture	Practical	Tutorial		
1	GE01	Design Thinking	2	-	1	3	2
2	GE02	Social Service Internship/ Project	-	6	-	3	3
3	GE03	Internship with other Institutes (Credit Transfer)	2	4	-	4	SE Break
4	GE04*	Wellness – Body, Mind & Spirit	1	2	-	2	Any
5	GE05*	Basics of Finance & Legal aspects for Business	2	-	-	2	Any
6	GE06*	Indian Constitution	2	-	-	2	Any
7	GE07*	Universal Human Values	2	-	-	2	Any
8	GE08*	Indian Traditional Knowledge System	2	-	-	2	Any
9	GE09*	Corporate and Social Etiquettes	2	-	-	2	Any
10	GE10*	Global Citizenship Education	2	-	-	2	Any

Note:

GE01, GE02 and GE03 are mandatory and will be offered by the department as per the programme scheme.

***A subset of courses from GE04 to GE10 shall be offered against GEXX* (recommended to be taken in Semester 1and 2 of B.Tech. Biomedical Engineering programme). However, the subset will depend on the GE courses made available by the institute for that semester.**