Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

NEP Compliant Structure & Syllabus

of

Department of Engineering, Sciences & Humanities (DESH)

Pattern 'A-23'

F. Y. B. Tech.

Effective from Academic Year 2023-24

Prepared by: - Board of Studies in Engineering, Sciences & Humanities

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Dean Academics   **Chairman Academic Board**

Contents

Program Outcomes

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

Academic Information – Please visit www.vit.edu

Module 1 - Semester 1 and 2							
Course Code	**Course Name**	**Type**	**Teaching Learning Scheme**				
			Th	**Tut**	**Lab**	**Hrs. / Week**	**Credits**
Module I (M1) Courses							
ES1051	Problem Solving and Programming	ESC	3	0	2	5	4
ES1054	**Discrete Mathematics**	**BSC**	**3**	**1**	**0**	**4**	**4**
OE100X*	Open Elective I	E&M	1	1	0	2	2
ES1059	Cognitive Aptitude	AEC	2	1	0	3	3
HS1052	Human Engineering	VEC	2	0	0	2	2
ES1060	Mobile Application Development	VSEC	1	0	2	3	2
HS1054	General Proficiency	AEC	0	0	2	2	1
Courses in Semester 1 Irrespective of Module							
ES1056	Design Thinking 1	CC	0	1	0	1	1
ES1057	Engineering Design and Innovation 1	VSC	0	0	4	4	2
HS1027	Induction Training	VEC	0	0	2	2	0
ES1014	Environmental Science	ESC	2	0	0	2	0
			14	**4**	**12**	**30**	**21**
Courses in Semester 2 Irrespective of Module							
ES1061	Design Thinking 2	CC	0	1	0	1	1
ES1062	Engineering Design and Innovation 2	VSC	0	0	4	4	2
HS1061	Social Service	HSSM	0	0	2	2	0
HS1036	Indian Democracy and Constitution	HSSM	1	0	0	1	0
HS1038	Professional Development	HSSM	1	0	0	1	0
Total →			**14**	**4**	**12**	**30**	**21**

Module 2 - Semester 1 and 2							
Course Code	**Course Name**	**Type**	**Teaching Learning Scheme**				
			Th	**Tut**	**Lab**	**Hrs. / Week**	**Credits**
Module II (M2) Courses							
ES1053	Robotics	ESC	3	0	2	5	4
ES1052	**Mathematics and Statistics**	**BSC**	**3**	**1**	**0**	**4**	**4**
OE100X*	Open Elective II	E&M	1	0	2	3	2
PC100X	Program Core Course	PC	2	0	0	2	2
HS1051	Indian Knowledge System	IKS	2	0	0	2	2
ES1055	Product Design and Development	VSEC	1	0	2	3	2
HS1053	Universal Human Values	VEC	2	0	0	2	2
Courses in Semester 1 Irrespective of Module							
ES1056	Design Thinking 1	CC	0	1	0	1	1
ES1057	Engineering Design and Innovation I	VSC	0	0	4	4	2
HS1027	Induction Training	VEC	0	0	2	2	0
ES1014	Environmental Science	ESC	2	0	0	2	0
			16	**2**	**12**	**30**	**21**
Courses in Semester 2 Irrespective of Module							
ES1061	Design Thinking 2	CC	0	1	0	1	1
ES1062	Engineering Design and Innovation II	VSC	0	0	4	4	2
HS1061	Social Service	HSSM	0	0	2	2	0
HS1036	Indian Democracy and Constitution	HSSM	1	0	0	1	0
HS1038	Professional Development	HSSM	1	0	0	1	0
Total →			**16**	**2**	**12**	**30**	**21**

FF No.: 654

Course Name: PROBLEM SOLVING AND PROGRAMMING

Course Code: ES1051

Credits: 4	Teaching Scheme: Theory: 3 Hours / Week
	Lab: 2 Hours / Week

Section I
Computing Fundamentals: Introduction to numbering systems: Decimal, Binary, Hexadecimal, Octal. Introduction to computing jargons: Nibble, Bit, Byte, Word, double word, KB, MB, GB etc.   **Overview:** Introduction to C programming, Introduction to Editor, Compiler, Interpreter, linker, Loader, debugger. Indentations and comments, data types, variables, Constants: language Reserved words, data types and modifiers, Identifier naming rules, variable declaration, variable storage, character constants character set, escape sequence, string constants, Integer constant, float and double constants   **Control Statements:** if statement, if-else statement, if-else-if ladder, compound and nested if statement, switch case statement, Loop Statements: while, do while and for loops, continue statement, break statement.   **Operators and Expressions:** Operators: Arithmetic operator, relational operator, logical operators, bitwise operators, stray operators, operator precedence & associatively.   **Arrays:** Array Basic, Array Types, Array Declaration, initialization of array, Array Accessing, Contiguous Memory, Applications illustrating use of arrays to store ordered and unordered sequences, Multidimensional Array, Initializing and accessing multidimensional array. Representation of array in memory   **Strings:** Strings Basics, Strings Declaration, Strings Initialization, NULL terminated string, reading and printing strings, string library functions

Section II
Functions: Function purpose, function declaration, definition and calling, function parameters and return type and value, passing array to function, introduction to call by value vs call by reference, Local and global variables. Recursive function – how, when, advantages and limitations.   **Pointers in C:** pointer basic concept, pointer variable – declaration and initialization, pointer & and *operators, why pointer to different data types are different? void pointer, pointer memory organization,\ pointer operations, pass by value Vs pass by reference   **Array and pointers:** array name and pointer, how operator operates on array name, passing array to a function, Dynamic memory allocation.   Structures, Union and Bit fields: Introduction to structure, unions and bit field: their usage and applications.   **Introduction to files:** file handling, create, read, write and append.

List of Practical:
1. Assignment based on different operators and expressions in C.
2. Assignment based Control Statements and Looping Statements in C.

3. Assignment based on 1 D Array.	4. Assignment Based on Multidimensional array.
5. Assignment based on Strings.	6. Assignment Based on Functions in C.
7. Assignment based on Recursion.	8. Assignment based on Pointers in C.
9. Assignment based on Array pointers.	10. Assignment based on Double Pointers in C.

11. Assignment based on Structure, Union and Bit field. 12. Assignment based on File handling in C.

List of Projects Areas:

1. Science and Numeric Applications.   2. Number theoretic algorithms

3. 3D Graphics and Animations.   4. Large integer Arithmetic using string processing

5. To solve the problems of rotational motion, Heat transfer problems etc

6. Database/File Handling Application.   7. Game development using C

8. Algorithms in computational geometry (eg. convex-hull, closest pair of points)

9. Desktop GUIs.   10. Solving statistical problems.

Text Books:

1. Herbert Schildt E. Horwitz, "C: The Complete reference", TMH Publication.

2. Yashwant Kanetkar, "Let Us C", BPB Publication.

Reference Books:

1. Brian Kernighan and Dennis Ritchie, "The C programming Language"; 2nd Edition , PHI.

2. Harry. H. Chaudhary, "C Programming :The Definitive Beginner Reference" , First MIT-Create Space Inc. O-D, Publishing, LLC USA .

3. R. G. Dromey, "How to solve it by Computer", Prentice Hall.

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

The student will be able to -

1. understand use of numbering system for computer programming and contrast storage of different data types in computer memory.

2. analyze and convert a given problem statement into a program using operators and flow control statements.

3. organize constants of identical data types into an array and use it for applications like searching and sorting.

4. justify modular programming approach by making use of functions.

5. appraise the power of pointers to get insight into memory management and to improve efficiency of code.

6. arrange and store data using data structures and file handling.

FF No.: 654

Course Name: MATHEMATICS AND STATISTICS (MAS)

Course Code: ES1052

Credits: 4	**Teaching Scheme: Theory: 3 Hours / Week**
	Tutorial: 1 Hour / Week

Section I
System of Linear Equations: Rank of matrix, Gauss-Jordan Elimination, Applications of System of Linear equations, Euclidean vector space R^n, Vector equations, linear Combination and span, subspace, linear dependence and linear independence, basis and dimension. **Linear Transformation:** Definition, Kernel, Range, Matrix of Linear Transformation, One-One, Onto transformation, Rank-Nullity theorem, Geometric transformations in R^2 and R^3. **Eigen Values and Eigen Vectors:** Characteristic polynomial, Eigen Values and Eigen Vectors, Eigen space, algebraic and geometric multiplicities, diagonalization.

Section II
Functions of two or more variables: Introduction to functions of two or more variables, limits and continuity (only introduction), partial derivatives, chain rules, maxima and minima of functions of two variables, Vector differentiation: Scalar and Vector point functions, gradient, directional derivative, divergence and curl. **Higher order Linear Differential equations:** First order linear ode, Second order ODE's and its applications: Homogeneous Linear ODE's, Non homogeneous ODE's. **Descriptive Statistics:** Population, sample, data types, data presentation, data distribution, measures of central tendency, data shapes, data visualization.

List of Tutorials:

1. Rank of matrix, Gauss-Jordan Elimination, Applications of System of Linear equations.
2. Vector equations, linear combination and span, linear dependence, linear independence,
3. subspace, basis and dimension.
4. Kernel, Range, Matrix of Linear Transformation, One-one, onto transformation, rank- nullity theorem.
5. Geometric transformations in R^2 and R^3.
6. Characteristic polynomial, eigen values and eigen vectors, algebraic and geometric multiplicities.
7. Diagonalization.
8. Functions of two or more variables, partial derivatives, chain rules, maxima & minima of
9. functions of two variables.
10. Scalar and Vector point functions, gradient, directional derivative, divergence and curl.
11. First and second order ODE's and solution of homogeneous ODE's.
12. Solution of non homogeneous ODE's.
13. Population, sample, data types, data presentation, data distribution.
14. Measures of central tendency, data shapes, data visualization.

Text Books:

1. Ron Larson and David C. Falvo, "Linear Algebra: An Introduction",1st Edition, Cengage Learning (Indian Edition).

2. Ron Larson and Bruce H. Edwards, "Textbook of Calculus", Brooke/Cole, a part of Cengage Learning (Indian Edition), (c) 2011.

3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley and sons, Inc, Dec. 2010.

4. Jay Devore, "Probability and Statistics for Engineering and Sciences", 9th Edition, Metric Version, Cengage Publications.

Reference Books:

1. David C. Lay, "Linear Algebra and its Applications", 3rd Edition, Pearson.

2. Jim DeFranza and Daniel Gagliardi, "Introduction to Linear Algebra with Applications", Tata McGraw-Hill Edition.

3. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill publishing co. Ltd.

4. Michael D. Greenberg, "Advanced Engineering Mathematics", Pearson Education Asia

5. Peter V. O'Neil, "Advanced Engineering Mathematics", 5th Edition, Thomson Brooks/Cole.

Course Outcomes:

The student will be able to -

1. solve the system of linear equations and analyze the related concepts.

2. demonstrate and visualize linear transformations.

3. compute and apply the knowledge of Eigen values and Eigen vectors.

4. acquire the knowledge of partial derivatives and interpret properties of gradient, curl and divergence.

5. solve linear differential equations and interpret the solution.

6. represent, visualize and analyze statistical data.

FF No.: 654

Course Name: ROBOTICS

Course Code: ES1053

Credits: 4	**Teaching Scheme: Theory: 3 Hours / Week**
	Lab: 2 Hours / Week

Section I
Robot Terminology: Introduction, Robotics basics, Anatomy, Robot: Specifications, Classification, Configurations, and Components: Mechanical, Electrical and Electronics, Accuracy, Precision, Resolution, Repeatability etc. Robot analogy with human body.

Robot Kinematics: Degrees of Freedom, Robot coordinates, Roll-Pitch-Yaw, Workspace, Kinematic linkages, reference frames, Forward and Inverse kinematics, D-H matrix.

Actuators: Pneumatic, Hydraulic, Electrical – Solenoid coil, Relay, Construction, Working principle of DC, BLDC, Stepper and Servo motors, Merits and Demerits, Applications and selection of actuators.

Semiconductor Devices: Diodes, Rectifiers, Zener Diode, LED, BJT (as switch, amplifier, and multi vibrator), FET, MOSFET, IGBT, Op-amp

Digital Electronics: Logic gates, Basic gates using transistor, Flip-flop, Counters, Register, ADC, DAC

Section II
Microcontrollers: Microcontroller, ATmega, architecture, peripherals, ports, registers, memory types, timer, counter, interrupts etc.

Sensors: Proximity sensor (Range sensor), Tactile sensor (Contact sensor), Light sensor (photo diode, IR, Photo transistor) Applications: opto-isolators, Opto - encoders, Camera etc., Tilt sensor, Gyroscope (Acceleration sensor), Hall effect sensors, Temperature sensor, Ultrasonic Sensor, Sensor Interfacing and Control, PWM etc.

Serial Communication Systems: Introduction to Serial communication w.r.t. ATMega328P – RS232, I2C, SPI, WiFi, Blue Tooth.

Self-Study and Virtual Laboratory Exercises:

1. Study of Mechanical components
2. Study of Basic Electrical and Electronic components
3. Link for Virtual Laboratory Experiments :-

https://drive.google.com/file/d/1Rp3DfpvY_rsP6GN0pDP3pPgQrcpInNmK/view?usp=sharing

List of Practical:

Interfacing of following components with Arduino Uno.

1) LED with Arduino   2) LED array / Traffic Signals / Push Button / Micro Switch   3) LDR

4) Ultrasonic Sensor   5) IR array   6) Temperature sensor   7) 16x2 LCD   8) 7 Segment Display

9) Bluetooth module   10) PMDC Motor   11) Servo Motor   12) Lab. exam. 13) viva.

Text Books:

1. R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw Hill Publication.
2. David G. Alciatore, Michael B. Histand, "Introduction to Mechatronics and Measurement Systems", 3rd Edition, Tata McGraw Hill Publication.

3. P. S. Bimbhra, "Power Electronics", Khanna Publishers,

4. D.P. Kothari , I.J. Nagrath , "Electrical Machines" , Tata McGraw Hill Publication.

5. T. Kenjo and S. Nagamori, "Permanent magnet and Brushless DC motors", Clarendon press, London, 1988.

6. George Kennedy and Bernard Davis, S R M Prasanna, "Kennedy's Electronic Communication System (SIE)", McGraw Hill Education.

7. Arduino Made Simple: With Interactive Projects.

8. Brock Craft, "Arduino Projects for Dummies", John Wiley & Sons Inc.

9. Serial Communication by:-Dr.UditSatija, IIT Patna.Lecture 16: Embedded System- Serial Communication (Synchronous, Asynchronous, UART, CAN)-Part 1 and Lecture 17: Embedded System-Serial Communication (I2C, SPI, RS-232)-Part 2.

Reference Books :

1. John J. Craig, "Introduction to Robotics: Mechanics and Control", Prentice Hall, 2004.

2. Richard D. Klafter, Thomas A. Chmielewski, Michel Negin, "Robotic Engineering: An Integrated Approach", Prentice Hall Publication.

3. Lawnthorn, Ray, "Electrical machines and actuators - Electric Motors for Robots : Mechanical Power", Kindle Edition.

Course Outcomes:

The student will be able to –

1. interpret various terminologies from Robotics and Robot Kinematics.

2. identify, distinguish and analyze fundamental terms and working mechanisms of different actuators used in Robotics.

3. identify, distinguish and interpret different semiconductor devices, digital devices used in Robotics.

4. illustrate the internal configuration, architecture and terminologies of microcontroller.

5. analyse and interface different sensors and its peripherals with microcontroller.

6. interpret and distinguish different serial communication protocols used in Robotics.

FF No.: 654

Course Name: DISCRETE MATHEMATICS

Course Code: ES1054

Credits: 4	**Teaching Scheme: Theory: 3 Hours /Week**
	Tutorial: 1 Hour/Week

Section I
Relations and Number Theory: Cartesian product of sets, Relation, Equivalence Relation, Partition, Partial Order relation, Divisibility, The Euclidean Algorithm, Modular Arithmetic, Solving Congruence's arithmetic with prime modulus, arithmetic with arbitrary modulus, Chinese remainder theorem. **Infinite Series:** Introduction to sequence, limit of sequence, convergence, introduction to infinite series, sequence of partial sums, p-series, geometric series, test of convergence: ratio test and comparison test, power series, region of convergence, Taylor and Maclaurin's series. **Linear recurrence relations with constant coefficients:** Linear recurrence relations with constant coefficients, solution of homogeneous recurrence relation, particular solution.

Section II
Basic Counting Principles: Sum rule, Product rule, permutations and combinations, Inclusion-Exclusion principal and its applications in probability. **Probability and Random Variables:** Sample spaces and events, axioms, properties of probability, random variable-discrete and continuous, probability mass function, probability density function, Expectation, Variance, Standard deviation of distribution. **Graph Theory:** Definition, basic concepts, types of graph (Simple, Directed, Undirected, Regular, Complete, Directed acyclic, Bipartite, Connected), Representation: Incidence matrix, Adjacency matrix, Cut set, cut vertex, bridge, Eulerian graph, Hamiltonian graph, Planar graph, Definition of tree, properties of trees, Spanning tree, minimal spanning tree.

List of Tutorials:

1. Cartesian product of sets, Relation, Equivalence relation, Partition, Partial order relation.

2. Divisibility, Euclidean algorithm, modular arithmetic & Chinese remainder theorem.

3. Sequence, limit of sequence, convergence, infinite series, sequence of partial sums, convergence, geometric series, p- series, ratio test & comparison test.

4. Power series, region of convergence, Taylor and Maclaurin's series and Taylor Theorem.

5. Linear homogeneous recurrence relations with constant coefficients.

6. Linear non-homogeneous recurrence relations with constant coefficients.

7. Permutations and combinations, Inclusion Exclusion principal and its applications in probability.

8. Discrete and continuous random variables, probability mass function, probability density function, Expectation and variance of distribution.

9. Types of graphs, representation of graphs, connectivity, connected components.

10. Cut vertex, cut edge**,** set operations on vertex and edge sets, complement of graphs.

11. Eulerian graphs, Hamiltonian cycles, Planar graphs.

12. Types & properties of trees, spanning tree, minimal spanning tree.

Text books:

1. Keneth Rosen, "Discrete Mathematics and its Applications", McGraw Hill, 2012.

2. Susanna S. Epp, "Discrete Mathematics and its Applications", Matric Version, 5th Edition, Cengage Publications.

Reference Books:

1. Richard Johnsonbaugh, "Discrete Mathematics", 8th Edition, Pearson.

2. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", 1st Edition, Tata McGraw-Hill.

3. D. B. West, "Introduction to Graph theory", Prentice Hall of India, 1998.

Course Outcomes:

The student will be able to –

1. understand the concepts of relations, divisibility, congruence and number theory.

2. identify the convergence of given series.

3. construct and solve recurrence relations.

4. apply the concepts of counting in various situations.

5. calculate expectation, variance and standard deviation and obtain a probability distribution of random variable.

6. demonstrate the terminology of graphs and the matrices associated with graphs.

Course Name: PRODUCT DESIGN AND DEVELOPMENT

Course Code: ES1055

Credits: 2	Teaching Scheme: Theory: 1 Hour / Week
	Lab: 2 Hour / Week

Section I
Product Design and Development processes: Understanding the Nature of Product Design and Development' processes in Industrial/ Business / Service/ IT organizations.
NPD Approaches and Prototyping: Traditional, Concurrent and Reverse Engineering Methodologies for New Product Development (NPD), What is prototyping?
Market Research and New Product Opportunities: Identifying customer needs, STP of marketing and product customization, opportunity identification,
Problem Solving Technique- TRIZ- Philosophy, Methodology, Benefits, Contradiction, Principles, TRIZ Matrix, Applications
Product Life Cycle Management: Product Life cycle - Phases and Characteristics, Software Product Life Cycle, Product Extension Strategies

Section II
Design Thinking & DFX: Design for Manufacturing, Assembly, Maintenance, DFX for Safety, Reliability, Environment, DFX aspects of Design for Aesthetics.
Ergonomics in Product Design: Role of Ergonomics/ Human Factors Engineering in product design, Product Design for differently abled persons, need, scope, importance.
UI-UX Design: HMI/HCI, UI-UX, Figma Software for UI Design, Design of Service Products
Product Visualization: Basics of Engineering Drawings, Engineering Views and Projection, 1st & 3rd angle projection
Product Viability and Cost Analysis: Break-Even Point Determination, BEP analysis, PV method of analysis.

List of Practical: (Any 6 to be conducted)

1. Reverse Engineering of a simple machine / Toy / gadget / PC.
2. Real life Creative Engg. problem solving - Using TRIZ / other techniques.
3. Case studies based on Interdisciplinary product development.
4. Case studies based on Product Life Cycle Management.
5. Design and develop a web or mobile app or an industrial control panel / HMI making use of the effective UI , UX , Human Centric Design principles.
6. Assignment based on DFX / QFD - Quality Function Deployment.
7. Assignment based on FMEA- Failure Modes and Effects Analysis.
8. Case study on Software Product Design.
9. Case study product Design for differently abled users.
10. Methods of Prototyping and Prototypes.
11. User Surveys for Product Performance Improvement.
12. Product Costing analysis for a physical/ Software/ service Product.

Text Books:

1. Ulrich, Karl T., Eppinger, Steve D., and Yang, Maria C., "Product Design and Development", 7th Edition, McGraw-Hill Education, 2020.

2. Kevin N. Otto, Kristin L. Wood, "Product design: techniques in reverse engineering and new product development", Prentice Hall, 2001.

3. Anil Mital, Anoop Desai, Anand Subramanian and Aashi Mital, "Product development: a structured approach to consumer product development, design, and manufacture, Elsevier, 2008.

4. Liu, Carl, "Innovative Product Design Practice", 2015.

5. Chitale A. K. and Gupta R. C. , "Product Design and Manufacturing", PHI Learning Pvt. Ltd. 2023.

Reference Books:

1. Industrial Designers Society of America, Design Secrets: Products: 50 Real-Life Product Design Projects, 2001.

2. Beno Benhabib, "Manufacturing: Design, Production, Automation, and Integration" (Manufacturing Engineering and Materials Processing), 2003.

3. Gavin Ambrose and Paul Harris, "Basics Design 08: Design Thinking", Bloomsbury Publishing India.

Moocs Links and additional reading material: https://www.pdd-resources.net/resources.html

Course Outcomes:

The student will be able to -

1. have a 360° understanding of the role of an engineer in society.

2. apply the understanding of Product life cycle phases & their Characteristics.

3. interpret & apply the Human & user centric aspects of Design and UI-UX.

4. understand the contemporary principles of design thinking, DFX etc

5. apply the techniques of Visualization and Modeling.

6. understand and apply sustainability aspect of product design and development .

FF No.: 654

Course Name: DESIGN THINKING 1

Course Code: ES1056

Credits: 1	Teaching Scheme: Tutorial: 1 Hours / Week

Section I

Fundamentals of Research (What is research?): Meaning of the terms Discovery, Research, Invention, Innovation, Novelty, Creativity and the difference between them with example. Videos of great inventions, Need for Research:- Socio-economic development, research impact on society and research impact on economy, explanation with one example for each, Examples of Engineering Research, Research Types Fundamental and applied with example and importance of both, and Research Components:-Tools, techniques and algorithms and domains in which it is used innovatively Identification of research problem:- Finding and reviewing the literature, Sources of literature, Types of research papers: Conference, Journals etc, framing of research problem statement and synopsis.

Conference: What is a conference? (International and National), Format of a conference, conference Theme, Invitation, selection process, keynote address, parallel sessions, oral and poster presentation, valedictory, selected papers for journals and explorer, conference proceedings.

Research Journals: What is a Research Journal? (International and National), Types of journals, Scopus, peer reviewed, refereed, Transactions and letters, various journal publishers like Elsevier, Springer, Taylor and Francis, ASME etc. Journal formats List of standard professional societies like IEEE, ASME, SAE etc

Literature Review: Meaning, Effective searching of literature, cross referencing, identifying research gaps, organizing the selected papers, Summary of literature review

Section II

Research Paper Writing: Structure of research paper; Title and abstract, Introduction, Method, Evaluation, Conclusion, References, Writing a research paper-Style of writing and formatting, Processing and Displaying Data:-Charts –Various types of charts through ms-excel format, Types of charts, Error bars, trend line; Figures; Tables, PPT, Preparation of posters. Referencing: Writing reference to research paper; Use of referencing style and tool, typical format of references like Books, Book Chapters, Journal Articles, Conference Papers, Technical Reports and Internet Sources.

Journal Ratings and Evaluation (How to rate a Journal?): Meaning of impact factor and citation index like h-index. Who gives it and how gives it? Calculation of impact factor, Example for calculation of impact factor and h-index, Importance of publication house in selecting a journal, Process for journal paper review

Intellectual property (IP): Introduction to IPR, Overview & Importance, Patents, their definition; Patent search, process of patent application; Copyrights, their definition; granting; searching & filing, Trademarks, role in commerce, importance, protection, registration; Case studies in IPR, charges for filing patents.

Research Ethics: Plagiarism, Authorship, use of language, Protecting confidentiality, Conflicts of interest, Research with humans and animals.

Entrepreneurship: Introduction to Entrepreneurship, Meaning and concept of entrepreneurship, The Entrepreneur, Meaning of entrepreneur, the skills required to be an entrepreneur, the entrepreneurial decision process, Business Opportunity Identification: Business ideas, methods of generating ideas, and

opportunity recognition, Preparing a Business Plan: Meaning and significance of a business plan, components of a business plan, and feasibility study, Financing the New Venture: Importance of new venture financing

Text Books:

1. Karsnitz, O'Brien, Hutchinson, "Engineering Design an Introduction", 2nd Edition, Cengage Publication.

2. C.R. Kothari, "Research Methodology, Methods and Techniques", 2nd Edition, New Age International Pvt. Ltd., Publishers, 2004.

3. R. Panneerselvam, "Research Methodology", Prentice Hall of India, New Delhi, 2004.

4. Vinayak Bairagi, Mousami V. Munot, "Research Methodology: A Practical and Scientific Approach", 1st Edition, CRC Press, 2019.

Reference Books:

1. W.M. Trochim, "Research Methods: the concise knowledge base", Atomic Dog Publishing, 2005

2. Arun Sharma, "How to Prepare for Logical Reasoning", McGraw Hill Publication.

MOOCs Links and additional reading material

1. https://nptel.ac.in/courses/121/106/121106007/ (Introduction to Research by IIT Madras

2. https://nptel.ac.in/courses/109/106/109106137/ (Intellectual Property by IIT Madras)

3. https://nptel.ac.in/courses/109/105/109105112/ (Introduction on Intellectual Property to Engineers. By IIT Kharagpur)

4. https://nptel.ac.in/courses/110/106/110106141/ (Entrepreneurship , by IIT Madras)

5. https://nptel.ac.in/courses/127/105/127105007/ (Entrepreneurship Essentials, By IIT Kharagpur)

6. https://nptel.ac.in/courses/110/107/110107094/ (Innovation, Business models and Entrepreneurship, by IIT Roorkee)

7. https://nptel.ac.in/courses/110/105/110105091/ (Research Writing, by IIT Kharagpur)

8. https://nptel.ac.in/courses/109/105/109105115/#video (Qualitative Research methods and Research Writing, by IIT Kharagpur)

9. https://swayam.gov.in/nd1_noc20_hs66/preview(Entrepreneurship and IP strategy, by IIT Kharagpur)

Course Outcomes :

The student will be able to –

1. understand the importance of doing research and its socio-economic impact.

2. interpret and distinguish different fundamental terms related to research, discovery, invention, innovation etc.

3. apply the methodology and tools of doing research and mode of its publication.

4. write a Research Paper based on project work.

5. understand Intellectual property rights (IPR).

6. use the concepts of Ethics in Research.

7. understand the Entrepreneurship and Business planning

FF No.: 654

Course Name: ENGINEERING DESIGN AND INNOVATION - 1

Course Code: ES1057

Credits: 2	Teaching Scheme: Lab: 4 Hours / Week

Activities

This course is Project Centric Learning providing hands on experience to students. Theoretical inputs / information will be provided through Design Thinking 1 Sessions while actual designing and implementations of project work is done through EDAI-1.

Step by step Implementation of activities by the students:

1. **Group Formation Activity: -** Project group formation within the allotted EDAI-1 Project batch, deciding Group leader and Assistant Group Leader.

2. **Brain Storming and Discussion Activity**: - Discussion on topics for EDAI-1 Project pertaining to Socially relevant areas as discussed in the subject Design Thinking 1 (DT1). Discussion on Domain areas and identifying the domain area.

3. **Dissuasion** on the selected domain area and required Tools and Technology also discussed in the subject Design Thinking 1 (DT1) for the project.

4. **Project Planning Activity:-** Discussion on Tools and Technology, Finalization of EDAI-1 Project topic considering appropriate Domain area, Tools & Technology in consultation with EDAI-1 project Guide.

5. **Project Planning Activity:-** Finalization of Problem statement, objectives, methodology and systematic strategy to complete the EDI-1 project in consultation with EDAI-1 Project guide.

6. **Synopsis Drafting Activity:-** Prepare Synopsis of the planned EDAI-1 project under the guidance of EDAI-1 Project guide and complete its online Registration.

7. **Team Work Activity**:- Report and update about project work progress regularly to EDAI-1 Project guide and timely complete the assigned tasks by him. Seek his advice guidance whenever required.

8. **Self Learning Activity:-** Refer available online offline Resources, books, soft materials, consult with domain expertise in context with the project.

9. **Self Learning Activity:-** Learn the required tools, skill sets, acquire knowledge through relevant MOOCs for the project.

10. **Project Review 1 , Mid Semester Assessment & Project Review 2:-** As part of in semester assessment of the EDAI-1 Project appear for the timely conducted project reviews by EDAI-1 Project guide to evaluate student progress.

11. **Project Prototype Designing Activity**:- Designing of project prototype based on domain areas by incorporating appropriate tools and technology.

12. **Prototype Validation and Testing Activity**:- Validation and Testing Activity of the prototype and the obtained results to give the best possible solution.

13. **Project Report/Paper Writing Activity:-** Completion of the set objectives of project and to start writing report of the EDI-1 Project in IEEE Research paper format.

14. **Project Report/Paper Writing Activity:-** Results and Discussions, writing the Interpretation of the

obtained results of the accomplished EDAI-1 Project work in the report i.e. IEEE paper in systematic format and preparing the final PPT for final end sem assessment of the project.

15. **Final checking and Report/Paper Proof Reading Activity:** - of the IEEE project paper and PPT by EDAI-1 Project guide followed by its approval after doing the needful corrections.

16. **Online** submission of pdf of the IEEE Paper based of EDAI-1 Project for the record.

17. **End Semester Assessment:-** Present the IEEE Paper based of EDAI-1 Project and the PPT at Student EDAI-1 Project Conference on the scheduled date as part of End Semester Assessment of the EDAI-1 Project.

18. **Paper presentation on the project work Conference :-** Present the as prepared paper on the Project work at suitable National/International Conference.

19. **Journal Publication :-** Publish the quality project work in a peer reviewed and International/ National Research journal with repute indexed in Web of Science/Scopus/UGC CARE).

20. **Patent/ Innovation :-** If the project work done has novelty, innovation and future commercial aspects then file a Patent on it.

Text Books:

1. K Nagrajan , "Project Management", 2nd Edition, New age International Ltd., 2004.

2. Pradeep Pai, "Project Management", 1st Edition, PEARSON INDIA, 2019.

3. Yousef Haik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning.

Reference Books:

1. H. S. Fogler and S. E. LeBlanc, "Strategies for Creative Problem Solving", 2nd Edition, Pearson, Upper Saddle River, NJ, 2008.

2. A. Whimbey and J. Lochhead, "Problem Solving & Comprehension", 6th Edition, Lawrence Erlbaum, Mahwah, NJ, 1999.

3. M. Levine, "Effective Problem Solving", 2nd Edition, Prentice Hall, Upper Saddle River, NJ, 1994.

4. John. R. Karsnitz, Stephen O"Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.

Course Outcomes :

The student will be able to –

1. identify projects relevant societal needs

2. map the technologies learned with the project needs

3. apply the technological knowledge to design various feasible solutions

4. Select best possible solution to solve the problem

5. develop/Fabricate a working model of the proposed solution

6. testing and validate product performance

FF No.: 654

Course Name: COGNITIVE APPTITUDE

Course Code: ES1059

Credits: 3	Teaching Scheme: Tutorial- 2 Hours / Week
	Tutorial- 1 Hour / Week

Section I
Coding Decoding, Direction Sense, Blood Relations, Analogy (word, letter, number, mixed), Ranking and Ordering, Eligibility Testing, Syllogism, Inequalities, Sitting Arrangements, Clock and Calendar. Statements & Arguments, Statements & Course of Action, Cause and Effect, Cubes and Dice. Image Analysis (mirror & water images), Cubes and Cuboid, Error Detection, Grammar, Cloze Test, Comprehension, Double Fillers, Para jumbled sentences, One-word substitution.

Section II
Divisibility Rules, Numbers, Factors and multiples, Applications of HCF and LCM. Number Systems, Linear Equations, Variation, Ages, Averages, Percentage, Ratio and Proportion. Simple Interest, Compound Interest, Mensuration. Time & Work, Pipes and Cisterns, Boats and Streams, Partnerships, Problems on Trains, working with different efficiencies, Work equivalence, Division of wages, Relative Speed, Problems based on Races. Percentages as Fractions and Decimals, Fundamental Counting principle, Basics of Permutation and Combination, Probability.

Text Books:

1. Shyam Saraf, Abhilasha Swarup, "Quantitative Apptitude and Reasoning", Cengage Publication
2. Dr. R. S. Aggarwal, "Quantitative Aptitude for Competitive Examinations", S. Chand Publications.
3. Dr. R. S. Aggarwal, "A Modern Approach to Logical Reasoning", S. Chand Publication

Reference Books:

1. Peeyush Bhardwaj, "TheHands-on Guide to Analytical Reasoning and Logical Reasoning", Arihant Publication.
2. Arun Sharma, "How to Prepare for Logical Reasoning", McGraw Hill Publication.
3. Nishit Sinha, "Logical Reasoning and DI", Pearson Publication.
4. Moore, Parker, "Critical Thinking", McGraw Hill Publication.
5. Arun Sharma, "How to Prepare for Quantitative Aptitude", Tata McGraw Hill.
6. K. Sarvesh Verma, "Quantitative Aptitude Quantum Cat Common Admission Test", Arihant Publications.

Course Outcomes :

The student will be able to –

1. Improve analytical and logical reasoning ability.
2. Identify and evaluate deductive and inductive arguments.
3. Identify logical errors and false conclusions.
4. Improve aptitude, problem solving skills and reasoning ability.
5. Critically evaluate various real-life situations by resorting to analysis of key issues and factors.
6. Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.

FF No.: 654

Course Name: MOBILE APPLICATION DEVELOPMENT

Course Code: ES1060

Credits: 2	Teaching Scheme- Theory: 1 Hour / Week
	Lab: 2 Hours / Week

Section I
Introduction: About Android, Pre-requisites to learn Android, Dalvik Virtual Machine & .apk file extension, Android API levels (versions & version names)   Android Java Basics: Getting started with Android development, project folder structure, simple programming, running project, generating build/APK of the app from Android Studio   First application: Creating Android Project, Android Virtual Device Creation, Set up debugging environment, Workspace set up for development, Launching emulator, debugging on mobile devices.   Basic UI design: Basics about Views, Layouts, Drawable Resources, Input controls, Input Events, Toasts.   More UI Components: Layouts – Grid View and List View, Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers - Date and Time, Spinners.

Section II
Activity and Fragment: Activity, Fragment, Activity Lifecycle and Fragment Lifecycle.   Intents: Implicit Intents, Explicit intents, communicating data among Activities.   Navigation Drawer: Panel that displays the app's main navigation screens on the left edge of the screen.   Android Notifications – Toast, Dialogs (Time Picker, Date Picker, Progress, Alert), Notification Manager and Push Notification   Introducing SQLite – SQLite Open Helper and creating a database - Opening and closing a database, Working with cursors Inserts, updates, and deletes.   As a term project student should implement a mobile app with the following: - Understand the app idea and design user interface/wireframes of mobile app   - Set up the mobile app development environment

List of Practical's:

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Develop an application that makes use of RSS Feed.
7. Implement an application that implements Multi-threading.
8. Develop a native application that uses GPS location information.
9. Implement an application that writes data to the SD card.
10. Implement an application that creates an alert upon receiving a message.
11. Write a mobile application that creates alarm clock.

Screen Shots of the application :

1. GUI components, Font and Colors.	2. Layout Managers and event listeners.

3. Calculator.	4…Basic graphical primitives.
5. Database Application.	6. RSS Feed Application.
7. Multi-threading Application.	8. GPS location information.
9. Writes data to the SD card.	10. Alert upon receiving a message.
11. Alarm clock Application.	

Text Books:

1. Head first Android Development.

2. Android Programming: Pushing the Limits, Wiley By Erik Hellman

3. Lauren Darcey and Shane Conder, "Android Wireless Application Development", 2nd Edition, Pearson Education, 2011.

Reference Books:

1. Pradeep Kothari, "Android Application Development Black Book", Dreamtech Press, KLSI.

Course Outcomes:

The student will be able to –

1. Identify various concepts of mobile programming that make it unique from programming for other platforms.

2. Program mobile applications for the Android operating system that use basic and advanced phone features.

3. Analyse mobile applications on their design pros and cons.

4. Utilize rapid prototyping techniques to design.

5. Develop sophisticated mobile interfaces.

FF No.: 654

Course Name: DESIGN THINKING 2

Course Code: ES1061

Credits: 1	**Teaching Scheme: Tutorial: 1 Hour / Week**

Section I

Structure of Research Paper

Title, Abstract, Keywords, Introduction (Literature review), Methodology, Design/ Testing, Results and Discussions, Conclusions, Acknowledgements, References. Figure, Equations, Tables etc formatting and editing

Journal List (Top 50 Journals) Journal rankings (https://www.scimagojr.com/journalrank.php), Find identify and short list the Top 50 research journals in respective engineering branch. Understand the quality, quantity, extent and most importantly the novelty of research work is required to publish into such reputed Journals

Selection of the journal

Indexing, impact factor, open access, Scopus indexed, Web of Science indexed Journals (SCI and SCIE) indexed journals

Use of various online journal selection tools

Springer (https://journalsuggester.springer.com/) Elsevier (https://journalfinder.elsevier.com/) Web of Science (https://mjl.clarivate.com/home)–Manuscript Matcher (It can be used after creating free account)

Plagiarism checking

Use of various online free plagiarism checker tools as well as licensed software tools like iThenticate (https://www.ithenticate.com/)

Section II

Improving contents of the paper

Based on the Plagiarism reports the manuscript draft can be refined and modified in order to make it not only unique but also technically and grammatically correct.

Patent search

Indian patent journal (https://ipindia.gov.in/journal.htm), Google Patent Search (https://patents.google.com/), International Patents, (https://patentscope.wipo.int/search/en/search.jsf) USA patent (https://www.uspto.gov/patents/search)

Patent drafting and Filing: Understand the forms, documentations and steps and the official procedure involved in the process of Patent drafting and filing

Writing answers to reviewer questions: - Addressing the queries/ comments/ questions raised by Research Journal reviewers in appropriate format with sound scientific and technical justification

Modification in manuscript

Modify the research paper manuscript as per the rational suggestions given by the reviewer or Journal Editor

Checking of publication draft

Important Task of Proof reading of the final manuscript; accepted for publication before it gets published. Meticulously checking personal details, affiliation and providing final remarks, suggestions to the Journal

Publisher pertaining to the Manuscript.

Text Books:

1. Karsnitz, O'Brien, Hutchinson, "Engineering Design an Introduction", 2nd Edition, Cengage Publication.

2. Laurie Rozakis, "Schum's quick guide to Write Great Research Papers", 2nd Edition, McGraw-Hill.

3. Chris A. Mack, "How to write a good Scientific Paper", SPIE PRESS Bellingham, Washington USA, 2018.

4. The Office of Controller General of Patents, Designs and Trademarks, "Manual Of Patent Office Practice and Procedure", version 3.0, Mumbai, India (2019).

Reference Books:

1. Anthony C. Winkler and Jo Ray Metherell, "Writing the Research Paper A Handbook", 8th Edition, Wadsworth, Cengage Learning, Boston USA, 2011.

2. World Intellectual Property Organization,"WIPO Patent Drafting Manual", 2nd Edition, Geneva, Switzerland (2022).

MOOCs Links and additional reading material

1. https://nptel.ac.in/courses/110/105/110105091/ (Research Writing, by IIT Kharagpur)

2. https://archive.nptel.ac.in/courses/127/105/109105115/(Qualitative Research Methods And Research Writing, by IIT Kharagpur)

3. https://archive.nptel.ac.in/courses/109/106/109106128/ (Patent Drafting for Beginners, By IIT Madras)

Course Outcomes:

The student will be able to

1. understand the structure of a research paper.

2. identify key research journals in different engineering areas and understand the importance of quality, extent and novelty in research papers

3. apply various online tools to select appropriate research journals based on different parameters

4. check plagiarism in the manuscript by using online plagiarism detection platforms and amend and improve its content accordingly

5. search different Patent (Indian/International) databases by using online patent search platforms

6. understand the process of Patent drafting and filing.

7. address the reviewer's queries, comments and do the proof reading of the manuscript

FF No.: 654

Course Name: ENGINEERING DESIGN AND INNOVATION - 2

Course Code: ES1062

Credits: 2	Teaching Scheme: Lab: 4 Hours / Week

Activities

This course is Project Centric Learning providing hands on experience to students. Theoretical inputs / information will be provided through Design Thinking 1 Sessions already conducted in SEM 1 while actual designing and implementations of project work is done through Engineering Design and Innovation 2 (EDAI-2) Course.

Step by step Implementation of activities by the students:

1. **Group Formation Activity: -** Project group formation within the allotted EDAI-2 Project batch, deciding Group leader and Assistant Group Leader

2. **Brain Storming and Discussion Activity**: - Discussion on topics for EDAI-2 Project pertaining to socially relevant areas as discussed in the subject Design Thinking 2 (DT2). Discussion on Domain areas and identifying the domain area.

3. **Dissuasion** on the selected domain area and required Tools and Technology also discussed in the subject Design Thinking 2 (DT2) for the project.

4. **Project Planning Activity:-** Discussion on Tools and Technology, Finalization of EDAI-2 Project topic considering appropriate Domain area, Tools & Technology in consultation with EDAI-2 Project Guide

5. **Project Planning Activity:-** Finalization of Problem statement, objectives, methodology and systematic strategy to complete the EDAI-2 Project in consultation with EDAI-2 Project guide

6. **Synopsis Drafting Activity:-** Prepare Synopsis of the planned EDAI-2 Project under the guidance of EDAI-2 Project guide and complete its online Registration

7. **Team Work Activity**:- Report and update about project work progress regularly to EDAI-2 Project guide and timely complete the assigned tasks by him. Seek his advice guidance whenever required.

8. **Self Learning Activity:-** Refer available online offline Resources, books, soft materials, consult with domain expertise in context with the project

9. **Self Learning Activity:-** Learn the required tools, skill sets, acquire knowledge through relevant MOOCs for the project

10. **Project Review 1 , Mid Semester Assessment & Project Review 2**:- As part of in semester assessment of the EDAI-2 Project appear for the timely conducted project reviews by EDAI-2 Project guide to evaluate student progress

11. **Project Prototype Designing Activity**:- Designing of project prototype based on domain areas by incorporating appropriate tools and technology

12. **Prototype Validation and Testing Activity**:- Validation and Testing Activity of the prototype and the obtained results to give the best possible solution

13. **Project Report/Paper Writing Activity:-** Completion of the set objectives of project and to start writing report of the EDAI-2 Project in IEEE Research paper format

14. **Project Report/Paper Writing Activity:-** Results and Discussions, writing the Interpretation of the obtained results of the accomplished EDAI-2 Project work in the report i.e. IEEE paper in systematic format and preparing the final PPT for final end semester assessment of the project

15. **Final checking and Report/Paper Proof Reading Activity:** - of the IEEE project paper and PPT by EDI-2 Project guide followed by its approval after doing the needful corrections.

16. Online submission of pdf of the IEEE Paper based of EDAI-2 Project for the record

17. **End Semester Assessment:-** Present the IEEE Paper based of EDAI-2 Project 2 project and the PPT at Student EDAI-2 Project Conference on the scheduled date as part of End Semester Assessment of the EDAI-2 Project.

18. **Paper presentation on the project work Conference :-** Present the as prepared paper on the Project work at suitable National/International Conference

19. **Journal Publication :-** Publish the quality project work in a peer reviewed and International/ National Research journal with repute indexed in Web of Science/Scopus/UGC CARE)

20. **Patent/ Innovation :-** If the project work done has novelty, innovation and future commercial aspects then file a Patent on it

Text Books:

1. K Nagrajan , Project Management 2nd Edition, New age International Ltd., 2004.

2. Pradeep Pai, Project Management, 1st Edition, PEARSON INDIA, 2019.

3. Yousef Haik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.

Reference Books:

1. H. S. Fogler and S. E. LeBlanc, "Strategies for Creative Problem Solving", 2nd Edition, Pearson, Upper Saddle River, NJ, 2008.

2. A. Whimbey and J. Lochhead, "Problem Solving & Comprehension", 6th Edition, Lawrence Erlbaum, Mahwah, NJ, 1999.

3. M. Levine, "Effective Problem Solving", 2nd Edition, Prentice Hall, Upper Saddle River, NJ,1994.

4. John. R. Karsnitz, Stephen O"Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) 2nd Edition, 2013.

Course Outcomes :

The student will be able to –

1. identify projects relevant societal needs

2. map the technologies learned with the project needs

3. apply the technological knowledge to design various feasible solutions

4. select best possible solution to solve the problem

5. develop/Fabricate a working model of the proposed solution

6. testing and validate product performance

FF No.: 654

OPEN ELECTIVE I
Course Name: BIOMEDICAL TECHNOLOGY
Course Code: OE1001

Credits: 2	**Teaching Scheme:** **Theory: 1 Hour / Week**
	Tutorial: 1 Hour / Week

Section I - Biomechanics and Applied Anthropometry
Human criteria's, human physical activities, features of the human body, Measures of physiological functions such as: energy expenditure, gross body activity, local muscular activity, work load, work efficiency, work and rest. Bio Mechanics -Type of movements of body members. manual material handling. Performance criteria for physical activity such as: Strength & endurance, speed of movements, accuracy of movements
Introduction to anthropometry, use & principles of anthropometry data, work spaces, work space envelopes for seated persons, design of work spaces such as: work surface height, seated & standing, principles of seat design, workplace design.
Design and Displays: Information input & processing, visual displays of static & dynamic information. Auditory, textual & olfactory displays, general location of controls & displays within workspace, concept of visibility
Physical space & arrangement, principles of arrangement of component, Functions of controls, types of controls, factors in control design, design of specific hand operated controls, foot controls and special control devices.

Section II - Work Physiology and Working Conditions
Human factors applications in system design, characteristics of system design, human factors data for interface design, ergonomic safety & health management, Case studies of ergonomically designed product, Illumination: Color systems, energy consideration
Atmospheric conditions: Measurement of thermal variables, wet-bulb globe temperature, heat stress index, heat index, wind chill index, Noise: Physiological effect of noise on performance, noise exposure limits, Effect of lighting on performance. Physiological effect of heat & cold on performance.
Noise controls. Work related musculoskeletal disorders, visual environment, thermal environment, auditory environment, Vibrations
Human Physiology and Energy Expenditure, Muscle mechanism, BMR, Heart Rate variations, Oxygen consumption, Rest allowances, Rate of energy expenditure, Manual Material Handling Capacity determination, Effect of environmental conditions and work design on Energy Expenditure

List of Tutorials :

1. Work related musculoskeletal disorders, visual environment, thermal environment, auditory environment, Vibrations.

2. Analysis of energy consumption for different activities performed in controlled conditions.

3. Analysis of energy consumption for different activities performed in uncontrolled condition.

4. Analyze effectiveness of work environment considering illumination level

5. Analyze effectiveness of work environment considering air velocity using anemometer

6.   Analyze effectiveness of work environment considering sound level using sound meter
Text Books:
1.E. Grad jean, Fitting Task to the Man.
Reference Books:
1. M. S. Sanders and Ernest J. McCormick, McGraw Hill Inc., Human Factors Engineering and Design.
Course Outcomes :
The student will be able to –   1.   analyze physical work content involved in any manual activity   2.   use and apply principles of work station design and anthropometric dimensions for work place design.   3.   analyze and improve working conditions so as to achieve work comfort and enhance productivity.   4.   use and analyze physiological parameters

OPEN ELECTIVE I
Course Name: ENTREPRENEURSHIP DEVELOPMENT
Course Code: OE1002

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Tutorial: 1 Hour / Week

Section I
Entrepreneurial Journeys: What is Entrepreneur & Entrepreneurship? Entrepreneur Success Stories, Know the Entrepreneur within you? GET Test.
Business Fundamentals: What is Business? Business Cycle, Customer and Consumer, Business Types- B2B, B2C, C2C, C2B.
Formats of Business: Sole Proprietorship, Partnership, OPC, LLP, Pvt Ltd, Franchise Models
Organization Structures: Flat, Functional, Matrix, Multi-divisional.
Entrepreneur and Entrepreneurship: What is Start-up? Unicorns? Motivation, Age, Personality Traits, Risk Taking for Entrepreneurship.
Self-Discovery: Entrepreneurial Psychology, Driving Forces, Discovers your own strengths, Entry Barriers.
New Age Businesses: FinTech, EdTech, HealthCare, AgriTech, Food Tech, E, m, Quick commerce.
Idea to Offering: Sources of Opportunities, Market Research, Idea Generation, Idea to Offering transition.

Section II
Competitive Advantage: First Mover Advantage, 2nd Mover, Last Mover advantage, Environment Analysis (Porter's 5 Forces framework), Resource Analysis (VRIO).
Business Plan: Elements of Business plan, B-Plan Report & Elevator Pitch.
Feasibility study: Functional Feasibilities -Technical, Economical, Financial, Marketing, Operational, Legal, Social and Sustainable aspects.
Managing People & Financing: Organization Management, Managing Team Members, Sources of Funds, Venture Capital and Angel Investment, Break Even Analysis.
Managing Growth: Start-up Survival, Expansion Strategies, Diversification- Product expansion, Market expansion /penetration, Exit Strategies.
Start-up Registration: Detailed Procedures to register a company, Documentation and Legal Formalities, Getting GST number etc.
Entrepreneurial Ecosystem in India: Institutional Financial Support, Benefits of Registered Start-ups, Incentives subsidies and grants, StartUp India, Incubation Centers, Support Agencies & Network.

List of Laboratory Tutorials :
1. Identification of Business Ideas through Brainstorming / Research / Surveys.
2. Develop Start-up Vision and Strategy.   3. Business Plan (B-Plan) – Marketing Feasibility.
4. B-Plan – Financial / Economic Feasibility. 5. B-Plan – Operational Feasibility.
6. B-Plan – Legal & Regulatory Feasibility.   7. B-Plan – Social & Environmental Feasibility.
8. Break Even Analysis and Crucial Financial Ratios.
9. Business Registration – How to Register a Business in India.

10. Pitch Elevator- Demonstrations.

11. Case study based on Manufacturing Business and its Operations.

12. Case study based on Service Business and its activities.

13. Case study based on New Age Business.

14. Learn from Entrepreneurs about managing self and well-being.

Text Books:

1. Safal Batra, "Entrepreneurship- New Venture Management", 2nd Edition, Cengagae, 2023.

2. Vasant Desai, "Small-Scale Enterprises and Entrepreneurship Ecosystem", 6th Edition, Himalaya Publishing House, 2016.

3. Poornima M. Charantimath, "Entrepreneurship Development and Small Business Enterprises", 3rd Edition, Pearson Education, 2018.

4. Rajeev Roy, "Entrepreneurship", 2nd Edition, Oxford University Press, 2011.

Reference Books:

1. Norman M. Scarborough and Jeffery R. Cornwall, "Essentials of Entrepreneurship and Small Business Management", 9th Edition, Prentice Hall, 2018.

2. Peter Thiel and Blake Masters, "Zero to One: Notes on Start Ups, or How to Build the Future", Random House, 2014.

3. Eric Ries, "The Lean Start-up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses", 1st Edition, Crown Publishing, 2011.

Course Outcomes :

The student will be able to –

1. understand the concept of entrepreneurship.

2. identify the business opportunities and resources required to establish a start-up.

3. convert ideas into product or service offering.

4. develop business plan by analyzing functional feasibility.

5. know sources of funds and entrepreneurial ecosystem in India.

6. identify own entrepreneurial traits and try to pursue entrepreneurship (a Campus Venture).

OPEN ELECTIVE I
Course Name: ENGINEERING ECONOMICS
Course Code: OE1003

Credits: 2	Teaching Scheme: Theory: 1 Hour / Week
	Tutorial: 1 Hour / Week

Section I
Elementary economic analysis, Product selection, Raw materials and processes selection, Engineering efficiency, Economic efficiency.
Time value of money, Simple and compound interests, Time value equivalence, Statistics for Economics, Numerical problems.
Inflation and its importance, Inflation adjusted decisions.
Role of estimation in economics, Types of estimates, units of measurement.
Estimated costs and its importance.
Cash flow analysis, cash flow diagrams, Numerical problems.
Present worth calculations, NPV analysis and comparison, Future worth method.
Role of various agencies in National Economy, Flows in Economy, Taxes in Economy, Economic reforms since 1991, Political and Legal Environment.

Section II
Elements of cost, Fixed and variable costs, Indirect costs, and its types.
Forms of Business organizations, Market equilibrium.
Product costing and its methods, Value Analysis.
Rate of return methods, Payback period calculations and analysis.
Depreciation, Replacement and Maintenance analysis.
Break-even analysis, sensitivity analysis.
Inventory control, selective control of materials, EOQ analysis.
Make or Buy decisions, Numerical problems.

List of Laboratory Tutorials :

Section I	Section II
1. Elementary economic analysis	1. Physical Product costing
2. Time value equivalence	2. Service Product costing
3. Costs Estimation	3. Rate of Return analysis
4. Cash Flow analysis	4. Payback Period calculations
5. Present worth method	5. EOQ analysis
6. Break Even analysis	6. Make or Buy decision analysis

Text Books:

1. Paneerselvam R, "Engineering Economics", Prentice Hall of India.
2. Riggs James, Bedworth, Randhawa, "Engineering Economics", McGraw Hill.
3. Sullivan, Wicks, "Engineering Economy", Pearson.

Reference Books:

1. Lindenberg Michael, "Engineering Economic Analysis", Professional Publications.

2. White John, Case, Pratt, "Principles of Engineering Economic Analysis", John Wiley.

3. Russell, Taylor, "Operations Management", Pearson.

Course Outcomes :

The student will be able to –

1. understand role of economy in social and national development.

2. plot cash flow diagrams and perform analysis.

3. determine Break-even point and perform analysis.

4. understand various techniques of inventory control.

5. perform product costing analysis.

6. analyse, make or buy strategic decision.

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FF No.: 654

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OPEN ELECTIVE I
Course Name: COSTING AND COST CONTROL
Course Code: OE1004

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Tutorial: 1 Hour / Week

Section I
Introduction to cost concepts in managerial decision making, methods of costing, Elements of costs, classification of costs, preparation of cost sheets, cost reporting to management.
Cost accounting of materials, Materials procurement and storage procedures, Stores accounting and materials control, Receipts, inspection and issue of materials, Inventory control and EOQ analysis, selective control techniques, R-system and Q-system of replenishment, Stock verification, Depreciation and obsolescence, Different methods of materials pricing: FIFO, LOFO, HIFO, weighted average.
Manpower planning, Recruitment and Training, Cost accounting of direct labor, Attendance, Time keeping and Time Booking, Remuneration and incentive schemes, Payroll procedures, Idle Time and Overtime, Labor Hour Rate.
Facility Costing and management, Facilities maintenance, Machine Hour Rate.
Cost of capital and capital management.
Concept of productivity, Labor productivity, Materials productivity, Measurement of productivity and improvement of productivity.

Section II
Introduction to Financial accounting, cost accounting, management accounting, and comparisons.
Budget and budgetary control, capital budgeting, functional budgeting, working capital budgeting, Allocation of overheads.
Methods of costing, Job costing, Batch costing, Numerical problems.
Concept of learning curve and its applications.
Marginal costing, Break-even analysis, P-V ratio, Margin of safety.
Standard costing and variance analysis, Ratio analysis.
Introduction to ABC, process costing, value analysis.

List of Laboratory Tutorials :

Section I	Section II
1. Classification of costs	1. Budgetary control
2. Selective control of materials	2. Job / Batch costing
3. EOQ analysis	3. Marginal costing
4. Replenishment systems	4. Break-even analysis
5. Methods of materials pricing	5. Ratio Analysis
6. Productivity Analysis	6. Value Analysis

Text Books:

1. Rajasekaran, Lalita, "Cost Accounting", Pearson Education.
2. Lal Jawahar, Srivastava Seema, "Cost Accounting", Tata McGraw Hill.

3.	Arora M.N., "Cost and Management Accounting", Vikas Publishing House.

Reference Books:

1. Kishor Ravi, "Advanced Cost Accounting and Cost Systems", Taxman, New Delhi.

2. Chakravarthy, "Cost and Management Accounting", Central Publication.

3. Bhar, B.K., "Cost Accounting Methods and problems", Academic Publishers.

Course Outcomes :

The student will be able to –

1. understand elements of costs in Industrial and Service organizations

2. analyze materials costing in Product manufacturing

3. understand methods of materials pricing

4. explain importance of Budgetary control in Business organizations

5. understand learning curve and its applications

6. perform Break-even analysis

FF No.: 654

OPEN ELECTIVE II
Course Name: PROJECT MANAGEMENT
Course Code: OE1005

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Lab: 2 Hours / Week

Section I

Introduction to Project Management: Definition & Characteristics of Project, Performance Parameters: Time, Cost, Quality. Classification of Projects: Sector based, Investment based, Technology based, Causation based, Need based, Modernization, Replacement, Expansion & Diversification Projects.

Project Life cycle: Project Life cycle phases and their characteristics, Project Formulation & Feasibility study, Types of Feasibility Studies–Pre-feasibility, Functional Feasibility Study, Aspects of Project Feasibility.

Managerial/Organizational: Promoters Background, Criteria of Evaluation.

Marketing/Commercial: Demand & Supply, Competition, Market Survey.

Operational/Technical: Process, Technology, Location, Capacity, Labour, Raw Material availability.

Financial: Cost of Project, Means of Finance.

Socio-Economic: Socio-Cost Benefit Analysis, Resources Costs.

Section II

Project Planning: Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications.

Project Implementation & Control: Work Breakdown Structure, Network Analysis & Duration Estimating, Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Project Crashing.

Project Human Resource: Project Organization & Management. Project Organization Structure, Role of Project Manager, Resource Levelling, Resource Smoothening.

Software Development Project Management: Project management aspects in software projects, tasks assignment to software engineering teams according to the specifications of a task.

List of Practical:

1. Preparation of Project Charter.
2. Construction of Work Breakdown Structure.
3. Preparation of Project Network Diagram.
4. Identification of Critical Path (CPM).
5. PERT
6. Project Crashing.
7. Project Resource Levelling, using JIRA/MS Project/ Open Project.
8. Project Resource Smoothening using JIRA/MS Project/ Open Project.
9. Course Project on preparation of a Project Feasibility Report.

10. Project Identification, Definition.

11. Project Feasibility – Managerial/Organizational Perspective.

12. Project Feasibility – Marketing, Exit Plan.   13. Project Feasibility – Operational.

14. Project Feasibility – Financial, Financial Projections.

Text Books:

1. Narendra Singh, "Project Management & Control", Himalaya Publishing House, Mumbai.

2. Prasanna Chandra, "Project: Preparation, Appraisal, Budgeting & Implementation".

3. Pinto Project Management – Achieving Competitive Advantage & MS Projects   Pearson Education.

Reference Books:

1. Maylor, "Project Management", Pearson Education.

2. Gopal & Ramamurthy, "Project Management Handbook", MacMillan.

3. PMI   Project Management Body of Knowledge PMI

4. Ghatak & Sandra Practical Project Management, Pearson Education 2001.

5. SARDA Handbook on Project Appraisal & Follow-up, Govind Prakashan, 2001.

Course Outcomes :

The student will be able to –

1. learn the characteristics of projects and project management

2. ascertain the feasibility of projects

3. plan and schedule projects using CPM method

4. understand the concept of project cost management

5. analyze risks involved in projects

6. understand aspects of manpower management in projects

OPEN ELECTIVE II
Course Name: SMART MATERIALS
Course Code: OE1006

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Lab: 2 Hours / Week

Section I
Material Structure & Properties: Introduction to Material Science, Structures and their property relationship in relation to engineering materials. Indexing of planes and directions. Classification of Engineering Materials. Important properties of each group & some typical applications of each group. Crystal Structures: Study of Crystal structures BCC, FCC, HCP and lattice parameters & properties, Miller indices, Crystal imperfections, and Diffusion Mechanisms.
Transportation and Earth movers: **Cast Irons**: Fe-Fe$_3$C Equlibrium diagram Types of Cast Irons Gray cast iron, White cast iron, Malleable cast iron, Ductile Iron. Microstructures, properties and applications.
Construction & Chemical and General Engineering Materials: Classification of steels, Plain Carbon steels, Alloy Steels, Effects of alloying elements on properties of plain carbon steels, Stainless Steels, Tool steels and tool materials.

Section II
Aerospace & Biomedical Materials (Light weight): Aluminum and Aluminum alloys, Titanium and Titanium alloys, Magnesium & Magnesium alloys, Cu & Cu base alloys Structures, Properties, Processing and applications of materials.
Composite Materials: Composite materials classifications, metal matrix composites, Polymer matrix composites and ceramic matrix composites. Processing techniques and characterization of mechanical and microstructures.
Shape Memory Materials: Ni-Ti shape memory alloys, Cu Base Shape memory alloys and Fe base shape memory alloys. Processing and Mechanism of shape memory effect. Martensitic transformation for shape memory effect. Applications of shape memory materials: Robot arm gripper, Biomedical implants, actuators, sensors etc.

List of Practicals

1. Metallographic specimen preparation for micro examination.
2. Microstructure analysis of plain carbon steels.
3. Phase analysis of microstructures of Cast Irons.
4. Microstructures analysis of non ferrous alloys.
5. Nondestructive testing: Dye penetrant and Magnaflux testing
6. Hardness testing and analysis any one (Brinell/Vickers/ Rockwell) any one.
7. Impact tests of metallic samples: (Izod/ Charpy) any one

8. Measurement of Case depth and case hardness of surface hardened samples.
9. Tensile test on mild steel and aluminum test pieces.
10. Compression test on cast iron and brass test pieces.
11. Measurement of shape memory effect.

List of Project areas:
1. Study Structure properties relationship of metals.
2. Development of MMC,PMC and CMC composites
3. Development of Shame memory alloys
4. Microstructural analysis of Specimens
5. Characterization of Mechanical properties

Text Books:
1. Dr. V. D. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publishing House, Pune.
2. Raymond A. Higgins, "Engineering Metallurgy, Part 1: Applied Physical Metallurgy", 5th Edition, English Language Book Society.
3. K.G. Budinski, M. K. Budinski, "Engineering Materials", Prentice –Hall India Pvt. Ltd.
4. Sidney H. Avner, "An Introduction to Physical Metallurgy", Indian Edition.

Reference Books:
1. E.C. Rollason, "Metallurgy for Engineers", English Language Book Society.
2. Donald Clark and Wilbur Varney, "Physical Metallurgy for Engineers", East- West Press Pvt. Ltd. New Delhi.
3. Donald. Askeland and P.P. Phule, "The science and engineering of materials", 4th Edition, Thomson learning Inc.
4. A.S.M. Metals Handbook Volume 4, Heat Treatments.3.

Course Outcomes :
The student will be able to –
1. understand the significance of structure & property relations in materials.
2. understand various ferrous materials, compositions, properties and applications.
3. apply materials for chemical and construction applications.
4. understand and apply light weight materials for aerospace applications.
5. synthesis composite materials as per functional requirements.
6. explore shape memory materials for robotic, biomedical implants and sensors.

FF No.: 654

OPEN ELECTIVE II
Course Name: ENGINEERING GRAPHICS
Course Code: OE1007

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Lab: 2 Hours / Week

Section I
Fundamentals of Drawing Standard: Principles of Engineering Graphics and its Significance, Bureau of Indian Standards (BIS), dimensioning, lettering, type of lines, scaling conventions.
Orthographic projection: Introduction to orthographic projection, Fundamentals of First and Third Angle methods of projections, Orthographic projections of points lying in four quadrants drawing orthographic views of objects from their isometric views.
Isometric Projection: Terminology, isometric scale, isometric view and isometric projection, isometric axes and lines, isometric views of simple solids.

Section II
Machine Drawing Conventions: Need for drawing conventions –Introduction to IS conventions. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears.
Drawing Of Machine Elements And Simple Parts: Screwed fasteners, popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws. Keys, Cotters and Pin joints: Saddle keys, sunk keys.
Computer Aided Drawing: Introduction to Auto CAD, 2D & 3D commands, Draw commands, modify commands, extrude, subtract, edit Commands, to construct simple figures, Plane surfaces, solid section and orthographic views, isometric views.

List of Practical :

1. BIS Types of dimensioning, lettering, type of lines, scaling conventions.
2. Orthographic views of simple products with manual drawing.
3. Isometric Views of Simple products with manual drawing.
4. Drawing Of Machine Elements & Simple Machine Parts.
5. Orthographic views of simple products with Auto CAD.
6. Isometric Views of Simple products with Auto CAD.

List of Project areas:

1. Construction of simple machine parts.
2. Construction of plan, elevation and section of product using Auto CAD.
3. Construction of Prototypes using 3D Printing.
4. Prototype preparation using Machine tools.
5. Prototype preparation using Welding methods.
6. Prototype preparation using Carpentry power tools.

Text Books:

1. Bhatt N. D., Engineering drawing, Charotar publishing house, 2014

2. Shah P. J., Engineering Graphics, S. Chand and Company, 2013

Reference Books:

1. French, T.E. Vierck, C. J:, and Foster, R.J., Engineering Drawing, Tata–Mc Graw Hill, 2012.

2. Luzadder W.J., Fundamentals of Engineering Drawing – Prentice Hall India, 1993

3. Narayana K.L., Kannaiah.P., Engineering Drawing – Scitech Publications, Chennai, 2014.

4. Venugopal K., Engineering Drawing – New Age International, 2004

5. Natarajan K.V., A text book on Engineering Drawing – Classic prints, 2000

6. Gopalakrishna K.R., Engineering Drawing – Subash Stores, 2000

Course Outcomes :

The student will be able to –

1. understand engineering drawing standards and practices

2. convert sketches to engineering drawings as per BIS standards

3. draw orthographic projections of solid objects

4. draw isometric projections of solid objects

5. understand Machine Drawing Conventions

6. understand and application of different Machine Elements.

FF No.: 654

OPEN ELECTIVE II
Course Name: DATA ANALYSIS
Course Code: OE1008

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Lab: 2 Hours / Week

Section I

1. Introduction: Data, importance of data, Data Formats. Data applications in different fields, for taking informed decisions, Excel as a storage and data analysis tool.

2. Getting started with Excel:-

Workbooks and worksheets, formulas and Functions, Cell References, Range Names, sorting Data, querying Data, importing and exporting Data, Aggregation (sum, average etc) functions, lookup functions etc.

3. PivotTables: Creating, Manipulating the PivotTable, Properties, Setting Pivot table Options. Working with Charts:- Working with Excel Charts. Creating Charts with the Chart Wizard, Formatting Chart Objects, plotting Several Variables

Section II

4. Statistics Basics:- Mean, Median, Mode, Skewness, Normal Distribution, Standard Deviation, Variance, ANOVA

5. Regression and Correlation:-Simple Linear Regression, Regression Functions in Excel, Performing a Regression Analysis. Checking the Regression Model, Correlation, Creating a Correlation Matrix, Outlier analysis, What is an Outlier, Box & whisker plots, Scatter plot

6. AI Assisted Power BI: Introduction to Power BI and its capabilities in data analysis. Exploring AI-driven features within Power BI for predictive analytics and data visualization enhancement. Hands-on sessions on implementing AI features in Power BI for data-driven insights.

List of Practical:

1. Familiarity with various sources of real life databases
2. Assignment based on basic and conditional formatting
3. Assignment based on advance lookup table functions
4. Assignment based on text formatting and manipulation using various text functions
5. Assignment based on data visualization using different types of charts I
6. Assignment on curve fitting/Regression
7. Assignments on Pivot table, Pivot charts
8. Predictive Analytics Lab. Students use Power BI's AI features to predict trends or outcomes based on provided datasets.
9. Data Visualization Enhancement Lab. Hands-on session demonstrating how AI-assisted tools in Power BI can enhance data visualization and storytelling.
10. Anomaly Detection Lab. Utilizing Power BI's AI capabilities to detect and analyze outliers or anomalies in datasets.
11. Natural Language Processing Integration Lab. Exploring how Power BI integrates AI-

driven natural language queries for data exploration and analysis.

Text Books:

1. Manisha Nigam, "Data Analysis with Excel", BPB Publications.

2. Roxy Peck, Chris Olsen and Jay Deore, "Introduction to Statistics and Data Analysis", Third Edition, Thomson/Brookes/Cole Publishers.

Reference Books:

1. Data Science & Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data Published by John Wiley & Sons, Inc.

2. Introduction to Data Analysis Handbook, Migrant & Seasonal Head Start Technical Assistance Center Academy for Educational Development Contract with DHHS/ACF/OHS/Migrant and Seasonal Program Branch.

3. Excel pivot tables: basic beginners' guide to learn excel pivot tables for data analysis and modeling, M. G. Martin.

4. Microsoft Excel 2019 Data analysis and business modeling, 6th Edition, Wayne L Winston PHI.

5. The Definitive Guide to DAX – 2nd Edition Alberto Ferrari, Marco Russo

6. The Definitive Guide to DAX, Marco Russo, Alberto Ferrari

Course Outcomes :

The student will be able to –

1. understand data and its importance in the data driven world

2. use and apply basic and advance formulae of Excel to analyze data.

3. process data using Pivot table functions

4. plot different types of appropriate charts for data visualization

5. understand basic statistical terminology and use statistical functions in excel

6. the concept of AI assisted power BI

OPEN ELECTIVE II

Course Name: COMPUTATIONAL TECHNIQUES IN CHEMICAL ENGINEERING

Course Code: OE1009

Credits: 2	**Teaching Scheme: Theory: 1 Hour / Week**
	Lab: 2 Hours / Week

Section I
1. **Introduction to Numerical Methods :** Overview of numerical approximation and its applications in engineering. Error analysis and understanding the limitations of numerical methods. Introduction to programming environments like MATLAB or Python. 2. **Ordinary Differential Equations (ODEs):** Euler's method, Runge-Kutta methods, and their applications in modeling dynamic systems. Application to chemical kinetics and reactor dynamics problems. Implementation of ODE solvers using MATLAB/Python. 3. **Partial Differential Equations (PDEs):** Finite difference methods for diffusion, convection, and reaction-diffusion problems. Applications in modeling heat and mass transfer in chemical processes. Practical implementation using MATLAB/Python for PDE solutions.
Section II
4. **One-Dimensional Unconstrained Optimization:** Golden-Section Search: Introduction to this method for optimizing one-dimensional functions, Parabolic Interpolation: Understanding its application for one-dimensional optimization, Newton's Method: Exploring its use for function optimization, Hands-on problem-solving in MATLAB/Python for one-dimensional optimization. 5. **Multidimensional Unconstrained Optimization:** Direct Methods: Introduction to direct methods like the Nelder-Mead algorithm for multi-dimensional optimization, Gradient Methods: Understanding gradient-based optimization for multi-dimensional functions, Hands-on application in MATLAB/Python for multi-dimensional optimization. 6. **Constrained Optimization:** Linear Programming: Introduction to techniques for constrained optimization problems, Nonlinear Constrained Optimization: Methods for handling nonlinearity within constraints, Optimization with Software Packages: Practical usage of software packages like MATLAB's Optimization Toolbox or Python's SciPy for solving optimization problems.
List of Practical:
1. Solve ODEs representing chemical reaction kinetics within a reactor using numerical methods. 2. Modeling Reaction Rate Kinetics using Differential Equations 3. Optimization of Chemical Reaction Pathways using ODEs 4. Optimization of Chemical Reactor Residence Time using Differential Equations 5. Multistage Reactor Optimization via ODEs 6. Modeling Heat Transfer in Reactors with Optimization of Cooling Systems 7. Optimal Reactor Design - Solve nonlinear reactor design equations using iterative methods. 8. Process Optimization: Mass Balance Analysis - Solve a system of linear equations representing a chemical process mass balance scenario. 9. Chemical Reactor Kinetics - Solve ODEs representing chemical reaction kinetics within a reactor using numerical methods. 10. Process Parameter Optimization - Apply optimization techniques to maximize/minimize parameters in a chemical process scenario for optimal performance. 11. Optimizing Reactor Temperature Profiles with Dynamic Differential Equations

12. Solve ODEs representing chemical reaction kinetics within a reactor using numerical methods.

List of Project areas:

1. Explore practical applications of numerical approximation in engineering problems.
2. Optimize mass and energy balance systems using numerical techniques for chemical engineering applications.
3. Model dynamic systems such as chemical kinetics and reactor dynamics using computational methods.
4. Simulate and analyze heat and mass transfer phenomena in chemical processes using numerical solutions.
5. Apply optimization methods to solve chemical process design and reactor optimization problems.

Text Books:

1. Chapra, S.C.; Canale, R.P., "Numerical Methods for Engineers", 4th Edition, Tata-McGraw Hill Publications, 2002.
2. Edger, T. F.; Himmelblau, D. M., "Optimization of chemical processes", McGraw-Hill, 2nd Edition, 2001.
3. R.B. Bird, W.E. Stewart and E.W. Lightfoot, "Transport Phenomena", John Wiley.

Reference Books:

1. Rice, R.G.; Do, D.D., "Applied Mathematics and Modeling for Chemical Engineers", John Wiley and Sons, 1995.
2. Jenson, V.G., Jeffreys, G. V., "Mathematical Methods in Chemical Engineering", 2nd Edition, Academic Press, 1997.
3. Mickley, H. S., Shewrwood, T. S.; Reed, C. E., "Applied Mathematics in Chemical Engineering", McGraw-Hill, 1957.
4. Riggs, James B., "An Introduction to Numerical Methods for Chemical Engineers", 2nd Edition, Texas Tech University Press, 1994.
5. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and sons, inc.

Course Outcomes :

The student will be able to –

1. apply numerical methods to solve engineering problems in chemical systems effectively.

2. use various ODE solvers to model dynamic systems in chemical kinetics and reactor dynamics.

3. utilize finite difference methods proficiently to solve diffusion, convection, and reaction-diffusion problems in chemical processes.

4. implement one-dimensional unconstrained optimization techniques for effective function optimization in chemical engineering scenarios.

5. apply multidimensional unconstrained optimization methods for optimizing multi-dimensional functions in chemical engineering problems.

6. utilize techniques for constrained optimization problems to solve real-world chemical engineering optimization challenges.

FF No.: 654

Course Name: PROGRAM CORE COURSE

SENSORS AND APPLICATIONS

Course Code: PC1001

(For E&TC and Instrumentation & Control)

Credits: 2	Teaching Scheme: Theory: 2 Hour s/ Week

Section I

Electronic Signal Conditioning Circuits:

Introduction to the operational amplifier, block diagram and working, Operational amplifiers datasheet interpretation and selection, Inverting and non-inverting amplifier configurations, Adder, differential and summing amplifiers. Schmitt trigger, sample and hold, precision rectifiers, I-V and V-I converter, instrumentation amplifier, active filters, oscillators, Digital–to-Analog converters: Types, working and selection. Analog-to-Digital converters: Types, working and Selection, ADC and DAC ICs, Specifications and selection of ADCs and DACs.

Displacement and Non-contact detection measurement: Transducer definition, classification and performance characteristics. Resistive: Potentiometer Inductive: LVDT, variable, reluctance, self-inductance and mutual inductance, variable capacitance, Digital transducers: encoders – types of translational and rotary encoders. Proximity sensors: inductive, capacitive, optical, ultrasonic, hall-effect and magnetic, Flapper nozzle sensor. Applications.

Speed and Vibration Measurement: Stroboscopes, toothed rotor, eddy current, electromagnetic transducers (moving coil, moving magnet), AC and DC tachometers: Hall Effect, proximity pickup, photoelectric, photo-reflective, pulse counting method, Seismic, piezoelectric. Weight measurement: Strain measurement: principle, strain gauge, types, gauge factor, gauge wire properties, Applications.

Section II

Temperature and Pressure Measurement:

Scales, units and relations, classification of temperature sensors, Mechanical: bimetallic thermometer, Electrical: Resistance temperature detectors, its types and comparison, circuits for lead wire compensation, Thermocouple: laws of thermoelectricity, types (B, E, J, K, R, S, T), characteristics, thermocouple tables, cold junction compensation techniques, Thermistor: its types (NTC, PTC), measuring circuits, thermopiles. Pressure scales, units and relations, manometers – U tube, inclined tube. Elastic – bourdon, diaphragm, bellows and their types, Differential pressure measurement: capacitance delta cell. Calibrating Instruments – Dead Weight Tester (Pressure, Vacuum)., Applications.

Flow Measurement:

Units, Newtonian and non-Newtonian fluids, Reynolds's number, laminar and turbulent flows, velocity profile, Bernoulli's equation for incompressible flow, density, Beta ratio, Reynolds's number correction, square root relation. Head type flow meters: Orifice (eccentric, segmental, concentric), different pressure taps, venture-meter, pitot tube, Variable area type: Rotameter Other flow meters: Turbine, target, electromagnetic, ultrasonic, etc., Applications.

Level Measurement:

Direct (Gauges): Hook type, sight glass: tubular, transparent and reflex, float and tape, wire, board.

Indirect: Hydrostatic pressure, bubbler. Electrical : Float, displacer, capacitive, resistive, ultrasonic, radioactive, radar (contact, non-contact – TDR / PDS), thermal. Solid level detectors electronic Load cell, Applications.

Text Books:

1. Albert Malvino; Electronic Principles by Albert Malvino; Tata McGraw Hill.
2. Ramakant A. Gayakwad; Op-Amps and Linear Integrated Circuits; 4th Edition, PHI.
3. H.S.Kalsi; Electronic Instrumentation; Tata McGraw Hill.
4. Nakra-Chaudhary, "Instrumentation Measurement and Analysis", 21st Reprint Tata McGraw Hill Publications.
5. A. K. Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons Publications, 2002.
6. R. K. Jain, "Mechanical and Industrial Measurement", 9th print, Khanna Publications.

Reference Books:

1. Leach, Malvino,Saha, "Digital Principles and Applications", 8th Edition, McGraw Hill.
2. R.P.Jain, "Modern Digital Electronics", 4th Edition, McGraw Hill.
3. B. G. Liptak, "Process Measurement and Analysis", 3rd Edition, Butterworth Heinemann.
4. E.O. Doebelin, "Measurement System Application and Design", 4th Edition McGraw-Hill International Publications.

Course Outcomes :

The student will be able to –

1. understand the working principle of different sensors and transducers.
2. able to evaluate characteristics of sensors and transducers.
3. analyze the mathematical equation and solve different example of sensor.
4. select suitable sensors and transducers for given application.
5. compare different sensors and transducers with their performance.
6. impart knowledge of operational amplifier and op-amp based signal conditioning with the concepts of ADCs and DACs and their selection.

FF No.: 654

COURSE NAME: PROGRAM CORE COURSE

PRINCIPLES OF PROGRAMMING LANGUAGES

COURSE CODE: PC1002

(FOR COMPUTER, CSAI, CSAIML, AIDS, IT)

Credits: 2	Teaching Scheme: Theory: 2 Hour s/ Week

Section I

Procedure based Programming:

History and Need of Various types of Programming Languages (PL), Types of PL, Characteristics of PL, Syntax, Semantics, Pragmatics Analysis General features, Data types, Abstract Data Types (ADT), Structuring, Syntax, Semantics, RAM model of computation, Example: C language.

Object Based Programming:

Concepts of objects, Class vs ADT, control structures, methods, General features-inheritance, polymorphism, derived classes & information hiding, Example: C++ and Java, Difference with C.

Concurrent Programming:

Concurrency structure for message passing, loosely coupled system, shared memory, PRAM, monitor, semaphore, Example: Java RMI, Parallel Java, Parallel C.

Section II

Logic Programming:

Predicate calculus- Logical operators, Propositional forms, Rules of inference, Logical equivalence, Quantification, Well-formed formula, Disproofs; Prolog- Syntax, Lists, Operators and arithmetic, Control, i/o, data structures.

Functional Programming:

Lambda calculus- Lambda expressions, Variables, Substitutions, Arithmetic, Conditionals, Recursion, Lambda reduction, Type assignment, Polymorphism, Lambda calculus and computability; Lisp- Control constructs, List processing, Files and i/o, Generic functions, Objects, Exceptions.

Exception Handling:

Exception Handling in Various Languages; Programming Events, Handling Large Databases; Special Languages.

Text Books:

1. Ravi Sethi, "Programming Languages: Concepts and Constructs", Pearson Education.
2. Carlo Ghezzi and Mehdi Jazayeri, "Programming Language Concepts", John Wiley & Sons.

Reference Books:

1. Doris Appleby and J. J. Vandekopple, "Programming Languages: Paradigm and Practices", McGraw Hill.
2. Robert W. Sebesta, "Concepts of Programming Languages", Pearson Education.

MOOCs Links and additional reading material: www.nptelvideos.in , www.geeksforgeeks.org, www.udemy.com

Course Outcomes :

The student will be able to –

1. apply procedure programming knowledge towards solving a real-world problem.

2. acquire the skills of object-oriented approach over procedural approach of solving a problem.

3. model the real-world problem with the help of concurrent programming approaches.

4. analyze the problems and use Logic programming approaches.

5. implement different programming problems using Functional programming.

6. comprehend and select exception handling in program execution.

Course Name: PROGRAM CORE COURSE

INTRODUCTION TO CHEMICAL ENGINEERING

Course Code: PC1003

(Only for Chemical Engineering)

Credits: 2	Teaching Scheme: Theory: 2 Hour s/ Week

Section I
Process Calculations - Dimensions and Units, Significance Unit conversions of mass, energy and pressure, chemical calculations including mole, equivalent weight; solids, liquids, solutions and their properties, properties of gases. Non ideal calculations, for gas and liquid mixtures   **Introduction to fluid mechanics**, properties of fluids, types of flow, Newton's law of viscosity, fluid statics, pressure measurement by using simple and differential manometer. Equation of mass balance, equation of energy balance. Flow measurement, Different types Transportation of fluids, introduction to pumps.   **Introduction to heat transfer,** modes of heat transfer, Fourier's law of heat conduction, thermal properties of different materials, steady state conduction through plane slab, composite slab, cylinder and composite cylinder. Newton`s law of cooling, natural and forces convection, introduction to convection with phase change. Stefan Bolzman law of radiation, radiation from a black body and nonblack bodies. Radiation shields. Introduction to heat exchangers

Section II
Introduction to solid fluid operations, grinding, screening of the materials. Gravity separation, centrifugation, Sedimentation, filtration.   **Introduction to mass transfer**, basic laws of mass transfer. Basics of distillation and its applications. The concept and mechanism of drying operations. Fundamentals of humidification process. Mass transfer concepts related to gas absorption systems. Crystallization process.

Text Books:

1. Bhatt B. I. and Thakore S. M., "Stoichiometry", Tata McGraw-Hill Publication, 5th Edition, 2010.

2. Bansal R.K., "A Textbook of Fluid Mechanics and Hydraulic Machines", 9th Edition, Laxmi Publications (P) Ltd.

3. Badger W. L. and Banchero J. T., "Introduction to Chemical Engineering", McGraw Hill Publications, 1997.

4. J. P. Holman, "Heat Transfer", 8th Edition, McGraw-Hill, New York, 1997.

5. B. K. Datta, "Principle of mass transfer", Edition, PHI Learning publication, 2015.

Reference Books:

1. Warren Lee McCabe, Julian Smith, Peter Harriott, "Unit Operations in Chemical Engineering", 7th Edition, McGraw Hill Publications.

2. Coulson J. M. Richardson, J. F., "Chemical Engineering – Vol. I & II", 6th Edition, Butterworth-Heinemann.

Course Outcomes :
The student will be able to –   1. apply the simple stoichiometry and mass balance concepts to chemical systems   2. determine type of flow and their properties   3. use manometers for the pressure measurements   4. identify and analyze the heat transfer mechanism   5. identify type of unit operations for the solid-fluid handling systems   6. apply the basic mass transfer concepts for the selected operations

FF No.: 654

Course Name: PROGRAM CORE COURSE
ELEMENTS OF MECHANICAL ENGINEERING
Course Code: PC1004
(Only for Mechanical Engineering)

Credits: 2	Teaching Scheme: Theory: 2 Hour s/ Week

Section I
Energy sources & its conversion, thermal energy, hydropower energy, nuclear energy, solar energy, geothermal energy, wind energy, hydrogen energy, biomass energy and tidal energy.

Laws of thermodynamics, heat engine, heat pump, modes of heat transfer, conduction, convection and radiation, Fourier's law, Newton's law of cooling, Stefan Boltzmann's law. Two stroke and four stroke engines (Petrol, Diesel and CNG engines).

Engineering materials, overview of properties of engineering materials, Selection of materials for different engineering applications. Different types of loading conditions, (tensile, compression, shear, bending, twisting etc.), engineering stress and strain relationship, True stress - true strain relationship, fracture and Creep failures.

Section II
Introduction to manufacturing, casting, forging, metal forming (Drawing, Extrusion, etc.), Sheet metal working, metal joining, etc. Metal cutting processes and machining operations, Turning, milling and drilling, Micromachining. Additive manufacturing and 3D Printing. CNC/IOT based machines.

Engineering and machine drawing, first and third angle projections, orthographic view, Isometric view, sectional views, GD&T, different symbols used in machine drawings, standard components, concept of details and assembly drawings.

Study of engineering systems - electric drives, electrical vehicle, engines, pumps, compressors, gears drives, belt-pulley, chain-sprocket, refrigerator, air conditioners, blower, vacuum cleaner, washing machines, water heater, electric iron etc.

Text Books:

1. Nag, P. K., "Engineering Thermodynamics", Tata McGraw-Hill Publisher Co. Ltd.

2. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai

3. Agrawal Basant and Agrawal, C. M., "Basics of Mechanical Engineering", John Wiley and Sons, USA, 2008.

4. N.D.Bhatt, "Machine drawing", McGraw Hill, 2018.

5. S.S. Ratan., "Strength of materials", McGraw Hill, 2018.

Reference Books:

1. Pravin Kumar, "Basic Mechanical Engineering", 2nd Edition, Pearson (India) Ltd, 2018.

2. Incropera, F. P. and Dewitt, D.P., "Fundamentals of Heat and Mass Transfer", 6th Edition, John Wiley and Sons, USA, 2007.

3. Groover, Mikell P., "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Prentice Hall, USA, 1996.

4. Juvinal, R. C., "Fundamentals of Machine Component Design", John Wiley and Sons, USA, 1994.

5. Ganeshan, V., "Internal Combustion Engines", McGraw Hill, 2018.

6. Anderson, Curtis Darrel and Anderson, Judy, "Electric and Hybrid Cars: A History", 2nd Edition, McFarland, 2010.

Course Outcomes :

The student will be able to –

1. describe and compare the conversion of energy from renewable and non-renewable energy sources

2. explain basic laws of thermodynamics, heat transfer and their applications

3. describe the engineering materials and properties

4. discuss several manufacturing processes and identify the suitable process

5. illustrate the application of machine drawing and symbols in used in engineering

6. explain working principle of various engineering systems and their applications

FF No.: 654

Course Name: INDIAN KNOWLEDGE SYSTEM

Course Code: HS1051

Credits: 2	**Teaching Scheme: Theory: 2 Hours/ Week**

Section I

Introduction to Indian Knowledge System:

Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas.

Sanskrit Language – Origins, Structure and Unique Characteristics of the Sanskrit Language, Sanskrit Metrics, Vak and Mantra in Sanskrit Language

Ancient Indian Universities -Nalanda, Takahashila Vallabhi, Vikramshila, Jagaddala University, Nagarjuna Vidyapeeth, Kanthalloor University etc.

Arts, Literature, Culture and Scholars:

Sixty-four art forms (64 Kalas) , Art, Music, and Dance, Naṭarāja– A Masterpiece of Bhāratīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghoṣā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Kauṭīlya, Pāṇini, Thiruvalluvar, Salient aspects of Indian Mathematics - Āryabhaṭa, Varāhamihira, Ādi Śaṅkarācārya, Bhāskarācārya, Mādhavācārya.

Science and Mathematics:

Number systems in India– Historical evidence, Concepts of Zero and Pi, decimal system, binary system, contributions in the area of arithmetic, algebra, geometry, trigonometry, combinatorial problems in Chandaḥ-sastra of Pingala, and Magic squares in India, Time – Concept of Kala, Cycles of Time, Measurement of Time, Knowledge of Time – the Science of Light, Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light.

Section II

Engineering and Technology Heritage:

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, bronze and copper artefacts, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, , Marine Technology, and Bet–Dwārkā.

Bhāratīya Civilization:

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization,Different dynasties, Mauryan age, Gupta age.

Indian conception of Economy and Management, Insights from Arthashastra, Management by Consciousness, Vāstu-śāstra – The science of architecture, Eight limbs of Vāstu , Temples in India: marvelous stone architecture for eternity , Temple architecture in India , Iconography.

Life, Environment and Health:

Concept of Nature in Indian Tradition, Panchbhutas – Elements of Nature, Concept of Rta, Sacred Environment, Panchvati, Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment,

Aurveda, Charaksamhita, Sushrutsamhita, Atrey, Nagarjuna, Kaṇāda , Patañjali.

Text Books:

1. Introduction to Indian knowledge system: concepts and Application, B. Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R.N, Publisher: PHI learning, 2023, ISBN: 9789391818203.

2. Traditional Knowledge System in India, Amit Jha, Atlantic Publisher, 2022, ISBN: 9788126912230

3. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan.

4. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).

2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).

3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

Course Outcomes :

The student will be able to –

1. understand the rich heritage that resides in the culture of our country.

2. learn to appreciate the need and importance of Sanskrit in getting to the roots of the philosophical concepts

3. understand the scientific value of the traditional knowledge of Bhārata.

4. understand the modern technological trends through Indian scientific and technological philosophy.

5. promote to do research in the various fields of Bhāratīya knowledge system.

6. convert the Bhāratīya wisdom into the applied aspect of the modern scientific paradigm.

FF No.: 654

Course Name: HUMAN ENGINEERING
Course Code: HS1052

Credits: 2	Teaching Scheme: Theory: 2 Hours / Week

Section 1 : Philosophy: The system of nyaya (logic) and analysis of various means of acquiring knowledge: empiric, speculative and from a person of authority.

Philosophy of sankhya (counting the elements) and an analysis of the 24 elements found in the universe as per sankhya and its basis. Connection to modern science and related research of body, mind and consciousness studies

Section 2: Influence of three modes or qualities of nature on the mind and the individual. Discussion of various examples where one observes each of these qualities or a combination of them.

A brief study of the Patanjali yoga sutras and the various stages of kriya yoga and their application. Role of Asanas (sitting postures) and pranayama (breath control) with respect to ones' body and mind

Summary of the six systems of Indian philosophy and their applications to one's personal and professional life, Lifestyle Management for Better Health (Modern and Vedic)

Text Books:

1. BKS Iyengar, "Light on yoga sutras of Patanjali"
2. Rajiv Malhotra, "Being Different: An Indian Challenge to Western Universalism", Happer Collins Publishers India, ISBN No: 978-93-5116-050-2.
3. SuhotraDasa, Tapovanachari, "The Six systems of Vedic Philosophy", (Online PDF book)

Reference Books:

1. Devamrita Swami, "Searching for the Vedic India", Bhaktivedanta Book Trust, ISBN 0-89213-350-3.
2. Patita Pavan, "Sri ChanakyaNiti: Ancient Sense for Modern Success", ISBN 978-93-82109-25-9. Abhay Ashram Publishing.
3. Govinda das, "Voice your Choice: Ethics from Epics", White Woods Publishing House. ISBN: 978- 93-81-283042.
4. Jostien Garder, ."Sophies World - A Novel about the History of Philosophy", Berkeley Books, New York, USA, 1996.
5. F. Max. Muller, "The six systems of Indian Philosophy".

Course Outcomes:

The student will be able to –

1. apply the most appropriate tool of acquiring knowledge for a suitable object of knowledge.
2. understand the purpose of the 8 steps of the Yoga sutras.
3. evaluate consequences of Yoga sutras on the human mind.
4. classify disease categories and identify various diseases and their impact.
5. recognize ideal human health parameters and their measurements, basic emergency managements.
6. demonstrate selection and maintenance of personal protective equipment.

FF No.: 654

Course Name: UNIVERSAL HUMAN VALUES

Course Code: HS1053

Credits: 2	Teaching Scheme: Theory: 2 Hour s/ Week

Section I

Universal human values - Need, Moving towards harmony

What is the Value education, need for the Value Education, moving towards value-based education from largely skill-biased education system. Understand the basic systems of a human society, i.e., Education-Sanskar, Health-Self regulation, Production-Work, Justice-Preservation, Exchange-Storage, Universal human values.

Human aspirations

Understand human aspirations, gain the skill for fulfilling the aspirations. Self-Exploration, Right understanding, difference between physical facility and the feeling of prosperity. Correct appraisal of Physical needs, meaning of Prosperity in detail.

Understanding Harmony in the Human Being - Harmony in Myself

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body', the Body as an instrument of 'I', understanding the harmony of I with the Body.

Section II

Understanding Harmony in the Family

Feeling of Relationship as the Basis for Harmony in the Family. Understanding harmony in the Family.

Understanding values in human-human relationship like: Trust, Respect, Affection, and Care. Guidance, Reverence, Glory, Gratitude, Love.

Understanding Harmony in the Nature and Existence as Co-existence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature. Nature as Collection of Units like (and not limited to): Physical order, Bio order, Animal order, Human order.

Understanding Harmony in the Society

The ultimate goal of humanity is harmony in the society at large. Acceptance of human values at the following four levels: Individual human being, As a member of a family, As a Responsible member of society, As a unit in nature/existence. Happiness at professional level, what are professional ethics/values? corelation of human values and professional values.

Text Books:

1. R S Naagarazan, "A text book on Professional Ethics and Human values", New age International.

2. R R Gaur, R Sangal, G.P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", 1st Edition, Excel Book, 2009.

Reference Books:

1. Ivan Illich, "Energy & Equity", The Trinity Press, Worcester, and Harper Collins, USA,

1974.

2. P. L. Dhar, R.R. Gaur, "Science and Humanism", Commonwealth Publishers, 1990.

3. A N Tripathy, "Human Values", New Age International Publishers, 2003.

4. E G Seebauer & Robert L., "Berry Fundamentals of Ethics for Scientists & Engineers", Oxford University Press, 2000.

5. M Govindrajan, S Natrajan & V.S.Senthil Kumar, "Engineering Ethics (including Human Values)", Eastern Economy Edition, Prentice Hall of India Ltd.

6. B P Banerjee, "Foundations of Ethics and Management", Excel Books, 2005.

7. https://uhv.org.in/uhv1notes, From AICTE.

Course Outcomes :

The student will able to

1. understand concept of Universal value Education and see the need for developing a holistic perspective of life

2. develop the clarity on the aspiration, what is my aspiration and how to fulfill my aspiration.

3. understanding the Human being as Co-existence of Self and Body.

4. feeling of Relationship as the basis for Harmony in the Family.

5. understanding Harmony in the Nature and Existence.

6. understand Harmony in the Society and professional ethics.

FF No.: 654

Course Name: GENERAL PROFICIENCY
Course Code: HS1054

Credits: 1	**Teaching Scheme: Lab: 2 Hours/Week**

Section I: Language Awareness

- Importance of English and foreign languages.

- Pronunciation. Vocabulary extension, basic aspects of Language Skills, modes of Writing, comprehension, composition, word order, structure of words

- Formal mechanisms of Language proficiency certifications like TOFEL, IELTS, PET, JLPT, TestDaF, DSH, TCF etc.

- Communication skills: Meaning, need, significance and types (written/oral, formal/informal, internal/external etc), Barriers in communication, How to start a communication?, Communication process (Articulation of thought) Concept of KISS(Keep It Short and Simple), Importance of nonverbal communication. Public speaking meaning, do's and don'ts

- Technical writing-Project, Innovation & Research - comparison. Writing SOPs. Importance of peer review & publications, protecting intellectual property - trademark, copyright & patents.

Section II: General Awareness

- Time management (Concept and importance), Techniques and rules and regulations during GD, Do's and don'ts in GD.

- Appreciating skills like negotiation, time management, positive thinking, recognizing diversity, networking etc. Contribution towards society, social initiatives**.**

- Etiquettes and manners: meaning and significance, Attitude, organizational ethics, Telephonic etiquettes, table manners, professional etiquettes, hygiene and clothing manners.

- Team building and leadership, Concept of team: difference between team and group, process of team building, significance and methods to develop team spirit, Characteristics of a leader. Walk the talk.

List of Practical:

1. Self- Introduction 2. Paragraph Writing 3. Analyse a newspaper article 4. Dialogues, Situational conversation, Relay conversation. 5. Techniques and rules and regulations during GD 6. Do's and don'ts in GD 7. Appreciating skills 8. Etiquettes and manners 9. Ethical Human conduct 10. Submission

Text Books:

1. Dr. K Alex, "Soft Skills", S.Chand and company ltd.

2. Mark Ibbotson, "Cambridge English for engineering", Cambridge university press, Delhi.

3. R R Gaur, R Asthana, G PBagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

Reference Books:

1. Daniel Coleman, "Emotional Intelligence", Bantam Book, 2006.

2. Shiv Khera, "You can win", A&C Black.

Course Outcomes:

The student will be able to –

1. use writing skills for formal documents.

2. demonstrate professional etiquettes in a workplace.

3. perform various speaking and writing tasks, such as role-plays, debates, group discussions.

4. improve appreciation skills.

5. transfer information in the writing tasks.

6. write academic papers, essays and summaries using the process approach.

FF No.: 654

Course Name: GENERAL PROFICIENCY
Course Code: HS1054
SOFT SKILLS

Credits: 1	Teaching Scheme: Lab: 2 Hours / Week

Section I

Introduction to soft skills: Soft skills importance in life and professional career. Soft Skills Vs Hard Skills.

Know Yourself: Self Introduction - Personal Information, achievements, family background

Self-Evaluation for Career Planning: Short term, Long term goals. Setting SMART goals, process of performing SWOT Analysis

Interpersonal Skill Development: Positive Relationship, Positive Attitudes, Handling Situations

Professional etiquettes: meaning and significance, organizational ethics, Telephonic etiquettes, table manners, professional etiquettes, hygiene and clothing manners.

Communication skills: Meaning and types, barriers in communication, Importance of non-verbal communication. Public speaking: do's and don'ts in public speech, Effective use of gestures through a product presentation.

Section II

Writing Skills: Application writing, email, BLOG writing, article writing, Effective Resume writing

Listening skills: Meaning, process of listening, Types, Barriers in listening, Tips for being a good listener

Team building: Concept of team, difference between team and group, process of team building, significance and methods to develop team spirit

Leadership skills: Characteristics of good leader, developing leadership skills as individual, Decision Making process,

Time Management: Concept, Importance, Time Management tools, Attendance, Discipline & Punctuality Act in time on commitment, Quality /Productive time

Group Discussion: Techniques and rules and regulations during GD, Do's and don'ts in GD.

Job Interviews: preparation, demonstration

Text Books:

1. Baun K. Mitra, "Personality Development and Soft Skills", Oxford University Press.

2. Gopalaswamy Ramesh, "The Ace of Soft Skills: Attitude, Communication and Etiquette for Success", Pearson Education.

3. Soma Mahesh Kumar, "Soft Skills", McGraw Hill Publications.

4. Uma Maheshwari, "J/W ExamXpert Soft Skills for Campus Placements", Wiley, 2018.

Reference Books:

1. Gopalaswamy Ramesh, Mahadevan Ramesh, "The ACE of Soft Skills: Attitude, Communication and Etiquette for Success", Pearson India.

2. Sharon Gerson, Steven Gerson, "Technical writing process and product", Pearson Education Asia, LPE Third edition.

3. Gajendra Singh Chauhan, Sangeeta Sharma, "Soft Skills: An Integrated Approach to Maximise Personality", Wiley.

4. B.N. Ghosh, "Managing Soft Skills for Personality Development", McGraw Hill.

Course Outcomes :

The student will be able to

1. define his / her goals for career with ability of writing skills for formal documents.
2. demonstrate professional etiquettes in a workplace.
3. apply appropriate communication skills to be an effective communicator.
4. lead a team successfully and work as a good team member as well.
5. apply time management skills to participate in group discussions.
6. demonstrate job interview skills by applying other skills viz. communication, presentation, Interpersonal skills.

FF No.: 654

Course Name: GENERAL PROFICIENCY

Course Code: HS1054

(GERMAN)

Credits: 1	Teaching Scheme: Lab: 2 Hours / Week

Introduction to German: Alphabets and sounds. International words in German. Introducing oneself and others. Times of the day. Greetings according to time of the day. Listening to conversations in day life situations

Grammar: Personal pronouns. Conjugations of weak verbs.

Food and drinks: Starting conversations. Meeting in Cafes. Vocabulary for food and drinks. Ordering food and paying the bill. Numbers. 1-1000. Tell and understand telephone numbers. Dates. Cities and countries. Nationalities and languages.

Grammar: Present and past tense of to be and have. Strong verbs. Forming and answering Wh questions and closed questions. Definite, indefinite articles. Singular and plural.

Living in Germany: Types of Houses, Types of Rooms, Description of rooms. Furniture in the house. Countries, nationalities, and languages. Directions and telling location. Family and relationships. Hobbies and pass time activities.

Grammar: Adjectives and Opposites. Nominative and Accusative cases. Negation

Time: Writing E-Mails, Times of the day, weekdays, and months. Learning clock hours, Taking formal appointments and casual meetings. Describing daily routine. Giving excuses for delays and absence. Professions and the describing responsibilities involved in that profession.

Grammar: Possessive pronouns. Separable verbs

Professions and responsibilities: Asking for place of work and answering Mode of transport for the same. Orientation of a workplace. Different professions and professional life. Responsibilities at the workplace.

Grammar: Weichsel prepositions and variable cases, Ordinal numbers

An excursion through Berlin: Tourism in Berlin, culture, places worth visiting, planning trips with the help of city map and bus / tram schedules. Narrating a trip. Asking for road directions and giving them to others.

Grammer: Modal verbs, writing a post card.

Text Books:

   1.Funk, Kuhn and Demme , " Studio d A1 Deautsch als Fremdsprache – Kurs- und Uebungsbuch",
     GOYAL SaaB and Cornelsen.

Course Outcomes:

The student will be able to

   1. pronounce the words correctly according to German language rules and formulate small and simple sentences in German using basic grammar structures.

   2. describe various types of houses and furniture items in various rooms of a house.

   3. make a conversation in German in daily life situations using vocabulary related to classrooms, family, restaurants, jobs, days, months etc

4. write emails, SMS or small essays in German.

5. read and understand small texts, advertisements, instructions in German.

6. read and tell time and use it for making an appointment and cancelling it.

FF No.: 654

Course Name: GENERAL PROFICIENCY

Course Code: HS1054

(JAPANESE)

Credits: 1	**Teaching Scheme: Lab: 2 Hours / Week**

Orientation (Jikoushokai, Aisatsu & Moji)

- Theory: Orientation Lecture

- Introduction of Hiragana script with basic words

- Youon, Sokuon, Chouon – Methods of writing words

- Greetings and Classroom Expressions

- Etiquettes and mannerisms

Introduction of Katakana (Moji Katakana)

- Introduction of Katakana script

- Introduction of Katakana rules

- Katakana words used in daily life

Calender & Numbers (Suji, Youbi, Hizuke, Jikaan)

- Introduction of numbers

- Writing Days of the week, Dates, Time, Months in Hiragana

- Special Greetings used in different situations in Japan

Basic Grammar Pattern (Bunnokatachi, Keiyoushi-To, Doushi)

- Introduction of ~は~です pattern

- Affirmative, Negative and interrogative sentences

- Introduction of demonstrative pronouns

- Learning い and な adjectives and opposites

- Introduction of some basic and useful verbs and their simple present tense

Introduction of 3rd Script Kanji (Kanji & Kanji Jukugo)

- Basics of Kanji

- Kanji for Numbers (1-10)

- Kanji for basic words

Culture of Japan (Nihon-No-Bunka)

- Some festivals in Japan

- Arts of Japan

- Foods and Dress of Japan

- Islands and seasons of Japan

- Some special things about and in Japan

- Revision of all topics and paper

Text Books:

1. Yoko Hasegawa, "Elementary Japanese", Vol. 1, Tuttle Publishing.

Course Outcomes:

The student will be able to

1. greet formally and introduce himself/herself in Japanese language with appropriate etiquettes and mannerism.

2. read and write Hiragana, Katakana, Scripts along with basic words, numbers, dates, telephone nos., days of the week, months, year, time.

3. read and write 3rd Script Kanji i.e Kanjis for nos., Days, dates, time, years as well as some basic words.

4. read/Write sentences using basic sentence pattern including all three scripts.

5. tell about his/her family. Describe things using basic adjectives and actions by using basic verbs.

6. become familiar to fascinating country like Japan & Japanese culture.

FF No.: 654

Course Name: GENERAL PROFICIENCY

Course Code: HS1054

(FRENCH)

Credits: 1	Teaching Scheme: Lab: 2 Hours / Week

Introduction: Alphabets, Numbers (0-100), Months, days of the week, Difference between Tu/Vous, Self, Introduction, Date of birth, Telephone numbers, Basic salutations.

Ecole de francais, Paris: Au secretariat: Indefinite Articles (c'est ce sont) Definite Articles, Introduction of third person, Nationalities, professions, Irregular verbs –Etre / Avoir.

Autour de l'école: Vocabulary related to family and colours, Regular « er » ending verbs, Prepositons, Directions.

La vie quotidienne: Quelle heure est- il?, Verbs « aller, venir, faire », Interrogation (yes /no), Reflexive verbs.

Ma chambre : Vocabulary for room and house, Regular "ir" ending verbs, Concept of si, oui and non, Les adjectifs possessifs.

Une Randonnée : La négation, Concept of Jouer a/jouer de.

Text Books:

Manjiri Khandekar and Roopa Luktuke, " JUMELAGE", Saraswati House Pvt Ltd.

Course Outcomes:

The student will be able to

1. greet formally as well as informally and introduce himself or herself in French, Read and write numbers, dates, telephone numbers, days of the week.

2. describe the culture of France and form grammatically correct sentences and introduce third person.

3. ask or tell the directions to reach the destination and describe your family.

4. tell and ask time, frame basic questions and describe your routine.

5. write emails, letters and small essays in French and describe your room using relevant vocabulary.

6. make negative sentences and use them in the dialogues.

Course Name: GENERAL PROFICIENCY

Course Code: HS1054

(CHINESE)

Credits: 1	Teaching Scheme: Lab: 2 Hours / Week

Developing oral skills [intensive and supplementary vocabulary]

- Greetings
- Introducing Oneself and Others
- Asking for Personal Information
- Talking About Date
- Talking About Time
- Talking About Age
- Talking About Plans

Outline of Grammar, Chinese Numerals - Nominal Classifiers – Sentences with Adjectival Predicate - Interrogative Sentences - Structural Particle - Verbs and Verbal Classifiers - Interrogative Pronouns and Prepositions - Sentences with Nominal Predicate - Affirmative-Negative Questions - - Modal Particle indicating Change - Alternative Questions - Confirmation Question - Approximate Numbers - Aspect Particle indicating Completion of Action - Reduplication of Verbs - Modal Verbs

Text Books:

Beijing Language Institute. comp., CHINESE CONVERSATION FOR FOREIGNERS (LU) Vol 1 (selected lessons). Beijing: BLCUP, 2006

Course Outcomes:

The student will be able to

1. greet formally as well as informally and introduce himself or herself in Chinese, Read and write numbers, dates, telephone numbers, days of the week.

2. describe the culture of China and form grammatically correct sentences and introduce third person.

3. ask or tell the directions to reach the destination and describe your family.

4. tell and ask time, frame basic questions and describe your routine.

5. write emails, letters and small essays in French and describe your room using relevant vocabulary.

6. make negative sentences and use them in the dialogues.

FF No.: 654

Course Name: INDIAN DEMOCRACY AND CONSTITUTION
Course Code: HS1036

Credits: Audit	Teaching Scheme: Theory: 1 Hour / Week

Section I

Democracy in India: a) Indian parliamentary democracy b) Lok Sabha c) Rajya Sabha

Important concepts of Indian Democracy - a) Fundamental rights in Indian constitution b) Fundamental duties in Indian constitution c) Challenges of national integrity

Good Governance a) Meaning and concepts of good governance b) Government and governance c) Good governance from directives principles of state policy

Section II

Introduction to Constitution - Meaning and importance of the Constitution, salient features of Indian Constitution. Fundamental Duties Content. History of the Indian Constitution. Constitution and Constitutionalism.

Preamble to the Indian Constitution - Philosophy of the Fundamental Rights. Different important Articles from the Indian Constitution.

Directive Principles of State Policy - An Introduction to Directive Principles of State Policy. Fundamental Duties in the Indian Constitution.

Text Books:

1. M.V.Pylee, "Introduction to the Constitution of India", 4th Edition, Vikas publication, 2005.

2. M P Jain, " Indian Constitutional Law", 8th Edition , Justice Jasti Chelameswar.

Reference Books:

1. Durga Das Basu, "Introduction to the Constitution of India", Gurgaon; LexisNexis, 23rd Edition, 2018.

2. Merunandan, "Multiple Choice Questions on Constitution of India", 2nd Edition, Meraga publication, 2007.

Course Outcomes:

The student will be able to –

1. analyze the democratic framework with the help of its standards of governance.

2. critically examine election process in the country.

3. enhance their understanding of good governance.

4. analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail.

Course Name: PROFESSIONAL DEVELOPMENT

Course Code: HS1038

Credits: Audit	Teaching Scheme: Theory: 1 Hour/Week

Section I: Campus Awareness and Self Awareness

➢ Institute information- Overall orientation, tour to college campus, Guidance to students about future.

➢ Branch wise Opportunities -Exposure to the department level activities, scope of the department

➢ Rules, dress code & Ethics-Rules to be followed on college campus, Dress code to be followed by students

➢ SWOC Analysis- Doing SWOC of organization, a well-known personality or friend.

➢ Importance of mandatory documents. Indian students must possess Aadhar, Passport, Driving License, Voter Id, Credit/ debit card, International students must have valid passport & visa approval, driving license, address proof.

➢ Life Skills- Appreciating skills like negotiation, time management, positive thinking, recognizing diversity, networking etc. Contribution towards society, social initiatives**.**

➢ Effective utilization of winter & summer vacation.

➢ SWOC Analysis-Self Analysis, Doing SWOC for self (Strengths, Weakness', Opportunities, Challenges)

➢ Career opportunities- Finding the future career opportunities, Guidance by expert, Finding own long term short term and medium term goals.

➢ Career planning, making choices of career - Filling up career choices form.

Section II: Professional Awareness

➢ General knowledge and awareness, Current affairs, technical, Financial and business

➢ Personal training – physiology, Family background and networking,

➢ Career Opportunity-Corporate job-types, Skills required for Higher studies, Public sectors, Entrepreneurship

➢ Corporate Jobs- IT and Non IT Jobs, Higher Studies – Education India- IIM, IIT, NIT, IIIT, Education Abroad- Country, Cost and Documents required, MBA.

➢ Public Sectors- Jobs, DRDO, IUCAA, ISRO, HAL

➢ Entrepreneurship – Startup Vs job, who wants to start, Type of start-up, Beneficial for start-up – grants , Steps for start-up, Patents, Success rate of start-up

➢ Resume writing, Selection Process

Submissions: Submissions to be accepted as scanned soft copy. Checklist to be prepared as follows

1. Aadhar card /(India & abroad Address proof for international students)

2. Passport 3. Driving License   4. Voter ID   5. English or foreign language proficiency proof   6. Aptitude assessment proof (Must)   7. SOP of one research statement (Must)8. Career planning form submission (Must)   9. SWOC Self – Analysis (Must)

Reference Book:

John Peter, "Self Development and Professional Excellance", Cengage Publications.

Course Outcomes:

The student will be able to

1. find opportunities available in her/his domain.

2. be ready to explore opportunities.

3. analyze strengths, weakness, opportunities and challenges.

4. decide his career goal and explore different career opportunities.

5. develop necessary professional skills.

6. write resume in efficient and presentable format.

Course Name: INDUCTION TRAINING

Course Code: HS1027

Credits: Audit	Teaching Scheme: Lab: 2 Hours/Week

Section I
➢ Physical activity
➢ Creative Arts
➢ Universal Human Values
➢ Literary

Section II
➢ Proficiency Modules
➢ Lectures by Eminent People
➢ Visits to local Areas
➢ Familiarization to Dept./Branch & Innovations

References:

Motivating UG Students Towards Studies, Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors), 31 March 2016, IIT Directors' Secretariat, IIT Delhi.

Course Outcomes:

The student will be able to

1. inculcate the ethics and culture of institution.
2. explore their academic interests and activities reducing competition.
3. develop awareness about the institute's culture in students.
4. promote bonding within themselves.
5. build relations between faculty members and students.

Course Name: ENVIRONMENTAL SCIENCE

Course Code: ES1014

Credits: Audit	**Teaching Scheme: Theory: 2 Hours / Week**

Section I
Nature of environmental studies: Definition, scope, importance, multidisciplinary nature of environmental studies, need of public awareness, Role of an individual in conservation and equitable use of natural resources, sustainable lifestyles, Natural resources and associated problems : Forest, water, mineral, food, energy, land resources
Ecosystems: Concept, Structure, function, characteristics of ecosystems, energy flow in ecosystem, producers, consumers, and decomposers, ecological succession
Biodiversity and its conservation: Introduction, value, hot spots of biodiversity, threats to biodiversity, conservation of biodiversity

Section II
Environment pollution: Introduction, definition, types of pollution, cause and effect of pollution, solid waste management, role of an individual in prevention of pollution, disaster management
Social issues and the environment: Unsustainable to sustainable development, urban problems related to energy, water conservation, environmental ethics, climate change, global warming, ozone layer depletion, wasteland reclamation, consumerism and waste products
Environmental protection: Environmental protection act, AIR (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection act, Forest conservation act, population growth and human health, human rights

Text Books:

1. G. Pyler Miller, Cott E. Spoolman, "Environmental Sciences", 16th Edition, Cengage Publications.

2. Erich Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2nd Edition, UGC Publications.

3. Mackenzie L. Davis and David A. Cornwell, "Introduction to Environmental Engineering", 4th Edition, Tata McGraw-Hill Education Private Limited New Delhi, 2010.

4. J. Tyler Jr. Miller and Spoolman, "Environmental Science with Mindtap", 14th Edition, Cengage Learning, 2014.

Reference Books:

1. Gilbert M. Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education. Dorling Kindersley (India) Pvt. Ltd. Delhi, 2007.

2. J. Glynn Henry and Gary W. Heinke, "Environmental Science and Engineering", 2nd Edition, Pearson Education (Singapore) Pte. Ltd, 2004.

Course Outcomes:

The student will be able to –

1. recognize renewable and non-renewable resources and associated problems and plan different activities to create awareness among the people and hence to conserve resources by minimizing degradation of environment.

2. understand different types of ecosystems and their importance in balancing the nature.

3. understand concept of biodiversity at national and global level and need to preserve it.

4. understand different types of pollutions and hence to find the remedial measures to minimize ill effects.

5. recognize various disaster and solid waste management techniques.

6. understand and appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

FF No.: 654

Course Name: SOCIAL SERVICE

Course Code: HS1061

Credits: Audit	**Teaching Scheme: Lab: 2 Hours / Week**

Contents

Orientation sessions on topics of social relevance by eminent experts.

Students are expected to plan, execute and actively participate in any one or more pre-determined social activities (under the supervision of faculty and members of team Student Council - Social Welfare and Development Committee) for a minimum duration of 30 hours during a semester. These activities will be carried out at various locations jointly with Non-Government Organizations, Semi-Govt. authorities, Govt. authorities, Social Forums, Foundations, etc.

Student is expected to prepare and submit a report under the supervision of Guardian faculty (in annexed format) on Vishwakarma Online Learning Platform.

List of Project areas includes:

1. Cleanliness drives at pre-defined places
2. Street Plays for social, economic awareness of citizens (drugs, corruption, election awareness, cleanliness, Women safety etc.)
3. Tree Plantation
4. Digital Literacy: Impart training regarding use of digital media for bill payments, online banking, Ticket booking, Social media handling, mailing, etc.
5. Teach for India: Training of school students in rural areas, government schools
6. Rain harvesting related activities
7. Awareness of Various Govt. schemes for benefit of citizens
8. Women empowerment
9. Contribution towards plastic free environment
10. Skill India: Training for skills development to unemployed youth.
11. Awareness regarding plan of action during natural and man-made disasters.
12. Assistance to various domains to grow in their profession (Professions like Teachers, Shopkeepers, Farmers, etc.)
13. Development of Engineering projects for social cause.

Books:

1. Krishna Kant Singh, Ram Shankar Singh, " An Introduction to Social Work", 1st Edition, Penguin Books Ltd, 2010.

Course Outcomes:

The student will be able to

1. enhance awareness and commitment towards active citizenship and social responsibility
2. examine and articulate personal social identities, privileges, and biases.
3. define personal role as a engineer and citizen in both local and global communities.
4. recognize the importance of and actively seek contributions from others regardless of differing social identities.

5. appropriately challenge the unfair, unjust, or uncivil behaviour of other individuals or groups.

6. develop positive attitude towards under-privileged sections of the society

7. correspond professionally with others (e.g. peers/team members, agents, campus offices, cosponsoring groups, etc.) to organize logistics related to specific programs or events.