`

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to SavitribaiPhule Pune University)

Structure & Syllabus of

Department of Engineering, Sciences & Humanities (DESH)

Pattern 'A-21'

F. Y. B. Tech.

Effective from Academic Year 2021-22

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

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

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 – Pleasevisitwww.vit.edu

FF No. 653

F. Y. B. Tech. Structure for Module I and II in Semester I and Semester II

F.Y. B. Tech. Structure for First Semester						
Course Code	**Course Name**	**Teaching Learning Scheme**				
		Th	**Tut**	**Lab**	**Hrs. / Week**	**Credits**
Module I (M_1) Course – Semester I						
ES1031	Cognitive Aptitude	3	0	0	3	3
HS1033	Human Engineering	3	0	0	3	3
ES1037	Mobile Application Development	0	0	2	2	1
ES1014	Environmental Science	2	0	0	2	0
Module Ii (M_2) Course – Semester I						
ES1032	Engineering Mathematics	3	0	0	3	3
ES1033	Systems Engineering	3	0	2	5	4
HS1034	General Proficiency and Professional Development	2	0	0	2	0
Courses Irrespective of Module In Semester I						
ES1034	Problem Solving and Programming	3	1	2	6	5
ES1035	Robot: Mechanics and Electronics	3	1	2	6	5
ES1036	Capstone Project 1	0	0	6	6	3
ES1041	Design Thinking 1	0	0	2	2	1
Grand Total Module I / Module II – Semester I		**14**	**2**	**14**	**30**	**21**
F.Y. B. Tech. Structure for Second Semester						
Course Code	**Course Name**	**Teaching Learning Scheme**				
		Th	**Tut**	**Lab**	**Hrs. / Week**	**Credits**
Module I (M_1) Course – Semester II						
ES1032	Engineering Mathematics	3	0	0	3	3
ES1033	Systems Engineering	3	0	2	5	4
HS1034	General Proficiency and Professional Development	2	0	0	2	0
Module Ii (M_2) Course – Semester II						
ES1031	Cognitive Aptitude	3	0	0	3	3
HS1033	Human Engineering	3	0	0	3	3
ES1037	Mobile Application Development	0	0	2	2	1
ES1014	Environmental Science	2	0	0	2	0
Courses Irrespective of Module In Semester II						
ES1038	Data Structures Using Python	3	1	2	6	5
ES1039	Mechatronics and Robotics	3	1	2	6	5
ES1040	Capstone Project 2	0	0	6	6	3
ES1042	Design Thinking 2	0	0	2	2	1
HS1036	Indian Democracy and Constitution	2	0	0	2	0
Grand Total Module I / Module II –Semester II		**14**	**2**	**14**	**30**	**21**

FF No. : 654

Course Name: COGNITIVE APTITUDE

Course Code: ES1031

Credits: 3 **Teaching Scheme: Theory: 3 Hours / 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, Ratio, Proportion, Variation, Linear Equations, Number Systems, 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. Dr. R. S. Aggarwal, “Quantitative Aptitude for Competitive Examinations”, S. Chand Publications.
2. Dr. R. S. Aggarwal, “A Modern Approach to Logical Reasoning”, S. Chand Publication.

Reference Books:

1. PeeyushBhardwaj, “TheHands-on Guide to Analytical Reasoning and Logical Reasoning”, Arihant Publication.
2. Arun Sharma, “How to Prepare for Logical Reasoning”, McGraw Hill Publication.
3. NishitSinha, “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. SarveshVerma, 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:ENGINEERING MATHEMATICS

Course Code: ES1032

Credits: 3 **Teaching Scheme: Theory: 3 Hours / Week**

Section I

System of Linear Equations: Rank of matrix, Elementary Matrices, System of linear equations.

Vector Spaces: Euclidean Vector space, Vector Space, Subspace, Span of a set, Spanning Set, Fundamental Subspaces, Linear Dependence, Independence, Basis and dimension of a vector space, Inner product, Orthogonal Bases: Gram Schmidt Process.

Linear Transformation: Definition, Kernel, Range, Matrix of Linear Transformation, One-one, Onto transformation, Orthogonal Transformation, Geometric transformations in R^2 andR^3.

Section II

Eigen Values and Eigen Vectors: Eigen Values and Eigen Vectors of a matrix, Diagonalization, Symmetric Matrices and Orthogonal Diagonalization, Quadratic forms and its Applications.

Functions of two or more variables: Introduction to functions of two or more variables, Level surfaces, limits and continuity, Partial derivatives, chain rules, Jacobian, maxima and minima of functions of two variables.

Higher order Linear Differential equations: First order linear ode, Second order ODEs and its applications: Homogeneous Linear ODE's, Non homogeneous ODE's.

System of Differential equations: Basics of system of differential equations, Solutions of system of differential equations.

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, 'Text book of Calculus', Brooke/Cole, a part of Cengage Learning (Indian Edition), (c) 2011.
3. Erwin Kreyszig, 'Advanced Engineering Mathematics'10th Edition, Dec. 2010, , John Wiley and sons, Inc.

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. Gilbert Strang, 'Linear Algebra and its Applications', 4th Edition, Cengage Learning.
4. B.V. Ramana, 'Higher Engineering Mathematics' Tata McGraw-Hill publishing co. Ltd.
5. Michael D. Greenberg; Advanced Engineering Mathematics; Pearson Education Asia
6. Peter V. O'Neil; Advanced Engineering Mathematics; 5th edition, Thomson Brooks/Cole.

Course Outcomes:

The student will be able to –

1. solve and analyze the system of linear equations.
2. recognize the concepts of spanning set, basis, dimension linear transformation, inner product, linear

dependence/independence, Basis and Dimension

3. find eigen values and eigen vectors
4. demonstrate the knowledge of partial derivative and its applications
5. solve linear differential equations and interpret the solution
6. translate a physical problem into a mathematical model and find a solution of the model by selecting and applying a suitable mathematical method.

FF No. : 654

Course Name: SYSTEMS ENGINEERING

Course Code: ES1033

Credits: 3 **Teaching Scheme: Theory: 3 Hours / Week**

Lab: 2 Hours / Week

Section I

Operations Strategy : Manufacturing vs Service Operations, Concept of Process as applied to manufacturing and services, SIPOC (Supplier-Input-Process-Output-Customer), Process Choices in Manufacturing: Project, Job Shop/Job Order, Batch, Mass/Assembly, Continuous Process, Terry Hill‟s Operations Strategy Framework, Order Winners vs Order Qualifiers.

Logistics & Supply Chain Management : Logistics Management, Functions – Transportation, transportation Cost calculations, Feasible Value & Optimal value calculation, Assignment Model, Product mix strategies, Calculation of total maximum profit, Warehousing, Warehouse space constraint, Ware House Inventory Cost Constraint, Inventory Management, EOQ vs EBQ, Selective Inventory Control Procedures like ABC,XYZ,FSN,SDE,HML,VED,SOS,GOLF etc Practical constraints used for modifying Theortical EOQ, Quantity Discount method, Material handling & Packaging, Order (Information) Processing, Supply Chain – Types: Product SC, Service Spares SC, Service SC, Sustainable SC – Green SC, Reverse Logistics. Inventory Under deterministic and probabilistic cases.

Conventional & Renewable Energy Systems: Various sources of renewable energy and their systems; Bio energy: introduction to bio fuels, biogas and bio fuels, Solar energy: solar thermal conversion devices, storage and applications, solar cell fundamentals, different solar cell technologies, photovoltaic systems, solar assisted heating and cooling systems; Thermal energy, Hydro-thermal energy, wave energy and ocean thermal energy conversion; Fuel cell: importance for fuel cell, classification of fuel cells, basic principle, design, materials used for developing fuel cells, applications and future prospects; Non-conventional energy: wind energy conversion, tidal energy, hydro energy and Nuclear energy

Section II

Project Management: Projects – Definition, Characteristics, Classification, Project Life Cycle Phases – Concept/Initiation, Feasibility, Planning & Organization, Implementation, Clean-up & Shut Down Phase, Project Planning – Project Charter, Statement of Works, Network Analysis – PERT/CPM, Project Crashing, Usage of software for drawing and calculating values of CPM & PERT, Resource Levelling and Resource Smoothing.

Quality Assurance : Quality – Concept, Definitions, Quality attributes for products & services, Cost & Value of quality, Inspection – 100% vs Sampling, Sampling Plans, Statistical Process Control, TQM, Six Sigma Concept – Measurements, DMAIC & DMADV, 7 QC Tools – Check sheets, Histogram, Fishbone diagram, Pareto diagram, Scatter Diagram, Lean Manufacturing System.

Sustainability : Energy – Requirements, Forms, Environment – Types of Pollution – Air, Water, Soil, Solid Waste Management, Important Legislations related to Energy & Environment, Hazardous & toxic waste management.

List of Practicals:(Any Ten)

1. Case study on Product Design Philosophy
2. Use of 7 quality tools implementation (using MS Excel)
3. Use of Statistical process Control (SPC) for manufacturing/Service industry (using MS Excel)
4. Implementation of Define and Measure phase of Six Sigma to manufacturing/Service industry (using standard templates made in MS Excel)
5. Case studies on Operation strategies
6. Coordinate Measuring machine
7. Implementation of Project Management concepts for managing projects (using MS Excel & MS Project Software tool)
8. 3D Printing Machine
9. Injection Molding Machine
10. Study of basic measuring instruments, VernierCaliper, Micrometer, Dial Indicator, Profile Projector etc.
11. Experiment on profile projector and vision measuring system
12. Tension test on Mild Steel and Aluminum
13. Brinell hardness test on different materials
14. Demonstration on Lathe Machine, Milling and drilling Machine.
15. Demonstration of CNC Lathe Machine Operation
16. Demonstration of various welding methods
17. Laser Beam Machining
18. Simulation model making using any software (Simio 3 D Software) (2 sessions)
19. Simulation software application to a real life problem of any organization
20. Use of excel solver tool for solving optimization problems
21. Design of solar system

Text Books:

1. R .Paneerselvam, Production & Operations Management,3rd Edition, PHI Publishers
2. Krishna Kumar Dwivedi and MukeshPandey, Fundamentals of Systems Engineering ,Wiley, ISBN-13 : 978-8126566549
3. Benjamin S. Blanchard and Wolter J. Fabrycky, SystemsEngineeringandAnalysis, 5th ed., PrenticeHall International Series in Industrial and Systems Engineering, (Upper Saddle River, NJ), 2006. ISBN-13: 978-0-13-221735-4

Reference Books:

1. Miller, John. QBQ! The Question Behind the Question: Practicing Personal Accountability atWorkand in Life. East Rutherford, NJ: Putnam Publishing Group, 2004. ISBN: 9780399152337.
2. Altshuller, Genrich, Dana W. Clarke, Uri Fedozeev, and Steve Rodman. 40 Principles: TRIZ Keys to Innovation. Worcester, MA: Technical Innovation Center, Inc., 2005. ISBN: 9780964074057
3. Inventory management by L.C.Jhamb, Everest Publishing House ISBN: 9788176314541

Course Outcomes:

The student will be able to –

1. Understand nature of manufacturing and service operations and apply principles of operations strategy for process choice.
2. Identify the key elements and processes in supply chain and their interaction.
3. Understand conventional and renewable energy systems.
4. Learn the basic concepts of project and project management.
5. Understand and apply principles of quality management, quality tools and six sigma methodology
6. Understand basic concepts of sustainability and environmental issues and its remedial measures

FF No. : 654

Course Name: MOBILE APPLICATION DEVELOPMENT

Course Code: ES1037

Credits: 1	**Teaching Scheme: 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 – GridView and ListView, 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 – SQLiteOpenHelper and creating a database - Opening and closing a database, Working with cursors Inserts, updates, and deletes

As a term project students 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:

1. Develop an application that uses GUI components, Font and Colors.
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", Pearson Education, 2nd ed. (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: HUMAN ENGINEERING

Course Code: HS1033

Credits: 3	**Teaching Scheme: Theory: 3 Hours / Week**

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

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.

Psychology: Introduction, Personality & memory:factors influencing personality, Models of memory, types, forgetting, Youth Psychology:Identity, Relationships, Careers.

Social Application of Psychology : Emotional Intelligence gender differences, applications in family setting and in interpersonal skills,

Motivation, motivational cycle, theories, Stress: common sources, Fight and flight response, managing stress,

Social Psychology, Crowd psychology, collective animal behavior, Aggressive behavior, Prosocial and Antisocial Behaviour, impact of social media on mental health.

Health Sciences: -Human Anatomy, General Diseases that causes impact on Human health and their Prevention and Cure

Ideal Human Health Parameters and their Measurement,

Diet and their Impact on Health and Lifestyle and their Side Effects, Life Style 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)
4. Robert S. Feldman, “Understanding Psychology”, 10th Edition by McGraw Hill.
5. Saundra Ciccarelli and Glenn Meyer, “Psychology”, Pearson Publication.
6. K. Park, Preventive and Social Medicine,Bhanot Publishers

Reference Books:

1. Devamrita Swami, “Searching for the Vedic India”, Bhaktivedanta Book Trust, ISBN 0-89213-350-3.

2. PatitaPavan, "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. Morgan, King, Weisz, Schopler , "Introduction to Psychology", McGraw Hill.
5. B. K. Mahajan, M. C. Gupta, Textbook of Preventive and Social Medicine
6. JostienGarder, ."Sophies World - A Novel about the History of Philosophy", Berkeley Books, New York, USA, 1996.
7. Devamrita Swami, "Searching for Vedic India",Bhaktivedanta Book Trust.
8. 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. evaluate the purpose of the 8 steps of the Yoga sutras and their consequence on the human mind.
3. understandthe subject matter of Psychology as a science &its various applications, Social Psychology to become an aware and responsible citizen.
4. study the concept of emotions and motivation to be able to apply in various areas of their life.
5. classify disease categories and identify various diseases and their impact
6. recognize ideal human health parameters and their measurements, basic emergency managements and demonstrate selection and maintenance of personal protective equipment

FF No. : 654

Course Name: PROBLEM SOLVING AND PROGRAMMING

Course Code: ES1034

Credits: 5	**Teaching Scheme: Theory: 3 Hours / Week** **Tutorial: 1 Hour / Week** **Lab: 2 Hours / Week**

Section I

Computing Fundamentals: How a data value is represented using binary symbols? 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 Compiler, Interpreter, Loader, linker, 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. Row and column representation of array in memory

Section II

Strings: Strings Basics, Strings Declaration, Strings Initialization, NULL terminated string , reading and printing strings using gets(), puts(), scanf() and printf() function, string library functions

Functions: Function purpose, function declaration, definition and calling, function parameters and return 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 - incrementing pointer, decrementing pointer, adding and subtracting integer value and pointer, subtracting two pointer variables, comparing two pointer variables, pointer invalid operations, swap function – the wrong way and the correct way, pass by value Vs pass by reference

Array and pointers: array name is pointer, how [] operator operates on array name, passing array to a function, Dynamic memory allocation.

Introduction to files: file handling, read, write and create.

List of Tutorials:

1. All tutorials must be focusing on development of a logic, flowchart, algorithm and pseudo code for the given problem statement.
2. Generate the Fibonacci series of elements.
3. Round off an integer to the next largest multiple of another integer.
4. Interchange the contents of two variables without using third variable.
5. Calculate the average of given numbers
6. Write a logic to find whether the given point (x, y) lies inside the circle with radius r, on the circle or outside the circle.
7. To calculate the monthly interest of customers fixed deposit.
8. To calculate the sum of series given as 1, ½!, 1/3!, ¼!,…..... 1/n!
9. Test the given number as prime number
10. Test whether the given number is Armstrong number
11. Convert the binary to decimal and decimal to Binary number
12. Write the logic to print the factorial of a number
13. Reverse the given string and separate the alphabets of string.
14. Find the smallest and largest numbers from given N numbers.
15. Calculate whether the given number is divisible by 3/5/7 etc.
16. Multiplication of two matrices
17. Calculate the surface area and volume of a cylinder
18. Addition of two matrices and algorithm for use of functional pointer
19. Exchange a string from one variable to another using pointers.
20. Debugging test cases at different instance of program

For example

```
Void main()
{int a;
        a=12;
printf(%d%d%d,"a, a++, ++a");
    }
```

21. Check whether the odd size given matrix is magic square or not
22. Enumeration of all subset, permutation, etc

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 Pointers in C.

8. Assignment based on Array pointers.
9. Assignment Based on Function Pointers in C.
10. Assignment based on Double Pointers in C.
11. 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. YashwantKanetkar, "Let Us C", BPB Publication.

Reference Books:

1. Harry. H. Chaudhary, **"**C Programming :The Definitive Beginner's Reference" , First MIT-CreateSpace Inc. O-D, Publishing, LLC USA .
2. R. G. Dromey, " How to solve it by Computer" Prentice Hall, ISBN 978-0134340012
3. Brian Kernighan and Dennis Ritchie, "The C programming Language" PHI; 2nd edition , ISBN-10 : 0131103628

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

Course Outcomes:

The student will be able to:

1. gain a broad perspective about the uses of Computer Programming in engineering industry.
2. develop basic understanding of computer programming, the concept of procedural programming and algorithmic thinking.
3. develop the ability to analyze a problem & provide a programming solution to it.
4. implement programming constructs to solve real world problems.
5. justify modular programming approach by making use of elementary as well as superior data structures.
6. apply programming fundamentals to construct concise solutions.

FF No. : 654

Course Name: ROBOT: MECHANICS AND ELECTRONICS

Course Code: ES1035

Credits: 5	**Teaching Scheme: Theory: 3 Hours / Week** **Tutorial: 1 Hour / Week** **Lab: 2 Hours / Week**

Section I

Robot Terminology : History and future of Robotics, Basics of Robotics, Anatomy andspecification of a Robot, Classification and configurations of robots, Mechanical, Electrical andElectronics Components used in Robotics, Degree of Freedom, Robot coordinates, Roll-Pitch-Yaw, terms like accuracy, precision, resolution, repeatability etc. Robot software interface,Robot analogy with human body.

Mechanics of Robots : Concepts of mechanics, Force, Torque, Equilibrium, Free bodydiagrams, friction, concept of centre of gravity, centre of mass, centroid and moment.

Robot Kinematics : Kinematic linkages, Forward and Inverse kinematics, numericalexamples. Introduction to trajectory planning**.**

Actuators : Pneumatic, Hydraulic, Electrical – Solenoid coil, Construction, working principle ofPMDC, BLDC, Stepper and Servo motors, Merits and Demerits, Applications and selection ofactuators.

Section II

Semiconductor Devices : Diodes, Rectifiers, zener, LED, photo diode, opto-isolators, BJT (asswitch and amplifier), Op-Amps, multivibrators**.**

Power devices: Introduction to SCR, Diac, Triac, FET, MOSFET, IGBT, motor driver circuits**.**

Digital Electronics : Overview of Number system, logic gates, Flip-flops, counters, registers,ADC, DAC**.**

Power supply :AC to DC conversion, regulated power supply, SMPS.

Tutorials:

1. PPT sessions on different topics allotted to groups
2. One topic per group per round
3. Week 1 to 5 – Round 1
4. Week 6 to 10 – Round 2

List of Practical:

1. Study of Mechanical components-1
2. Study of Mechanical components -2
3. Study of Electrical components
4. Study of Electronic components
5. Circuit Simulation – 1 (Relay based DC motor drive circuit)
6. Circuit Simulation – 2 (DC Regulated Power Supply (7805 / 7812, Rectifier & Filter Circuit)
7. 7) and 8) Circuit Simulation – 3 and 4 (Applications of IC 555)
8. 9) to 12) Course Project Work

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 , 3 rd Edition, Tata McGraw Hill Publication.

3. Ferdinand P. Beer, E. Russell Johnston,Mechanics of Materials.
4. P. S. Bimbhra, Power electronics,Khanna Publishers,
5. S.B.Dewan, G.R.Slemon&A.Stranghan, Power Semi conductor controlled Drives, John Willey Pub.
6. T.Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.
7. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.

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. understand importance of Robotics and the terminology w.r.t. different mechanical, electrical and electronics components and their applications in Robotics..
2. understand the significance and make basic calculations based on Robot Mechanics.
3. understand the working principle and working of different actuators used in Robotics.
4. understand the concept, significance and make basic calculations based on Robot Kinematics.
5. understand use of different electronic and power devices in circuits related to Robotics.
6. understand use of different digital components and devices in circuits related to Robotics.

FF No. : 654

Course Name: DESIGN THINKING 1

Course Code: ES1041

Credits: 1	**Teaching Scheme: Theory: 2 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. *C.R. Kothari , Research Methodology, Methods and Techniques ,2nd Edition, New Age International Pvt. Ltd., Publishers (2004)*
2. *R. Panneerselvam, Research Methodology, Prentice Hall Of India, New Delhi,2004*
3. *VinayakBairagi, 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*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 concepts of discovery, invention, innovation, research etc.
2. Know socio-economic impact of research.
3. Understand various research tools, its application and methods.
4. Understand the process of paper publication.
5. Understand the concept and process of IPR and ethical Practices in Research.
6. Understand the concept and process of Entrepreneurship and Business planning

F.F No. : 654

Course Name: CAPSTONE PROJECT 1

Course Code: ES1036

Credits: 3 **Teaching Scheme: Theory: 6 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 Capstone Project 1

Step by step Implementation of activities by the students:

1. **Group Formation Activity: -** Project group formation within the allotted Capstone Project 1 (CP1) batch, Deciding Group leader and Assistant Group Leader
2. **Brain Storming and Discussion Activity**: - Discussion on topics for Capstone Project 1 (CP1) 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 Capstone Project 1 (CP1) topic considering appropriate Domain area, Tools & Technology in consultation with Capstone Project 1 (CP1) project Guide
5. **Project Planning Activity:-** Finalization of Problem statement, objectives, methodology and systematic strategy to complete the Capstone Project 1 (CP1) project in consultation with CP1 guide
6. **Synopsis Drafting Activity:-** Prepare Synopsis of the planned CP1 project under the guidance of CP1 guide and complete its online Registration
7. **Team Work Activity**:- Report and update about project work progress regularly to CP1 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 Capstone Project appear for the timely conducted project reviews by CP1 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 Capstone Project 1 in IEEE Research paper format

14. **Project Report/Paper Writing Activity:-** Results and Discussions, writing the Interpretation of the obtained results of the accomplished CP1 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 CP1 project guide followed by its approval after doing the needful corrections.
16. **Online** submission of pdf of the IEEE Paper based of CP1 for the record
17. **End Semester Assessment:-** Present the IEEE Paper based of CP1 project and the PPT at Student Capstone Project 1 Conference on the scheduled date as part of End Semester Assessment of the CP1 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. *PradeepPai, Project Management, 1st Edition, PEARSON INDIA (2019)*
3. *YousefHaik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning, Second*

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", Cengagelearning (International edition) Second Edition, 2013.*

Course Outcomes :

The student will be able to –

1. identify projects relevant to societal needs
2. map the technologies learned with the project needs
3. apply design thinking process with technological knowledge to design various feasible solutions
4. select the 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: GENERAL PROFICIENCY AND PROFESSIONAL DEVELOPMENT

Course Code: HS1034

Credits: Audit	**Teaching Scheme: Lab: 2 Hours/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.
- Importance of English and foreign languages. Formal mechanisms of Language proficiency certifications like TOFEL, IELTS, PET, JLPT, TestDaF, DSH, TCF etc.
- Career planning, making choices of career - Filling up career choices form.
- Project, Innovation & Research - comparison. Writing SOPs. Importance of peer review & publications, protecting intellectual property - trademark, copyright & patents.

Section II:General Awareness and Professional Awareness

General knowledge and awareness, Current affairs, General awareness -technical, Financial and business, Personal training – physiology, Family background and networking, Attitude - Mathematical skills, Complex problem solving, Critical thinking, Career Opportunity-Corporate job-types, Skills required, 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)
Course Outcomes:
The student will be able to – 1. find opportunities available in his domain. 2. be ready to explore opportunities. 3. analyze strengths, weakness, opportunities and challenges. 4. decide his career goal. 5. explore different career opportunities. 6. develop necessary professional skills. 7. Write resume in efficient and presentable format.

FF No. : 654

Course Name: DATA STRUCTURES USING PYTHON

Course Code: ES1038

Credits: 5 **Teaching Scheme: Theory: 3 Hours / Week**

Tutorial: 1 Hour / Week

Lab: 2 Hours / Week

Section I

Fundamentals of Python

Features of Python, How to Run Python code, Identifiers, Reserved Keywords, Variables, Comments in Python, Indentation in Python, Input, Output statements.

Operators: Arithmetic Operators, relational Operators, Logical Operators, bitwise operators, other stray operators, Operator Precedence, Mathematical Functions, Trigonometric Functions, Random Number Functions,Strings in python : subscript operator, indexing, slicing a string, string methods

Flow Control and Loops

Decision Making: if statement, if…else statement, if..elif ..else statement, Nested if statement; Loops : while loop , for loop, range() function, continue and break statement, while and for loop with else statement , pass statement.

In-built Data Structures in Python

List, Tuple, Set, Dictionary; Mutable and Immutable Objects, Data Type Conversion, Built-in methods and comprehensions.

Section II

Functions and Modules

Function Definition, Function Calling, Function Arguments, Anonymous Functions (Lambda Functions), recursive function, Function with more than one return value, default value to parameter, keyword parameter.

Modules and Packages : Built-in Modules , Creating Modules , import Statement , import with renaming , from…import statement , import all names , Locating Modules , PYTHONPATH variable Namespaces and Scope : dir() , reload() functions , Packages in Python.

File Handling and Database Programming

Opening a File, Modes for Opening a File , Attributes of file object , Closing a File , Reading from a File, writing to a File, File Methods.

List of Tutorials: (Any Three)

1. A timestamp is three numbers: a number of hours, minutes and seconds. Given two timestamps, calculate how many seconds is between them. The moment of the first timestamp occurred before the moment of the second timestamp.
2. Hour hand turned by α degrees since the midnight. Determine the angle by which minute hand turned since the start of the current hour. Input and output in this problems are floating-point numbers.
3. Write a program that solves a linear equation ax = b in integers. Given two integers a and b (a may

be zero), print a single integer root if it exists and print "no solution" or "many solutions" otherwise.

4. A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. Given two integers A and B, print the number of primes between them, inclusively.
5. Given a string. Cut it into two "equal" parts (If the length of the string is odd, place the center character in the first string, so that the first string contains one more character than the second). Now print a new string on a single row with the first and second half's interchanged (second half first and the first half second) Don't use the statement if in this task.
6. A sequence consists of integer numbers and ends with the number 0. Determine how many elements of this sequence are equal to its largest element.
7. In chess it is known that it is possible to place 8 queens on an 8×8 chess board such that none of them can attack another. Given a placement of 8 queens on the board, determine if there is a pair of queens that can attach each other on the next move. Print the word NO if no queen can attack another, otherwise print YES. The input consists of eight coordinate pairs, one pair per line, with each pair giving the position of a queen on a standard chess board with rows and columns numbered starting at 1.
8. Given a positive real number aa and integer nn. Compute anan. Write a function power(a, n) to calculate the results using the function and print the result of the expression.

Don't use the same function from the standard library.

9. To keep record of patients' medical data, manipulate files to store, update, and delete such information.
10. Insert and retrieve data of an insurance company by manipulating database tables.

List of Practical: (Any Six)

1. A school decided to replace the desks in three classrooms. Each desk sits two students. Given the number of students in each class, print the smallest possible number of desks that can be purchased.

The program should read three integers: the number of students in each of the three classes, a, b and c respectively.

In the first test there are three groups. The first group has 20 students and thus needs 10 desks. The second group has 21 students, so they can get by with no fewer than 11 desks. 11 desks is also enough for the third group of 22 students. So we need 32 desks in total.

2. H hours, M minutes and S seconds are passed since the midnight ($0 \le H < 12$, $0 \le M < 60$, $0 \le S < 60$). Determine the angle (in degrees) of the hour hand on the clock face right now.
3. Given integer coordinates of three vertices of a rectangle whose sides are parallel to the coordinate axes, find the coordinates of the fourth vertex of the rectangle. In the first test the three given vertices are (1, 4), (1, 6), (7, 4). The fourth vertex is thus (7, 6).
4. There was a set of cards with numbers from 1 to N. One of the card is now lost. Determine the number on that lost card given the numbers for the remaining cards.

Given a number N, followed by N − 1 integers - representing the numbers on the remaining cards (distinct integers in the range from 1 to N). Find and print the number on the lost card.

5. Given a string. Delete from it all the characters whose indices are divisible by 3.
6. Given a sequence of integer numbers ending with the number 0. Determine the length of the widest fragment where all the elements are equal to each other.
7. In bowling, the player starts with 10 pins at the far end of a lane. The object is to knock all the pins down. For this exercise, the number of pins and balls will vary. Given the number of pins N and then the number of balls K to be rolled, followed by K pairs of numbers (one for each ball rolled), determine which pins remain standing after all the balls have been rolled. The balls are numbered from 1 to N (inclusive) for this situation. The subsequent number pairs, one for each K represent the start to stop (inclusive) positions of the pins that were knocked down with each role. Print a sequence of N characters, where "I" represents a pin left standing and "." represents a pin knocked down.
8. Given a sequence of integers that end with a 00. Print the sequence in reverse order.
   Don't use lists or other data structures. Use the force of recursion instead.
9. To keep record of students' data, manipulate files to store, update, and delete students' information.
10. Insert and retrieve data of a company by manipulating database tables.

List of Projects:

Students will be doing course projects in different areas of application of python programming such as web application, data analysis, computer vision, machine learning, artificial intelligence, web technologies, numerical analysis etc.

Text Books:

1. "Programming And Problem Solving With Python", Ashok Kamthane and Amit Ashok Kamthane , ISBN 9789387067578
2. "Beginning Programming with Python for Dummies", John Paul Mueller , Wiley Publishing, ISBN 9788126553488

Reference Books:

1. Dive into Python 3: Mark Pilgrim, Jesse Noller, Wiley Publishing , ISBN 9788184899115.
2. Python in Easy Steps, Tata McGraw Hill Education, ISBN 9789351343080
3. Learning Python, 5th Edition, Mark Lutz, O'Reilly, ISBN 978-1449355739

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

Course Outcomes:

The student will be able to –

1. understand Python programming basics and paradigm
2. demonstrate different mathematical functions and string manipulation functions in Python.
3. learn to apply core Python scripting elements such as flow control structures and loops.
4. develop essential skills in python programming concepts like data structures and different built in functions.
5. justify modular programming approach by making use of functions and modules
6. demonstrate the ability to handle files in different modes and database connectivity

FF No. : 654

Course Name: MECHATRONICS AND ROBOTICS

Course Code: ES1039

Credits: 5	**Teaching Scheme: Theory: 3 Hours / Week** **Tutorial: 1 Hour / Week** **Lab: 2 Hours / Week**

Section I

Sensors : Proximity sensor (Range sensor), Tactile sensor (Contact sensor), Current sensor,Tilt sensors, Gyroscope, Encoders, Hall effect sensors, Temperature sensor, Accelerationsensor, Image sensor, Camera etc.

Microcontrollers : Microcontroller, ATmega, architecture, peripherals, ports, registers, timer,counter, serial communications, ADC, interrupts etc**.**

Microcontroller programming & Interfacing : Introduction to Assembly languageprogramming, Embedded C Programming, Port configuration- for Signal in and Signal outconfiguration and programming, Interfacing of relay, stepper motor, LCD display, keyboard,RS232, ADC etc.

Section II

Actuators and Control : Interfacing of Relay, Solenoid, pneumatic, hydraulic actuator basics,programming for control, motor driver and speed control – PWM**.**

Communication Systems : Introduction to Serial communication - RS232, I2C, SPI. Basics ofWired and Wireless Communication, WiFi, Bluetooth**.**

Industrial Robotics and Applications: Introduction to different systems in IndustrialRobotics, Automation, PLC, Basics of Ladder programming, Ladder logic, basic instructions,Introduction to SCADA,.

Tutorials:

1. PPT sessions on different topics allotted to groups
2. One topic per group per round
3. Week 1 to 5 – Round 1
4. Week 6 to 10 – Round 2

List of Practical:

Interfacing of following components and their combinations with Arduino Uno.....

1. LED with Arduino 2. LDR 3. Push Button / Micro Switch
4. Ultrasonic Sensor 5. IR array 6. Temperature sensor
7. 16x2 LCD 8. 7 Segment Display 9. Bluetooth module
10. DC Motor Control 11. Servo Motor Control 12. Course Project based on above sensors with feedback

Text Books:

1. R. K. Mittal, I. J. Nagrath,Robotics and Control, Tata McGraw Hill Publication
2. Muhammad Ali Mazidi,The 8051 Microcontroller and Embedded Systems using Assembly and C, 2nd edition, Pearson

3. Kenneth Ayala ,The 8051 Microcontroller (with CD) ,Cengage Learning
4. – Fu, Lee ,Robotics – Control, Sensing, Vision and Intelligence,TataMcGraw Hill
5. Vijay Singh ,Fundamentals of Programmable Logic Controllers, New Age International (P) Ltd.
6. Hackworth, Programmable Logic Controllers Programming Methods And Applications with CD, Pearson India.
7. George Kennedy and Bernard Davis, S R M Prasanna,Kennedy's Electronic Communication System (SIE), McGraw Hill Education.
8. Arduino Made Simple: With Interactive Projects
9. Brock Craft ,Arduino Projects for Dummies, John Wiley & Sons Inc.
10. 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,Robotic Engineering: An Integrated Approach, Thomas A. Chmielewski, Michel Negin, 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. identify different sensors, understand their significance related to Robotics and select a sensor as per the requirement.
2. understand the internal configuration and architecture of microcontroller.
3. interface different sensors and peripherals to a microcontroller and program the same.
4. interface different display devices, actuators and control them using a program.
5. Use different communication protocols to control a robot.
6. understand significance of different systems used in Robotics and Automation.

FF No. : 654

Course Name: DESIGN THINKING 2

Course Code: ES1042

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

Section I

Basics of Projects -

Importance of Project Centric Learning,Concept of Domains, Tools and Technology**,** Socially Relevant Project Areas

Design Thinking Introduction

Introduction and Need of Design Thinking, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, Tools for Design Thinking, Relevance of Design and Design Thinking in Engineering

Team Formation and Documentation: Team Building Domain Selection (Society/Industry project), Importance of Documentation, Strategy Design

Design Thinking Exercise: Formation of Team and aspects for the selection, Domain selection, Observation exercise, Design activities, Brainstorming for the problem, Users Interview conduction

Problem Solving Skills Introduction: Developing logical thinking, Errors in reasoning, analogy problems lateral thinking

Problem Solving Techniques: Deductive and hypothetical reasoning; computational problem solving; generating, implementing, and evaluating solutions; interpersonal problem solving

Reverse Engineering: Introduction, Reverse Engineering Leads to New Understanding about Products, Reasons for Reverse Engineering, Reverse Engineering Process, Case Study

Section II

Domain Project Areas: Awareness and identification of appropriate areas for project work such as: Agriculture, Defense, Healthcare, Smart city, Smart energy, Security Systems, Automobile, Space, Green Earth, Automobiles, Assistive Aid, Water Management, Swachh Bharat (any other socially relevant research area)

Tools: *Self learning Activity* Learn and use latest engineering tools as per the project need. A few are listed below

Tools in Computer Engineering:

Programming / Coding Tools :- JavaScript, Python, Java, C#, C++, PHP, **Computer Vision Tools** :- OPENCV,MATLAB), **Single board computers:** Raspberry Pi, **Neural network simulators Tools:-** Neural Lab, NEST **, Machine Learning Tools:-** Torch, TensorFlow, Data Science **Tools :-** R language programming**,** SQL,

Tools in Electronics and Electronics & Telecommunication Engineering:

Electronic Design Simulation Integrated Circuit Tools:- VHDL, Xilinx, Modelsim , Cadence learn, **Embedded System Tools**:- AVR Studio, Arduino ,Kiel µvision, **Circuit Simulation Tools:-**Pspice, Simulink, Workbench, Tinkercad, ThingSpeak, Proteus, CircuitPro ,**Processor based integrated circuits** :Microcontroller, electronic prototype platforms: Arduino,**Networking Tools** :- Wired / Wireless and

Ad-hoc Networking NS-2 , Packet Tracer, **Signal Processing Tools**:- Code Composer Studio along with Integrated circuits

Tools in Instrumentation and Control Engineering:- System Automation Tools: - PLC , SCADA , PADS, ORCAD ,Eagle, Kicad,

Tools in Mechanical, Industrial, Production, Engineering:- Engineering Design Tools:- AutoCAD, CATIA,COMSOL Multiphysics, Solidworks, Inventor, PTC Creo**Fluid Dynamics:-** Fluent, HyperWorks, **Finite Element/ Structural Analysis:-**Ansy's, Ansy's Free Student software Thermal Simulation:- FlowTherm, AnsysIcepak

Tools in Chemical Engineering :-

Chemical process simulator:- DSIM - Open Source Process Simulator, chemical simulation software:- Schrödinger, *(Any other suitable tool as per the project requirement)*

Technology: **Map theappropriate technology:**

Emerging Technologies :- Artificial Intelligence, 5G networks, IoT, Serverless Computing, Blockchain , Virtual reality (VR)/Augmented reality (AR), Drone, Quantum Computing, Robotics

Interdisciplinary Technologies:- Nanotechnology, Nanomaterials, Nanoelectronics, Quantum Computing , Spintronics

Computer Technologies: - Big Data, Cloud Computing, Human Machine Interface (HMI), Cyber Security

Medical and Healthcare Technologies:- Biomedical Technology

Energy Technologies :- Solar Energy Based Technologies, Wind energy, Green energy Technologies, Energy Storage

Electronics, Communication Technologies:- Wireless, GPS, Bluetooth, Mobile/social Internet Automation, Mobile Technologies, Voice Assistants, signal processing, image processing, Machine vision, Sensors, Optoelectronics,

Other imp Technologies:- Automobile ,3 D printing

(any other technology as per the project requirement)

Project Implementation: Selection of the domain area, Literature review, Identify and finalize the Problem Statement (student in consultation with Guide), Understand and select and use the appropriate tools, Map the technologies learned with the project needs (refer available online offline Resources, books, soft materials, relevant MOOCs, consult with domain expertise) Self Learning:- learn the required tools, skill sets, acquire knowledge to do the project

Designing & Testing: Designing of project prototype based on domain areas by incorporating appropriate tools and technology, validation and Testing of the prototype to give the best possible solution

Documentation and Final Assessment : Develop and demonstrate the optimized prototype /working model of project , Documentation of project report in stipulated standard format as per the preset norms i.e. IEEE Research paper format, Present Project work at final viva voce

Text Books:

1. *K Nagrajan , Project Management 2nd Edition, New age International Ltd.(2004)*
2. *PradeepPai, Project Management, 1st Edition, PEARSON INDIA (2019)*
3. *YousefHaik 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) Second Edition, 2013.*

MOOCs Links and additional reading material

1. https://nptel.ac.in/courses/106/105/106105077/ **(**Artificial Intelligence - by IIT Kharagpur)
2. https://nptel.ac.in/courses/112/103/112103280/ (Fundamentals of Artificial Intelligence by IIT Guwahati)
3. https://nptel.ac.in/courses/106/106/106106212/ (Python for Data science .By IIT Madras)
4. https://nptel.ac.in/courses/106/106/106106179/ (Data science for Engineers, by IIT Madras**):**

Course Outcomes :

The student will be able to

1. Identify projects relevant to societal needs and use design thinking as a tool of innovation.
2. Map the technologies learned with the project needs
3. Apply design thinking process with technological knowledge to design various feasible solutions
4. Select the best possible solution to solve the problem using reverse engineering approach
5. Develop/Fabricate a working model of the proposed solution
6. Testing and validate product performance

FF No. : 654

Course Name: CAPSTONE PROJECT 2

Course Code: ES1040

Credits: 3	**Teaching Scheme: Theory: 6 Hours / Week**

Activities

This course is Project Centric Learning providing hands on experience to students. Theoretical inputs / information will be provided through Design Thinking 2 Sessions while actual designing and implementations of project work is done through Capstone Project 2

Step by step Implementation of activities by the students:

1. **Group Formation Activity: -** Project group formation within the allotted Capstone Project 2 (CP2) batch, Deciding Group leader and Assistant Group Leader
2. **Brain Storming and Discussion Activity**: - Discussion on topics for Capstone Project 2 (CP2) 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 Capstone Project 2 (CP2) topic considering appropriate Domain area, Tools & Technology in consultation with Capstone Project 2 (CP2) project Guide
5. .**Project Planning Activity:-** Finalization of Problem statement, objectives, methodology and systematic strategy to complete the Capstone Project 2 (CP2) project in consultation with CP2 guide
6. **Synopsis Drafting Activity:-** Prepare Synopsis of the planned CP2 project under the guidance of CP2 guide and complete its online Registration
7. .**Team Work Activity**:- Report and update about project work progress regularly to CP2 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 Capstone Project appear for the timely conducted project reviews by CP2 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. **PrototypeValidation 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 Capstone Project 1 in IEEE Research paper format
14. **Project Report/Paper Writing Activity:-** Results and Discussions, writing the Interpretation of the obtained results of the accomplished CP2 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 CP1 project guide followed by its approval after doing the needful corrections.
16. Online submission of pdf of the IEEE Paper based of CP2 for the record
17. **End Semester Assessment:-** Present the IEEE Paper based of CP2 project and the PPT at Student Capstone Project 2 Conference on the scheduled date as part of End Semester Assessment of the CP2 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. *PradeepPai, Project Management, 1st Edition, PEARSON INDIA (2019)*
3. *YousefHaik 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) 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: ENVIRONMENTAL SCIENCE

Course Code: ES1014

Credits: Audit **Teaching Scheme: Lab: 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. Erich Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Second Edition, UGC Publications.
2. Mackenzie L. Davis and David A. Cornwell, "Introduction to Environmental Engineering", 4e, Tata McGraw-Hill Education Private Limited New Delhi, 2010.
3. 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", 2e, Pearson Education. Dorling Kindersley (India) Pvt. Ltd. Delhi, 2007.
2. J. Glynn Henry and Gary W. Heinke, "Environmental Science and Engineering", 2e. 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: INDIAN DEMOCRACY & CONSTITUTION

Course Code: HS1036

Credits: Audit	**Teaching Scheme: Theory: 2 Hours / 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", Eight Edition , Justice Jasti Chelameswar

Reference Books:

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.).
2. Merunandan, "Multiple Choice Questions on Constitution of India", 2 nd Edition,Meraga publication,2007

Course Outcomes:

The student will be able to –

1. Students will analyse the democratic framework with the help of its standards of governance.
2. Students will critically examine election process in the country.
3. Students will enhance their understanding of good governance.
4. Students will analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail.