Computer Organization and Architecture (KCS302)		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Study of the basic structure and operation of a digital computer system.	K_1, K_2
CO 2	Analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating-point arithmetic operations.	K_2, K_4
CO 3	Implementation of control unit techniques and the concept of Pipelining	K_3
CO 4	Understanding the hierarchical memory system, cache memories and virtual memory	K_2
CO 5	Understanding the different ways of communicating with I/O devices and standard I/O interfaces	K_2, K_4

DETAILED SYLLABUS		**3-1-0**
Unit	**Topic**	**Proposed Lecture**
I	**Introduction**: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes.	**08**
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers	**08**
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro programme sequencing, concept of horizontal and vertical microprogramming.	**08**
IV	**Memory:** Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 1/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	**08**
V	**Input / Output**: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	**08**

Text books:

1. Computer System Architecture - M. Mano
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky Computer Organization, McGraw-Hill, Fifth Edition, Reprint 2012
3. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, Third Edition, 1998. Reference books
4. William Stallings, Computer Organization and Architecture-Designing for Performance, Pearson Education, Seventh edition, 2006.
5. Behrooz Parahami, "Computer Architecture", Oxford University Press, Eighth Impression, 2011.
6. David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier, a division of reed India Private Limited, Fifth edition, 2012
7. Structured Computer Organization, Tannenbaum(PHI)

B.TECH. (COMPUTER SCIENCE AND ENGINEERING)
THIRD SEMESTER (DETAILED SYLLABUS)

DATA STRUCTURE (KCS301)		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory, used by the algorithms and their common applications.	**K_1, K_2**
CO 2	Discuss the computational efficiency of the sorting and searching algorithms.	**K_2**
CO 3	Implementation of Trees and Graphs and perform various operations on these data structure.	**K_3**
CO 4	Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.	**K_4**
CO 5	Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.	**K_5, K_6**
DETAILED SYLLABUS		**3-1-0**

Unit	Topic	Proposed Lecture
I	**Introduction:** Basic Terminology, Elementary Data Organization, Built in Data Types in C. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT) **Arrays**: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.	08
II	**Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.	08
III	**Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. **Sorting:** Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort and Radix Sort.	08
IV	**Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.	08

V	**Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer(Linked List) Representation, Binary Search Tree, Strictly Binary Tree ,Complete Binary Tree . A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertation , Deletion, Searching & Modification of data in Binary Search . Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree , B Tree & Binary Heaps	08

Text books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
3. Lipschutz, "Data Structures" Schaum's Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.
4. Thareja, "Data Structure Using C" Oxford Higher Education.
5. AK Sharma, "Data Structure Using C", Pearson Education India.
6. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.
7. Michael T. Goodrich, Roberto Tamassia, David M. Mount "Data Structures and Algorithms in C++", Wiley India.
8. P. S. Deshpandey, "C and Data structure", Wiley Dreamtech Publication.
9. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education.
10. Berztiss, AT: Data structures, Theory and Practice, Academic Press.
11. Jean Paul Trembley and Paul G. Sorenson, "An Introduction to Data Structures with applications", McGraw Hill.
12. Adam Drozdek "Data Structures and Algorithm in Java", Cengage Learning

RCS301: DISCRETE STRUCTURES & THEORY OF LOGIC

UNIT I

Set Theory: Introduction, Combination of sets, Multi sets, ordered pairs, Set Identities.
Relations: Definition, Operations on relations, Properties of relations, Composite Relations, Equality of relations, Order of relations.
Functions: Definition, Classification of functions, Operations on functions, Recursively defined functions.
Natural Numbers: Introduction, Mathematical Induction, Variants of Induction, Induction with Nonzero Base cases.

UNIT II

Algebraic Structures: Definition, Groups, Subgroups and order, Cyclic Groups, Cosets, Lagrange's theorem, Normal Subgroups, Permutation and Symmetric groups, Group Homomorphism's, Definition and elementary properties of Rings and Fields, Integers Modulo n.

UNIT III

Partial order sets: Definition, Partial order sets, Combination of partial order sets, Hasse diagram.
Lattices: Definition, Properties of lattices – Bounded, Complemented, Modular and Complete Lattice, Morphisms of lattices.
Boolean Algebra: Introduction, Axioms and Theorems of Boolean algebra, Algebraic manipulation of Boolean expressions. Simplification of Boolean Functions, Karnaugh maps, Logic gates, Digital circuits and Boolean algebra. Combinational and sequential Circuits.

UNIT IV

Propositional Logic: Proposition, well formed formula, Truth tables, Tautology, Satisfiability, Contradiction, Algebra of proposition, Theory of Inference, Natural Deduction.
Predicate Logic: First order predicate, well formed formula of predicate, quantifiers, Inference theory of predicate logic.

UNIT V

Trees: Definition, Binary tree, Binary tree traversal, Binary search tree.
Graphs: Definition and terminology, Representation of graphs, Multi graphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring.
Recurrence Relation & Generating function: Recursive definition of functions, Recursive algorithms, Method of solving recurrences.
Combinatorics: Introduction, Counting Techniques, Pigeonhole Principle

References:

1. Liu and Mohapatra, "Elements of Discrete Mathematics", McGraw Hill
2. Jean Paul Trembley, R Manohar, "Discrete Mathematical Structures with Application to Computer Science", McGraw-Hill
3. YN Singh, "Discrete Mathematical Structures", Wiley India, New Delhi, First Edition, August 2010**.**
4. RP Grimaldi, Discrete and Combinatorial Mathematics, Addison Wesley,

A Foundation course
In
Universal Human Values and Professional Ethics

Universal Human Values and Professional Ethics [L-T-P: 3-0-0]

Course Objectives

This introductory course input is intended

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or value prescriptions.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

Course Syllabus: Universal Human Values and Professional Ethics [L-T-P: 3-0-0]

The whole course is divided into 5 modules.

After every two lectures of one hour each, there is a 2 hour practice session.

The teachers are oriented to the inputs through an eight to ten day workshop (Teachers' Orientation Program).

The Teacher's Manual provides them the lecture outline. The outline has also been elaborated into presentations and provided in a DVD with this book to facilitate sharing.

The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue. The process of dialogue is enriching for both, the teacher as well as the students.

The syllabus for the lectures is given below:

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in **harmony** at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure *Sanyam* and *Swasthya*

    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. *Understanding Harmony in the family – the basic unit of human interaction*
14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
    Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
17. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
18. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family!

    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

19. Understanding the harmony in the Nature
20. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature
21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
22. Holistic perception of harmony at all levels of existence

    - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

23. Natural acceptance of human values
24. Definitiveness of Ethical Human Conduct
25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
26. Competence in professional ethics:
    a) Ability to utilize the professional competence for augmenting universal human order
    b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
    c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
27. Case studies of typical holistic technologies, management models and production systems
28. Strategy for transition from the present state to Universal Human Order:
    a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    b) At the level of society: as mutually enriching institutions and organizations

Guidelines and Content for Practice Sessions

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

PS 1: Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you differentiate between right and wrong? What have been your achievements and shortcomings in your life? Observe and analyze them.

Expected outcome: the students start exploring themselves; get comfortable to each other and to the teacher and start finding the need and relevance for the course.

PS 2: Now-a-days, there is a lot of voice about many techno-genic maladies such as energy and natural resource depletion, environmental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. – all these seem to be man-made problems threatening the survival of life on Earth – What is the root cause of these maladies & what is the way out in your opinion?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, criminalization of politics, large scale corruption, scams, breakdown of relationships, generation gap, depression & suicidal attempts, etc – what do you think, is the root cause of these threats to human happiness and peace – what could be the way out in your opinion?

Expected outcome: the students start finding that technical education without study of human values can generate more problems than solutions. They also start feeling that lack of understanding of human values is the root cause of all problems and the sustained

solution could emerge only through understanding of human values and value based living. Any solution brought out through fear, temptation or dogma will not be sustainable.

PS 3:

1. Observe that each one of us has Natural Acceptance, based on which one can verify right or not right for him. Verify this in case of

i) What is Naturally Acceptable to you in relationship- Feeling of respect or disrespect?

ii) What is Naturally Acceptable to you – to nurture or to exploit others?

Is your living the same as your natural acceptance or different?

2. Out of the three basic requirements for fulfillment of your aspirations- right understanding, relationship and physical facilities, observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

Expected outcome:

1. The students are able to see that verification on the basis of natural acceptance and experiential validation through living is the only way to verify right or wrong, and referring to any external source like text or instrument or any other person cannot enable them to verify with authenticity; it will only develop assumptions.
2. The students are able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.
3. The students are able to see that lack of right understanding leading to lack of relationship is the major cause of problems in their family and not the lack of physical facilities in most of the cases, while they have given higher priority to earning of physical facilities in their life ignoring relationships and not being aware that right understanding is the most important requirement for any human being.

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!

PS 4: List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body.

Expected outcome: the students are able to see that they can enlist their desires and the desires are not vague. Also they are able to relate their desires to 'I' and 'Body' distinctly. If any desire appears related to both, they are able to see that the feeling is related to I while the physical facility is related to the body. They are also able to see that 'I' and 'Body' are two realities, and most of their desires are related to 'I' and not body, while their efforts are mostly centered on the fulfillment of the needs of the body assuming that it will meet the needs of 'I' too.

PS 5:

1. a. Observe that any physical facility you use, follows the given sequence with time :

Necessary & tasteful→ unnecessary & tasteful → unnecessary & tasteless → intolerable

b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If naturally acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your activities. Observe whether the activity is of 'I' or of Body or with the participation of both 'I' and Body.
3. Observe the activities within 'I'. Identify the object of your attention for different moments (over a period of say 5 to 10 minutes) and draw a line diagram connecting these points. Try to observe the link between any two nodes.

Expected outcome:

1. The students are able to see that all physical facilities they use are required for a limited time in a limited quantity. Also they are able to see that in case of feelings, they want continuity of the naturally acceptable feelings and they do not want feelings which are not naturally acceptable even for a single moment.
2. the students are able to see that activities like understanding, desire, thought and selection are the activities of 'I' only, the activities like breathing, palpitation of different parts of the body are fully the activities of the body with the acceptance of 'I' while the activities they do with their sense organs like hearing through ears, seeing through eyes, sensing through touch, tasting through tongue and smelling through nose or the activities they do with their work organs like hands, legs etc. are such activities that require the participation of both 'I' and body.
3. The students become aware of their activities of 'I' and start finding their focus of attention at different moments. Also they are able to see that most of their desires are coming from outside (through preconditioning or sensation) and are not based on their natural acceptance.

PS 6:

1. Chalk out programs to ensure that you are responsible to your body- for the nurturing, protection and right utilisation of the body.
2. Find out the plants and shrubs growing in and around your campus. Find out their use for curing different diseases.

Expected outcome: The students are able to list down activities related to proper upkeep of the body and practice them in their daily routine. They are also able to appreciate the plants wildly growing in and around the campus which can be beneficial in curing different diseases.

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

PS 7: Form small groups in the class and in that group initiate dialogue and ask the eight questions related to trust. The eight questions are :

1a. Do I want to make myself happy?
2a. Do I want to make the other happy?
3a. Does the other want to make him happy?
4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to make myself always happy?
2b. Am I able to make the other always happy?
3b. Is the other able to make him always happy?
4b. Is the other able to make me always happy?

What is the answer?

Competence

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate your intention & competence as well as the others' intention & competence.

Expected outcome: The students are able to see that the first four questions are related to our Natural Acceptance i.e. Intention and the next four to our Competence. They are able to note that the intention is always correct, only competence is lacking! We generally evaluate ourselves on the basis of our intention and others on the basis of their competence! We seldom look at our competence and others' intention as a result we conclude that I am a good person and other is a bad person.

PS 8:

1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.

Expected outcome: The students are able to see that respect is right evaluation, and only right evaluation leads to fulfillment in relationship. Many present problems in the society are an outcome of differentiation (lack of understanding of respect), like gender biasness, generation gap, caste conflicts, class struggle, dominations through power play, communal violence, clash of isms, and so on so forth. All these problems can be solved by realizing that the other is like me as he has the same natural acceptance, potential and program to ensure a happy and prosperous life for him and for others though he may have different body, physical facilities or beliefs.

PS 9:

1. Write a note in the form of story, poem, skit, essay, narration, dialogue to educate a child. Evaluate it in a group.
2. Develop three chapters to introduce 'social science- its need, scope and content' in the primary education of children

Expected outcome: The students are able to use their creativity for educating children. The students are able to see that they can play a role in providing value education for children. They are able to put in simple words the issues that are essential to understand for children and comprehensible to them. The students are able to develop an outline of holistic model for social science and compare it with the existing model.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

PS 10: List down units (things) around you. Classify them in four orders. Observe and explain the mutual fulfillment of each unit with other orders.

Expected outcome: The students are able to differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them. They are also able to see that human beings are not fulfilling to other orders today and need to take appropriate steps to ensure right participation(in terms of nurturing, protection and right utilization) in the nature.

PS 11:

1. Make a chart for the whole existence. List down different courses of studies and relate them to different units or levels in the existence.
2. Choose any one subject being taught today. Evaluate it and suggest suitable modifications to make it appropriate and holistic.

Expected outcome: The students feel confident that they can understand the whole existence; nothing is a mystery in this existence. They are also able to see the interconnectedness in the nature, and point out how different courses of study relate to the different units and levels. Also they are able to make out how these courses can be made appropriate and holistic.

UNIT 5: Implications of the above Holistic Understanding of Harmony at all Levels of Existence

PS 12: Choose any two current problems of different kind in the society and suggest how they can be solved on the basis of natural acceptance of human values. Suggest steps you will take in present conditions.

Expected outcome: The students are able to present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.

PS 13:

1. Suggest ways in which you can use your knowledge of Technology/Engineering/ Management for universal human order, from your family to the world family.
2. Suggest one format of humanistic constitution at the level of nation from your side.

Expected outcome: The students are able to grasp the right utilization of their knowledge in their streams of Technology/Engineering/ Management to ensure mutually enriching and recyclable productions systems.

PS 14: The course is going to be over now. Evaluate your state before and after the course in terms of

a. Thought b. Behavior and c. Work d. Realization

Do you have any plan to participate in the transition of the society after graduating from the institute? Write a brief note on it.

Expected outcome: The students are able to sincerely evaluate the course and share with their friends. They are also able to suggest measures to make the course more effective and relevant. They are also able to make use of their understanding in the course for a happy and prosperous society.

Reference Material

The primary resource material for teaching this course consists of

a. The text book

R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

b. The teacher's manual

R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010

c. A set of DVDs containing

- Video of Teachers' Orientation Program
- PPTs of Lectures and Practice Sessions
- Audio-visual material for use in the practice sessions

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
3. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in, *http://www.uptu.ac.in*
2. Story of Stuff, *http://www.storyofstuff.com*
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*
6. *Gandhi A., Right Here Right Now, Cyclewala Productions*

ROE030/ROE040: MANUFACTURING PROCESS

UNIT I

Basic Metal and Alloys: Properties and Application

Properties of material: Strength, elasticity, stiffness, malleability, ductility, brittleness and hardness. Elementary ideas of fracture, fatigue, and creep. Testing of materials, destructive and nondestructive testing.

Ferrous materials: Carbon steels, its classification based on % carbon as low mild, medium and high carbon steel, its properties and applications. Wrought iron, Cast iron, Alloy steels: stainless steel, tools steel.

Heat Treatment of Materials: Elementary introduction to Heat-treatment of carbon steels: annealing, normalizing, quenching and tempering and casehardening.

Non-Ferrous metal and alloys: Common uses of various non-ferrous metals and alloys and its composition such as Cu-alloys: Al-alloys such as Duralumin.

UNIT II

Metal forming: Introduction, Cold working and hot working, basic metal forming operations and use of such as: Forging, Rolling, Wire & Tube drawing and Extrusion, product and applications. Press-work, die and punch assembly, cutting and forming, applications.

Casting: Introduction, Casting process, Pattern and allowances, Moulding sands and its desirable properties, Mould making techniques, Gating system, Casting defects and remedies, Cupola Furnace, Die-casting and its uses.

UNIT III

Machining: Introduction, Classification of machining processes, Lathe-machine: working principle, parts and operations. Shaper and planer machines: principles, parts and operations. Drilling machine: principle, parts and operations. Milling: Principle, parts and operations. Grinding: principle, parts and operations.

Welding: Introduction, classifications, basic principles of welding processes, Arc welding: principle, equipment and operations. Gas welding: working principle, types of flames, Soldering and brazing and its uses, heat affected zone in welds and weld defects.

UNIT IV

Manufacturing: Importance of Materials and Manufacturing towards Technological and Socioeconomic developments, Plant location, plant Layout- its types. Types of Production systems, Production versus Productivity.

Product quality: Introduction, definition of quality, improvement of product quality, basic quality tools, flow charts, check sheets, histogram, cause and effect diagram, pareto diagram, control charts, their applications and importance, consequences of bad quality.

UNIT V

Non-Metallic Materials: Common types and uses of Wood, characteristics of wood, applications, Cement, types, composition, Concrete, properties and applications, Ceramics, classifications and applications, Rubber, Plastics and Composite-materials, classifications and applications.

Miscellaneous Process: Powder-metallurgy process, working principle and applications, plastic-part manufacturing, processes and applications, Galvanizing and Electroplating, principles, processes and applications.

Text/Reference Books:

1. Kalpakjian and Schmid, Manufacturing Engineering and Technology, 6 ed., Pearson.
2. Lindberg, Processes & Materials of Manufacture, Prentice Hall India.
3. Kumar & Gupta, Manufacturing Processes, Prentice Hall India.
4. Jain, Production Technology, Khanna Publications.
5. Rao, Manufacturing Processes, McGraw Hill Education.
6. James G Brala. Handbook of Manufacturing Processes, How Products, Components and Materials are Made. Industrial Press, New York, 2006.
7. Bruce J Black. Workshop Processes, Practices and Materials, 4 ed., Elsevier, 2010.

ROE031/ROE041: INTRODUCTION TO SOFT COMPUTING

UNIT I

Neural Networks-1(Introduction & Architecture): Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

UNIT II

Neural Networks-II (Back Propogation networks): Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; Back Propagation learning methods, effect of learning rule co-efficient; back propagation algorithm, factors affecting Back Propagation training, applications.

UNIT III

Fuzzy Logic-I (Introduction): Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT IV

Fuzzy Logic –II (Fuzzy Membership, Rules): Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.

UNIT V

Genetic Algorithm (GA): Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

References:

1. S. Rajsekaran & GA Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications”, Prentice Hall of India.
2. NP Padhy, “Artificial Intelligence and Intelligent Systems”, Oxford University Press.
3. Siman Haykin, “Neural Netowrks”, Prentice Hall of India
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley India.
5. Kumar Satish, “Neural Networks”, Tata Mc Graw Hill
6. Fakhreddin O. Karray, Clarence W. De Silva, “Soft Computing and Intelligent System Design: Theory Tools and applications”, Pearson
7. Tripathy, Anuradha, “SoftComputing: Advances And Applications”, Cengage

ROE032/ROE042: NANO SCIENCE

UNIT I

Introduction: Definition of Nano-Science and Nano Technology, Applications of Nano-Technology.

Quantum Theory for Nano Science: Particle in a box, Potential step: Reflection and tunneling (Quantum leak). Penetration of Barrier, Potential box (Traped particle in 3D: Nanodot).

Physics of Solid State Structures: Size dependence of properties, crystal structures, face centered cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations.

Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

Localized Particles: Acceptors and deep taps; mobility; Excitons.

UNIT II

Quantum Nanostructure: Preparation of quantum wells, Wires and Dots, Size and Dimensionality effect, Fermi gas; Potential wells; Partial confinement; Single electron Tunneling, Infrared detectors; Quantum dot laser superconductivity.

Properties of Individual Nano Particles: Metal nano clusters; Magic numbers; Theoretical modeling of nanoparticles; geometric structure; electronic structure; Reactivity, Fluctuations, Magnetic clusters; Bulk to nanostructure, semiconducting nanoparticles, Optical Properties, Photofragmentation, Coulombic Explosion. Rare Gas & Molecular clusters; Inert gas clusters; Superfluid clusters; Molecular clusters.

UNIT III

Growth Techniques of Nanomaterials: Litho and Nonlithograpahic techniques, RF Plasma, Chemical methods, Thermolysis, Pulsed laser method, Self-assembly, E-beam evaporation, Chemical Vapour Deposition, Pulsed Laser Deposition.

UNIT IV

Methods of Measuring Properties: Structure: X-ray Diffraction Technique, Particle size determination, surface structure. Microscopy: Scanning Probe Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy(TEM). Spectroscopy: Infra red and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.

UNIT V

Carbon Nano Materials: Bucky Ball and Carbon Nano- Tubes: Nano structures of carbon (fullerene), Fabrication, Structure. Electrical, Mechanical and Vibrational properties and applications. Nano Diamond, Boron Nitride Nano-tubes, Single Electron Transistors, Molecular Machine, Nano-Biometrics, Nano Robots.

Text/Reference Books:

1. CP Poole Jr, FJ Owens, “Introduction to Nanotechnology”.
2. C Kittel, “Introduction to S.S. Physics”-(7^{th} Edn.) Wiley 1996.
3. HS Nalwa, “Handbook of Nanostructured Materials & Nanotechnology” vol. 5. Academic Press 2000.

ROE033/ROE043: LASER SYSTEMS AND APPLICATIONS

UNIT I

Basic Principle of Modern Physics: Black body radiation, Atomic structure, Spectral series of hydrogen atom, Polarization, Absorption and florescence of X-ray, Energy distribution in electrons, Probability of distribution of free electrons, Free electron in metals, Energy level in free electrons, Application of Schrodinger equation in potential well, potential step, tunneling effect.

UNIT II

Elements and Techniques of Laser: Concept of coherence, Temporal and Spatial coherence, Coherence length and time, Brightness and Intensity, Directionality and Monochromacity. Absorption, Spontaneous and Stimulated Emission process and Einstein's coefficients. Population inversion, Pumping and pumping schemes, laser gain, Optical cavities and its types.

UNIT III

Principle of Laser & General Lasers: Main components of Laser, Principle of Laser action, Introduction to general lasers and their types. Three & four level Lasers, Continuous Wave Lasers, Pulsed Lasers, Q-switch lasers.

UNIT IV

Types of Laser Systems:

Solid state Lasers: Neodymium laser, Nd-Yag laser, Nd-Glass laser and Alexandrite laser.

Liquid Lasers: Dye laser, Tuning in Dye laser, Model-Locked Ring Dye laser.

Gas Laser: Ionic lasers, Argon ion laser, Krypton ion laser, He-Cadmium laser, Copper vapour laser, Carbon dioxide laser and Excimers laser.

Semiconductor Laser: Characteristics of semiconductor lasers, Semiconductor diode lasers, Hetrojunction lasers, Homojunction lasers, Quantum well lasers.

UNIT V

Laser Applications:

Material Processing: Material processing with lasers, Interaction mechanism, Material processing mechanism, Drilling, Cutting and Welding process with laser. Laser hardening.

Medical Science: Medical lasers, Laser diagnostic, Laser in ophthalmology, laser in glaucoma, Laser for general surgery, Laser in dermatology, laser in dentistry, Laser in medicine.

Optical Communication: Optical source for fiber optical communication, powering and coupling, Transmission, Hologram their characteristics. LIDAR.

Reference Books:

1. KR Nambiar, "Laser Principles, Types and Application" New Age International.
2. SA Ahmad, "Laser concepts and Applications" New Age International.
3. AK Katiyar, CK Pandey and Manisha Bajpai, Fundamentals of Laser Systems and Applications.

ROE034/ROE044: SPACE SCIENCE

UNIT I

Introduction: Important Individual Contributions [Pre Telescopic: Ptolemy, Copernicus, Brahe and Keplar. Post Telescopic Era: Galileo, Newton, Hubble, Gauss, Riemann, Einstein and Hawkins]. Various International Organizations involved in the development of space Science (NASA, ESA, ISRO)

UNIT II

Space Observations: Problems related to Eye and Atmosphere and their Remedies, Distance in Space and Magnitude, Measurement Techniques, Non-Optical Telescopic Techniques used in space observation (Covering entire Electromagnetic Region).

UNIT III

Solar System: Nebular theory of formation of our Solar System. Sun-its origin and fate, Source of Energy and Solar wind. Brief description of Planets about shape, size, period of rotation about axis and period of revolution, distance of planets from sun. Bode's law, Keplar's Laws of planetary motion, Newton's deductions from Kepler's Laws, Newton's Law of gravitation, correction of Kepler's third law. Determination of mass of Earth, Determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets.

UNIT IV

Stars and Galaxy: Stellar Evaluation and Stellar Remnants, Nucleo-Synthesis and Formation of Elements. Classification of Stars: Harvard classification system, Hertzsprung-Russel Diagram, Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars); Chandrasekhar limit. Galaxies: Galaxies and their evolution and origin, active galaxies and quasars.

UNIT V

Cosmology: Hubble Law, Redshift and Expansion of the Universe, Cosmic Microwave, Background Radiations, Matter density in Universe, Cosmological principle, Important Models of Universe (Steady State and Big Bang), Dark Matter and Dark Energy.

Text Books / Reference Books:

1. Baidyanath Basu, T. Chattopadhyay, SN Biswas, "An Introduction to Astrophysics" PHI 2nd Edition.
2. KS Krishnaswami, "Astrophysics: A modern Perspective" New Age International.

ROE035/ROE045: POLYMER SCIENCE AND TECHNOLOGY

UNIT I

Basic Concepts of Polymers: A brief history. what are polymers? how are polymers made? Classification of polymers.

UNIT II

Chemistry of Polymerization: Introduction, Chain polymerization, step growth polymerization, Miscellaneous polymerization reactions. Polymerization Techniques.

UNIT III

Molecular weight and Size: Average molecular weight, Number average and weight average molecular weight. Sedimentation and viscosity-average molecular weight. Molecular weight and degree of polymerization. Polydispersity and molecular weight distribution in polymers. Practical significance of polymer molecular weight. Size of polymer molecules.

UNIT IV

Polymer Degradation: What is polymer degradation? Types or degradation, thermal and mechanical degradation, degradation by ultrasonic waves. photo degradation, degradation by high energy radiation, oxidative degradation, hydrolytic degradation.

UNIT V

Preparations and Applications: Preparation, properties and technical applications of thermoplastics, thermosetting, elastomer and synthetic fibres. Silicones. Applications of polymers in aerospace, ocean, electronics, medical, agriculture, automobile, sports and building constructions.

ROE036/ROE046: NUCLEAR SCIENCE

UNIT I

Nucleus and Its Basic Features: Nuclear structure, Nuclear forces and their properties, Nuclear binding energy, Nuclear stability, Nuclear radius and its measurement, Nuclear spin, Nuclear magnetic and Electrical moments.

UNIT II

Nuclear Models: Single particle model, Liquid drop model and Semi-Emperical mass formula, Nuclear potential and Shell model, Collective model.

UNIT III

Nuclear Reaction: Nuclear reaction and Laws of conservation, Types of nuclear reaction, Mechanism of nuclear reaction-Q value, Nuclear fission and their explanation by liquid drop model, Nuclear fusion and its applications.

UNIT IV

Radioactivity: Radioactive disintegration, Decay constant, Half life period and Mean life, Alpha decay, Beta decay, Gamma decay, Interaction of nuclear radiation with matter.

UNIT V

Accelerators: Mass spectrograph: General principle, Aston's Mass Spectrograph Van de Graph Generator, Cyclotron, Synchrotron.

Detectors: G M Counter, Scintillation counter, cloud chamber, Bubble Chamber, production and detection of neutrons and Gamma-photon.

Application of Nuclear Techniques: Nuclear magnetic resonance, positron emission topography, radiotracer techniques and applications in material science and agriculture.

Reference Books:

1. Tayal, "Nuclear Physics" Himalaya Publishing House.
2. SN Ghosal, "Nuclear Physics" S. Chand & Co.
3. SB Patel, "Nuclear Physics: An Introduction New Age International.
4. HB Lal, "Introductory Nuclear Physics" United Book Depot.
5. Wang, "Introductory Nuclear Physics", PHI Learning
6. Roy & Nigam, "Nuclear Physics" John Wiley & sons.

ROE037/ROE047: MATERIAL SCIENCE

UNIT I

Introduction: Historical perspective, importance of materials, Brief review of modern & atomic concepts in Physics and Chemistry. Atomic models, Periodic table, Chemical bonding.

Crystallography and imperfections: Concept of unit cell, space lattice, Bravais lattices, common crystal structures, Atomic packing factor and density. Miller indices. X-ray crystallography techniques, imperfections, Defects &Dislocations in solids.

UNIT II

Mechanical Properties and Testing: Stress strain diagram, Ductile and brittle materials, stress Vs strength, toughness, hardness, fracture, fatigue and creep. Testing, such as Strength testing, Hardness testing, Impact testing, Fatigue testing Creep testing, Non-destructive testing (NDT)

Micro Structural Exam: Microscope principle and methods, Preparation of samples and micro structure exam and grain size determination, comparative study of microstructure of various metals and alloys, such as Mild steel, CI, Brass.

Phase Diagram and Equilibrium Diagram: Unitary and Binary diagrams, Phase rules, Types of equilibrium diagrams: solid solution type, eutectic type and combination type, Iron-carbon equilibrium diagram.

UNIT III

Ferrous materials: Iron and steel manufacture, furnaces, various types of carbon steels, alloy steels and cast irons, its properties and uses.

Heat Treatment: various types of heat treatment, such as Annealing, Normalizing, Quenching, Tempering and Case hardening. Time Temperature Transformation (TTT) diagrams.

Non-Ferrous metals and alloys: Non-ferrous metals, such as Cu, Al, Zn, Cr, Ni etc. and its applications. Various types of Brass, Bronze bearing materials their properties and uses. Aluminum alloys, such as Duralumin, Other advanced materials/alloys.

UNIT IV

Magnetic properties: Concept of magnetism-Dia, para, ferro magnetic materials, Hysteresis, Soft and hard magnetic materials, Magnetic Storages.

Electric Properties: Energy band, concept of conductor, insulator and semi conductor. Intrinsic and extrinsic semi-conductors, P-n junction and transistors, Basic devices and their applications. diffusion of Solid. Super conductivity and its applications, Messier effect. Type I & II superconductors. High Temp. superconductors.

UNIT V

Ceramics: Structure, types, properties and applications of ceramics. Mechanical/Electrical behavior and processing of ceramics.

Plastics: Various types of polymers/plastics and their applications. Mechanical behavior and processing of plastics, Future of plastics.

Other Materials: Brief description of other materials, such as optical and thermal materials, concrete, composite materials and their uses.

Performance of materials in service: Brief theoretical consideration of fracture, fatigue, and corrosion and its control.

Text/ Reference Books:

1. WD Callisster Jr. “Material Science & Engineering Addition”, Wesly Publishing Co.
2. Van Vlash, “Elements of Material Science & Engineering”, John Wiley & Sons.
3. V. Raghvan, “Material Science”, Prentice Hall of India.
4. Narula, “Material Science”, Tata Mc Graw Hill.
5. Srivastava, Srinivasan, “Science of Materials Engineering”, New Age International.

ROE038/ROE048: DISCRETE MATHEMATICS

UNIT I

Relation: Definition, types of relation, composition of relations, pictorial representation of relation, properties of relation, partial order relation.

Function: Definition and types of functions, composition of functions, recursively defined functions.

Group: Monoid, Semi-group, Abelian Group, Properties of groups, Cyclic Group, Permutation groups, Caley's Theorem, Rings and Fields (definition, examples and standard results).

UNIT II

Propositional logic: Introduction to logic, logical connectives, truth tables, Tautologies, contradiction, normal forms (conjunctive and disjunctive), modus ponens and modus tollens, validity, predicate logic, universal and existential quantification.

Notion of proofs: proof by implication, converse, inverse, contrapositive, negation, and contradiction, direct proof, proof by using truth table, proof by counter example.

UNIT III

Combinatorics: Mathematical induction, recursive mathematical definitions, basics of counting, Cardinality and Countability, Pigeonhole principle, permutations, combinations, inclusion-exclusion.

UNIT IV

Recurrence relations (*n* th order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function, properties of generating functions (G.F.), Solution of recurrence relation using G.F, solution of combinatorial problem using G.F.

UNIT V

Graphs: Graph terminology, types of graph, connected graphs, components of graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number.

Tree: Definition, types of tree (rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).

Text/Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Mc.Graw Hill, 2002.
2. J.P. Tremblay & R. Manohar, "Discrete Mathematical Structure with Applications to Computer Science", Mc.Graw Hill, 1975.
3. V. Krishnamurthy, "Combinatories: Theory and Applications", East-West Press.
4. Seymour Lipschutz, M. Lipson, "Discrete Mathemataics", Tata McGraw Hill, 2005.
5. Kolman, Busby Ross, "Discrete Matheamatical Structures", Prentice Hall International.

ROE039/ROE049: APPLIED LINEAR ALGEBRA

UNIT I

Fields, Vector-spaces, sub-spaces, linear-combination, linear-dependence and independence. Basis and dimensions (each and every fact to be illustrated by suitable examples).

UNIT II

Linear-transformation, definition and examples, matrix representation, similarity, range and kernel, rank-nullity theorem and its consequences.

UNIT III

Singular and non-singular linear transformations, sum and product of linear transformations, vector space of linear transformations, nilpotent linear transformations.

UNIT IV

Inner product spaces, definition and examples, orthogonality, Cauchy-Schwartz Inquality, Minkowski Inequality, polarization Identity, complete orthonormal set, Bessel's Inequality, Gram-Schmidt's orthogonalization process.

UNIT V

Linear functional, definition and examples, vector space of linear functional, dual vector spaces, adjoint, self adjoint, unitary and normal operators, examples and properties, eigen values and eigen vectors, diagonalisation of linear operators, quadratic forms, principle axis theorem (without proof), some applications to engineering problems.

Text/Reference Books:

1. Dym, H., Linear Algebra in action, University Press, 2012
2. Halmos, PR, Finite Dimensional Vector Spaces (1990), Narosa.
3. Hoffman, K. and Kunze, R., Linear Algebra, PHI (2012)
4. Kolman, B. and Hill, DR, Introductory linear algebra with applications (2008), Pearson
5. Lipschutz, S. and Lipson M., Linear Algebra (2005), Schaum's Series.
6. Noble, B. And Daniel, JW, Applied linear algebra (1988), PHI

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Text books:

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.

2. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

3. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.

4. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, Handbook of Applied Cryptography, CRC Press, 2001.

Mapped With : https://ict.iitk.ac.in/product/computer-system-security/

PYTHON PROGRAMMING		
Course Outcome (CO)		**Bloom's Knowledge Level (KL)**
At the end of course , the student will be able to understand		
CO 1	To read and write simple Python programs.	K_1, K_2
CO 2	To develop Python programs with conditionals and loops.	K_2, K_4
CO 3	To define Python functions and to use Python data structures –- lists, tuples, dictionaries	K_3
CO 4	To do input/output with files in Python	K_2
CO 5	To do searching ,sorting and merging in Python	K_2, K_4
DETAILED SYLLABUS		**3-1-0**

Unit	**Topic**	**Proposed Lecture**
I	**Introduction:** The Programming Cycle for Python , Python IDE, Interacting with Python Programs , Elements of Python, Type Conversion. **Basics:** Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression.	**08**
II	**Conditionals:** Conditional statement in Python (if-else statement, its working and execution), Nested-if statement and Elif statement in Python, Expression Evaluation & Float Representation. **Loops:** Purpose and working of loops , While loop including its working, For Loop , Nested Loops , Break and Continue.	**08**
III	**Function:** Parts of A Function , Execution of A Function , Keyword and Default Arguments ,Scope Rules. **Strings :** Length of the string and perform Concatenation and Repeat operations in it. Indexing and Slicing of Strings. **Python Data Structure :** Tuples , Unpacking Sequences , Lists , Mutable Sequences , List Comprehension , Sets , Dictionaries **Higher Order Functions:** Treat functions as first class Objects , Lambda Expressions	**08**

IV	**Sieve of Eratosthenes:** generate prime numbers with the help of an algorithm given by the Greek Mathematician named Eratosthenes, whose algorithm is known as Sieve of Eratosthenes. **File I/O :** File input and output operations in Python Programming **Exceptions and Assertions** **Modules :** Introduction , Importing Modules , **Abstract Data Types :** Abstract data types and ADT interface in Python Programming. **Classes :** Class definition and other operations in the classes , Special Methods (such as _init_, _str_, comparison methods and Arithmetic methods etc.) , Class Example , Inheritance , Inheritance and OOP.	**08**
V	**Iterators & Recursion:** Recursive Fibonacci , Tower Of Hanoi **Search :** Simple Search and Estimating Search Time , Binary Search and Estimating Binary Search Time **Sorting & Merging:** Selection Sort , Merge List , Merge Sort , Higher Order Sort	**08**

Text books:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

2. Guido van Rossum and Fred L. Drake Jr, ―An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

3.John V Guttag, ―Introduction to Computation and Programming Using Python‘‘, Revised and expanded Edition, MIT Press , 2013

4.Robert Sedgewick, Kevin Wayne, Robert Dondero, ―Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

5.Timothy A. Budd, ―Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd.,, 2015.

6.Kenneth A. Lambert, ―Fundamentals of Python: First Programs‖, CENGAGE Learning, 2012.

7.Charles Dierbach, ―Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition, 2013.

8.Paul Gries, Jennifer Campbell and Jason Montojo, ―Practical Programming: An Introduction to Computer Science using Python 3‖, Second edition, Pragmatic Programmers, LLC, 2013.

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