FOURTH SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/ week	Credit	Full Marks
1.	Humanities Science - 3	HU 401	Engineering Economics and Accountancy	3	0	0	3	3	100
2.	Humanities Science - 4	HU 402	Universal Human Values-II: Understanding Harmony	2	1	0	3	3	100
3.	Program Core - 6	PCCS403	Discrete Mathematics	3	1	0	4	4	100
4.	Program Core - 7	PCCS404	Computer Organization & Architecture	3	1	0	4	4	100
5.	Program Core - 8	PCCS405	Operating Systems	3	0	0	3	3	100
6.	Program Core - 9	PCCS406	Object Oriented Programming	3	0	0	3	3	100
7.	Program Core - 10	PCCS407	IT Workshop (Python/R)	0	0	2	2	1	100
8.	Program Core - 11	PCCS408	Operating System Lab	0	0	2	2	1	100
9.	Program Core - 12	PCCS409	Object Oriented Programming Lab	0	0	2	2	1	100
10.	Mandatory Course - 4	MC 410	Essence of Indian Knowledge Tradition	2	0	0	2	0	100
Total:				19	3	6	28	23	1000

Engineering Economics and Accountancy

Course Code	HS 401
Course Title	Engineering Economics and Accountancy
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	-
Course Category	Humanities Science (HS)
Number of classes	38 hours

Course Outcomes:

At the end of the course, the student will be able to

CO Number	CO Description	K-level
CO-1	Explain the importance of engineering economics in business.	K2
CO-2	Demonstrate the necessary knowledge and skills for running a business organisation.	K2
CO-3	Interpret the financial statement and position of an organisation.	K2
CO-4	Analyze the accounting information for decision making.	K4
CO-5	Develop the knowledge & skill on business and management.	K3

Course Content:

Module 1: Engineering economics (9 hrs)

- Engineering economy and its importance;
- Demand& supply: Wants, satisfaction of wants, demand, supply, elasticity of demand, estimation of demand, supply chain economy;
- Production-Factors of production (land, labor, capital, and entrepreneurship), Laws of return.
- Money – Value of money, quantity theory; inflation and deflection.

Module 2: Business Skills for Engineers (9 hrs)

- Business Structure: Proprietorship, Partnership and Joint Stock Company;
- Basic management for businesses: Basic functions of management,
- Risk Management: Type of risk, Risk management steps
- Entrepreneur and Leadership: Leadership styles, Qualities of a good leader for a business;
- Financing and the business: Objectives and sources of funds;
- Taxation: Basics of Income tax & Goods and Services Tax (GST)

Module 3: Financial Accounting for Business (10 hrs)

- Transactions: Financial event, Features of transactions; Recording of transactions;
- Basic accounting: Ledger, Trail balance, Cash book (double column only);
- Final account: Objectives, Preparation of final accounts (Trading A/C, Profit & Loss A/C and Balance Sheet).

Module 4: Managerial Accounting for Decision-making (10 hrs)

- Cost classifications – Material cost control, labor cost control and overhead cost control (only theory);
- Cost sheet: Objective and preparation of Cost sheet (Basic problem);
- Capital budgeting: Objectives Pay-back period and NPV method for feasibility testing of investment
- Working capital management: Factors and sources of WC
- Ratio analysis: Interpretation for industrial control, Basic ratios- Current Ratio, Debt-equity ratio, proft ratio

References / Suggested Learning Resources:

- Fundamentals of Engineering Economics, 4th Edition, by Chan S. Park, Pearson Publishing;
- Engineering Economics And Financial Accounting Paperback, by Arasu, Scitech publication
- Engineering Economics and Financial Accounting for Anna University Paperback by A. Bagad,Technical Publications;
- Financial Management- An analytical framework , Nayak& Manna, Parul Library;
- Principles of Management, Ghose and Basu,ABS Publishing House;

Universal Human Values-II: Understanding Harmony

Course Code	HU-402
Course Title	Universal Human Values-II: Understanding Harmony
Number of Credits	3(L: 2, T: 1, P: 0)
Prerequisites	Induction Programme and Universal Human Values -I
Course Category	Humanities Science (HS)
Number of classes	36 hours

Course Outcome:

At the end of the course, the student will be able to:

CO Number	CO Description	K-level
CO-1	Explain the term self-exploration and its application for self-evaluation and development.	K2
CO-2	Identify the holistic perception of harmony at level of self, family, society, nature and explain it by various examples.	K3
CO-3	Illustrate the role of a human being in ensuring harmony in society and nature.	K2
CO-4	Distinguish between ethical and unethical practices, and start identifying a strategy to actualize a harmonious environment wherever they work.	K4

Module 1: Introduction- Need, Basic Guidelines, Content and Process for Value Education (8 Hrs)

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility-the basic requirement for fulfillment of aspirations of every human being with their correct priority.
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module2: Understanding Harmony in the Human Being (10 Hrs)

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body'-happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'.
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Module 3: Understanding Harmony in the Nature and Existence – Whole existence as Coexistence (8Hrs)

Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

Module 4: Implications of the above Holistic Understanding of Harmony on Professional Ethics (10Hrs)

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
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.

ReferenceBooks

1. Human Values and Professional Ethics by RR Gaur, RSangal, GP Bagaria, Excel Books, New Delhi,2010
2. Jeevan Vidya:Ek Parichaya, A Nagaraj, JeevanVidya Prakashan, Amarkantak, 1999.
3. HumanValues, A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
4. TheStoryofMyExperimentswithTruth byMohandasKaramchandGandhi.
5. BharatMeinAngrejiRaj-PanditSunderlal
6. RediscoveringIndia-byDharampal
7. HindSwarajor Indian HomeRule- by MohandasK.Gandhi
8. IndiaWinsFreedom-MaulanaAbdulKalamAzad
9. Vivekananda-RomainRolland(English)
10. Gandhi-RomainRolland(English)

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Discrete Mathematics

Course Code	PC CS 403
Course Title	Discrete Mathematics
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	BS 101, BS 202
Course Category	Program Core(PC)
Number of classes	48 hours

Course Outcome:

At the end of the course, the student will be able to:

CO Number	CO Description	K-level
CO-1	Construct a logic sentence in terms of predicates, quantifiers, and logical connectives	K3
CO-2	Simplify and Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	K4
CO-3	Classify its algebraic structure for a given a mathematical problem.	K4
CO-4	Analyze and Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.	K4
CO-5	Develop the given problem as graph networks and solve with techniques of graph theory	K4

Course Content:

Module 1: (10 Hours)

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module 2: (10Hours)

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination. Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication,

Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module 3: (15 Hours)

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form.

Module 4: (13 Hours)

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.

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Computer Organization & Architecture

Course Code	PC CS 404
Course Title	Computer Organization & Architecture
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	ES204
Course Category	Program Core(PC)
Number of classes	48 hours

Course Outcome:

At the end of the course, the student will be able to:

CO Number	CO Description	K-level
CO-1	Apply the basics of stored program concepts.	K3
CO-2	Utilize the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle	K3
CO-3	Examine a memory module and analyze its operation by interfacing with the CPU.	K4
CO-4	Apply design techniques to enhance performance using pipelining, parallelism and RISC methodology	K4

Course Content:

Module 1 **(12 Hours)**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Module 2 **(12 Hours)**

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Module 3 **(12 Hours)**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Module 4: **(12 Hours)**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

Suggested books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by CarlHamacher, McGraw Hill Higher Education

Suggested reference books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

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Operating Systems

Course Code	PC CS 405
Course Title	Operating Systems
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Computer Basics
Course Category	Program Core(PC)
Number of classes	38 hours

Course Outcome:

At the end of the course, the student will be able to:

CO Number	CO Description	K-level
CO-1	Create processes and threads.	K3
CO-2	Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.	K4
CO-3	Develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	K4
CO-4	Design and implement file management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	K4

Course Content:

Module 1 **(8 Hours)**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Module 2 **(10 Hours)**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores,

Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module 3 **(10 Hours)**

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction;

Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU)

Module 4: **(10 Hours)**

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

Suggested books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.

2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing

2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, AddisonWesley

3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India

Object Oriented Programming

Course Code	PC CS 406
Course Title	Object Oriented Programming
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	ES204,PCCS306
Course Category	Program Core(PC)
Number of classes	38 hours

Course Outcome:

At the end of the course, the student will be able to:

CO Number	CO Description	K-level
CO-1	Classify simple abstract data types and design implementations, using abstraction functions to document them.	K4
CO-2	Classify features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.	K4
CO-3	~~A~~pply some common object-oriented design patterns and give examples of their use.	K4
CO-4	Design applications with an event-driven graphical user interface.	K4

Course Content:

Module 1: Abstract Data Types and Their specifications (5 Hours)

Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example

Module 2: Features of Object Oriented Programming (10 Hours)

Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance

Module 3: Inheritance in Object Oriented Design (10 Hours)

Inheritance in Object Oriented design. Design patterns. Introduction and classification. The iterator pattern. Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.

Module 4: Generic Types and Collections (13 Hours)

Generic types and collections, GUIs. Graphical programming with Scale and Swing . The software development process

Suggested books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – PrenticeHall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox 7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

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IT Workshop

Course Code	PC CS407
Course Title	IT Workshop
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	ES 208(Programming for Problem Solving Lab)
Course Category	Program Core (PC)
Number of classes	24 hours

Course Outcome:-

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

CO No	CO Description	K-level
CO-1	Develop algorithmic solutions to simple computational problems.	K3
CO-2	Demonstrate programs using Python control flow and functions.	K3
CO-3	Utilize Python datatypes for accessing different data.	K3
CO-4	Analyse and use different machine learning libraries using python	K4

List of Experiments (*Minimum 6 experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Download & Install Python and introduction to Python Language, Python Language Syntax, python Keywords and Identifiers, python Comments and python Variables.
2. Python Data Types, User Input, and Operators.
3. Python Modules.
4. Python Control Flow – Decision Making.
5. Python Control Flow – Looping and Branching.
6. Python Function.
7. Python Numbers and Lists
8. Python Tuples and Strings.
9. Python Sets and Dictionaries.
10. PythonArrays.
11. Python OOPs Concepts, Classes and Object and Constructors.
12. Python Inheritance and Polymorphism.
13. Python Regular Expressions.
14. Python Database Access.
15. Python-Numpy, SciPy, Matplotlib.

16. Python-Pandas.
17. Python Scikit-learn.
18. Python Scikit-image, PIL, Pillow etc.

References / Suggested Learning Resources:-

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India.
2. R. Nageswara Rao, “Core Python Programming”, dreamtech.
3. Wesley J. Chun. “Core Python Programming - Second Edition”, Prentice Hall
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Pyhon”, Wiley.
5. Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication.
6. MySQL for Python, by Albert Lukaszewski, Packt Publishing.

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Operating Systems Lab

Course Code	PC CS 408
Course Title	Operating Systems Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Computer Basics
Course Category	Program Core (PC)
Number of classes	24 hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Implement deadlock avoidance, and Detection Algorithms	K3
CO-2	Compare the performance of various CPU scheduling Algorithm	K4
CO-3	Analyze the performance of the various page replacement algorithms	K4
CO-4	Create processes and implement IPC	K3
CO-5	Implement C programs using Unix system calls	K4

List of Experiments (*Minimum 6 experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Basics of UNIX commands.

2. Shell Programming- creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands)
3. Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.

4. Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

5. Implement all file allocation strategies a) Sequential b) Indexed c) Linked
6. Implement Inter-process communication- pipes (use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory (IPC version V).
7. Implement Semaphores
8. Implement all File Organization Techniques:
   a) Single level directory b) Two level c) Hierarchical d) DAG
9. Implement Bankers Algorithm for Dead Lock Avoidance
10. Implement an Algorithm for Dead Lock Detection
11. Implement e all page replacement algorithms a) FIFO b) LRU c) LFU
12. Implement Shared memory and IPC

13. Implement Paging Technique of memory management.
14. Implement Threading & Synchronization Applications
15. Implement disk management algorithms-FCFS, SSTF, SCAN, C-SCAN

SUGGESTED TEXT BOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Advanced programming in the Unix environment, W.R.Stevens, Pearson education.

REFERENCE BOOKS:

1. Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition– 2005, Pearson Education/PHI
2. Operating System - A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI
4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education
5. UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education

Object Oriented Programming Lab

Course Code	PCCS409
Course Title	Object Oriented Programming Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	ES208
Course Category	Program Core (PC)
Number of classes	24 hours

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Inspect simple abstract data types and design implementations, using abstraction functions to document them.	K4
CO-2	Identify features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity	K4
CO-3	Apply some common object-oriented design patterns and give examples of their use	K4
CO-4	Design applications with an event-driven graphical user interface	K4

List of Experiments (*Minimum 10 experiments are to be performed. Use of virtual laboratory to perform few experiments may be explored, if available****):***

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, arrays
3. Assignments on developing interfaces- multiple inheritances, extending interfaces
4. Assignments on creating and accessing packages
5. Assignment on using third party libraries
6. Assignment on multithreaded programming.

Essence of Indian Knowledge Tradition

Course Code	MC-410
Course Title	Essence of Indian Knowledge Tradition
Number of Credits	0 (L: 2, T: 0, P: 0)
Prerequisites	Nil
Course Category	Mandatory Course (MC)
Number of classes	26

Course Outcome:

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

CO Number	CO Description	K-level
CO-1	Outline Vedic literature, Puranic Literature and other ancient knowledge tradition of India.	K2
CO-2	Explain about scientific heritage of ancient India along with comprehending its relevance and application in various modern scientific disciplines.	K2
CO-3	Demonstrate Indian Philosophical systems with a conscious emphasis on their relevance and application in modern scientific enquiry.	K2
CO-4	Illustrate Indian Linguistic tradition along with its branches.	K2
CO-5	Critically analyse the worth of Indian intellectual heritage, traditional practices and Indian lifestyle from scientific lenses.	K4

Course Content:

Module 1: Introduction to Vedic Literature, Dharmaśāstra and Purāṇas (08 hrs)

- General structure of Vedic Literature,
- Different theories on the age of the Vedas,
- Educational system in the Vedic times
- Subject-matter of Ṛgveda-samhitā, Sāmaveda -Saṁhitā, Yajurveda-Saṁhitā, Atharvaveda-Saṁhitā, Brāhmaṇa and Āraṇyaka literature, Upaveda
- Vedāṅga Literature
- History of Dharmaśāstra
- Basic concepts of Purānas

Module 2: Indian Knowledge System, Yoga and Health care (06 hrs)

- Origin and Development of Indian Knowledge System
- Concept of Dharma in Indian knowledge tradition
- General ideas about Yoga,
- Origin and Development of Pātañjala Yoga
- Origin and Development of Āyurveda and its relevance

Module 3: Introduction to Indian Philosophy (06 hrs)

- General introduction to Indian Philosophical systems, i.e. Orthodox and Heterodox
- Concept of Puruṣārthas in Indian Philosophy
- General introduction of Upaniṣadic literature
- Indian Philosophy and Modern Science
- Principles in different philosophical systems
- Relevance of Indian Philosophy in Modern time

Module 4: Indian Linguistic and Artistic Tradition (06 hrs)

- Origin and Definition of Language
- Branches and aspects of Science of language
- Vedic and Classical Sanskrit
- Indo-European family of Language
- Role of Sanskrit in comparative Philology
- Sanskrit Phonology and Phonetic laws
- History of Sanskrit Grammar
- Introduction to Śikṣā literature
- Origin and Development of Artistic tradition

References / Suggested Learning Resources :

1) Capra, Fritjof. The Tao of Phisics. New York: Harpercollins, 2007.
2) Capra, Fritjof. The Web of Life. London: Harpar Collins Publishers, 1996.
3) Chaitanya, Krishna. Arts of India, Abhinav Publications, 1987.
4) Chatterjee, S.C & Datta, D.M. An Introduction to Indian Philosophy, Calcutta: University of Calcutta, 1984.
5) Cowell, E.B and Gough. A.E (Ed.), Sarvadarśanasaṅgraha. Sadguru Publications, 2008.
6) Dasgupta, Surendranath & De, Sushil Kumar. A History of Sanskrit Literature.Delhi: Motilal Banarsidass, 2017.
7) Dasgupta, Surendranath. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991.
8) GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016.

9) Gonda, Jan. A History of Vedic Literature. Delhi: Monohar Publishers and Distributors, 2020.
10) Jha, R.N. Science and Consciousness Psychotherapy and Yoga Practices. Delhi: Vidyanidhi Prakashan, 2016.
11) Jha, V.N. Language, Thought and Reality.
12) Kane. P.V. History of Dharmasastra, Poona: Bhandarkar Oriental Research Institute, 1930.
13) Knowledge traditions and practices of India, CBSE Publications.
14) Max Muller. Ancient Sanskrit Literature, London: Spottiswoode and Co., 1859.
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