TRIPURA UNIVERSITY
(A CENTRAL UNIVERITY)

CURRICULUM STRUCTURE

OF

4 YEARS

BACHELOR OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL &

COMPUTER SCIENCE ENGINEERING

(ECSE)

4th Semester

2021

4th SEMESTER

Sl. No.	Course Category	Subject Code	Subject Title	L	T	P	Contact Hours/week	Credit	Full Marks
1.	*Humanities Science - 3*	*HS 401*	*Engineering Economics and Accountancy*	*3*	*0*	*0*	*3*	*3*	*100*
2.	*Humanities Science - 4*	*HS 402*	*Universal Human Values-II: Understanding Harmony*	*2*	*1*	*0*	*3*	*3*	*100*
3.	Program Core - 6	PC ECS 403	Electrical Circuit Theory	3	1	0	4	4	100
4.	Program Core - 7	PC ECS 404	Electrical Machines	3	1	0	4	4	100
5.	Program Core - 8	PC ECS 405	Fields Theory	3	0	0	3	3	100
6.	Program Core - 9	PC ECS 406	Data Structure & Algorithms	3	0	0	3	3	100
7.	Program Core - 10	PC ECS 407	Circuit Theory lab	0	0	2	1	1	100
8.	Program Core - 11	PC ECS 408	Electrical Machines Lab	0	0	2	1	1	100
9.	Program Core - 12	PC ECS 409	Data Structure & Algorithms Lab	0	0	2	1	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	Understand the importance of engineering economics in business.	K2
CO-2	Demonstrate the necessary knowledge and skills for running a business organisation.	K2
CO-3	Understand 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 (09 Hours)

- 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 (09 Hours)

- 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 (10Hours)

- 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 Hours)

- 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: Course Introduction - Need, Basic Guidelines, Content andProcess for Value Education (08 Hours)

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 requirements for fulfillment of aspirations of every human being with their correct priority.
Understanding Happiness and Prosperity correctly- A critical appraisal of thecurrent scenario.
Method to fulfill the above human aspirations: understanding and living inharmony at various levels.

Module 2: Understanding Harmony in the Human Being (10 Hours)

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 (08 Hours)

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 unitsin 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 (10 Hours)

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.

Reference Books

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G PBagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Bharat Mein Angreji Raj - PanditSunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)

Electrical Circuit Theory

Course Code	PC ECS 403
Course Title	Electrical Circuit Theory
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	Mathematics, Basic Electrical Engineering.
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	Analysis of electrical circuits using graph theory of networks circuital laws and theorems for magnetic or electric circuit solution.	K2
CO-2	Applications of network functions.	K3
CO-3	Develop a clear understanding of the important parameters of a magnetic circuit.	K4
CO-4	Analyze two-port network by using network parameters.	K4
CO-5	Summarize poly phase circuits and active filters.	K4

Course Content:

Module 1: Network Theorems & Network Topology (12 Hours)

AC & DC circuits; Thevenin's, Norton's, Superposition and Maximum power transfer theorems; Compensation, Reciprocity and Tellegen's theorems, Concept of network graphs, tree, link, cut set, network matrices, node incidence matrix, loop incidence matrix, cut set incidence matrix, network analysis using network incidence matrices, Duality, Solution of Problems.

Module 2: Coupled Circuits & Filters Coupled Circuits (12 Hours)

Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of self and mutual inductance, coefficient of coupling, modeling of coupled circuits, solution of problems. Transient Network Analysis: Response of R-L, R-C and R-L-C networks using Laplace Transforms for unit step, impulse and ramp inputs. Network Functions: Driving point impedances; Transfer functions of networks.

Module 3: Two Port Networks and their Characterization (12 Hours)

Open circuit, short circuit, hybrid and transmission parameters; Series, parallel and tandem connections of two-port networks, multi-port networks, multi-terminal networks; Indefinite admittance matrix and its properties. Network Synthesis: Concept of Transfer function, natural frequency and damping ratio & poles and zeros of network functions, positive real functions and their properties, tests for positive real functions, Hurwitz polynomials.

Module 4: Three-Phase A.C. Circuit Analysis (12 Hours)

Poly phase circuits: 3 phase system, Phase sequence, advantages over 1-phase system, Inter connection of 3-phase sources & loads, Relation between line & phase values of voltage & current both in star & delta connections, 3-phase power, problems on balanced as well as unbalanced (3- phase 4-wire) system. Fourier series of periodic functions and waveforms and its applications in electrical circuits, some properties of Fourier transform. Active Filters: Second Order Low pass, High pass, Band pass and Band stop, Solution of Problems.

References / Suggested Learning Resources:

1. Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd, 2008.

2. Desoer C. A. and Kuh E. S., "Basic Circuit Theory", McGraw Hill International Book Company, 1984.
3. C.L. Wadhwa, "Network Analysis and Synthesis", New Age International Publishers.
4. Dr. Abhijit Chakrabarty, "Circuit theory", Dhanpat Rai & Co Pvt. Ltd.
5. Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition, 2007.
6. Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India. 2008.

Electrical Machines

Course Code	PC ECS 404
Course Title	Electrical Machines
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	Physics, Basic Electrical Engineering
Course Category	Program Core (PC)
Number of classes	48 Hours

Course Outcome:

After completing the course in Electrical Machines, the students will be able to-

CO Number	CO Description	K-level
CO-1	List the different parts of transformer also they can explain the working of transformer. Students can estimate equivalent circuit parameters and different losses that occurs into transformer.	K1
CO-2	List the different parts of DC machines also they can explain the working of DC machines. Students can estimate different losses that occurs into transformer. Students also can differentiate between generator and motor.	K2
CO-3	List the different parts of induction machines also they can explain the working of induction machines. Students can estimate equivalent circuit parameters and different losses that occurs into induction machines.	K2
CO-4	Gather the knowledge of special type single phase induction motor that are used in industrial applications.	K3

Course Content:

Module 1: Transformer **(16 Hours)**

Transformers- Principle, construction and operation of single-phase transformers, phasor diagram, equivalent circuit, voltage regulation, losses and efficiency, Testing- Open & short circuit tests, Polarity test. Three phase Transformer-Constructional features, various types of connection, Parallel operation of single

phase and three phase transformers, Autotransformers- Construction & Principle operation, Applications and Comparison with two winding transformer. Tap changing Transformers- No load and on load tap changing of transformers.

Module 2: DC Machines (14 Hours)

D.C. Machines- Working principle, construction and methods of excitation, Armature Winding- Detailed study of simple lap and wave windings, D.C. Generators e.m.f. equation. Circuit models, Armature reaction, Effect of brush shift. Compensating winding, Characteristics of various types of generators, applications.

D.C. Motors- Torque equation, Circuit models Characteristics of d.c. shunt, series and compound motors, applications, Starting & Speed Control- Starting methods and speed control of d.c. shunt and series motors, Commutation- Causes of bad commutation, Methods of improvement, Testing- Direct and regenerative methods to test d.c. machines.

Module 3: Induction Machines (10 Hours)

Induction Machines -Constructional features , production of torque, phasor diagram, equivalent circuit, performance analysis, torque-slip characteristics, blocked rotor and no load test, Effect of rotor resistance, deep bar and double cage induction motor, Starting methods of squirrel cage and wound rotor induction motor, Speed Control- Various methods of speed control of squirrel cage and wound rotor induction motor.

Module 4: Single phase induction motor (08 Hours)

Single phase induction motors- Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split phase, starting methods & applications, Universal Motor and its operation, Constructional features of Stepper Motor and its application in Industries

References / Suggested Learning Resources:

1. A Text Book of Electrical Technology by B. L. Thereja – S. Chand publication
2. Theory & Performance of Electrical Machine by J. B. Gupta
3. Electrical Machines by S. K. Bhattacharya – Tata McGrew Hill Publications
4. Electric Machines, by : Ashfaq Husain (Dhanpat Rai publications)
5. Electric Machinery Fundamentals, by : Stephen J. Chapman (Tata McGrew Hill Publications)

Fields Theory

Course Code	PE ECS 405
Course Title	Fields Theory
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Basic Electrical, Vector Algebra & Differential Calculus
Course Category	Program Core (PC)
Number of classes	38 Hours

Course Outcome:

After completing the course in Fields Theory, the students will be able to-

CO Number	CO Description	K-level
CO-1	Recall vector algebra to understand and discuss the behavior of static electric and magnetic fields in standard configuration.	K1
CO-2	Learn to apply Divergence & Stoke's Theorem &use concepts of scalar and vector fields in solving problems related to electromagnetic fields.	K3
CO-3	Demonstrate& derive Laws of Electrostatics, Gauss's Law, Electric potential, Laplace's and Poisson's equation. Analyze boundary value problems, method of images, and energy storage in electric fields.	K4
CO-4	Interpret the concepts of magneto statics and the different laws associated with magneto statics-Biot-Savart's law, Ampere's law, Lenz's law and differentiate magnetic scalar and vector potentials, boundary relations.	K4
CO-5	Formulate the continuity equation for steady and time varying currents, Conclude Maxwell's equations from both electrostatic & Magneto static field equations, develop the concept of displacement current and displacement current density, Derive Poynting Vector &Poynting Theorem, and generate the wave equations for electromagnetic waves.	K6

Course Content:

Module-1: Concept of vectors (08 Hours)

Introduction to Coordinate systems, Concepts on vector algebra and vector calculus. Concept of scalar and vector fields. Physical interpretation of differential vector operations-divergence, gradient and curl. Divergence and Stoke's theorem.

Module-2: Electrostatics (10 Hours)

Coulomb's law, Electric field intensity, principle of superposition, concept of electric potential, electric flux density, Gauss's law and its application, permittivity and polarization concepts, capacitance, Laplace and Poisson's equation, boundary value problems, concept of energy stored in electric field.

Module-3: Magnetostatics (10 Hours)

Magnetic field due to a current carrying element, Ampere circuital law.Biot-Savart's law, concept of magnetic flux density and field intensity, Lenz's law, concept of inductance and energy and energy density in an inductor, magnetic vector potential, concept of dielectrics, boundary relations.

Module-4:Time varying electric and magnetic fields (10 Hours)

Faraday's law, transformers and mutual induction, Continuity equation for steady and time varying current, displacement current, displacement current density, ampere's law and it's inconsistency for time varying fields,

Maxwell's equations. Boundary relations, Poynting vector and Poynting theorem. concept of electromagnetic waves and wave equations from Maxwell's equations.

References / Suggested Learning Resources:

1. Electromagnetic Waves and Radiation Systems: Jordan and Balmain: PHI
2. Electro magnetics : Kraus: T.M.H
3. Elements of Electromagnetics: Matthew N.O. Sadiku: O.U.P
4. Electromagnetism: Parmanik:PHI
5. Electro magnetics: Edminister: Schaum Series
6. Electrodynamics: BB Laud: New Age Publisher

Data Structure & Algorithm

Course Code	PC ECS 406
Course Title	Data Structure & Algorithms
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Physics, Mathematics, Basic Knowledge of Computers.
Course Category	Program Core (PC)
Number of classes	38 Hours

Course Outcome:-

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

CO No	CO Description	K-level
CO-1	Interpret and compute asymptotic notations of an algorithm to analyze the consumption of resources (time/space).	K3
CO-2	Exemplify and implement stack, queue, list ADT, Non-linear Data Structure and advanced data structures to manage the memory using static and dynamic allocations.	K3
CO-3	Develop and compare the comparison-based search algorithms and sorting.	K4
CO-4	Apply data structure and algorithm for a given contextual problem and implement it.	K3

Course Content :-

Module- 1: Linear Data Structure (09 Hours)

Concepts of data structures: a) Data and data structure b) abstract Data Type and Data Type. Algorithms and programs. Algorithm efficiency and analysis, time and space analysis of algorithms -Asymptotic Order notations , Induction. Array: Different representations row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked List: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module- 2: Stack & Concept of Recursion& Iterations (09 Hours)

Stack:Stack and its implementations(using array, using linked list), applications. Queues: circular queue, dequeue. Implementation of queue-both linear and circular (using array, using linked list),applications. Recursion: Principles of recursion use of stack, differences between recursion and iteration, tail recursion. Applications -The Tower of Hanoi, Eight Queens Puzzle. Pattern search and matching algorithms : Knuth-Morris-Pratt and Boyer-Moore algorithms.

Module- 3: Non-Linear Data Structure (12 Hours)

Trees: Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in -, post - order), threaded binary tree (left, right, full) - non -recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree - operations (creation, insertion, deletion, searching). Height balanced binary tree AVL tree (insertion, deletion with examples only). B- Trees operations (insertion, deletion with examples only). Graph: Graph definitions and Concept. Shortest path algorithms: Dijkstra (greedy algorithm) and Bellman -Ford (dynamic programming). Graph traversal and connectivity- Depth-first search (DFS), Breadth -first search (BFS) concepts of edges used in DFS and BFS (tree -edge, back-edge, cross-edge, forward -edge), applications. Minimal spanning tree- Prims's algorithm.

Module- 4: Searching and Sorting Algorithms (08 Hours)

Sorting Algorithms: Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application priority queue), radix sort. Searching: Sequential search, binary search, interpolation search. Hashing: Hashing functions, collision resolution techniques.

References/ Suggested Learning Resources :-

1. Fundamentals of Data Structure in c++ by Ellis Horrowitz, Sartaj Sahni, Dinesh Mehta
2. Data Structures using c and C++ by A M Tanenbaum
3. Data Structures by S. Lipschutz.

4. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein

5. "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" by Narasimha Karumanchi

Electrical Circuit TheoryLaboratory

Course Code	PC ECS 407
Course Title	Electrical Circuit Theory Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Electrical Circuit & System.
Course Category	Program Core (PC)
Number of classes	24 Hours

Course Outcome:

After completing the Course inElectrical Circuit Theory Laboratory, the students will be able to-

CO Number	CO Description	K-level
CO-1	Solve basic circuit components to make an electrical network.	K2
CO-2	Generalize the characteristics of electrical circuits.	K2
CO-3	Determination of different parameters of series resonant circuit.	K3
CO-4	Determination of parameters of two port networks and their applications in the higher courses of Electrical Engineering.	K3
CO-5	Analyze the time constant of transient circuits and also to analyze transfer function of 2nd order circuit from its transient response and as well as its frequency response.	K4

List of experiments:

1. Determination of open circuit Z-parameters and short circuit Y-parameters of a two port D.C. circuit and verifications of them.
2. Determination of transmission and hybrid parameters of a two port D.C. Network.
3. Determination of overall short circuit Y-parameters of a parallel connected two identical two port networks.
4. Determination of overall transmission parameters of cascade combination of two identical two port Networks.
5. Study of series R-L-C resonance circuits and determination of resonance frequency and bandwidth.
6. Study of transient responses of R-L & R-C series circuits and determination of time constants of these circuits.
7. Study of transient characteristics of R-L-C series circuit and observation of characteristics of under damped, over damped and critically damped 2nd order R-L-C circuit by varying circuit elements.
8. Study of characteristics of time responses of series circuits due to continuous periodic triangular wave form at different frequency.
9. Study of frequency response of 1st order series circuits and determination of transfer function of circuits.
10. Study of frequency response of 2nd order R-L-C circuit and determination of transfer function of the circuit.

References / Suggested Learning Resources:

1. Hayt W. H., Kemmerly J. E. and Durbin S. M., "Engineering Circuit Analysis", 6th Ed., Tata McGraw-Hill Publishing Company Ltd, 2008.
2. Desoer C. A. and Kuh E. S., "Basic Circuit Theory", McGraw Hill International Book Company, 1984.
3. C.L. Wadhwa, "Network Analysis and Synthesis", New Age International Publishers.
4. Dr. Abhijit Chakrabarty, "Circuit theory", Dhanpat Rai & Co Pvt. Ltd.
5. Valkenberg V., "Network Analysis", 3rd Ed., Prentice Hall International Edition, 2007.
6. Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India. 2008.

Electrical Machines Laboratory

Course Code	PC ECS 408
Course Title	Electrical Machines Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Electrical Machines
Course Category	Program Core (PC)
Number of classes	24 Hours

Course Outcome:

After completing the Course in Electrical Machines Laboratory, the students will be able to -

CO Number	CO Description	K-level
CO-1	Apply knowledge on transformer tests to determine different parameters, losses, efficiency	K3
CO-2	Apply knowledge on DC motor tests to determine different parameters, losses, efficiency	K3
CO-3	Apply knowledge on universal motor tests to determine different parameters, losses, efficiency	K3
CO-4	Apply knowledge on Induction motor tests to determine different parameters, losses, efficiency	K3

List of experiments:

1. To study polarity test of three single phase transformer.
2. To study parallel operation of two single phase transformer.
3. To study OC and SC test of single phase transformer.
4. To perform load test on DC series motor.
5. To study load test on DC shunt motor.
6. To study load test on DC compound motor.
7. To study speed torque characteristics of universal motor.
8. Study of DC machine starter and speed control of DC shunt motor by armature control method.
9. Study of DC machine starter and speed control of DC shunt motor by field control method.
10. To study no load & blocked rotor test on induction motor.
11. To study load test on three phase squirrel cage induction motor.

References / Suggested Learning Resources:

1. A Text Book of Electrical Technology by B. L. Thereja – S. Chand publication
2. Theory & Performance of Electrical Machine by J. B. Gupta
3. Electrical Machines by S. K. Bhattacharya – Tata McGrew Hill Publications
4. Electric Machines, by : Ashfaq Husain (Dhanpat Rai publications)
5. Electric Machinery Fundamentals, by : Stephen J. Chapman (Tata McGrew Hill Publications)

Data Structure & Algorithms Laboratory

Course Code	PC ECS 409
Course Title	Data Structure & Algorithms Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Data Structure & Algorithms
Course Category	Program Core (PC)
Number of Classes	24 Hours

Course Outcome:-

After completing the course in Data Structure & Algorithm Laboratory, the students will be able to-

CO No	CO Description	K-level
CO-1	**Assess** performance efficiency of sequential algorithms.	K6
CO-2	**Construct** data structures to enable algorithms and implement sequential algorithms for performance.	K5
CO-3	**Apply** essential data structures such as lists, stacks, queues, treesand graph.	K3
CO-4	**Use** generic data structures for common problems using various programming languages.	K3

List of Experiments:

List of Experiments should include but not limited to following exercises:

1. Program to calculate series.
2. Implementation of array operations.
3. Stacks and Queues: adding, deleting elements, Circular Queue: Adding & deleting elements Merging Problem.
4. Evaluation of expressions operations on multiple stacks & Queues.
5. Implementation of linked lists: inserting, deleting, and inverting a linked list.
6. Implementation of stacks & queues.
7. Conversion of infix to postfix expression.
8. Evaluation of postfix expression.
9. Using linked lists: Polynomial addition, Polynomial multiplication Sparse Matrices: Multiplication, addition.
10. Sparse Matrices: Multiplication, addition.
11. Recursive and Non-recursive traversal of Trees.
12. Threaded binary tree traversal. AVL tree implementation.
13. Implementation of Tree, sorting and searching algorithms, Hash implementation: searching, inserting and deleting, searching & sorting techniques.
14. Finding simple interest for a given Principal, Time and rate of Interest.
15. Finding sum, average, maximum and maximum in an integer array.
16. Searching and insertion of element in integer array.
17. Implementation of different sorting techniques in integer array.
18. Construction of Graph using 2-D array for directed and undirected, weighted and unweight graphs.

19. Implementation of minimum spanning tree in a given graph.
20. Construction of binary tree using linked list ADT.
21. Implementation of Depth First Search in binary tree.
22. Implementation of Breadth First Search in binary tree.
23. Preorder Tree Traversal technique.
24. Inorder Tree Traversal technique.
25. Postorder Tree Traversal technique.
26. Finding shortest path in a given graph.

References / Suggested Learning Resources :-

1. Fundamentals of Data Structure in c++ by Ellis Horrowitz, Sartaj Sahni, Dinesh Mehta
2. Data Structures using c and C++ by A M Tanenbaum
3. Data Structures by S. Lipschutz.

4. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein

5. "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles" by Narasimha Karumanchi

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 Hours

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 Hours)

- 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 Hours)

- 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 Hours)

- 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 Hours)

- 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 :

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4) Chatterjee, S.C & Datta, D.M. An Introduction to Indian Philosophy, Calcutta: University of Calcutta, 1984.
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