Tripura University
(A Central University)

Detailed syllabus for

B.Tech in Electronics and

Communication Engineering

Fourth Semester

2021

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	PC EC 403	Analog Circuits	3	1	0	4	4	100
4.	Program Core - 7	PC EC 404	Microprocessor & Microcontrollers	3	0	0	3	3	100
5.	Program Core - 8	PC EC 405	Electromagnetic Theory	3	0	0	3	3	100
6.	Program Core - 9	PC EC 406	Signals and Systems	4	0	0	4	4	100
7.	Program Core - 10	PC EC 407	Analog Circuits Lab	0	0	2	2	1	100
8.	Program Core - 11	PC EC 408	Microcontrollers Lab	0	0	2	2	1	100
9.	Program Core - 12	PC EC 409	Basic Simulation Laboratory	0	0	2	2	1	100
10.	Mandatory Course - 4	MC 410	Essence of Indian Knowledge Tradition	2	0	0	2	0	100
			Total:	20	2	6	28	**23**	**1000**

1. Engineering Economics and Accountancy(HS 401)

Course Code	HS 401
Course Title	Engineering Economics and Accountancy
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	10+2
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	Explain the necessary knowledge and skills for running a business organization.	K2
CO-3	Explain the financial statement and position of an organization.	K2
CO-4	Analyze the accounting information for decision making.	K4
CO-5	Built theknowledge & skill on business and management.	K3

Course Content:

Module 1: Engineering economics (9 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 (9 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 (10 hours)

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, profit ratio.

***REFERENCES / SUGGESTED LEARNING RESOURCES*:**

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

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02. Universal Human Values-II: Understanding Harmony (HU-402)

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

Module1: (08 Hours)

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

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 the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Module2: (10Hours)

Understanding Harmony in the Human Being

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 andcompetence. Understanding the harmony in the society (society being an extension offamily):Resolution, Prosperity, fearlessness (trust) and co-existence ascomprehensiveHumanGoals

Module 3: (08 Hours)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

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.

Module4: (10Hours)

Implications of the above Holistic Understanding of Harmony on Professional Ethics

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

Competenceinprofessionalethics:

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 R R Gaur, R Sangal, GPB agaria, Excel Books, New Delhi,2010.
2. JeevanVidya:Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

3. HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi.
5. Bharat Mein Angreji Raj-Pandit Sunderlal
6. Re-discovering India-by Dharampal
7. Hind Swarajor Indian HomeRule- by MohandasK.Gandhi
8. India Wins Freedom-Maulana Abdul Kalam Azad
9. Vivekananda-Romain Rolland(English)
10. Gandhi-Romain Rolland(English)

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3. Analog Circuits (PC EC 403)

Course Code	PC EC 403
Course Title	Analog Circuits
Number of Credits	4 (L: 3, T: 1, P: 0)
Prerequisites	Basics of Electronics Devices
Course Category	Program Core (PC)
Number of classes	48 hours

Course Outcome:

At the end of this course students will demonstrate the ability to:

CO Number	CO Description	K-level
CO-1	Construct various diode circuits and amplifier models.	K3
CO-2	Construct and analyze high frequency transistor models.	K3
CO-3	Explain sinusoidal and non-sinusoidal oscillators	K2
CO-4	Explain the functioning of OP-AMP and design OP-AMP based circuits.	K2
CO-5	Construct ADC and DAC circuits.	K3

Module- 1: Diode Circuits, Amplifier models (14 hours)

Diode Circuits:clipper, clamper P-N Junction as a rectifier, Half wave rectifier, Full wave rectifier, Bridge rectifier. Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L-section filter, π- section filters and comparison of various filter circuits, Voltage regulation using zener diode, voltage multipliers circuit.
Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

Module 2: High Frequency Transistor Models (10 hours)

High frequency transistor models, frequency response of single stage and multistage amplifiers, cascade amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Module- 3: Oscillators and Differential Amplifiers (12 hours)

Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.
Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

Module-4: OP-AMP applications (12 hours)

Review of inverting and non-inverting amplifiers, integratorand differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications.
Active filters: Low pass, high pass, band pass and band stop, design guidelines. Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistorstring etc. Analogto-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.
Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

***TEXT/REFERENCE BOOKS*:**

1. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
3. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
4. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11
5. Publishing, Edition IV 6. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

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4. Microprocessor and Microcontrollers (PC EC 404)

Course Code	PC EC 404
Course Title	Microprocessor and Microcontrollers
Number of Credits	3 (L: 3, T: 0, P: 0)
Prerequisites	Digital Electronics
Course Category	Program Core (PE)
Number of classes	38 hours

Course Outcome:

At the end of this course students will demonstrate the ability to:

CO Number	CO Description	K-level
CO-1	Explain the architecture of 8085 and 8051 Microcontroller.	K2
CO-2	Apply the knowledge of Assembly level language to write the programming in 8085 and 8051.	K3
CO-3	Classify the different addressing mode of the Assembly level instructions.	K4

CO-4	Explain the concept of machine cycle and Timing diagram.	K2
CO-5	Demonstrate interfacing method of the various programmable peripheral devices with the 8085 and 8051.	K2
CO-6	Make use of external code and data memory for interfacing various external unit/devices with 8051.	K3

Course Content:

Module 1: Architecture of 8085 (9Hrs.)

Introduction to 8085A CPU, architecture-register organization, addressing modes and their features. Pin description and features and Reset Operation of 8085 Microprocessor. Software instruction set and Assembly Language Programming. Instruction cycle, machine cycle, Timing diagram, Bus Idle Machine Cycle & INA Machine Cycle.

Module 2: Interrupt and peripheral (10 Hours.)

Hardware Interfacing: Interfacing of memory, peripheral chips (IO mapped IO & Memory mapped IO).Interrupts of 8085 Microprocessor: Software Interrupts, Hardware Interrupts & Vectored Interrupts.Peripherals: 8255PPI, 8251Usart and 8253/ 8254 Timer/ Counter. Synchronous, Asynchronous, Interrupt driven and DMA Modes of Date Transfer Techniques.

Module 3: Architecture of 8051 (9 Hours.)

Introduction to 8051 Micro-Controller, its Architecture and Pin Configurations.Registers, Timers Counters, Flags, Special Function Registers, DPTR, PC, PSW, SP Internal RAM &ROM, Input/ Output pins, Ports, Serial Data Input/ Output.
Interrupts:- Different Modes of Interrupts of 8051 Micro-controller.

Module 4:8051 Assembly Programming and Interfacing Techniques: (10 Hours.)

Simple 8051 Micro-Controller based Assembly Level Language programming, Assembling and running an 8051 program. Addressing modes and accessing memory using various addressing modes. Instruction Set of 8051 Micro Controller and programming, Single bit instructions and programming, Timer/counter programming in the 8051Micro-Controller.
Interfacing Techniques of External Memory units, Peripheral Devices, Analog to Digital & Digital Converters with 8051 Micro-controller.

***REFERENCES*:**

1) Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989 by Ramesh S. Gaonkar.
2) Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley inter science publications, 1980.
3) Advanced Microprocessors by Ray and Bhurchandi - TMH
4) Intel Corp. Micro Controller Handbook – Intel Publications, 1994.
5) Assembly Language Programming the IBM PC by Alan R. Miller, SubexInc, 1987
6) Textbook On Microprocessor Based Laboratory Experiments And Projects, A. K. Mukhopadhyaya, Wheeler Publishing
7) Fundamentals Of Microprocessors And Microcomputers, B. Ram, Dhanpat Rai
8) Advanced Microprocessors and Interfacing, B. Ram, TMH.
9) 8051 Microcontroller & Embedded systems By Madizi M.A.

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5. Electromagnetic Theory (PC EC 405)

Course Code	PC EC 405
Course Title	Electromagnetic Theory
Number of Credits	3 (L: 3, T:0 ,0: 0)
Prerequisites	10+2 Physics
Course Category	Electronics and Communication Engineering
Number of classes	38 hours

Course Outcome:-

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

CO Number	CO Description	K-level
CO-1	Analyze fields a potentials due to static changes	K4
CO-2	Analyze static magnetic fields	K4
CO-3	Explain how materials affect electric and magnetic fields	K2
CO-4	Illustrate the relation between the fields under time varying situations	K2
CO-5	Explain the principles of propagation of uniform plane waves.	K2

Course Content:-

Module- 1: STATIC ELECTRIC FIELD (12 hours)

Introduction to Different Co-ordinate System, Introduction to line, Surface and Volume Integrals, Curl, Divergence and Gradient, Stokes theorem and Divergence theorem,

Electric Field: Coulomb's Law, Electric Field Intensity, Electric Field due to charges distributed uniformly on an infinite and finite line, Electric Field on the axis of a uniformly charged circular disc, Electric Field due to an infinite uniformly charged sheet.
Electric Scalar Potential, Relationship between potential and electric field, Potential due to infinite uniformly charged line, Potential due to electrical dipole, Electric Flux Density, Gauss Law and its Applications. Electric field in multiple dielectrics, Boundary conditions, Poisson's and Laplace's equation, Capacitance

Module- 2:STATIC MAGNETICFIELD (10 hours)

Lorentz force, magnetic field intensity (H), Biot-Savart's Law, Ampere's Circuit Law, H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B), B in free space, Magnetic materials, Magnetization, Magnetic field in multiple media, Boundary conditions, scalar and vector potential, Determination of Self Inductance of a Solenoid and Toroid and Mutual Inductance Between a Straight, Long Wire and a Square Loop Wire in the Same Plane, Energy Stored and Intensity in a Magnetic Field.

Module- 3:TIME VARYING ELECTRIC AND MAGNETIC FIELDS (8 hours)

Faraday's Law of Electromagnetic Induction, Statically and Dynamically Induced E.M.F, Transformers and mutual induction, Continuity equation for steady and time varying current. Displacement current, Establishing Maxwell's equations from different laws of Electric & magnetic fields. ampere's law and it's inconsistency for time varying fields

Maxwell's four equations in integral form and differential form. Maxwell's equation in point form.

Poynting Vector and the flow of power, Power flow in a co-axial cable, Instantaneous Average and Complex Poynting Vector.

Module- 4: ELECTROMAGNETIC WAVES (8 hours)

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material.

Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect.

Linear, Elliptical and circular polarization, Wave propagation in dielectrics and conductors, normal incidence, Oblique incidence, Snell's law, and total internal reflection.

REFERENCES/ SUGGESTED LEARNING RESOURCES:-

TEXT BOOKS:-

1. W H.Hayt& J A Buck : "Engineering Electromagnetics" TATA McGraw-Hill,
2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems." Pearson Education/PHI

REFERENCES:-

1. Matthew N.O.Sadiku: "Elements of Engineering Electromagnetics" Oxford University Press.
2. Narayana Rao, N : "Elements of Engineering Electromagnetics" Pearson Education, New Delhi.
3. Ramo, Whinnery and Van Duzer: "Fields and Waves in Communications Electronics" John Wiley & Sons.
4. G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education.

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6. Signal and Systems (PC EC 406)

Course Code	PC EC 406
Course Title	Signal and Systems
Number of Credits	4 (L: 4, T: 0, P: 0)
Prerequisites	Electrical Circuits, Basic Mathematics
Course Category	Electronics & Communication Engineering
Number of classes	48 hours

Course Outcome:

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

CO Number	CO Description	K-level

CO-1	Identify different types of signals and systems.	K3
CO-2	Make use of different operation on signal.	K3
CO-3	Make use of Fourier transform for frequency analysis	K3
CO-4	Solve the problems with Laplace and Z-transform and their inverses	K3
CO-5	Explain Sampling theorem.	K2
CO-6	Interpret random signals and systems	K2

Course Content:

Module 1: Introduction to Signal and Systems(12 hours)

Introduction to signal and systems: Continuous and discrete time signals: Classification of Signals – Periodic aperiodic even – odd – energy and power signals – Deterministic and random signals – complex exponential and sinusoidal signals – periodicity –unit impulse – unit step – Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions, Determination of Fourier series coefficients of signal.

Module 2:Signal Transformation (12 hours)

Signal Transformation: Fourier transformation of continuous and discrete time signals and their properties. Laplace transformation- analysis with examples and properties. Parseval's theorem; Convolution in time (both discrete and continuous) and frequency domains with magnitude and phase response of LTI systems.

Module 3: Laplace and Z- Transform(12 hours)

Laplace Transform: Recapitulation, Analysis and characterization of LTI systems using Laplace transform: Computation of impulse response and transfer function using Laplace transform.
Z-Transforms: Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion.

Module 4: Sampling of signals(12 hours)

Sampling Theorem: Representation of continuous time signals by its sample –Types of sampling, Sampling theorem. Reconstruction of a Signal from its samples, aliasing –sampling of band pass signals.

Random Signals & Systems: Definitions, distribution & density functions, mean values & moments, function of two random variables, concepts of correlation, random processes, spectral densities, response of LTI systems to random inputs.

***REFERENCES*:**

1) Signals and Systems by Tarun kumar Rawat.
2) Circuits and Systems: A Modern Approach" by A. Papoulis
3) Signals and Systems: Continuous and Discrete" by R.F. Ziemer, W.H. Tranter and D.R. Fannin.
4) Signals and Systems" by A.V. Oppenheim, A.S. Willsky and I.T. Young.

5) Signals and Systems : Pearson New International Edition" by Alan V Oppenheim, S. Hamid, Alan S. Willsky.
6) Problems and Solutions in Signals and Systems" by R. Gopal.
7) Continuous and Discrete Signals and Systems" by Samir S. Soliman, Mandyam D. Srinath

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7. Analog Circuits Lab (PC EC 407)

Course Code	PC EC 407
Course Title	Analog Circuits Lab
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Basics of electronics devices
Course Category	Program Core (PC)
Number of classes	20 - 24 hours

Course Outcome:

At the end of this course students will demonstrate the ability to:

CO Number	CO Description	K-level
CO-1	Construct and analyze different rectifier circuits using diode.	K2
CO-2	Explain the knowledge of transistor biasing methods.	K2
CO-3	Construct and analyze different op-amp circuits.	K3
CO-4	Analyze transistorized Phase shift, Wein-bridge , Hartley, Collpit oscillators	K4
CO-5	Analyze the output of Class A Power Amplifier (Transformer less), Class B Complementary Symmetry Amplifier.	K4

Course Content:

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

1. Study of diode rectifier circuits (half wave, full wave, bridge rectifiers without filters and with filters).
2. Study of transistor biasing methods for BJT (CE, CB, CC).
3. Study of transistor biasing methods for FET (CS, CG, CD).
4. OP AMP Applications as Adder, Subtractor, Comparator Circuits.
5. Integrator and Differentiator Circuits using IC 741
6. Schmitt Trigger Circuits using IC 741.
7. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
8. Study of Transistorized oscillators – Phase shift
9. Study of Class A Power Amplifier (Transformer less).
10. Study of Class B Complementary Symmetry Amplifier.

***TEXT/REFERENCE BOOKS*:**

1. Lab Manual
2. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and

applications, McGraw Hill, 1992.
3. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
4. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press, 1989.
5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College11
6. Publishing, Edition IV 6. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

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8. Microcontrollers Lab (PC EC 408)

Course Code	PC EC 408
Course Title	Microprocessor and Microcontrollers
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Digital Electronics
Course Category	Program Core (PE)
Number of classes	20- 24 hours

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

CO No	CO Description	K-level
CO-1	Explain the execution of program in Assembly level languages of 8085 microprocessors and 8051 microcontroller using hardware kit and software tools.	K2
CO-2	Interpret the generation of waveform using DAC by interfacing with 8051.	K2
CO-3	Demonstrate the BCD to Binary Conversion and vice-versa.	K2
CO-4	Illustrate Binary to ASCII conversion and vice-versa (Using Subroutine Call)	K2
CO-5	Built Traffic Light Controller using 8085 microprocessors and 8051 microcontroller based system.	K6

List of Experiments*(Minimum 8experiments to be performed).Use of virtual laboratory to perform few experiments if available may be explored.*

1. Execution of Assembly level languages program to perform Arithmetic operation.
2. Execution of Assembly level languages program to perform Logical operation.
3. Execution of Assembly level languages program to find out largest, smallest number from a group of number.
4. Execution of Assembly level languages program to find larger, smaller number from two numbers, to find out negative number, to count negative number from a data array.
5. Execution of assembly level language program for sorting of data array in ascending and descending order.
6. BCD to Binary Conversion and vice-versa.
7. Familiarization with 8051 Simulator on PC. Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical).
8. Different waveforms generation using 8051 microcontroller based DAC.
9. Binary to ASCII conversion and vice-versa (Using Subroutine Call)
10. Design Traffic Light Controller using 8051 microcontroller based system.

***REFERENCES*:**

References / Suggested Learning Resources:-

1. Bhurchandi and Ray, Advanced Microprocessors and Peripherals, Third Edition McGraw Hill.
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design,Pearson Education.
3. Douglas V. Hall, SSSP Rao, Microprocessors and Interfacing, Third Edition, McGrawHill Education.
4. Barry B. Brey, The Intel Microprocessors – Architecture, Programming and Interfacing, Eigth Edition, Pearson Education.
5. A. NagoorKani, Microprocessors and Microcontrollers, Second Edition, Tata McGraw Hill.

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9. Basic Simulation Laboratory (PC EC 409)

Course Code	PC EC 409
Course Title	Basic Simulation Laboratory
Number of Credits	1 (L: 0, T: 0, P: 2)
Prerequisites	Engineering Mathematics
Course Category	Program Core
Number of classes	20-24 hours

Course Outcome:

On completion of the course the students shall be able to:

CO Number	CO Description	K-level
CO-1	Demonstrate the creation of arrays and matrices and perform simple matrix operations.	K3
CO-2	Experiment with the arithmetic, trigonometric and logical operations on matrices	K3
CO-3	Interpret the different string operations on a string.	K2
CO-4	Illustrate script-file and function files for different operations	K2
CO-5	Demonstrate the knowledge of basic plotting functions.	K2
CO-6	Apply knowledge of Simulink to design simple circuits	K3

Course Content:

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

1. Create 1-D arrays and matrices of given size and perform arithmetic operations- Addition, Subtraction, Multiplication and Exponentiation.
2. Perform matrix operation to obtain Obtaining Modified Matrix - Inverse, Transpose, with Appended and Deleted Elements.
3. Create a matrix of given size and perform matrix manipulation operation Concatenating, Indexing, Sorting, Shifting,
4. Perform matrix operation for Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis
5. Create a matrix of given size and perform trigonometric, relational and logical operations.
6. Create a matrix of given size and demonstrate the operation of various built-in functions like sum,

cumulative sum, standard deviation, product, cumulative product etc.
7. Generate a string and perform various string operation
8. Write script files for simple arithmetic and logical operations.
9. Write function files for user-defined operations
10. Perform basic plotting, plot multiple graphs in a plot, demonstrate the use of sub-plot command, stylize the plots. Illustrate A Rectangular Plot, (B).A Semi log Plot,(C).A log-log Plot.
11. Model simple circuits, equations using simulink
12. Createa Structure, An Array of Structures and Write Commands toaccess the elements of the created structure and array of structures.

***REFERENCES/ SUGGESTED LEARNING RESOURCES*:-**

1. MATLAB: A Practical Introduction to Programming and Problem Solving : Stormy Attaway
2. MATLAB For Dummies : Jim Sizemore
3. MATLAB for Beginners: A Gentle Approach : Peter I. Kattan
4. A Guide to MATLAB®: For Beginners and Experienced Users : Hunt, Lipsman, Rosenburg
5. MATLAB Programming for Engineers : Stephen Chapman

Suggested software/learning websites:

1. MATLAB,SCILab,Octave
2. MIT Open Courseware
3. NPTEL
4. MATLAB Online

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10. Essence of Indian Knowledge Tradition (MC-410)

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 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 *Purāna*s.

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 *Puruṣārtha*s 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 :

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: MotilalBanarsidass, 2017.
7) Dasgupta, Surendranath. *A History of Indian Philosophy*. Delhi: MotilalBanarsidass, 1991.
8) GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*,VidyanidhiPrakashan, 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: VidyanidhiPrakashan, 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.
15) Nagaswamy, R. *Foundations of Indian Art*, Tamil Arts Academy, 2002.
16) Pride of India, New Delhi: Samskrita Bharati, 2006.
17) Shastri, Gourinath. *A History of Vedic Literature*, Kolkata: Sanskrit Pustak Bhandar, 2006.
18) Sinha, Jadunath. *Indian Philosophy*. Delhi: Motilal Banarsidass,1938.
19) Subrahmanialyer,K.S. *Vakyapadia of Bhrarthrihari*. Pune: Deccan College, 1965.
20) V. Sivarama krishnan (Ed.), *Cultural Heritage of India-course material*. Mumbai: Bharatiya Vidya Bhavan, 5th Edition, 2014.
21) Wujastiyk, Dominik. *The Roots of Ayurveda*. India: Penguin India, 2000.

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