Amrita Vishwa Vidyapeetham  
School of Engineering  
Department of Electronics and Communication Engineering  
Branch: Computer and Communication Engineering

Vision of the Department

To provide a value-based learning environment for producing engineers with a blend of technical skills, moral values and leadership qualities in the field of Electronics, Communication and Computing channelized towards technological advancement to cater to the needs of the industry and the society.

Mission of the Department

M1: Achieving excellence in teaching and learning with an emphasis on fundamental knowledge and hands-on exposure to match the state-of-the-art in technology.

M2: Providing an environment for core competency development and enhancing quality research in emerging areas.

M3: Facilitating professional growth to the students for higher education and career in industry and academia.

M4: Imbibing the essence of human values, ethics and professional skills to sustain socio-economic development.

Course Outcomes (CO)

Statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behavior that students acquire in their progress through the course.

Program Outcomes (POs)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behavior that students acquire through the program. The National Board for Accreditation (NBA) has defined the program outcomes for each discipline.

Program Outcomes for Engineering

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Educational Objectives (PEOs)**

To understand the

- **PEO1:** Principles of Computer Science
- **PEO2:** Principles of Computational Engineering
- **PEO3:** Design of Computing Systems and Software
- **PEO4:** Principles and Techniques of Signal Processing
- **PEO5:** Principles of Communication Engineering
- **PEO6:** Principles of Modern Communication Systems

**Program Specific Outcomes (PSO)**

- **PSO1:** To design and develop algorithms for Communication Systems
- **PSO2:** To design and develop Embedded and Computing Systems
- **PSO3:** To design, prototype and analyse the performance of Modern Communication Systems

The following specializations will be offered as part of this program:

1. Signal Processing
2. Embedded Systems
3. Software Engineering
4. Computational Engineering
5. Computational Communication
### ABBREVIATIONS USED IN THE CURRICULUM

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# B.Tech Computer and Communication Engineering

## Curriculum (2023)

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Semester VIII

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Cumulative CREDITS 160

Evaluation Pattern:

1. All courses offered by the School of Engineering will have the following evaluation pattern:

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2. All courses offered to B.Tech – Computer and Communication Engineering, by other Schools, will follow the evaluation pattern mandated by the individual Schools offering the course.

List of courses in Amrita Value Programme I & II

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### CHEMISTRY

### PHYSICS

### Mathematics

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Course Objectives
- To provide an understanding of nature from an engineering perspective
- To enable the study of engineering systems inspired by nature
- To motivate the development of technological ideas based on nature

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand the principles of systems in nature
CO2: Understand engineering principles that are derived from nature
CO3: Identify and ideate technological concepts inspired by nature
CO4: Apply the concepts learnt to address simple engineering problems

CO-PO Mapping

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Syllabus
The course will consist of discussions of case studies, broadly classified into three groups of a minimum of 5 each:
Unit 1: Introduction – Biological inspiration; Common characteristics of natural and engineered systems; Examples - Bullet train shape / Kingfisher’s beak (helping to reduce aerodynamic stress); Beehive structure (evaporative cooling and natural ventilation); Whale fin structure / Wind turbine blades (role of tubercules); Velcro tape / Hooks and loops (plants); Golden ratio in nature / Fibonacci numbers (ratio of dimensional properties)
Unit 2: Biomimetics – Mimicking nature; Examples - Gene Therapy / Immunotherapy; Dam / Beavers (structural engineering); Aerodynamics / Flight / Birds (Wings, heavier-than-air flight, Humming Bird); Earthworm / Self-Cleaning by means of small electric currents; Lizards / locomotion (inter-atomic bonding); Lizards – change in direction of hair, with no stickiness / Scotch tape; Bones / Material shaping
Unit 3: Bio-inspired Innovations; Control Theory / Feedback / Biomechanisms; Digital Electronics / Human logic; Echolocation / Dolphins / Bats (echolocation); Artificial Intelligence / Neural Networks

Textbooks:

References:

Other resources:
2. https://tinyurl.com/Pawlyn-01
Course Objectives

- To strengthen the concepts of single variable calculus and linear ODEs
- To provide the fundamentals of matrix algebra
- To introduce the concepts and importance of Eigen values and Eigen vectors

Course Outcomes: At the end of the course, the student should be able to

CO1: solve problems involving limits, derivatives and ODEs
CO2: model and solve system of linear equations
CO3: characterize systems using Eigen values and vectors
CO4: apply the mathematical concepts learnt, to engineering problems

CO-PO Mapping

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Syllabus

Unit 1
Calculus: Limit and Continuity: Limit of Functions, Continuous functions, Discontinuities, Monotonic Functions, Infinite Limits; Derivatives, Integration- Definite Integrals, Mean value theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques. Examples of applications of the above in solving real engineering problems.

Unit 2
Differential Equations: Ordinary differential equations (ODE), Linear differential equations, Modelling problems: Electric circuits; Second order Differential Equations, Homogeneous Systems and Non-homogeneous with constant coefficients, System of ODEs, Basic concepts and theory; Examples of applications of the above in solving real engineering problem.

Unit 3
Matrix Algebra: Review - System of linear Equations, linear independence; Properties of Matrices, Symmetric and Skew Symmetric Matrices, Hermitian and Skew Hermitian Matrices and Orthogonal matrices; Eigen values and Eigen vectors; Positive definite, negative definite and indefinite, Diagonalization and Orthogonal Diagonalization; Examples of applications of the above in solving real engineering problem.

Text Books

References
Course Objectives

- To provide insight into computational logic
- To introduce the fundamentals of computational thinking
- To introduce computational approach to problem solving

Course Outcomes:

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

CO1: understand the concepts of computational logic
CO2: develop algorithmic thinking
CO3: identify algorithms and their suitability
CO4: apply algorithms to solve a problem

CO-PO Mapping

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Syllabus

What is computational thinking? – corner stones of computational thinking – characteristics of algorithms -- problem solving strategies –computational logic– boolean expressions and logic --data organization – variables, list, arrays and strings– Algorithmic thinking – name binding, sequence, selection, repetition and modularization.


Textbook(s)


References(s)


Course Objectives

- To understand fundamental electrical quantities and their measurements
- To help in the use of analytical tools for circuit analysis
- To provide an understanding of electromagnetic machines

Course Outcomes:

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

CO1: understand fundamental electrical quantities
CO2: understand the principles of electrical measurements
CO3: analyse ac and dc circuits
CO4: understand the operation of electromagnetic machines

CO-PO Mapping

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Syllabus

Unit 1

Unit 2
ac and dc circuit Analysis – Ohm’s law, Kirchhoff’s voltage and Current law, Voltage divider and Current divider Rule, Mesh and Nodal Analysis, Supernode and Supermesh analysis, Source transformation, Superposition Theorem, Thevenin & Norton’s Theorems, and Maximum power transfer theorem.

Unit 3
Electrical Machines – Construction, Principle of operation and applications, DC generator and DC Motors. Significance of back EMF and EMF equation. Types of DC motors. Speed, Torque, Torque-Speed characteristics, Load characteristics, Construction and working principles of three phase induction motor and single phase transformer.

Textbook(s)

References(s)

SEMESTER I

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Course Objectives
- To provide an understanding of crystal structure
- To help appreciate the band gap nature of semiconductors
- To introduce the concepts of transport phenomena in semiconductors

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the crystal structure of semiconductors
CO2: understand semiconductors based on energy band gap
CO3: understand current flow in semiconductors
CO4: understand the behaviour of pn junctions & MOSFETs
CO-PO Mapping

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Syllabus

Unit 1
Crystal structures - Crystal lattice, basis, unit cell and lattice parameters, crystal systems and Bravais lattices – Structure and packing fractions of SC, BCC, FCC, diamond cubic, NaCl; ZnS structures – crystal planes, directions and Miller indices, Imperfections in crystals.

Unit 2

Unit 3
Basic structure of PN junctions – Built-in-potential, Space Charge region, electric field across junction, Forward and reverse bias, band diagram, minority carrier distribution across junction in forward and reverse bias, boundary conditions; Basics of MOSFET – Structure of MOSFET, band diagram of MOS, Ideal MOS Capacitor, FET operation and their applications.

Textbook(s)

Reference(s)

**SEMESTER I**

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Course Objectives
- To provide understanding of basic programming in C
- To provide knowledge on programming constructs
- To enable development of modular programs

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the syntax and semantics of programming
CO2: apply appropriate programming constructs
CO3: analyze programs and debug errors
CO4: develop programs to solve specific problems
CO-PO Mapping

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Syllabus

Unit 1:
Introduction, structure of C program - data types, storage classes, constants, enumeration constant, keywords, variables, operators, expressions, input/output statements, assignment statement conditional statements; number system: binary, decimal, hexadecimal, conversion between number system types; Introduction to tools – IDE, compilation, linking, debugging.

Unit 2:
Control flow statements - if-else, Looping – for, while, do-while, switch case, break and continue, goto and labels; Functions – function prototype, function definition, function call, built-in functions, recursion; Arrays – declaration, initialization, one-dimensional, matrix, multi-dimensional, array operations; string operations – length, compare, concatenate, copy. Recursion – recursive definition, recursive solution, designing recursive functions, limitations of recursion.

Unit 3:
Pointers – pointer operators, pointer arithmetic, array and pointers, array of pointers, parameters passing – pass by value, pass by reference; Structures – simple structure, nested structure, pointers and structure, array of structures, self-referential structures, dynamic memory allocation, typedef; Input-output – command line arguments; File operations – types, sequential access, random access.

Textbooks(s)

References(s)
- To provide hands-on exposure to programming in C
- To facilitate usage of Integrated Development Environment (IDE)
- To enable develop and debug programs

**Course Outcomes:** At the end of the course, the student should be able to

**CO1:** write and execute simple programs
**CO2:** employ IDE for compiling and debugging
**CO3:** handle dynamic input-output operations
**CO4:** develop programs for specific applications

**CO-PO Mapping**

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**Syllabus**
1. Practice of Simple C Programs.
2. Control statements.
3. Array concept.
4. 1D and multi-dimensional arrays.
5. Strings and sorting of strings.
6. Various types of functions and recursive functions.
7. Pointers.
8. Strings and pointers.
10. File input/output and command line arguments.
11. File handling and Dynamic memory allocation.

**Textbook(s)**

**References(s)**
Course Outcomes: At the end of the course, the student should be able to
CO1: identify electrical components and their specifications
CO2: measure electrical quantities such as voltage and current
CO3: verify theorems for dc circuits
CO4: understand the operation of electrical machines

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Syllabus

1. Identification of electrical components and their specifications.
2. Familiarization of equipments like Multimeter, Function generator, DC Power supply and DSO, etc.
3. Verification of Kirchhoff’s laws.
4. Verification of Superposition theorem
5. Verification of Thevenin and Norton theorems
6. Speed control of a D.C motor.
7. Single phase transformers – turns ratio measurement, Step down/up

Textbook(s)

Reference(s)
2. Electrical Engineering fundamentals by Vincent Deltoro, Pearson Education India, 2015

22ADM101 Foundations of Indian Heritage L-T-P-C: 2-0-1-2

Course Objectives
- To introduce students to the depths and richness of the Indian heritage and knowledge traditions,
- To enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields.
- To equip students with a knowledge of their country and its eternal values.

Course Outcomes: At the end of the course, the student should be able to
CO1: Increase understanding of true essence of India’s cultural and spiritual heritage.
CO2: Understand the ethical and political strategic concepts to induce critical approach to various theories about India.
CO3: Realise the multidimensionality of man’s interaction with nature, fellow beings and society in general.
CO4: Appreciate the socio-political and strategic innovations based on Indian knowledge systems.

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Syllabus
Unit 1
Educational Heritage of Ancient India; Life and Happiness; Impact of Colonialism and Decolonization; A timeline of Early Indian Subcontinent
Unit 2
Pinnacle of Selflessness and ultimate freedom; Indian approach towards life; Circle of Life; Ocean of love; Indian Mahatmas.

Unit 3
Man’s association with Nature; Celebrating life 24/7; Metaphors and Tropes; Become A Strategic Thinker (Games / Indic activity)

Unit 4
India: In the Views of Other Scholars and Travellers; Personality Development Through Yoga; Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness; Conversations on Compassion with Amma

Textbook
1. Foundations of Indian Heritage- In-house publication

References
1. The beautiful tree by Dharampal – Other India Press,Mapusa, 2000
3. India, that is Bharat: Coloniality, Civilisation, Constitution by J Sai Deepak -Bloomsbury India, 2021
4. Awaken Children Dialogues with Mata Amritanandamayi, MAM Publications
5. Man, and Nature by Mata Amritanandamayi Devi , MAM Publications

SEMESTER I

22AVP103 Mastery Over Mind (Prerequisite: Nil) L-T-P-C: 1-0-2-2

Course Objectives
• To enhance health and wellbeing of students
• To introduce the students to the immediate and long-term benefits of MA OM meditation
• To equip every attendee to manage stressful emotions and anxiety, facilitating inner peace and harmony.
• To enhance the understanding of experiential learning based on the University’s mission: “Education for Life along with Education for Living”
• To allow learners to realize and rediscover the infinite potential of one’s true Being and the fulfillment of life’s goals.

Course Outcomes: At the end of the course, the student should be able to
CO1: To be able to describe what meditation is and to understand its health benefits
CO2: To understand the causes of stress and how meditation improves well-being
CO3: To understand the science of meditation
CO4: To learn and practice MAOM meditation in daily life
CO5: To understand the application of meditation to improve communication and relationships
CO6: To be able to understand the power of meditation in compassion-driven action

CO-PO Mapping

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Syllabus
Unit 1
Meditation and Understand its Benefits - A: Importance of meditation. How does meditation help to overcome obstacles in life (Pre-recorded video with Swami Shubhamritananda Puri)
Reading 1: Why Meditate? (Swami Shubhamritananda ji)

Unit 2
Causes of Stress and How Meditation Improves Well-being - A: Learn how to prepare for meditation. Understand the aids that can help in effectively practicing meditation. Understand the role of sleep, physical activity, and a balanced diet in supporting meditation. (Pre-recorded video with Dr. Ram Manohar); B: Causes of Stress. The problem of not being relaxed. Effects of stress on health. How meditation helps to relieve stress. Basics of stress management at home and the workplace. (Pre-recorded video with Prof Udhaykumar)


Unit 3:
The Science of Meditation - A: A preliminary understanding of the Science of meditation. What can modern science tell us about this tradition-based method? (Pre-recorded video with Dr. Shyam Diwakar); B: How meditation helps humanity according to what we know from scientific research (Pre-recorded video with Dr. Shyam Diwakar)

Reading 1: Does Meditation Aid Brain and Mental Health (Dr Shyam Diwakar)

Unit 4:
Unit 5


Unit 6

Meditation and Compassion-driven Action - Understand how meditation can help to motivate compassion-driven action. (Pre-recorded video with Dr Shobhana Madhavan)


Textbooks / References

1. Meditation and Spiritual Life-Swami Yatiswarananda, Ramakrishna Math
3. Dhyana Yoga-Holy Gita Swami Chinmayanda
4. Voice of God, Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
5. Hindu Dharma-Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
6. Mind: It’s Mysteries and control-Swami Sivananda Saraswati
8. Books on Amma’s teachings like Awaken children, From Amma’s Heart etc.

Book Modules

SEMESTER II

23MAT130 Engineering Mathematics – II

(Prerequisite – Engineering Mathematics-I)

L-T-P-C: 3-1-0-4

Course Objectives

- To introduce the concepts of multivariable calculus
- To introduce the concepts of vector space and inner products
- To provide the foundations of matrix transformations and decompositions

Course Outcomes: At the end of the course, the student should be able to

CO1: solve problems involving vector differentiation and integration
CO2: understand the concepts of vector spaces and orthonormalisation
CO3: apply matrix transformations to linear system
CO4: apply concepts of vector calculus and linear algebra to engineering problems

CO-PO Mapping
Syllabus

Unit 1
Vector Spaces - Vector spaces, subspaces, linear independence, basis, row, column and null spaces and dimension theorem. Inner product space, orthogonally, Gram-Schmidt orthogonalization. Linear Transformation (matrix transformation) and inverse linear transformation; Matrix Decompositions: LU, QR, Jordan, EVD, and SVD decompositions. Examples of applications of the above in solving real engineering problems.

Unit 2
Vector Differentiation- Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration, Gradient of a Scalar field, Directional derivative, Divergence of a Vector field, Curl of a Vector field. Examples of applications of the above in solving real engineering problems.

Unit 3

Text Books

Reference Books

SEMESTER II

23CCE111 Digital Electronics (Prerequisite: Nil) L-T-P-C: 3-0-0-3

Course Objectives
• To provide an understanding of basic building blocks of digital circuits
• To enable the understanding of Boolean algebra and logic function optimization
• To enable design of combinational and sequential circuits

Course Outcomes: At the end of the course, the student should be able to
CO1: realise a given expression in terms of basic building blocks
CO2: minimise a given logic expression
CO3: design combinational circuits
CO4: design Sequential circuits

CO-PO Mapping

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understanding of basic building blocks of digital circuits

To enable the understanding of Boolean algebra and logic function optimization

To enable design of combinational and sequential circuits
Syllabus

Unit 1

Unit 2

Unit 3

Textbook(s)

Reference(s)

Course Objectives
- To introduce the concepts of Signals and Systems
- To provide the foundation of transforms
- To enable the design of digital filters

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the concepts of Signals and Systems
CO2: understand transform techniques
CO3: signals and systems using transform techniques
CO4: design simple digital filters for specific applications

CO-PO Mapping

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Syllabus
Unit 1
Introduction to Signals- Continuous time and discrete time signals - Classification of Signals: Periodic, Aperiodic, Even, Odd, Energy and Power signals, Deterministic and Random signals, Elementary signals: unit step, unit impulse, unit ramp, sinusoidal and complex exponential signals - Basic operations on signals: Multiplication by a scalar, signal addition, linear combination, signal multiplication, time shifting, time scaling, combination of time shifting and time scaling- Introduction to Systems- Classification of Systems: Continuous time, discrete time. Invertible, non-invertible, Causal, non-causal systems, time-invariant, time-variant systems, Linear and non-linear systems, BIBO stable and unstable systems, Time Domain characterization of continuous time and discrete time LTI system-Convolution Integral-Convolution Sum.

Unit 2

Unit 3

Textbook(s)

References(s)

SEMIESTER II

23CCE114 Electronics Engineering

(Prerequisite: Physics of Semiconductors)

L-T-P-C: 3-0-0-3

Course Objectives
• To provide an understanding of diodes and diode-based circuits
• To provide a working knowledge of transistor-based amplifiers
• To provide an overview of opamp-based circuits

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand diode operation
CO2: Understand the operation of simple diode-based circuits
CO3: Understand the operation of transistor amplifiers
CO4: Obtain an overview of opamp-based circuits

CO-PO Mapping

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Syllabus
Unit 1
R, L & C circuits –RC Filters, Resonance -LC, RLC Parallel and Series. Diodes: Forward Bias, Reverse Bias, Diode Equation; VI Characteristics; Diode model (Cut-in voltage; (Vr) & short-circuit); Simple circuits using diodes; Rectifiers- Half wave, Full wave, Bridge; Basic Clipper and Clamper circuits.
Unit 2
Bipolar Junction Transistors (BJT): Transistor construction and working principle (qualitative); Characteristics; Modes of operation, Input and output characteristics of CB, CE and CC Configurations, Biasing; Fixed bias without and with emitter resistance, collector to base bias, voltage divider bias and emitter bias; Transistor as an amplifier, switch; Amplitude Modulator and Demodulator.

Unit 3
Operational Amplifiers (opamp): Ideal opamp; Inverting & Non-inverting amplifiers; Summing Amplifier; Comparator; Astable & Monostable Multivibrators; Oscillators - concept, Phase Shift Oscillator (without loading); Phase locked loop (PLL).

Textbook(s)

Reference(s)

### Syllabus

#### Unit I
Error Analysis, Mechanics of Writing: Grammar rules -articles, tenses, auxiliary verbs (primary & modal) prepositions, subject-verb agreement, pronoun-antecedent agreement, discourse markers and sentence linkers, impersonal passive, modifiers, phrasal verbs, General Reading and Listening comprehension - rearrangement & organization of sentences

#### Unit II
Different kinds of written documents: Definitions- Descriptions- Instructions-Recommendations- User manuals - Reports – Proposals; Formal Correspondence: Writing Formal Letters/Emails; Punctuation; Scientific Reading & Listening Comprehension

#### Unit III
Technical paper writing: Documentation style - Document editing – Proof reading - Organizing and Formatting; Tone and style; Graphical representation; Reading and listening comprehension of technical documents; Mini Technical project / Term paper (10 - 12 pages); Technical presentations

### Reference(s)

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**SEMESTER II**

**23CCE183**  
Signal Processing Laboratory  
(Prerequisite: Nil)  
L-T-P-C: 0-0-3-1  

**Course Objectives**

- To provide a hands-on exposure to signal generation and manipulation
- To enable carry out spectral analysis
- To enable design and apply digital filters for simple applications

**Course Outcomes:** At the end of the course, the student should be able to

**CO1:** generate, manipulate and visualize signals  
**CO2:** characterize and analyze LTI systems  
**CO3:** analyze signals and systems through transforms  
**CO4:** design and apply digital filters for specific applications

**CO-PO Mapping**

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**Syllabus**

- Generation of Signals  
- Basic Operations on Signals  
- Properties of Systems  
- Convolution  
- Sampling of analog signals and study of aliasing  
- DTFT  
- Computation of DFT using direct/linear transformation method  
- Properties of DFT  
- Design of FIR filter using different windowing techniques  
- Applications of DSP - denoising of sine wave and speech signals

**Textbook(s)**


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**SEMESTER II**

**23CCE184**  
Internet of Things Lab  
(Prerequisite: Nil)  
L-T-P-C: 0-0-3-1  

**Course Objectives**

- To introduce mobile application development for IoT  
- To help build and prototype IoT based systems
Course Outcomes: At the end of the course, the student should be able to
CO1: interface sensors and actuators to hardware platforms
CO2: transfer data and control remote devices
CO3: develop mobile application for IoT
CO4: build and demonstrate IoT based systems

CO-PO Mapping

| PO/PSO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
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Syllabus
1. GPIO and ADC Programming – LED – Switch – Relay – Proximity Sensor - Seven Segment
2. ADC Programming - Potentiometer - Temperature Sensor – Moisture Sensor - Gas Sensor
3. LCD and Keypad Interfacing
4. Serial Communication – Bluetooth - GPS.
5. SPI and I2C Programming – RFID - RTC
6. Speed and Direction Control of Motors – DC – Stepper/Servo
7. WebServer and IoT Cloud Communication – ESP8266, Thingspeak
8. Basic Mobile Application Development – MIT App Inventor 2

Textbook(s)

References(s)

Course Objectives
- To provide hands-on experience in realising simple logic expressions
- To demonstrate the power of logic function optimization
- To enable the implementation of combinational and sequential circuits

Course Outcomes: At the end of the course, the student should be able to
CO1: use datasheets & simulation tools effectively
CO2: realise simple logic circuits
CO3: design & implement combinational circuits
CO4: design & implement sequential circuits

CO-PO Mapping

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Syllabus
1. Logic Gates: Implement logic gates using NAND / NOR.
2. Boolean functions: using logic gates
4. Sequential Circuits: Flip-Flops, Counters, State Machines

Experiments
1. Verification of Basic Logic Gates.
3. Simplification and Realization of a given Boolean Expression
   i) Using basic gates
   ii) SOP Using NAND gates only
   iii) SOP Using NOR gates only
   iv) POS Using NAND gates only
   v) POS Using NOR gates only and
   vi) Compare and analyze the above implementations
4. Design and verification of Adders and Subtractors.
5. Design and verification of Parallel Adder / Subtractor.
6. Design and verification of Binary to Gray code converter and vice versa.
7. Design and verification of BCD to Excess-3 code converter and vice versa.
8. Design and verification of 2-bit Magnitude Comparator.
9. Design and verification of Multiplexers
10. Implementation and verification of Half adder, full adder, half subtractor and full subtractor using multiplexers.
11. Design and verification of Flip-flops (D, T and JK flipflop).
12. Design and verification of shift Registers.
13. Design and verification of Ring and Johnson Counters.
14. Design and verification of 4-bit asynchronous Up and Down Counters

Textbook(s)

References(s)

Course Objectives:
At the end of the course, the student should be able to

CO1: To recognise the call of Upanishads and outstanding personalities for confronting the wicked in the real world while admiring the valour, pursuit and divinity in both classical and historical female characters of India.

CO2: Know Acharya Chanakya, his works, and his views on polity and nation to find synchrony between public and personal life, alongside understanding India’s cultural nuances and uniqueness concerning the comprehension of God across major global communities.

CO3: Appreciate Bhagavad Gita as the source of the Indian worldview through the various Yogic lessons enshrined in it, making it one of India’s numerous soft powers, and also understand the faith-oriented mechanism of preserving nature.

CO4: Understand the enormous contribution of Indian civilisation over two and a half millennia to humanity and develop awareness about India’s approach toward science, devoid of dogmas and rooted in humanism.

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SEMESTER II
Syllabus

Unit 1
Face the Brutes; Role of Women in India; Acharya Chanakya; God and Iswara

Unit 2
Bhagavad Gita: From Soldier to Samsarin to Sadhaka; Lessons of Yoga from Bhagavad Gita; Indian Soft powers; Preserving Nature through Faith

Unit 3
Ancient Indian Cultures (Class Activity); Practical Vedanta; To the World from India; Indian Approach to Science

Text Book:
1. Glimpses of Glorious India - (In-house publication)

References:
1. Fear Not: Be Strong (Swami Tathagatananda)
2. Essays on Gita (Sri Aurobindo) - Aurobindo Ashram
3. Indian Contribution to Science (Vijana Bharati Publication)
4. The Culture And Civilisation Of Ancient India In Historical Outline (D. D. Kosambi)

SEMESTER III

<table>
<thead>
<tr>
<th>22ADM211</th>
<th>Leadership from Ramayana</th>
<th>L-T-P-C: 1-0-0-1</th>
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Course Objectives
- To gain a deeper understanding of the ethical grandeur of Indian culture, through a study of the Rāmāyaṇa
- To be inspired to follow the ideals of the characters depicted therein.

Course Outcomes: At the end of the course, the student should be able to

CO1: Appreciate the significance of Rāmāyaṇa as an itihāsa, and important aspects of Bālakāṇḍa.
CO2: Understand the family values and ideal human relationships portrayed in the Ayodhyakāṇḍa and Aranyakāṇḍa of Rāmāyaṇa.
CO3: Understand dharma and its nuances, emphasizing its applicability in an individual’s life through Kishkindhakāṇḍa and Sundarakāṇḍa of Ramayana.
CO4: Appreciate the triumph of dharma over adharma through Yuddhakāṇḍa of Rāmāyaṇa
CO5: Appreciate the spiritual values from Rāmāyaṇa in resolving personal and social conflicts through varied effective presentations of important episodes of the Rāmāyaṇa.

CO-PO Mapping

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Unit 1
An overview of Valmiki’s epic - Introduction to the content and structure of the epic text and it’s principal characters; Bala-Kāṇḍa: Preparing for the renowned mission.

Unit 2

Unit 3
Kishkindha-Kāṇḍa: The Empire of Holy Monkeys; Sundara-Kāṇḍa: Heart of the Ramayana

Unit 4
Yuddha-Kāṇḍa: The most popular part of the Ramayana; Uttara-Kāṇḍa: An attempt to explain the untold stories.

Unit 5
Ramayana and Modern-day learning; Ecological Awareness in the Ramayana; Different Ramayana: Epic that connects the world.

Textbook / References
1. Leadership Lessons from the Ramayana, ASCSS
2. Rajagopalachari. C, The Ramayana

**SEMESTER III**

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Course Objective:

- To impart knowledge on the concepts of chemistry involved in the application of engineering materials that are used in the industry/day-to-day life.

Course Outcomes: At the end of the course, the student should be able to

- CO1: Characterize the solids using X-ray diffraction technique
- CO2: Analyse the materials using computational tools.
- CO3: Apply the fundamental principles of electrochemistry to illustrate the functioning of electrochemical energy systems.
- CO4: Understand the application of polymers in fabricating integrated electronic devices.

CO-PO Mapping

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Syllabus

Unit 1
Recap of fundamentals of crystalline structures – unit cell, lattice parameters, Bravais lattices and types of crystals; X-ray diffraction - Bragg’s equation and experimental methods (powder method and rotating crystal technique); Elements of symmetry in crystal systems, defects in crystals – stoichiometric, non-stoichiometric, extrinsic and intrinsic defects. Vesta – for visualization of crystal structures.

Solar energy - introduction, utilization and conversion, photovoltaic cells - design, construction and working, panels and arrays. Advantages and disadvantages of PV cells. DSSC (elementary treatment).

Unit 2
Faradays laws, origin of potential, electrochemical series, reference electrodes, Nernst equation, introduction to batteries - classification - primary, secondary and reserve (thermal) batteries. Kinetics of electrochemical reaction – Tafel equations, Characteristics - cell potential, current, capacity and storage density, energy efficiency. Construction, working and application of Leclanche cell-Duracell, lead acid batteries. Ni-Cd battery, Lithium ion batteries. Fuel cell - construction and working of PEMFC and biofuel cell.
Unit 3

Textbooks / References:
2. Vladimir S. Bagotsky, Alexander M. Skundin, Yuriy M. Volkovich, Electrochemical Power Sources

Course Objectives:
- To provide an understanding of data structures
- To enable implementation of data structures
- To enable application of data structures in standard algorithms for computational problems

Course Outcomes: At the end of the course, the student should be able to
CO1: understand elementary data structures
CO2: implement data structures
CO3: select appropriate data structures for computational problems
CO4: apply simple algorithms using data structures for specific applications

CO-PO Mapping

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Syllabus
Unit 1

Unit 2

Unit 3

Textbook(s)

Reference(s)
Course Objectives

- To provide understanding of Microcontrollers and its Applications
- To enable the understanding of Microcontroller Peripherals and their configuration
- To provide insight on the design of a simple Embedded System for specific Applications

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the fundamentals of Microcontroller and its Peripherals
CO2: configure the Internal Peripherals of a Microcontroller
CO3: interface External Peripherals with an Embedded Platform
CO4: design a Microcontroller based System for real world applications

CO-PO Mapping

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Syllabus

Unit 1
Introduction to Embedded Systems - Introduction to ARM Architecture - ARM Programmer’s Model - ARM Processor Modes and States - Addressing Modes - ARM Instruction Set - Types - Data Processing Instructions - Assembly Language Programming - Binary Encoding of Data Processing Instructions - Data Transfer Instructions - Binary Encoding of Data Transfer Instructions

Unit 2
Pipeline in Processor - Pipeline Hazards - ARM 3 Stage Pipeline - LPC2148 Microcontroller Architecture – GPIO - PLL - Introduction to serial communication - Serial Transmission and Reception using UART

Unit 3

Textbook(s)

References(s)

Semester III

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Course Objectives

- To introduce the fundamentals of Operating Systems
- To introduce the concepts of Threading and Scheduling
- To provide the foundations of Operating System’s Management Process

Course Outcomes: At the end of the course, the student should be able to
CO1: understand the functionalities and structure of Operating Systems
CO2: understand Threading Processes and Scheduling Algorithms
CO3: understand the operation of Synchronization and Semaphores
CO4: understand various Management concepts of Operating Systems
CO-PO Mappin

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Syllabus

Unit I

Unit 2

Unit 3
Disk scheduling algorithms and policies - File management: file concept - types and structures - directory structure – directory implementation – disk scheduling - Case study: threading concepts in operating systems - kernel structures.

Textbook(s)

References(s)

Course Objectives
- To introduce the statistical concepts necessary for exploratory data analysis
- To provide the foundations of data pre-processing, interpretation & visualization
- To introduce the concepts of statistical testing
Course Outcomes: At the end of the course, the student should be able to
CO1: Understand descriptive statistics and data distributions
CO2: Apply pre-processing techniques
CO3: Interpret and visualise data
CO4: Apply statistical tests

CO-PO Mapping

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Syllabus
Unit 1:
Importance of Probability for Data Science, Axioms of Probability, Conditional Probability and Bayes theorem, Random Variables: Discrete- Uniform and Binomial Distribution, Continuous- Normal Distribution, Exponential and Poisson Distribution, Types of Data, Central Tendency Measures, Dispersion Measures, Skewness and Mean, Covariance and Correlation, Central limit theorem.

Unit 2:
Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration, Encoding techniques- Ordinal, One hot and Binary, Data Reduction-PCA, Data Transformation and Discretization, Exploratory data analysis: Visualization Before Analysis, visualizing a Single Variable, Examining Multivariate Data- Heat map.

Unit 3:
Introduction to Hypothesis Testing-Null and alternative hypothesis, Type of Errors, A/B testing, Parametric test: the T-test, Z-test, non-parametric tests- Chi-square tests, P Value, Confidence Intervals, Parametric Confidence Intervals, Bootstrap Confidence Intervals

Textbook(s)

References(s)

SEMESTER III

23MAT210 Numerical Methods L-T-P-C: 3-1-0-4
(Prerequisite: Engineering Mathematics II)

Course Objectives
- To provide foundations of modern numerical techniques
- To introduce the mathematical formulation, discretization and iterative solutions
- To introduce the applications of numerical methods to communication engineering

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand the foundations of numerical techniques
CO2: Perform discretization of differential equations
CO3: Apply iterative techniques to solve problems
CO4: Develop mathematical models for specific problems

CO-PO Mapping

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Syllabus

Unit 1

Unit 2

Unit 3

Textbook(s)

References(s)
1. S. Seongjai Kim, “Numerical Methods for Partial Differential Equations”, Lectures Notes, Mississippi State University, 2021

Course Objectives
- To provide hands-on experience of a Microcontroller and its Peripherals
- To provide experience in the interfacing of External Peripherals with a Microcontroller
- To enable the design and implementation of simple Embedded Systems

Course Outcomes: At the end of the course, the student should be able to
CO1: program in Assembly Language and Embedded C
CO2: configure the Internal Peripherals of a Microcontroller
CO3: interface External Peripherals with a Microcontroller
CO4: prototype a Microcontroller based System
CO-PO Mapping

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Syllabus
1. Assembly Language Programs for Addition, Subtraction, Indirect Addressing Modes
2. LED Blinking and Control of LED with Switch using GPIO Peripheral in LPC2148
3. Serial Transmission and Reception using UART
4. Sensor Interfacing using ADC
5. Square Wave Generation using Timer
6. DC Motor Speed Control using PWM
7. LCD Interfacing
8. Term Project

Textbook(s)

References(s)

Course Objectives
- To provide hands-on experience in implementing data structures
- To introduce implementation of simple algorithms
- To enable apply data structures to specific problems

Course Outcomes: At the end of the course, the student should be able to
CO1: implement data structures
CO2: compare complexity of data structures
CO3: implement simple algorithms
CO4: apply appropriate data structures to specific problem

CO-PO Mapping

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Syllabus
1. Implement stacks, queues and binary trees using arrays and linked list
2. Implement hash tables and hashing functions to recover the entries.
3. Construct and traverse a binary / binary search tree
4. Check whether a given tree is binary search tree or AVL tree
5. Construct and carry out operations on red-black trees / 2-3 trees / splay trees.
6. Convert a given BST to an AVL tree and vice-versa
7. For a given graph, determine the shortest path – single source / destination / entire network
8. Perform breadth and depth first search on a given graph structure – use coloring.
9. Determine the minimum spanning tree for a given graph

Textbook(s)

References(s)

Course Objectives
- To provide hands-on experience on the concepts of Processes and Threads
- To provide experience on Synchronization and Scheduling Algorithms
- To enable the understanding of Resource Management

Course Outcomes: At the end of the course, the student should be able to
CO1: use basic commands to control different Threads and Processes
CO2: carry out performance analysis of different Scheduling Algorithms
CO3: synchronize various Operating System Processes
CO4: effectively manage Operating System Resources

CO-PO Mapping

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Syllabus
1. Basics of Commands
2. Introduction to Shell Programming
3. System calls implementations using Scripts
4. Knowing to build multi-threaded and multi-process applications and performance analysis
5. Scheduling of different tasks
6. Performance analysis of different scheduling algorithms
7. Implementation of Semaphores, shared memories
8. Implementation of synchronization applications
9. Deadlock and its avoidance
10. Memory Allocation Methods for fixed partition
11. Implementation of Paging Techniques and replacement
12. Implementation of the various File Organization Techniques (Single level directory, two level, Hierarchical, DAG)
13. File Allocation Strategies (eg: Sequential, Indexed, Linked)

Textbook(s)

References(s)
Objectives

- To study the nature and facts about environment.
- To appreciate the importance of environment by assessing its impact on the human world.
- To study the integrated themes and biodiversity, pollution control and waste management.

Course Outcomes: At the end of the course, the student should be able to

CO1: understand aspects of nature and environment
CO2: analyze impact of environment on human world
CO3: to comprehend pollution control and waste management

CO-PO Mapping

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Syllabus

Unit I
Introduction- Overview of the global environment crisis; Biogeochemical cycles; Climate change and related international conventions & treaties and regulations. Ozone hole and related International conventions & treaties and regulations; Over population; Energy crisis; Water crisis; Ground water hydrogeology; Surface water resource development.

Unit II
Ecology, biodiversity loss and related international conventions– treaties and regulations. Deforestation and land degradation; Food crisis; Water pollution and related International and local conventions – treaties and regulations. Sewage - domestic and industrial; Effluent treatment; Air pollution and related international and local conventions, treaties and regulations. Other pollution (land, thermal, noise).

Unit III

Textbook(s)

Reference(s)
Course Objectives

- Assist students in inculcating Soft Skills and developing a strong personality
- Help them improve their presentation skills
- Support them in developing their problem solving and reasoning skills
- Facilitate the enhancement of their communication skills

Course Outcomes

**CO1:** Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.

**CO2:** Soft Skills: To empower students to create a better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.

**CO3:** Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.

**CO4:** Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.

**CO5:** Verbal: To infer the meaning of words and use them in the right context. To have a better understanding of the basics of English grammar and apply them effectively.

**CO6:** Verbal: To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

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**Syllabus**

**Soft Skills**
**Soft Skills and its importance**: Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback, Need for change in mindset and up-skilling to keep oneself competent in the professional world.

Managing Self: Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up-gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

**Aptitude**

**Problem Solving I**

**Numbers**: Types, Power Cycles, Divisibility, Prime, Factors & Multiples, HCF & LCM, Surds, Indices, Square roots, Cube Roots and Simplification.


Data Interpretation: Tables, Bar Diagrams, Venn Diagrams, Line Graphs, Pie Charts, Caselets, Mixed Varieties, Network Diagrams and other forms of data representation.

**Verbal**

**Vocabulary**: Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

**Grammar (Basic)**: Help students learn the usage of structural words and facilitate students to identify errors and correct them.

**Reasoning**: Stress the importance of understanding the relationship between words through analogy questions.

**Speaking Skills**: Make students conscious of the relevance of effective communication in today’s world through various individual speaking activities.

**Reference(s):**

5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan’s – GRE Comprehensive Programme
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
Evaluation Pattern: 50:50

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Pass / Fail

*CA - Can be presentations, speaking activities and tests.

SEMESTER IV

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<td>To introduce the concept of asymptotic complexity of algorithms</td>
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<td>To introduce various algorithmic approaches</td>
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<td>To enable design of algorithms for specific applications</td>
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Course Outcomes: At the end of the course, the student should be able to
CO1: Analyze the asymptotic performance of algorithms
CO2: Apply algorithmic design paradigms and methods of analysis
CO3: Design efficient algorithms for specific applications
CO4: Understand approaches to reduce time complexity of algorithms

CO-PO Mapping

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Syllabus

Unit 1

Unit 2

Unit 3

Textbook(s)

References(s)

Objectives
- To introduce fundamental concepts of database management systems
- To enable systematic design of relational databases
- To provide the knowledge of SQL programming constructs for building relational databases and querying information

Course Outcomes: At the end of the course, the student should be able to
CO1: understand basic concepts of database systems
CO2: apply programming constructs in SQL effectively
CO3: apply E-R models and formal methods to design relational databases
CO4: understand database management concepts

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Syllabus

Unit 1
Introduction - General introduction to database systems; Database - DBMS distinction, approaches to building a database, data models, three-schema architecture of a database, challenges in building a DBMS, components of a DBMS. E/R Model - Conceptual data modeling - motivation, entities, entity types, attribute types, relationship types, E/R diagram notation. Relational Data Model - Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators: selection, projection, cross product, joins, division, example queries, tuple relation calculus, domain relational calculus, converting the database specification in E/R notation.

Unit 2
SQL - Introduction, data definition in SQL, table, key and foreign key definitions, update behaviors. Querying in SQL - basic select-from-where block and its semantics, nested queries - correlated and uncorrelated, notion of aggregation, aggregation functions group by and having clauses, embedded SQL. Dependencies and Normal forms - Importance of a good schema design, problems encountered with bad schema designs, motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, definitions of 1NF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, algorithms for 3NF and BCNF normalization, multi-valued dependencies and 4NF, join dependencies and definition of 5NF.

Unit 3
Data Storage and Indexes - file organizations, primary, secondary index structures, various index structures - hash-based, dynamic hashing techniques, multi-level indexes, B+ trees. Transaction processing and Error recovery - concepts of transaction processing, ACID properties, concurrency control, locking based protocols for CC, error recovery and logging, undo, redo, undo-redo logging and recovery methods.

Textbook(s)
References

Course Objectives
- To provide introduction to Computer System Architecture
- To provide foundation on various building blocks of a Computer Architecture
- To introduce the concepts of Pipelining and Parallel Processing

Course Outcomes: At the end of the course, the student should be able to
CO1: understand various functional units and mathematical operations of Computer Systems
CO2: design data-path and control-path operations during execution
CO3: understand Memory Organization and Input Output interfacing
CO4: understand the effect of Pipelining and Parallel Processing

CO-PO Mapping

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Syllabus
Unit 1
Introduction to computer system – Usage of basic digital blocks - Floating point number – IEEE single precision and double precision representation - Floating point arithmetic - Floating point adder/Subtractor - Addressing modes with examples - Data path and controller design – Single bus dataflow unit - Multi bus architecture

Unit 2
Introduction to CPU design - Processor organization - Execution of complete instruction - Design of control unit - Hardwired Control - Microprogrammed Control - Memory and system organization – CPU and memory interaction - Organization of memory modules and interfacing - Cache memory: introduction, related mapping and replacement policies -
Unit 3
Input/output processing - Introduction to Interrupts - Interrupt controlled I/O transfer DMA - Introduction to RISC and CISC approaches - Introduction to pipelining - Pipeline performance - Hazards in pipeline and types – Introduction to Parallel Processing - Parallel Processing Performance – Multithreading - Cache coherence for shared data - Message passing in distributed memory systems - Mathematical modeling of performance.

Textbook(s)

References(s)

**Course Objectives**
- To introduce the concepts of analog communication
- To provide the knowledge of time and frequency domain representation of analog modulation techniques
- To introduce the concepts of random processes and noise in analog communication systems

**Course Outcomes**: At the end of the course, the student should be able to
- **CO1**: understand the principles of analog modulation and demodulation techniques
- **CO2**: analyze the performance of different analog modulation techniques
- **CO3**: understand the concepts of random processes
- **CO4**: analyze the effect of noise in analog communication systems

**CO-PO Mapping**

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**Syllabus**

**Unit 1**
Introduction: Examples of communication systems, Analog vs. Digital, building blocks and their functions, channel types – wired vs. wireless, channel impairments – attenuation, noise, interference, fading, need for modulation, bandwidth and power; Amplitude Modulation (AM): types of AM – DSB-SC, Conventional AM, SSB, VSB, Comparison in terms of bandwidth, power, complexity, etc.; Demodulation: coherent detection, envelop detection; complex low pass representation of narrowband signals, Multiplexing, Super heterodyne receiver; Introduction to AM modulators and demodulators.

**Unit 2**
Angle Modulation: Introduction and representation; types of angle modulation – FM, PM; modulation index, Generation of narrowband and wideband FM; Spectral characteristics of WBFM, effective bandwidth, Carson’s rule; Modulators and demodulators – Armstrong” modulator, PLL-based demodulator; FM radio systems.
Unit 3
Effect of Noise: Review of probability and random variables; Random Processes – auto- and cross-correlation, weak and strong stationarity, power spectral density, Gaussian processes through LTI systems, narrowband noise and filtering; Effect of noise on AM and FM systems, signal to noise ratio (SNR), Performance comparison.

Textbook(s)

References(s)

Course Objectives
- To provide the foundations of machine learning
- To introduce supervised and unsupervised learning techniques
- To enable the appreciation of machine learning techniques

Course Outcomes: At the end of the course, the student should be able to
CO1: Understand the mathematical foundations of machine learning
CO2: Understand supervised and unsupervised learning techniques
CO3: Apply machine learning techniques to standard datasets
CO4: Analyze the performance of machine learning models

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Syllabus

Unit 1:
Introduction to Machine Learning: Machine Learning Pipeline - Data Preprocessing: Standardization, Normalization, Missing data problem, Data imbalance problem, Data visualization - Setting up training, development and test sets, Cross validation, Problem of Overfitting, Bias vs Variance, Evaluation measures

Unit 2
Supervised Learning: Linear regression – single and multi-variable cases, regularization, bias and variance, Logistic regression, Classification: K-Nearest Neighbor, Naïve Bayes, Decision Tree, Random Forest, Support Vector Machine, Case study on advanced supervised ML techniques for regression and classification

Unit 3
Unsupervised learning: Clustering - K-means, DBSCAN, Gaussian Mixture Model, Parameter Estimation: MLE and Bayesian Estimate, Expectation Maximization, Case study on advanced unsupervised ML techniques for regression and classification
Artificial Neural Networks: Multi-layer Perceptron, Back Propagation Algorithm, ANN applications to classification and regression
Textbook(s)

Reference

Course Objectives
- To provide hands-on experience on the SQL programming language
- To enable efficient query of information from relational databases
- To enable implementation and management of relational databases

Course Outcomes: At the end of the course, the student should be able to
- CO1: create and perform basic operations on tables
- CO2: apply queries to efficiently retrieve information
- CO3: apply SQL features for data and access management
- CO4: develop relational databases for specific applications

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Syllabus
1. Set up a local database, schema and management console
2. Create and modify SQL tables
3. Basic SQL query structure and variations
4. Set operations, aggregation functions
5. Nested subqueries
6. Joins
7. Indexing
8. Views and authorization
9. Data types, schemas, and integrity constraints
10. PL/SQL Programs using Triggers, Stored Procedures, Functions and Exception Handling.
Textbook(s)

References(s)

Course Objectives
- To provide hands-on experience in the training of ML models
- To enable the performance analysis of Machine Learning algorithms
- To enable the identification of optimal model hyperparameters

Course Outcomes: At the end of the course, the student should be able to
CO1: Preprocess data
CO2: Train ML models
CO3: Analyze the performance of ML algorithms
CO4: Optimize model performance

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Syllabus
Data pre-processing: Data cleaning, scaling, Encoding; Descriptive Statistics - Central tendency and dispersion; Regression- Single and Multivariable, Classification – Logistic regression, kNN, Naïve Bayes classifier, Decision Trees; Clustering - K-means, GMM; Performance evaluation: Confusion matrix, precision, recall, ROC; Hyper-parameter tuning for improving the performance; Artificial Neural Networks; Case Study involving classification including document classification or with applications like recommendation systems, advertising on the web, using ML tools.

Textbook(s)
Course Objectives
- To provide hands-on experience in implementing algorithms
- To enable run-time analysis of algorithms
- To enable apply algorithms to specific applications

Course Outcomes: At the end of the course, the student should be able to
CO1: implement algorithms
CO2: analyze run-time performance of algorithms
CO3: understand algorithms applied to engineering problems
CO4: develop algorithms for communication related applications

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Syllabus
1. Asymptotic Analysis of sorting methods on arrays and lists – bubble sort, insertion sort, selection sort, shell sort
2. Asymptotic analysis on advanced sorting methods - merge sort, quick sort, radix sort, heap sort
3. Simple cryptography using hashing functions
4. Huffman encoding
5. Linear programming for portfolio maximization
6. Bandwidth allocation / job scheduling
7. Dynamic programming on graphs
8. Knapsack problem – 0/1 and fractional
9. Shortest paths in the presence of negative edges
10. Intelligent exhaustive search - Branch and bound method
11. Local search heuristics - Graph partitioning

Textbook(s)

References(s)
Course Objectives
- To gain a deeper understanding of the ethical grandeur of Indian culture, through a study of the Mahabharata
- To be inspired to follow the ideals of the characters depicted therein

Course Outcomes: At the end of the course, the student should be able to

CO1 Understand the impact of itihasas on Indian civilization with a special reference to the Adiparva of Mahabharata.
CO2 Understand the importance of fighting adharma for the welfare of the society through Sabha and Vanaparva.
CO3 Understand the nuances of dharma through the contrast between noble and ignoble characters of the epic as depicted in the Vana, Virata, Udyoga and Bhishma parvas.
CO4 Gain a deeper understanding of the Yuddha Dharma through the subsequent Parvas viz., Drona, Karna, Shalya, Sauptika Parvas.
CO5 Appreciate the spiritual instruction on the ultimate triumph of dharma through the presentations of the important episodes of the MB with special light on Shanti, Anushasana, Ashwamedhika, Ashramavasika, Mausala, Mahaprasthanika and Swargarohana Parvas.

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Syllabus
Unit 1
Introduction and Summary of the Mahabharata - A Preamble to the Great Itihasa; Unbroken Legacy

Unit 2
Dharmic Insights of a Butcher; The Vows We Take; Kingship and Polity Acumen

Unit 3
Karna – The Maestro that Went Wide off the Mark; Tactics of Krishna; Yajnaseni

Unit 4
Popular Regional Tales; Maha Prasthanam – The Last Journey.

Unit 5
Mahabharata - An All-Encompassing Text; Mahābhārata- Whats and WhatNots; Nyayas in Mahabharata

Textbook / References
1. Leadership Lessons from the Mahabharat, ASCSS
Course Objectives

To know about Indian constitution, Indian society, central and state government functionalities in India

Course Outcomes: At the end of the course, the student should be able to

CO1: understand the functions of the Indian government
CO2: understand and abide the rules of the Indian constitution
CO3: understand and appreciate different culture among the people

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Syllabus

Unit I

Unit II
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

Unit III

Textbook(s)

Reference(s)

Pre-requisite(s): An inquisitive mind, basic English language skills, knowledge of high schoollevel mathematics.

Course Objectives

• Assist students in inculcating Soft Skills and developing a strong personality.
• Help them improve their presentation skills.
• Aid them in developing their problem solving and reasoning skills.
• Facilitate them in improving the effectiveness of their communication.

Course Outcomes

CO1: Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.

CO2: Soft Skills: To empower students to create better impact on a target audience through content creation, effective
delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.

**CO3:** Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.

**CO4:** Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.

**CO5:** Verbal: To learn to use more appropriate words in the given context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.

**CO6:** Verbal: To be able to read texts critically and arrive at/predict logical conclusions. To learn to organize speech and incorporate feedback in order to convey ideas with better clarity.

**CO-PO Mapping**

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**Syllabus**

**Soft Skills**

Communication: Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication

Presentations: Need, importance, preparations, research and content development, structuring and ensuring flow of the presentation. Ways and means of making an effective presentation: Understanding and connecting with the audience – using storytelling technique, managing time, appropriate language, gestures, posture, facial expressions, tones, intonations and grooming. Importance of practice to make an impactful presentation.

**Aptitude**

**Problem Solving II**

**Equations:** Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages.

**Logarithms, Inequalities and Modulus:** Basics

**Time and Work:** Basics, Pipes & Cistern, and Work Equivalence.

**Time, Speed and Distance:** Basics, Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks.

**Logical Reasoning:** Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams, Binary Logic, and Logical Connectives.

**Verbal**

**Vocabulary:** Aid students learn to use their vocabulary to complete the given sentences with the right words. Usage of more appropriate words in different contexts is emphasized.

**Grammar (Basic-intermediate):** Help students master usage of grammatical forms and enable students to identify errors and correct them.

**Reasoning:** Emphasize the importance of avoiding the gap (assumption) in arguments/statements/communication.

**Reading Comprehension (Basics):** Introduce students to smart reading techniques and help them understand different
tones in comprehension passages.

**Speaking Skills**: Make students be aware of the importance of impactful communication through individual speaking activities in class.

**Writing Skills**: Introduce formal written communication and keep the students informed about the etiquette of email writing.

**Reference(s)**

5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan’s – GRE Comprehensive Programme
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

**Evaluation Pattern**: 50:50

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<th>Assessment</th>
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*CA - Can be presentations, speaking activities and tests.

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**SEMESTER V**

**23CCE301**  
IoT and Cloud Computing  
(Prerequisite: Nil)  
L-T-P-C: 3-0-0-3

**Course Objectives**
To provide understanding of Access Technologies and underlying Protocols
To provide foundation on Cloud Layers and Deployment Models
To enable integration of IoT and Cloud Computing

**Course Outcomes:** At the end of the course, the student should be able to

**CO1:** understand IoT Technologies and Protocols
**CO2:** understand IoT based system design
**CO3:** understand different Cloud Deployment Models and their uses
**CO4:** understand integration of IoT and Cloud Computing Platforms

**CO-PO Mapping**

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**Syllabus**

**Unit 1**
Drivers behind New Network Architectures - IoT Architecture - Core IoT Functional Stack - IoT Data Management and Compute Stack - Sensor and Actuators - Smart Object - Connecting Smart Objects - IoT Access Technology - 802.15.4

**Unit 2**
LoRaWAN - IP as IoT Network Layer - Need for IP Optimization in IoT - IoT Transport Methods - IoT Application Layer Protocols - CoAP - MQTT - Data Analytics for IoT – Introduction to Big Data Analytics - Basic Hadoop Architecture - IoT Strategies for Smart Cities, Transportation

**Unit 3**

**Textbook(s)**

**References(s)**

**Course Objectives**

- To introduce the challenges in software engineering
- To provide exposure to life-cycle models
- To introduce the concepts of specification, design and testing

**Course Outcomes:** At the end of the course, the student should be able to

**CO1:** understand concepts of software engineering
**CO2:** understand the models for software development life-cycle
**CO3:** understand software specification and design processes
**CO4:** understand the concepts of software testing

**CO-PO Mapping**

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Syllabus

Unit 1
Introduction to software engineering, writing requirements, system analysis, system design, software design, testing, deployment, maintenance, updates, quality attributes and crisis management. Software development life cycles—water fall model, V-model, evolutionary model, RAD model, concurrent-Agile model, enhancement model, spiral model, prototype model.

Unit 2
Introduction to Agile methodologies, types—scrum, Kanban framework, LEAN, extreme programming; Scrum framework, product owner, scrum master, development team, product backlog, sprint backlog, product increment, daily scrum; Agile sprint planning—creation of user stories, estimation and assignment of story points, building and refining product backlog; Introduction to DevOp tools; Case studies on latest agile frameworks.

Unit 3
Introduction to full stack development—front end development, data base handling, backend development, API, web server, version control; Testing—objectives, unit testing, integration testing, acceptance testing, regression testing, validation testing, system testing, black-box testing, white box testing; Test harness—test drivers, test stubs.

Textbook(s)

References(s)

Course Objectives
- To introduce the concepts of digital modulation and demodulation techniques
- To provide an understanding of optimum receiver design
- To enable performance analysis of digital communication systems

Course Outcomes: At the end of the course, the student should be able to

CO1: understand the concepts of waveform coding and signal design
CO2: understand the principles of digital modulation techniques
CO3: design optimum receivers for digital communication systems
CO4: conduct performance analysis of digital modulation techniques

CO-PO Mapping

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Syllabus

Unit 1
Introduction: major blocks and functions; Analog to Digital Conversion; Waveform Coding—PCM—DPDM—DM; Time Division Multiplexing; Geometric representation of signal waveforms—Binary pulse modulation—Optimum receiver for binary modulated signals in additive white Gaussian noise; M-ary binary and orthogonal pulse modulation—Probability of error for binary and M-ary pulse modulation.

Unit 2
Transmission of digital information via carrier modulation: Types of digital modulation – Amplitude shift keying (ASK) – Phase shift keying (BPSK, QPSK, M-PSK); Quadrature amplitude modulated signals (M-QAM) – Frequency shift keying (FSK), Minimum Shift Keying (MSK), Continuous phase modulation - calculation of probability of error, Performance analysis and comparison of different modulation techniques.

**Unit 3**
Digital Transmission through band-limited channel- Baseband, Bandpass, Band limited channels, Inter-Symbol Interference (ISI) - Signal design for band-limited channels – Probability of error for detection of digital PAM – System design in the presence of channel distortion.

**Textbook(s)**

**References(s)**

**Course Objectives**
- To provide foundation on Embedded System Platforms
- To enable configuration of advanced peripherals for Embedded Applications
- To provide basic understanding of Real Time Operating Systems

**Course Outcomes**: At the end of the course, the student should be able to
CO1: understand the architectural features of an Embedded System
CO2: configure the peripherals of an advanced Microcontroller
CO3: understand the concepts of Real Time Operating Systems
CO4: understand the design of an Embedded System

**CO-PO Mapping**

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**Syllabus**

**Unit 1**

**Unit 2**

**Unit 3**

**Textbook(s)**

References(s)
1. D. V. Gadre, S. Gupta, Getting Started with Tiva ARM Cortex M4 Microcontrollers, Springer, 2018

### Course Objectives
- To provide platform for creative and innovative thinking
- To enable understanding of available state of art in the identified area of interest
- To enable simulation/hardware-prototyping of solutions to effectively transform ideas to reality

### Course Outcomes:
At the end of the course, the student should be able to

**CO1:** analyze simple practical problems and investigate scope for applying technology to develop feasible solutions

**CO2:** design a solution for the identified, using appropriate tools

**CO3:** simulate the solution and analyse the results

**CO4:** suggest improvements or modifications

**CO5:** Present and defend the results

### CO-PO Mapping

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### Course Objectives
- To provide hands-on experience to use peripherals of an advanced Microcontroller
- To enable implementation of Real Time Operating System (RTOS) concepts
- To enable design of an Embedded System using advanced Microcontroller

### Course Outcomes:
At the end of the course, the student should be able to

**CO1:** configure peripherals of an advanced Microcontroller

**CO2:** interface External Peripherals with an Embedded Platform

**CO3:** implement Task Management and Inter Task Communication using RTOS

**CO4:** prototype an Embedded System using advanced Microcontroller

### CO-PO Mapping

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### Course Objectives
- To provide platform for creative and innovative thinking
- To enable understanding of available state of art in the identified area of interest
- To enable simulation/hardware-prototyping of solutions to effectively transform ideas to reality

### Course Outcomes:
At the end of the course, the student should be able to

**CO1:** analyze simple practical problems and investigate scope for applying technology to develop feasible solutions

**CO2:** design a solution for the identified, using appropriate tools

**CO3:** simulate the solution and analyse the results

**CO4:** suggest improvements or modifications

**CO5:** Present and defend the results

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Syllabus
1. GPIO Programming using Cortex M4
2. Delay Time Generation using Timer
3. Analog Sensor Interfacing using ADC
4. External DAC Interfacing using SPI
5. External RTC Interfacing using I2C
6. Task Management using FreeRTOS
7. Inter Task Communication using FreeRTOS
8. Term Project

Textbook(s)

References(s)

Course Objectives
- To provide hands-on experience on IoT Hardware
- To provide exposure to Cloud Computing Platforms
- To enable integration of IoT with Cloud Computing Systems

Course Outcomes: At the end of the course, the student should be able to
CO1: prototype simple IoT based Systems
CO2: use Cloud Computing Platforms for Data Processing
CO3: integrate IoT with Cloud Computing
CO4: demonstrate simple IoT Applications on Cloud

CO-PO Mapping

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Syllabus
1. GPIO and Motor Control using Raspberry Pi
2. Sensor interfacing and Data Logging using Raspberry Pi with SenseHAT
3. LCD Interfacing using Raspberry Pi
4. Web Server Implementation using Raspberry Pi
5. Raspberry Pi and IoT Cloud Server Interface using MQTT Protocol
7. Image Processing using Raspberry Pi
9. Training Deep Neural Networks on Azure

Textbook(s)

References(s)

Course Objectives
- To provide hands-on exposure to digital communication techniques using ICs and discrete components
- To enable performance analysis of various digital modulation schemes
- To provide exposure to hardware platforms for communication systems

Course Outcomes: At the end of the course, the student should be able to
- CO1: build electronic circuits for digital communication
- CO2: simulate and verify digital modulation schemes
- CO3: analyze the performance of digital modulation techniques
- CO4: utilize hardware platforms to realize communication systems

CO-PO Mapping

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Syllabus
1. Sampling and reconstruction of an analog signal by designing pulse amplitude modulator and demodulator circuits.
2. Application of sampling by designing time division multiplexer and demultiplexer circuits.
3. Amplitude modulator which can be used to transmit digital information via carrier and be able to reconstruct the message signal.
4. Phase modulator which can be used to transmit the digital information via carrier and be able to reconstruct the message signal.
5. Pulse code modulator and Delta modulator
6. Geometric representation of the given signal using Gram-Schmidt orthogonalization procedure implemented in MATLAB.
7. ASK (OOK) and BPSK modulator and demodulator and BER performance comparison
8. M-PSK and QAM modulator and demodulator and BER performance comparison
9. To study the effects of ISI by generating an Eye pattern
10. Specifications, characterization of Hardware platforms like NooRadio, SDR, etc.
11. Establishment of wireless communication link using a pair of hardware platform

Textbook(s)

References(s)
Pre-requisite(s): Willingness to learn, communication skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Help students understand corporate culture, develop leadership qualities and become good team players
- Assist them in improving group discussion skills
- Help students to sharpen their problem solving and reasoning skills
- Empower students to communicate effectively

Course Outcomes

**CO1** - Soft Skills: To improve the inter-personal communication and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.

**CO2** - Soft Skills: To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.

**CO3** - Aptitude: To identify, investigate and arrive at appropriate strategies to solve questions on geometry, statistics, probability and combinatorics.

**CO4** - Aptitude: To analyze, understand and apply suitable methods to solve questions on logical reasoning.

**CO5** - Verbal: To be able to use diction that is more refined and appropriate and to be competent in spotting grammatical errors and correcting them.

**CO6** - Verbal: To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

**CO-PO Mapping**

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Syllabus

**Soft Skills**


**Group Discussions**: Advantages of group discussions, Types of group discussion and Roles played in a group discussion.
Personality traits evaluated in a group discussion. Initiation techniques and maintaining the flow of the discussion, how to perform well in a group discussion. Summarization/conclusion.

**Aptitude**

**Problem Solving III**

**Geometry:** 2D, 3D, Coordinate Geometry, and Heights & Distance.

**Permutations & Combinations:** Basics, Fundamental Counting Principle, Circular Arrangements, and Derangements.

**Probability:** Basics, Addition & Multiplication Theorems, Conditional Probability and Bayes' Theorem.

**Statistics:** Mean, Median, Mode, Range, Variance, Quartile Deviation and Standard Deviation.

**Logical Reasoning:** Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding & Decoding, Cryptarithmic Problems and Input - Output Reasoning.

**Verbal**

**Vocabulary:** Create an awareness of using refined language through idioms and phrasal verbs. **Grammar (Upper Intermediate-Advanced):** Train Students to comprehend the nuances of Grammar and empower them to spot errors in sentences and correct them.

**Reasoning:** Enable students to connect words, phrases and sentences logically.

**Oral Communication Skills:** Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

**Writing Skills:** Practice closet tests that assess basic knowledge and skills in usage and mechanics of writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style.

**Reference(s)**

5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.

**Evaluation Pattern:** 50:50

<table>
<thead>
<tr>
<th>Assessment</th>
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Continuous Assessment (CA) – Aptitude  |  10  |  25  
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*CA - Can be presentations, speaking activities and tests.

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Objectives

- Identify and analyse the various challenge indicators present in the village by applying concepts of Human Centered Design and Participatory Rural Appraisal.
- Assess the user need through quantative and qualitative measurements
- Design a solution by integrating human centered design concepts
- Devising proposed intervention strategies for sustainable social change management

Course Outcome: At the end of the course, the student should be able to

CO1: learn ethnographic research and utilise the methodologies to enhance participatory engagement.
CO2: prioritize challenges and derive constraints using Participatory Rural Appraisal.
CO3: identify and formulate the research challenges in rural communities.
CO4: design solutions using human centered approach.

CO-PO Mapping

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Syllabus

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas

- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure

The objectives and the projected outcome of the project will be reviewed and approved by the department chairperson and a faculty assigned as the project guide.
Course Objectives
- To provide advanced level of theoretical knowledge on baseband processing
- To enable analysis, configuration and programming for software defined radio
- To introduce integration of programmable hardware baseband processing with RF modules

Course Outcomes: At the end of the course, the student should be able to
CO1: understand baseband processing techniques including multi-rate systems
CO2: understand Multi-standard radio systems
CO3: understand the integration of baseband techniques with radio systems
CO4: analyze the performance of baseband techniques for SDR

CO-PO Mapping

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Syllabus

Unit 1
Introduction to wireless communication systems – Baseband signal processing – overview of wireless digital communication – Digital modulation and demodulations techniques: transmitter for complex PAM – symbol mapping – pulse shaping – wireless channel: source and channel coding schemes – channel impairments techniques: time and frequency offset corrections - Signal processing with passband signals – Multi-rate signal processing – down sampling – up sampling – polyphase structure – changing the sampling rate– Digital generation of signals – Analog to Digital (ADC) and Digital to Analog (DAC) conversion architectures

Unit 2

Unit 3

Textbooks

References(s)
1. www.gnuradio.org
• To provide the fundamental techniques to combat fading channels
• To introduce multiple access techniques in wireless networks

Course Outcomes: At the end of the course, the student should be able to
CO1: characterize wireless channels
CO2: apply techniques to improve performance in fading channels
CO3: understand multiple access techniques in wireless networks
CO4: understand working principles of modern wireless networks

CO-PO Mapping

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Syllabus
Unit 1
Introduction: Wireless communication, importance and requirements, types and classifications; Block diagram, brief function of major blocks; Wireless channels- characterization of wireless channel, Communication link, propagation phenomenon, LoS, NLoS; Mobile wireless channel- multipath propagation, ISI, fading, large scale-Friss free-space path-loss model, ray tracing model, two-ray tracing model, shadowing, small scale multipath measurements; Rayleigh, Rician model, Fading parameters like power-delay profile, coherence bandwidth, delay spread, etc., Passband representation of received signal; Channel capacity –AWGN, fading channel capacity, outage capacity, BER performance.

Unit 2
Performance improvement techniques: Equalization-adaptive, DFE; Diversity techniques- types, receive diversity, transmit diversity, MIMO, MIMO-Channel, capacity, data rate; receiver architecture – combiners, rake receiver. Chanel Coding – Parity, block codes, convolution codes, interleaving, randomizer. Multicarrier communication – Frequency selective channels, OFDM, Single-carrier vs multi-carrier. Multiple access- techniques, TDMA, FDMA, CDMA, space division.

Unit 3
Introduction to Wireless networks: Wireless Local Area Networks, 802.11n; Cellular mobile communication architecture, 2G network, evolution of cellular mobile communication 1G-5G.

Textbook(s)

References(s)

SEMESTER VI

<table>
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<tr>
<th>23CCE313</th>
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• understanding of layered architecture of computer networks
• To provide fundamentals of internetworking
• To provide foundations on network protocols

Course Outcomes: At the end of the course, the student should be able to
CO1: understand layered architecture of computer networks
CO2: understand the concepts of addressing, switching, routing and reliable transport of data
CO3: understand the working of network protocols
CO4: analyze the qualitative aspects of protocols

**CO-PO Mapping**

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**Syllabus**

**Unit 1**

**Unit 2**

**Unit 3**
Data link layer and its functions-protocols, Frame, ARP - Error detection and correction - Medium Access control (MAC)- Random access- Controlled access- Ethernet; PHY Layer and its functions, PHY protocols.

**Textbook(s)**

**References(s)**

**Course Objectives**
- To provide platform for creative and innovative thinking
- To enable understanding of available state of art in the identified area of interest
- To enable simulation/hardware-prototyping of solutions to effectively transform ideas to reality

**Course Outcomes:** At the end of the course, the student should be able to

- **CO1:** analyze simple practical problems and apply technology to develop feasible solutions
- **CO2:** identify, troubleshoot and rectify simple problems while prototyping
- **CO3:** analyse the results and develop justifiable inferences
- **CO4:** understand the process of developing ideas to feasible prototypes
- **CO5:** Present and defend the results

**CO-PO Mapping**

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## Course Objectives

- To provide an exposure to wireless communication over fading channels through simulations
- To enable develop wireless networks using hardware modules
- To provide hands-on exposure to computer networks and protocols

### Course Outcomes:

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

- CO1: analyze performance of wireless communication systems over fading channels
- CO2: demonstrate wireless networks using hardware modules
- CO3: simulate and configure wireless networks
- CO4: analyze the performance of computer networks

### Course PO Mapping

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### Syllabus

1. Study of Propagation Path loss Models: Indoor & Outdoor
2. Performance comparison of different propagation models including fading channels, Rayleigh, Rician, CDF, PDF
3. Outdoor Propagation – Okumura Model, Hata Model
4. Hardware based radio set up, communication through wireless channel using hardware platform like SDR
5. Network topology design using any tool like OMNET++, NS, Cisco Packet Tracer, NetSim
6. Simple topology, WAN design with few routers, study and configure of protocols
7. Study of TCP protocol using packet sniffers.
8. Study of application layer protocols - HTTP.
9. Client-server communication using socket programming (TCP and UDP).

### Textbook(s)

2. A Hands-On Introduction to SDR with USRP and GNU Radio, ETUSS

### Reference(s)


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## SEMESTER VI

### 23CCE386 Wireless Communication and Networks Laboratory

(Prerequisite: Communication Systems Laboratory)  
L-T-P-C: 0-0-3-1  

Course Objectives

- To provide hands-on experience on baseband techniques for software defined radio (SDR)
- To enable configuration and programming for SDR
- To enable implementation of SDR-based communication systems

Course Outcomes: At the end of the course, the student should be able to

- CO1: carry out performance analysis of baseband techniques for SDR

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### SEMESTER VI

### 23CCE387 Software Defined Radio Laboratory

(Prerequisite: Signal Processing and Communication Systems Laboratory)  
L-T-P-C: 0-0-3-1  

Course Objectives

- To provide hands-on experience on baseband techniques for software defined radio (SDR)
- To enable configuration and programming for SDR
- To enable implementation of SDR-based communication systems

Course Outcomes: At the end of the course, the student should be able to

- CO1: carry out performance analysis of baseband techniques for SDR
CO2: implement and evaluate multi-rate signal processing schemes for communication systems
CO3: implement baseband techniques on SDR platform
CO4: demonstrate communication system using SDR

**CO-PO Mapping**

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**Syllabus**

1. Generation and analysis of real, complex analog signals and digital signals with its time / spectral / waterfall / constellation / eye diagram plots. (Simulation and Real time)
2. Creation of LTI system and its performance. (Simulation and Real time)
3. Design and analysis of LPF/HPF/BPF filter. (Simulation and Real time)
4. Amplitude Modulation and demodulation. (Simulation and Real time)
5. Frequency Modulation and demodulation. (Simulation and Real time)
6. Performance analysis of Binary/Quad Phase shift keying modulation and demodulation. (Simulation and Real time)
7. Performance analysis of QAM modulation and demodulation-based communication system. (Simulation and Real time)
8. Performance study of various wireless channels impairments and recovery. (Simulation and Real time)
9. Simple audio / video streaming and decodding. (Simulation and Real time)
10. Spectrum sensing implementation using SDR hardware. (Simulation and Real time)

**Textbook(s)**

   - Software Tools: PYTHON / C++ / GNU Radio / MATLAB / LABVIEW
   - Hardware: USRP / RTL-SDR / ADALM-PLUTO

**References(s)**

1. www.gnuradio.org
4. www.rtl-sdr.com
5. www.ettus.com

**Pre-requisite(s):** Self-confidence, presentation skills, listening skills, basic English languages skills, knowledge of high school level mathematics.

**Course Objectives**

- Help students prepare resumes and face interviews with confidence
- Support them in developing their problem-solving ability
- Assist them in improving their problem solving and reasoning skills
- Enable them to communicate confidently before an audience

**Course Outcomes**

CO1: Soft Skills: To acquire the ability to present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.
**CO2**: Soft Skills: To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one’s right candidature through displaying etiquette, positive attitude and courteous communication.

**CO3**: Aptitude: To manage time while applying suitable methods to solve questions on arithmetic, algebra and statistics.

**CO4**: Aptitude: To investigate, understand and use appropriate techniques to solve questions on logical reasoning and data analysis.

**CO5**: Verbal: To use diction that is less verbose and more precise and to use prior knowledge of grammar to correct/improve sentences.

**CO6**: Verbal: To understand arguments, analyze arguments and use inductive/deductive reasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.

**CO-PO Mapping**

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**Syllabus**

**Soft Skills**

**Teamwork**: Value of teamwork in organizations, Definition of a team. Why team? Effective team building. Parameters for a good team, roles, empowerment and need for transparent communication, Factors affecting team effectiveness, Personal characteristics of members and its influence on team. Project Management Skills, Collaboration skills.

**Leadership**: Initiating and managing change, Internal problem solving, Evaluation and co-ordination, Growth and productivity, Importance of Professional Networking.

**Facing an interview**: Importance of verbal & aptitude competencies, strong foundation in core competencies, industry orientation / knowledge about the organization, resume writing (including cover letter, digital profile and video resume), being professional. Importance of good communication skills, etiquette to be maintained during an interview, appropriate grooming and mannerism.

**Aptitude**

**Problem Solving II**

**Sequence and Series**: Basics, AP, GP, HP, and Special Series.

**Data Sufficiency**: Introduction, 5 Options Data Sufficiency and 4 Options Data Sufficiency.
Logical reasoning: Clocks, Calendars, Cubes, Non-Verbal reasoning and Symbol based reasoning.

Campus recruitment papers: Discussion of previous year question papers of all major recruiters of Amrita Vishwa Vidyapeetham.

Competitive examination papers: Discussion of previous year question papers of CAT, GRE, GMAT, and other management entrance examinations.

Miscellaneous: Interview Puzzles, Calculation Techniques and Time Management Strategies.

Verbal

Vocabulary: Empower students to communicate effectively through one-word substitution. Grammar: Enable students to improve sentences through a clear understanding of the rules of grammar.

Reasoning: Facilitate the student to tap his reasoning skills through Syllogisms, critical reasoning arguments and logical ordering of sentences.

Reading Comprehension (Advanced): Enlighten students on the different strategies involved in tackling reading comprehension questions.

Public Speaking Skills: Empower students to overcome glossophobia and speak effectively and confidently before an audience.

Writing Skills: Practice formal written communication through writing emails especially composing job application emails.

References

5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
10. A Modern Approach to Verbal Reasoning – R.S. Aggarwal
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
18. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal

Evaluation Pattern: 50:50

<table>
<thead>
<tr>
<th>Assessment</th>
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23LIV490
Live-in Lab-II
(Pre-requisite: Nil)

Course Objectives:

- Identify and analyse the various challenge indicators present in the village by applying concepts of Human Centered Design and Participatory Rural Appraisal.
- Assess the user need through quantitative and qualitative measurements
- Design a solution by integrating human centered design concepts
- Devising proposed intervention strategies for sustainable social change management

Course Outcome: At the end of the course, the student should be able to

- **CO1**: learn ethnographic research and utilise the methodologies to enhance participatory engagement.
- **CO2**: prioritize challenges and derive constraints using Participatory Rural Appraisal.
- **CO3**: identify and formulate the research challenges in rural communities.
- **CO4**: design solutions using human centered approach.

CO-PO Mapping

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Syllabus

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas

- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure

The objectives and the projected outcome of the project will be reviewed and approved by the department chairperson and a faculty assigned as the project guide.

Courses offered under the framework of

Amrita Values Programmes I and II
22AVP201 Message from Amma’s Life for the Modern World

Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

22ADM211 Leadership from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

22ADM201 Strategic Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

22AVP204 Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

22AVP205 Message of the Bhagavad Gita


22AVP206 Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

22AVP207 Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, AdiShankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri RamanaMaharshi, Mata Amritanandamayi Devi.

22AVP208 Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

22AVP209 Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

22AVP210 Kerala Mural Art and Painting
Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

22AVP213 Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is ‘Unity in Diversity’ and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

22AVP214 Principles of Worship in India

Indian mode of worship is unique among the world civilizations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realization of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

22AVP215 Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirties, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the Vasthupurusha.

22AVP218 Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svarā – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala,- Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

22AVP219 Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

22AVP220 Insights into Indian Classical Dance
The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinaBharati. The course introduces various styles of Indian classical dance such as Bharatanatyam, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.

22AVP221  Indian Martial Arts and Self Defense

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala’s traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

PROFESSIONAL ELECTIVES UNDER SCIENCE STREAM

CHEMISTRY

23CHY240  COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING  L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: Get to understand the structure of molecules using symmetry.

CO2: Understanding Quantum mechanical approach to calculate the energy of a system.

CO3: Applying mathematical knowledge and quantum mechanical approach in finding out the characteristics-reactivity, stability, etc., of the molecule.

CO4: To get a brief idea about molecular mechanics based chemical calculations.

CO5: To get an idea about general methodology of molecular modeling.

Syllabus

Unit 1

Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.


Introduction to Quantum mechanics - Schrodinger equation - Position and momentumMO formation - Operators and the Hamiltonian operator - The quantum oscillator Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.
Unit 2

Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel’s coefficient matrix - Wheeland’s method - Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3

Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman’s theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes

Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction tomolecular simulation - M.D. simulation.

TEXTBOOKS:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Outcomes:

CO1: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics
CO2: Learn the application of the electrochemical principles for the functioning and fabrication of industrial batteries and fuel cells
CO3: Acquire knowledge in solving numerical problems on applied electrochemistry
CO4: Analysis and practical problem solving in fabrication of batteries and fuel cells
CO5: Application of concepts and principle in industrial electrochemical processes
CO6: Evaluation of comprehensive knowledge through problem solving

Syllabus Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3


Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical
machining of metals and alloys.

TEXTBOOKS:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:

To provide the basic knowledge about fuels, rocket propellants and explosives.

Course Outcomes:

CO1: Understand the types of fuels and variation in their properties
CO2: Able to analyze the fuel content
CO3: Obtain knowledge in identifying a proper fuel as per the requirement
CO4: Ability to know the preparation and working of propellants and explosives

Syllabus

Unit 1

Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels - Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.


Unit 2

Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Objectives:

1. Understand the principles of green chemistry and its contribution to the development of sustainable products
2. Possess knowledge of the migration from a hydrocarbon-based economy to carbohydrate-based economy
3. Evaluate the deficiencies of traditional process and acknowledge the invention of new processes
4. Distinctly map the culmination of academic research to industrial chemistry

Course Outcomes:

CO1: Understand the evolving concept of Green Chemistry and its application to the manufacture of sustainable products

CO2: Appreciate the need for Renewable energy and Feed stock along with carbon sequestration through the fundamentals of Green Chemistry Techniques

CO3: Develop a coherence to evaluate systematic deficiencies in traditional Chemical science process and products

CO4: Undertake a purposeful Journey through the microscopic domain of academic research to the macroscopic domain of Industrial chemistry

Syllabus

Unit 1

Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2

Greener strategies of the synthesis of ibuprofen synthesis, terephthalic acid etc. phase behaviour and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from biomass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

Unit 3

Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:

1. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes:

CO1: To develop an understanding of principle and working of the range of instrumental methods in analytical chemistry

CO2: To provide an understanding and skills in contemporary methods of separation and appropriate selection of instruments for the successful analysis of chemical compounds

CO3: To impart skills in the scientific method of planning, conducting, reviewing, reporting experiments and problem solving in chemical analysis.

Syllabus

Unit 1


Separation Techniques: Brief outline of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2

Gas chromatography - principle and applications – gel chromatography.


Unit 3


Thermal and Diffraction techniques: Principles and applications of DTG - DTA DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

TEXTBOOKS:
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## Evaluation Pattern

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objective:

To provide sound knowledge on the application of electrochemistry in energy storage systems.

Course Outcome

CO1: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics
CO2: Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries and fuel cells
CO3: Analysis of practical problem solving in fabricating batteries and fuel cells
CO4: Evaluation of comprehensive knowledge through problem solving

Syllabus

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler- Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafelplots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanché type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other
components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.


TEXTBOOKS:


REFERENCES:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcome:

CO1: Development of skill in identifying the nature and type of corrosion
CO2: Understanding the mechanism of various types of corrosion
CO3: Analysing the problem and find out a solution to combat corrosion in any sort of environment.

CO-PO Mapping

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Syllabus

Unit 1

Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2

Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Unit 3

Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.


TEXTBOOKS:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
PHYSICS

23PHY240 ADVANCED CLASSICAL DYNAMICS L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: Able to use the Lagrangian formalism to solve simple dynamical system

CO2: Able to understand Hamiltonian formalism and apply this in solving dynamical systems

CO3: Able to apply Lagrangian formalism in bound and scattered states with specific reference to Kepler’s laws and Scattering states

CO4: Able to solve problems in the Centre of Mass frame and connect it to Laboratory Frame of Reference

CO5: Understand and solve problems in rigid body rotations applying of Euler’s equations.

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Syllabus

Unit 1

Introduction to Lagrangian dynamics

Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert’s principle and Lagrange’s equation, simple applications of the Lagrangian formulation, variational principles and Lagrange’s equations, Hamilton’s principles, derivation of Lagrange’s equations from Hamilton’s principle, conservation theorems and symmetry properties.

Unit 2

Central field problem
Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler’s problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler’s theorem on the motion of a rigid body.

**Unit 3**

Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.
Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite manoeuvring and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity gradient stabilization.

TEXTBOOKS:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes

CO1: To understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic and electrical properties.

CO2: Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.

CO3: Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro and ferri magnetic materials.

CO4: Fundamentals concerned with conduction mechanism in metals and superconductors.

CO5: Understand the basics for classification of materials based on its conductivity, nature of chemical bonds in Si and Ge, carrier density, energy band structure and conduction mechanism in intrinsic and extrinsic semiconductors.

CO-PO Mapping

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Syllabus

Unit 1

Conducting materials: The nature of chemical bond, crystal structure Ohm’s law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it’s consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2
Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it’s applications.

**Unit 3**

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of
the p-n junction rectifier, the n-p-n transistor.

TEXTBOOK:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Unit 1

Review of some basic concepts and principle of laser.


Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3

Types of LASERS


Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homojunction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.
Applications of LASERS in other fields:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes

CO1: Understand, Comprehend and acquaint with concepts of NanoPhysics

CO2: To familiarize the material’s property changes with respect to the dimensional confinements.

CO3: Acquire knowledge on the modern preparation process and analysis involved in the nanomaterial’s research

CO4: To learn about the technological advancements of the nano-structural materials and devices in the engineering applications

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Syllabus Unit 1

Introduction

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement

Basic concepts – excitons, effective mass, free electron theory and its features, band structure of solids. Bulk to nano transition – density of states, potential well - quantum confinement effect – weak and strong confinement regime.

Unit 2

Tools for characterization:


Nanoscale materials – properties and applications:

Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

Unit 3

Nanoelectronics and nanodevices:

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes:

CO1: Understand, comprehend and acquaint with the basics working principles and governing equations of electronic devices like diodes, Bipolar junction transistors, Mosfet and heterojunction transistors

CO2: Analyze and Solve physics problems pertaining to various process like charge conduction across semiconductor device.

CO3: Apply the knowledge for the development and design of new methods to determine semiconductor parameters and devices

Syllabus

Unit 1

Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects


Unit 2


Theory of p-n junctions – diode and transistor: p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

Unit 3


Semiconducting devices: Optical devices: optical absorption in a semiconductor, e–hole generation. Solar cells – p-n junction,
conversion efficiency, heterojunction solar cells. Photo detectors – photo conductors, photodiode, p-i-n diode. Light emitting diode (LED) – generation of light, internal and external quantum efficiency.

Modern semiconducting devices: CCD - introduction to nano devices, fundamentals of tunneling devices, design considerations, physics of tunneling devices.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Outcomes:

After completion of the course students should be able to

CO1: Get a broad knowledge of scientific and technical methods in astronomy and astrophysics. CO2: Apply mathematical methods to solve problems in astrophysics.

CO3: Develop critical/logical thinking, scientific reasoning and skills in the area of modern astrophysics.

CO-PO Mapping:

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Syllabus

Unit 1


Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler’s laws - and derivations from Newton’s laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2


Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.
Unit 3

Galactic astronomy: Distance measurement - red shifts and Hubble’s law – age of the universe, galaxies – morphology

- Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.


Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - planklength and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

REFERENCES:

Publishing Company, 1996

5. ‘Stellar Astronomy’ by K. D Abhayankar.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
MATHEMATICS

23MAT240 STATISTICAL INFERENCE L-T-P-C: 3-0-3

Syllabus

Unit 1

Unit 2

Unit 3
Regression: Introduction, Least Squares Estimators of the Regression Parameters, Distribution of the Estimators, Statistical Inferences about the Regression Parameters, the Coefficient of Determination and the Sample Correlation Coefficient, Analysis of Residuals, transforming to Linearity, Weighted Least Squares, Polynomial Regression, Multiple Linear Regression, Predicting Future Responses, Logistic Regression Models for Binary Output Data.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

Elements of Game theory, examples, Strategic Games, 2 Player Strategy Games, payoffs, Minimax, Weak and Strong Domination, Saddle Points, Nash Equilibrium, Prisoner’s Dilemma, Stag Hunt, Matching pennies, BOS, Multi NE, Cooperative and Competitive Games, Strict and Non Strict NE, Best response functions for NE.

Unit 2

Combinatorial games, Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games.

Unit 3

Cournot’s Oligopoly, Bertrand’s Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory, Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg’s model of Duopoly, Buying Votes, Committee Decision making, Repeated Games, Prisoner’s Dilemma, Supermodular Game and Potential games

TEXTBOOK:

1. Martin Osborne, An Introduction to Game Theory, Oxford University Press.

REFERENCES:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
23MAT242  NUMERICAL METHODS AND OPTIMIZATION  L-T-P-C: 3-0-0-3

Syllabus

09 (a) Roots finding methods:
Roots of Transcendental and Polynomial Equations: Bisection method, Iteration methods based on first degree equation, Rate of convergence, system of nonlinear equations.

09 (b) Interpolations:
Interpolation and Approximation: Lagrange, Newton’s Divided Difference, Newton’s Forward and Backward interpolations.

07 (b) Multivariable optimization (2 Credits)

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
FREE ELECTIVES OFFERED UNDER MANAGEMENT STREAM COMMON TO ALL PROGRAMS

23MNG331 FINANCIAL MANAGEMENT L-T-P-C: 3-0-0-3

Course Objectives

- Understand the overview of financial management
- Inculcate methods and concepts on valuation
- Familiarize with working capital management, financial analysis and planning

Course Outcomes

CO1: Understand and apply time value concept of money and use this for investment criteria decisions.

CO2: Evaluate the risk and return for various alternatives of investment.

CO3: Apply the capital budgeting techniques and evaluate the investment decisions.

CO4: Understand working capital management, cash and liquidity management and financial statements. CO/PO

Mapping

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Syllabus

Unit 1


Unit 2

Unit 3


Mergers and Takeovers-International trade.

TEXT BOOKS

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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- Understand the complexity and key issues in supply chain management.
- Describe logistics networks, distribution planning, routing design and scheduling models.
- Familiarize dynamics of supply chain and the role of information in supply chain.
- Understand the issues related to strategic alliances, global supply chain management, procurement and outsourcing strategies.

Course Outcomes

**CO1:** Analyze the complexity and key issues in supply chain management

**CO2:** Evaluate single and multiple facility location problems, logistics network configuration, vehicle routing and scheduling models

**CO3:** Analyze inventory management models and dynamics of the supply chain

**CO4:** Develop the appropriate supply chain through distribution requirement planning and strategic alliances

**CO5:** Identify the issues in global supply chain management, procurement and outsourcing strategies

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**Syllabus Unit 1**

Introduction: Introduction to SCM—the complexity and key issues in SCM—Location strategy—facility location decisions—single facility and multiple location models.

Unit 2

Inventory: Inventory Management and risk pooling-managing inventory in the SC. Value of Information-bullwhip effect-lead time reduction.


Unit 3


TEXT BOOK

REFERENCE BOOKS


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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objective

To educate the students to apply concepts and techniques in marketing so that they become acquainted with the duties of a marketing manager with an emphasis to make the students exposed to the development, evaluation, and implementation of marketing management in a variety of business environments.

Course Outcomes

On successful completion of the Course students will be able to:

CO1: Illustrate key marketing concepts, theories and techniques for analysing a variety of marketing situations

CO2: Identify and demonstrate the dynamic nature of the environment in which marketing decisions are taken and appreciate the implication for marketing strategy determination and implementation

CO3: Develop the ability to carry out a research project that explores marketing planning and strategies for a specific marketing situation

CO4: Understand the need and importance of sales promotions and make use of advertising

CO5: Manage a new product development process from concept to commercialization.

CO6: Illustrate the importance of modern trends in retailing and marketing logistics

CO/PO Mapping

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Syllabus

Unit 1
Marketing Process: Definition, Marketing process, dynamics, needs, wants and demands, value and satisfaction, marketing concepts, environment, mix. Philosophies, selling versus marketing, organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy.

Buying Behaviour and Market Segmentation: Major factors influencing buying behaviour, buying decision process, business buying behaviour. Segmenting consumer and business markets, market targeting.

UNIT 2
Product Pricing and Marketing Research: Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT 3
Advertising Sales Promotion and Distribution: Characteristics, impact, goals, types, and sales promotions- point of
purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

TEXT BOOKS


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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- To discuss the project life cycle and build a successful project from pre-implementation to completion.
- To introduce different project management tools and techniques

Course Outcomes

CO1: Appraise the selection and initiation of individual projects and its portfolios in an enterprise.
CO2: Analyze the project planning activities that will predict project costs, time schedule, and quality.
CO3: Develop processes for successful resource allocation, communication, and risk management.
CO4: Evaluate effective project execution and control techniques that results in successful project completion

CO/PO Mapping

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Syllabus

Unit 1

Overview of Project Management: Verities of project, Project Features, Project Life Cycle – S-Curve, J-C Project
Selection: Project Identification and Screening – New ideas, Vision, Long-term objectives, SWOT Analysis (Strength, Weakness, Opportunities, Threats).


Project Selection – Decision Matrix, Technique for Order Preference using Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW).
**Project Presentation:** WBS, Project Network – Activity on Arrow (A-O-A), Activity on Node (A-O-N).

**Project Scheduling:** Gant Chart, Critical Path Method (CPM), Project Evaluation & Review Technique (PERT). *(6hrs)*

Linear time cost trade-offs in project - Direct cost, indirect cost, Project crashing

**Resource Consideration:** Profiling, Allocation, Levelling.

**Introduction to project management software:** Primavera/ Microsoft project

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**Unit 3**

**Project Execution:** Monitoring control cycle, Earned Value Analysis (EVA), Project Control – Physical control, Human control, financial control.

**Organizational and Behavioral Issues:** Organizational Structure, Selection-Project Manager, Leadership Motivation, Communication, Risk Management.

**Project Termination:** Extinction, Addition, Integration, Starvation.

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**TEXT BOOKS**

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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- To impart knowledge on the fundamentals of costing, pricing methods and strategies.
- To give an overview of production operations planning.
- To summarize various quantitative methods of plant location, layout and lean manufacturing.
- To familiarize the concepts of e-commerce, e-purchasing, MRP and ERP in business

Course Outcomes

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

**CO1:** Understand the concepts of cost and pricing of goods and appraise project proposals

**CO2:** Design and analyze manufacturing and service processes and to measure the work performed.

**CO3:** Understand and analyze the key issues of supply chain Management

**CO4:** Understand the application of lean manufacturing tools and six sigma concepts

**CO5:** Select appropriate plant location and their layout methods

**CO6:** Create capacity plan, aggregate plan, schedule, ERP & MRP systems

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Syllabus

Unit 1


**Unit 2**


– importance, planning process, methods – problems.

**Unit 3**


**TEXT BOOKS**

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*CA – Can be Quizzes, Assignments, Projects, and Reports.
Course Objectives

Familiarizing the students with quantitative tools and techniques, which are frequently applied in operational decisions

Course Outcomes

CO1: Formulate operations research models to optimize resources.
CO2: Solve transportation and assignment problems using suitable techniques.
CO3: Apply appropriate technique to analyze a project with an objective to optimize resources.
CO4: Solve operational problems using decision theory approaches.
CO5: Select suitable inventory model for effective utilisation of resources.
CO6: Solve Operations Research problems using software package

CO/PO Mapping

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Syllabus

Unit 1


Unit 2

Decision Theory: Decision Trees. Game theory - 2 person zero sum; mixed strategies; 2 x n and m x 2 games. Network Models- Project Networks- CPM / PERT- Project Scheduling – crashing networks and cost considerations-Resource
leveling and smoothing - shortest route problem, minimal spanning tree problem, maximal flow problem.

**Unit 3**

Sequencing model – 2 machines ‘n’ jobs, ‘m’ machines ‘n’ jobs – n jobs 2 machines.


Simulation – Monte Carlo simulation: simple problems

**Lab session**: Practicing case problems with excel solver/MatLab/LINGO package

**TEXT BOOK**


**REFERENCE BOOKS**


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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- To inculcate the concepts of work study and its application to industrial practice
- Impart skills to design, develop, implement, and improve manufacturing/service systems

Course Outcomes

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

**CO1:** Create value to organizations through the analysis, evaluation, and improvement of work systems using work study and method study

**CO2:** Develop work systems through motion economy principles

**CO3:** Apply work measurement techniques to improve productivity, fix wages and incentives

**CO4:** Apply systematic layout planning techniques and work station design principles based on ergonomics and material handling.

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**SyllabusUnit 1**

Work System: Elements of work, maintenance of machines, interaction, effect of working conditions and environment, physical and mental fatigue.

Productivity: Productivity, factors affecting production, Measurement of productivity.

Work Study: Definition and scope of work study; Areas of application of work study in industry; Human aspects of work study.
Method Study: Information collection, recording techniques, and processing aids; critical examination; development, installation and maintenance of improved methods.

Unit 2

Motion Economy and Analysis: Principles of motion economy; Motion analysis; Micromotion and Memomotion study; Therbligs and SIMO charts; Normal work area and design of work places; Basic parameters and principles of work design.

Work Measurement: Work measurement techniques; Calculation of standard time, work sampling and predetermined Motion time systems.

Wages and Incentive Schemes: Introduction, wage payment of direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour

Unit 3

Plant Layout: Concept of plant layout, types of layout; factors affecting plant layout.

Ergonomics: Ergonomic Design of equipment and work place. work station design, factors considered in designing a work station, ergonomic design standards - Study of development of stress in human body and their consequences. Case Studies. Production planning and scheduling.

Material Handling: Introduction and functions of material handling equipment, selection of material handling equipment for different requirements, safety requirements.
Recent advances in Industrial Engineering.

**TEXT BOOKS**


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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objective

To impart the knowledge of basic statistical tools for analysis and interpretation of qualitative and quantitative data for decision making.

Course Outcomes

CO1: Apply basic probability and statistics concepts for various business problems
CO2: Perform test of hypothesis
CO3: Compute and interpret the result of regression and correlation analysis for forecasting
CO4: Solve real time problems by applying different decision making methods.

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Syllabus

Unit 1

Quantitative methods: Basic terminology in probability, probability rules, conditions of statistical dependence and independence, Bayes Theorem, Discrete Random Variables review of probability distributions, measure of central tendency.

Sampling and sampling distributions: Introduction to sampling, random sampling, design of experiments, introduction to sampling distributions

Estimation: point estimates, interval estimates and confidence intervals, calculating interval estimates of mean from large samples, using t test, sample size estimation.

Unit 2
Testing hypothesis: Introduction, basic concepts, testing hypothesis, testing when population standard deviation is known and not known, two sample tests.

Chi-square and analysis of variance: introduction, goodness of fit, analysis of variance, inferences about a population variation

Unit 3

Regression and correlation: Estimation using regression line, correlation analysis, finding multiple regression equation, modelling techniques,

Non-parametric methods and time series and forecasting: Sign test for paired data, rank sum test, rank correlation, Kolmogrov – Smirnov test, variations in time series, trend analysis, cyclic variation, seasonal variation and irregular variation. Decision theory: Decision tree analysis

TEXT BOOKS


REFERENCE BOOKS

March 2000 - 2nd Edition


Evaluation Pattern

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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objective

To impart knowledge on quality management principles, tools, techniques and quality standards for real life applications.

Course Outcomes

CO1: Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.

CO2: Evaluate the performance measures using various quality and management tools.

CO3: Apply the Quality Function Deployment, Taguchi principles, Total Productive Maintenance and Failure Mode and Effect Analysis concepts to solve industrial problems.

CO4: Practice the various quality system in industry.

CO/PO Mapping

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Syllabus

Unit 1

Definition of quality - dimensions of quality. Quality planning - quality costs. Total Quality Management: historical review and principles –leadership - quality council - quality statements - strategic planning - Deming philosophy. Barriers to TQM implementation

Unit 2

Customer satisfaction – Customer retention - Employee involvement - Performance appraisal - Continuous process improvement - Supplier partnership - Performance measures. Seven tools of quality. Statistical fundamentals - Control Charts for variables and attributes - Process capability - Concept of six sigma - New seven management tools - Benchmarking.

Unit 3

TEXT BOOK


REFERENCE BOOKS

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*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- Understand Lean manufacturing principles and tools
- Inculcate the concepts of value stream mapping
- Familiarize lean implementation practices

Course Outcomes

CO1: Identify key requirements and concepts in lean manufacturing.

CO2: Initiate a continuous improvement change program in a manufacturing organization

CO3: Analyze and improve a manufacturing system by applying lean manufacturing tools

CO4: Build value stream map for improving the productivity

CO5: Improve productivity through lean practices

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Syllabus

Unit 1

Introduction to Lean and Factory Simulation: History of Lean and comparison to other methods - The 7 Wastes, their causes and the effects - An overview of Lean Principles / concepts / tools - Stockless Production.


Ford production systems – FPS gear model

Unit 2

Value Stream Mapping – Current state: Preparation for building a Current State Value Stream Map – Building a Current State Map (principles, concepts, loops, and methodology) – Application to the factory Simulation scenario.
Unit 3

Value Stream Mapping – Future State: Key issues in building the Future State Map – Process tips in building the map and analysis of the customer loop, supplier loop, manufacturing loop and information loop – Example of completed Future State Maps – Application to factory simulation


TEXT BOOKS


REFERENCES BOOKS

## Evaluation Pattern

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*CA – Can be Quizzes, Assignments, Projects, and Reports*
Course Objectives

- This course describes the key aspects of a software project.
- It introduces the basic principles of Engineering Software Projects. Most, if not all, students’ complete projects as part of assignments in various courses undertaken. These projects range in size, subject and complexity but there are basic project essentials that need to be understood and practiced for successful team project outcomes.
- The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process management for software development.

Course Outcomes

CO 1: To understand the basic concepts, terminologies and issues of software project management.

CO 2: To apply appropriate methods and models for the development of solutions.

CO 3: To analyze the cost-benefits of calculations so as to optimize the selection strategy

CO 4: To evaluate methods, models and technologies towards achieving project success

CO 5: To design and evaluate network planning models with criticality

CO-PO Mapping

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Syllabus

Unit 1

Introduction to Software Project Management- Software Projects - ways of categorizing software projects - problems with software projects - Project Life Cycle- Management - Setting objectives - Stakeholders - Project Team- Step-wise

An overview of project planning - project Evaluation - Selection Of Appropriate Project Objectives- Software Effort Estimation Techniques, Function Point Analysis- Object Point-COCOMO.
Unit 2

Activity planning -- project schedules - sequencing and scheduling projects - Network planning model – AON and AOA - identifying critical activities - Crashing And Fast Tracking - Risk management — Categories, Risk planning, Management and Control - Evaluating risks to the schedule. PERT - Resource Allocation, Monitoring and Tracking - Monitoring and control - allocation - identifying resource requirements - scheduling resources - creating critical paths

- publishing schedule - cost schedules - sequence schedule.

Unit 3

Monitoring and control – Visualizing Progress, Earned value analysis, managing people and organizing teams - organizational structures - Planning for small projects. Case Study: PMBOK, Agile Development

TEXT BOOK(S)


REFERENCE(S)


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Pre-Requisite(s): 19MAT112 Linear Algebra, 19MAT205 Probability and Random Processes

Course Objectives

- This course serves as an introduction to financial engineering including cash flows, financial decision making etc.
- It gives a thorough yet highly accessible mathematical coverage of standard and recent topics of introductory investments: fixed-income securities, modern portfolio theory, optimal portfolio growth and valuation of multi-period risky investments.

Course Outcomes

CO1: Apply basic concepts to understand and evaluate cash flows

CO2: Evaluate and arrive at a financial investment decision employing the underlying knowledge of stocks and derivatives

CO3: Analyse and design Portfolio selection methods

CO4: Understand capital market theory for stock performance evaluation

CO-PO Mapping

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Syllabus

Unit 1

Cash Flows and Fixed income securities: Investments and markets - Principal and interest - Present and future values of streams - IRR. Fixed income securities - Market value for future cash - Bond value - Bond details - Yields – Convexity – Duration - Immunization. Bond portfolio management - Level of market interest rates, Term structure of interest-rate theories.
Unit 2


- Black Scholes formula - Utility functions - Applications in financial decision making.

Unit 3


TEXT BOOK(S)

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives

- Prepare engineering students to analyze and understand the business, impact of economic environment on business decisions

Course Outcomes

CO1: Understand and evaluate the economic theories, cost concepts and pricing policies and draw inferences for the investment decisions for appraisal and profitability

CO2: Appraise the dynamics of the market and market structures and portray implication for profit and revenue maximization

CO3: Employ operations research and allied techniques in managerial economics for an enhanced analysis and decision making

CO-PO Mapping

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Unit 1


Unit 2


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Objectives

- This course is to expose the students to the managerial issues relating to information systems and also understand the role of Business Process Reengineering technique in an organization.
- The course also focuses on the management of information technology to provide efficiency and effectiveness or strategy decision making.

Course Outcomes

CO1: Understand the fundamental concepts of Information Systems in business.

CO2: Understand and analyze the strategic role played by Information Systems in e-commerce.

CO3: Analyse management challenges in Global Businesses predominantly dependent on IS functions.

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Syllabus Unit 1


Unit 2


Unit 3


TEXT BOOK(S)

REFERENCE(S)

Laudon K, Laudon JP. Management Information Systems; 2010

Evaluation Pattern

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMS COMMON TO ALL PROGRAMS

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<td>ACHIEVING EXCELLENCE IN LIFE - AN INDIAN PERSPECTIVE</td>
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Course Objectives:

The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.

Syllabus

Unit 1

Goals of Life – Purushartha

What are Purushartha (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;

Yogic way of Achieving Life Goals – (Stress Free & Focused Life)

Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop); Experiencing life through its Various Stages

Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2

Personality Development

What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;

Learning Skills (Teachings of Amma)

Art of Relaxed Learning; Art of Listening; Developing ‘Shraddha’ – a basic qualification for obtaining Knowledge; Communication Skills - An Indian Perspective;

Unit 3

Developing Positive Attitude & Friendliness - (Vedic Perspective);

Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);

Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);
REFERENCE BOOKS:

1. Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9
2. Complete works of Swami Vivekananda (Volumes 1 to 9)
3. Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)
4. Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)
7. Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
10. Yoga In Daily Life - Swami Sivananda – published by Divine Life Society
12. All about Hinduism – Swami Sivananda - Published by Divine Life Society
15. Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi

17. *Mind Sound Resonance Technique (MSRT)* Published by Swami Vivekananda Yoga Prakashana, Bangalore.

18. *Yoga & Memory* - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.

**Evaluation Pattern**

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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1

1. The anatomy of ‘Excellence’. What is ‘excellence’? Is it judged by external factors like wealth?
2. The Great Flaw. The subject-object relationship between individual and world. Promote subject enhanceexcellence.
3. To work towards excellence, one must know where he is. Our present state... An introspective analysis. Our faculties within.

Unit 2

4. The play of the mind. Emotions – convert weakness into strength.
5. The indispensable role of the intellect. How to achieve and apply clear thinking?
7. Increase Productivity, reduce stress. work patterning.

Unit 3

8. The art of right contact with the world. assessment, expectations.
9. Myths and Realities on key issues like richness, wisdom, spirituality.
10. Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:

The Bhaja Govindam and the Bhagavad Gita.

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OBJECTIVES:

This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as actual techniques.

Syllabus

Unit 1

1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2

1. Astronomy & mathematics in Jain and Buddhist literature;
2. The transition to the Siddhantic period; Aryabhata and his time;
3. The Aryabhatiya: concepts, content, commentaries;
4. Brahmagupta and his advances;
5. Other great Siddhantic savants;
6. Bhaskara II and his advances;

Unit 3

1. The Kerala school of mathematics;
2. The Kerala school of astronomy;
3. Did Indian science die out?;
4. Overview of recent Indian scientists, from S. Ramanujan onward;
5. Conclusion: assessment and discussion;

TEXTBOOK:

*Indian Mathematics and Astronomy: Some Landmarks*, by S. Balachandra Rao

REFERENCE:

*IFIH’s interactive multimedia DVD on Science & Technology in Ancient India.*

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OBJECTIVES:

This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.

Syllabus

Unit 1

Introduction

Introduction to Modern Psychology

A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology

What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of all Yoga schools.

Patanjali Yoga Sutra – 1


Patanjali Yoga Sutra – 2


Unit 2

Patanjali Yoga Sutra – 3

Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

Patanjali Yoga Sutra – 4

Main obstacles in the path of Yoga: other obstructions - removal of obstacles by one-pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.


Patanjali Yoga Sutra – 10

Asanam – Pranayamah - various kinds of Pranayamah - Pratyahararar - Mastery over the senses. Report review Conclusion

REFERENCES:

1. The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
3. Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttarajan.
4. ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To introduce business vocabulary; to introduce business style in writing and speaking; to expose students to the cross-cultural aspects in a globalised world; to introduce the students to the art of persuasion and negotiation in business contexts.

Course Outcomes

CO1: Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in the professional context

CO2: Understand organizational structures, pay structures and performance assessments

CO3: Apply language skills in drafting various business documents and other necessary communications in the business context

CO4: Understand and address cross cultural differences in the corporate environment

CO5: Participate in planned and extempore enactments of various business situations

CO-PO Mapping

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Syllabus

Unit 1

Unit 2

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

Unit 3

Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques.

Activities

Case studies & role-plays.

BOOKS RECOMMENDED:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
OBJECTIVES:

To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about the societal changes in the recent past.

Syllabus

Unit 1
Poems
Rabindranath Tagore’s Gitanjali (1-10); Nizzim Ezekiel’s Enterprise; A.K. Ramanujam’s Small-Scale Reflections on a Great House.

Unit 2
Prose
Khushwant Singh’s The Portrait of a Lady; Jhumpa Lahiri’s Short Story - Interpreter of Maladies.

Unit 3

Drama and Speech
Vijay Tendulkar’s Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru/ S. Radhakrishnan
/ A. P. J. Abdul Kalam’s My Vision for India etc. (any speech).

REFERENCES:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.

Syllabus

Unit 1
Poems

Unit 2
Short Stories

Unit 3
Prose

Practicals:

Role plays: The Proposal, Chekov / Remember Ceaser, Gordon Daviot / Final Solutions, Mahesh Dattani, Bookreviews, Movie reviews.

SUGGESTED READING:

The Old Man and the Sea, Hemingway / Any one of the novels of R.K. Narayan, etc.

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OBJECTIVES:

To introduce the students to the elements of technical style; to introduce the basic elements of formal correspondence; to introduce technical paper writing skills and methods of documentation; to improve oral presentation skills in formal contexts.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand and use the basic elements of formal correspondence and methods of documentation

CO2: Learn to edit technical content for grammatical accuracy and appropriate tone and style

CO3: Use the library and internet recourses for research purposes

CO4: Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities

Mapping of course outcomes with program outcomes:

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Syllabus:
Unit 1


Unit 2

Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals -reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

Unit 3


Practice in oral communication and Technical presentations

REFERENCES:

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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
OBJECTIVES:

To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio-cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Syllabus
Unit 1

Unit 2

Unit 3
Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

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REFERENCE:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

Population - Identity

How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions; Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

Unit 2

The suburbs - At the train station

Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city (church, town hall, post office...)

Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3

Paris and the districts - Looking for a room

Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.

Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:

Metro St Michel - Publisher: CLE international

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

The first room of a student

A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière, dans…), Read advertisement; Appreciation (I like, I prefer,).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son…); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2 Small jobs

Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.
Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec …); Pronoun as direct object (le, la, l’, les).

Unit 3

University Restaurant

Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de…); Comparison (plus...que, moins....que, autant ...que); Interrogation (continuation), inversion, Est-ce que, qu’est-ce que?.

TEXTBOOK:

Metro St Michel - Publisher: CLE International

Evaluation Pattern

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation. Numbers 1-100; Saying the telephone number. Countries and Languages.

Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles.

Vocabulary: Professions.

Unit 2

Giving the personal details. Name, age, marital status, year of birth, place of birth, etc. Numbers till 1000. Saying a year. Alphabets – spelling a word.

Filling up an application form; In the restaurant – making an order.

Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article Vocabulary: Food items.

Unit 3


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Syllabus

Unit 1
Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form. Vocabulary: Consumables and measurements;

Unit 2
Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing up an appointment.

Grammar: Model verbs; Prepositions with time and place; Ordinal numbers. Vocabulary: Leisure activities, weekdays, months and seasons.

Unit 3
Family and household; Family and relations; household and daily routine. Grammar: Possessive articles; Divisible and indivisible verbs.

Vocabulary: Family circle; Household articles.

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Syllabus

To have an elementary exposure to German language; specifically

1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.

(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.) Some useful websites will be given.

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Syllabus

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative. Some German culture. Films.

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OBJECTIVES:

To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Gain knowledge about the nature and culture of Hindi language
CO2: Understand the structural aspects of Hindi language
CO3: Apply the knowledge of the grammatical structures to communicate in Hindi
CO4: Analyse the social significance of modern literature.
CO5: Develop the ability to translate a given text to Hindi

CO-PO Mapping:

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Syllabus

Unit 1

Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindilanguage,
Devanagari script and Hindi alphabet.


Unit 2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context –understanding proper pronunciation - Conversations, Interviews, Short speeches.

Unit 3

Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit 4


Unit 5

Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloo.
BOOKS:

1. Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran, Anuvad thaha Rachana: Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi

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OBJECTIVES:

Appreciation and assimilation of Hindi Literature both drisya & shravya using the best specimens provided as anthology.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Understand the grammatical structures of Hindi CO2: Understand the post modern trends of literature CO3: Enhance critical thinking and writing skills CO4: Identify and analyse different literary and audio-visual material CO5: Apply fundamental knowledge of Hindi in formal and informal writing

CO-PO Mapping:

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Syllabus:

Unit 1
Kavya Tarang; Dhumil ke Anthim Kavitha [Poet-Dhumil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakth [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

Unit 2
Communicative Hindi - Moukhik Abhivyakthi

Unit 3
Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. Newsreading and presentations in Radio and TV channels in Hindi.

Unit 4
Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

Unit 5

BOOKS:
2. *Gadya Manjusha: Editor: Govind, Jawahar Pustakalay, Mathura*

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Syllabus

Unit 1

Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2


Unit 3

Emotional Intelligence at Work place: Importance of Emotional Intelligence at Work place? Cost–savings of Emotional Intelligence, Emotionally Intelligent Leaders, Case Studies Measuring Emotional Intelligence: Emotionally Intelligence Tests, Research on Emotional Intelligence, Developing Emotional Intelligence.

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Syllabus

Unit 1
Introduction
General Introduction; ‘His + Story’ or ‘History’?; The concepts of ‘nation’, ‘national identity’ and ‘nationalism’; Texts and Textualities: Comparative Perspectives.

Unit 2
Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

Unit 3
Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:
Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.

Conclusion.

REFERENCES:
1. Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.
2. Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.
5. Coomaraswamy, Ananda K. Essays in Indian idealism (any one essay) / Dance of Shiva.

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Syllabus

Unit 1

Introduction

A peep into India’s glorious past

Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira’s ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmany Dharma and the rise of Jainism and Buddhism

– the sixteen Mahajanapadas and the beginning of Magadhan paramountcy - Kautilya and his Arthasasstra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2

India’s contribution to the world: spirituality, philosophy and sciences

Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.

The arrival of Europeans, British paramountcy and colonization

What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wrecked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

Unit 3

Women in Indian society

The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadaranyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya’s Arthasasstra and Mrichchhakatikamof Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

Modern India

The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore;
Understanding Mahatma Gandhi: A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

Conclusion

The Wonder that was India; The ‘politics’ and ‘purpose’ of studying India.

REFERENCES:

17. Aurobindo, Sri. The Indian Renaissance / India’s Rebirth / On Nationalism.
25. Danino, Michel. The Invasion That Never Was.
34. Dharampal. Archival Compilations (unpublished)

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# Syllabus

## Unit 1
### Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.

Ancient India – up to 600 B.C.

Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramarajya) – Yudhisthira’s ramarajya; Sarasvati - Sindhu civilization and India’s trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

## Unit 2
### Classical India: 600 B.C. – 1200 A.D.

The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya’s Arthasastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India’s maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.

Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

## Unit 3
### Modern India: 1720 - 1947

the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was ‘traditional’ or ‘Indian’) – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways –
money and credit – foreign trade; Towards partition – birth of two new nations
– division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947

India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new/emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

Introduction to Health

Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2

Food and Nutritional Requirements during Adolescence

Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3

Need for a Positive Life Style Change

Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire-healthy Snacks

TEXTBOOKS:

**REFERENCE BOOKS:**

2. WHO Report on Adolescent Health: 2010

**Evaluation Pattern**

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Introductory study of the Bhagavad Gita and the Upanishads.

Unit 2
The relevance of these classics in a modern age.

Unit 3
Goals of human life - existential problems and their solutions in the light of these classics etc.

REFERENCE:

The Bhagavad Gita, Commentary by Swami Chinmayananda

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
PREAMBLE:

This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Syllabus

Unit 1

A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2

Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3

Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

TEXTBOOK:

Material given by the Faculty

BACKGROUND LITERATURE:

1. Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
2. Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
3. *Invitations to Indian Philosophy*, T. M. P. Mahadevan, University of Madras, Chennai.
4. *Outlines of Indian Philosophy*, M. Hiriyanna, MLBD.
6. *India Since 1526*, V. D. Mahajan, S. Chand & Company
8. *India’s Rebirth*, Sri Aurobindo.
13. *Awaken Children: Conversations with Mata Amritanandamayi*
15. *Indian Philosophy of Beauty*, T. P. Ramachandran, University of Madras, Chennai.
Evaluation Pattern

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit; to help students appreciate and imbibe India’s ancient culture and values.

Syllabus

Unit 1


Unit 2

Language Studies - Role of Sanskrit in Indian & World Languages.

Unit 3


Unit 4


Unit 5

Indology Studies – Perspectives and Innovations.

TEXTBOOKS AND REFERENCE BOOKS:

1. Vakya Vyavahara- Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi
2. The Wonder that is Sanskrit - Dr. Sampadananda Mishra, New Delhi
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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1

Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.

NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village / slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2

Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3

Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.

Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy lifestyle

Unit 4

Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.


Unit 5

Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.

Project Work / Practical
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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
23HUM239  PSYCHOLOGY FOR EFFECTIVE LIVING  L-T-P-C: 2-0-0-2

Course Objectives

1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Course Outcome

CO 1: Understand the basic concepts of Behavioral Psychology
CO 2: Demonstrate self reflective skills through activities
CO 3: Apply the knowledge of psychology to relieve stress
CO 4: Analyse the adverse effects of health compromising behaviours.
CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping

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Syllabus

Unit 1

Self-Awareness & Self-Motivation
Self analysis through SWOT, Johari Window, Maslow’s hierarchy of motivation, importance of self esteem and enhancement of self esteem.

Unit 2

The Nature and Coping of Stress


Unit 3

Application of Health Psychology

Health compromising behaviours, substance abuse and addiction.

TEXTBOOKS:

1. V. D. Swaminathan & K. V. Kaliappan “Psychology for effective living - An introduction to Health
REFERENCE BOOKS:


Evaluation Pattern

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as a whole
3. To connect the concepts of psychology to personal and professional life

Course Outcome

CO 1: Understand the fundamental processes underlying human behavior such as learning, motivation, individual differences, intelligence and personality.

CO 2: Apply the principles of psychology in day-to-day life for a better understanding of oneself and others.

CO 3: Apply the knowledge of Psychology to improve study skills and learning methods

CO 4: Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurture healthy relationships.

CO-PO Mapping

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Syllabus

Unit 1

Psychology of Adolescents: Adolescence and its characteristics.

Unit 2

Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills,
Mnemonics.

**Unit 3**

Attention & Perception: Definition, types of attention, perception.

**TEXTBOOKS:**


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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1
Introduction
Western and Indian views of science and technology
Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2
Indian sciences
Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD
Science and technology under the British rule
Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3
Science and technology in Independent India
Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition
Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion
REFERENCES:

18. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

* The syllabus and the study material in use herein has been developed out of a ‘summer programme’ offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha. ArjunaVishada

Yoga: Arjuna’s Anguish and Confusion – Symbolism of Arjuna’s Chariot.


Unit 2

Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3


TEXTBOOKS / REFERENCES:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

Syllabus

Unit 1
An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

Unit 2
The challenge of human experience & problems discussed in the Upanishads — the True nature of Man — the Moving power of the Spirit — The Message of Fearlessness — Universal Man - The central problems of the Upanishads — Ultimate reality — the nature of Atman - the different manifestations of consciousness.

Unit 3
Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada’s answers to the six questions in Prasnopanishad.

REFERENCES:

1. The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama
3. Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press
4. Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore
5. Upanishads in Daily Life, Sri Ramakrishna Math, Mylapore.
7. Upanishad Ganga series – Chinmaya Creations

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:

- To introduce the significance of food, nutrients, locally available food resources, synergic food combinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food, allergic food, food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.

Course Outcome:

CO1: Acquire knowledge about the various food and food groups

CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups

CO3: Understand the significance of safe food and apply the food safety standards

CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives

CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

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Syllabus

Unit 1

Food and Food Groups

Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food poisoning, food safety standards.
Cookery Practicals - Balanced Diet

Unit 2

Nutrients and Nutrition
Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

Practicals - Traditional Foods

Unit 3

Introduction to Food Biotechnology
Future foods - Organic foods and genetically modified foods, Fortification of foodsvalue addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food
technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

Practicals - Value added foods

TEXTBOOKS:


REFERENCE BOOKS:


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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover, this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Syllabus

Unit 1
Adalitha Kannada: bhashe, swaroopa, belavanigeya kiru parichaya Paaribhaashika padagalu
Vocabulary Building

Unit 2
Prabhandha – Vyaaghr Geethe - A. N. Murthy Rao
Prabhandha – Baredidi...baredidi, Baduku mugiyuvudilla allige...- Nemi Chandra Paragraph writing –Development: comparison, definition, cause & effect Essay – Descriptive & Narrative

Unit 3
Mochi – Bharateepriya
Mosarina Mangamma – Maasti Venkatesh iyengar Kamalaapurada Hotelnalli – Panje Mangesh Rao Kaanike – B.
M. Shree

Unit 4
Letter W riting - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5
Reading Comprehension; nudigattu, gaadegalu Speaking Skills: Prepared speech, pick and speak
REFERENCES:

1. H. S. Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru
2. N. Murthy Rao – Aleyuva Mana – Kuvi Kanna Adhyaya Samste
3. Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication
4. Sanna Kathegalu - Prasaranga, Mysuru University, Mysuru
5. B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu
6. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.
7. Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Syllabus

Unit 1
Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2
Nanna Hanate - Dr. G. S. Shivarudrappa
Ella Marethiruvaga - K. S. Nissaar Ahmed Saviraru Nadigalu – S Siddalingayya

Unit 3

Unit 4
Sarva Sollegala turtu Maha Samelana - Beechi Swarthakkaagi Tyaga - Beechi

Unit 5
Essay writing: Argumentative & Analytical Précis writing

REFERENCES:

1. H. S. Krishnaswami Iyanger – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
4. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house
5. Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication

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Course Objectives:

To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality

Course Outcome:

After the completion of the course the student will be able to:

CO1: Understand and inculcate philosophical thoughts and practices
CO2: Understand and appreciate the post modern trends of literature.
CO3: Analyse the literary texts and comprehend the cultural diversity of Kerala
CO4: Distinguish the different genres in Malayalam literature
CO5: Demonstrate the ability to effectively communicate in Malayalam

CO-PO Mapping:

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Syllabus Unit 1
Ancient poet trio: Adhyatmaramayanam,
Lakshmana Swanthanam (valsa soumitre... mungikidakayal), Ezhuthachan - Medieval period classics –Jnanappana (kalaminnu... vilasangalingane), Poonthanam

Unit 2

Unit 3
Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer - Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4
Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

Unit 5
Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettilatha Malayalam
Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:


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OBJECTIVES:

To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Course Outcome:

After the completion of the course the student will be able to:

CO1: Understand the different cultural influences in linguistic translation
CO2: Identify and appreciate the Romantic elements of modern literature
CO3: Analyze the genre of autobiographical writing
CO4: Critically evaluate the significance of historical, political and socio-cultural aspects in literature
CO5: Demonstrate good writing skills in Malayalam

CO-PO Mapping:

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Syllabus Unit 1

Unit 2

Unit 3
Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

Unit 4
Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.

Unit 5
Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam
Writing - a. Expansion of ideas; b. Précis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Syllabus

Unit 1
Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit

Unit 2
Verbs- Singular, Dual and plural – First person, Second person, Third person. Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi-karthariprayoga

Unit 3
Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4
Selected slokas from Valmiki Ramayana, Kalidasa’s works and Bhagavad Gita. Ramayana – chapter VIII - verse5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa’s Sakuntalam Act IV – verse 4

Unit 5
Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. *Namalinganusasnam* by Amarasimha published by Travancore Sanskrit series

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OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Syllabus

Unit 1

Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2


Unit 3

Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

Unit 4

Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas- Bhagavad Gita – chapter - II verse 47, chapter - IV verse 7, chapter -VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa’s Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5

Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
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*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1
Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy, CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2
CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3
Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

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23SWK231 WORKPLACE MENTAL HEALTH L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Mental Health – concepts, definition, Bio psycho-social model of mental health. Mental health and mental illness, characteristics of a mentally healthy individual, Signs and symptoms of mental health issues, presentation of a mentally ill person. Work place – definition, concept, prevalence of mental health issues in the work place, why invest in workplace mental health, relationship between mental health and productivity, organizational culture and mental health. Case Study, Activity.

Unit 2


Unit 3

Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being- corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case Study, Activity.

REFERENCES:

3. Canadian Mental Health Association, Ontario “Workplace mental health promotion, A how to guide” wmhp.cmhaontario.ca/
6. Mental Health Act 1987 (India) www.mhealth.org/mha.htm
7. Persons with disabilities Act 1995 (India) socialjustice.nic.in
8. The Factorys Act 1948 (India) www.caaa.in/image/19ulabourlawshb.pdf

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Course Objectives:

- To introduce the students to different literature - Sangam literature, Epics, Bhakthi literature and modern literature.
- To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

Course Outcomes

CO 1: To understand the Sangam literature CO 2: To understand the creative literature CO 3: To understand the literary work on religious scriptures CO 4: To improve the communication and memory skills CO 5: To understand the basic grammar components of Tamil language and their usage and applications CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

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Syllabus

Unit 1

The history of Tamil literature: Nāṭṭupurap pāṭalkal, kataikkal, pajamolikal - cirukataikal tōṟṟamum valarcciyum, cirilakkiyankal: kalinkattup paraṇi (pōrpāṭiyatu) - mukkūṭar paḻu 35.

Kēppiyankal: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiṅciṟuṇ kēppiyankal toṭarpāṇa ceytikal.

Unit 2

tiṇai ilakkiyamum niṭṭiyilakkiyamum - patiṇeṇkijjikanakkū nūlkal toṭarpāṇa piṟa ceytkal - tirukkuraḷ (aṉṟu, paṇpu, kalvi, oļukkam, naṭpu, vāymai, kēlvī, ceynṇṟi, periyāraittunakkōṭal, vēḻippunaru pēṟa atikārattil uḷḷa ceytkal.

Aṟanūlkaḷ: Ulakanīti (1-5) – elāti (1,3,6). - Cittarkal: Kaṭuveḷi cittar pāṭalkal (aṅnantak kalippu –1, 4, 6, 7, 8), maṟṟum akappēy cittar pāṭalkal (1-5).

Unit 3

tamil ilakkanam: Vākkiya vaikaikal – taṉviṇai piṟaviṇai – nēṛkkūṟu ayaṇkūṟu
Unit 4


Unit 5


Textbooks:


Evaluation Pattern

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*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives

- To learn the history of Tamil literature.
- To analyze different styles of Tamil Language.
- To strengthen the creativity in communication, Tamil basic grammar and use of computer on Tamil Language.

Course Outcomes

CO 1: Understand the history of Tamil literature.

CO 2: Apply practical and comparative analyses on literature.

CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature.

CO 4: Understand the tamil scholars’ service to Tamil language and society.

CO 5: Understand components of Tamil grammar and its usage.

CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

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Syllabus

Unit 1

The history of Tamil literature: Nāṭṭupurap pāṭalkal, kataikkal, pajamolikal - cirkukataikal tōṟṟamum valarcciyum, cirkilakkiyankal: Kalinkattup paraṇi (pōrpāṭiyatu) - mukkūṭar paḻu 35.

Kāppiyankal: Cilappatikāram – manimēkalai naṭaiiyial āyvu marṟum imperum – aiṉićiruṅ kāppiyankal toṭarpāṅa ceytikal.

Unit 2

tiṇai ilakkiyamum nitiyilakkiyamum - paṭiṇeṅkikkanakku nūlkal toṭarpāṅa piṟa ceytikal - tirukkuṟal (aṟpu, paṉpu, kalvi, oḷukkam, natpu, vāymai, kēḷvi, ceynaṟi, periyāraitunakkōṭaḷ, vilippunaru daratula ceytikal.

Aṟanūlkaḷ: Ulakanīti (1-5) – elāti (1,3,6). - Cittarkal: Katuveli ciṭṭar pāṭalkal (āṉantak kalippu −1, 4, 6, 7, 8), marṟum akappēy cittar pāṭalkal (1-5).
Unit 3

தமிழ் இலக்கணம்: வாக்கியா வகால் – தாண்பிட்டை பிரவினை – நெர்க்குர்ச் அயர்க்குர்ச்

Unit 4

தமிழகா ஆர்களின் தமிழ் தொந்தும் சமுதாய தொந்தும்: பராதியர், பராதிஷ்கான், பாதுக்கோட்டை கல்யாணநுட்பதானம், சுராதா, சுஜாதா, சிர்பி, மெற்றா, பாரூலர் ரகுமான், na Piczaimūrtti, akilaṅ, kalkī, ji. Yu. Pōp, vīramāmunivar, anān, parimāṅ kalaiñar, maṟaimalaiyathikal.
### Unit 5

tamil moji āyvil kanini pavanpātu. - Karuttu parimāṟṟam - vilampaṟa mojjiyamaippu – pēccu - nātakam pataippu -cirukatai, katai, putiṇam pataippu.

### Text Books / References

Mu.Varatarācaṇ “tamil ilakiya varalāṟu” cāhitya aṅkāṭemi paplikēṇa, 2012


### Evaluation Pattern

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