UG-2 Sem-4 Syllabus

CSE Syllabus

Semester: 4

Type	Course Name	L-T-P-C
Institute Core	Computer and Communication Networks	3-1-0-4
Program Core	Fundamentals of Full Stack Development	2-1-1-4
Program Core	Theory of Computation	3-1-0-4
Program Core	Artificial Intelligence	3-1-0-4
SSHAM 6	Advanced Communication Skills	1-1-0-2
SSHAM 7	SSHAM 7	x-x-0-2
	Total Credits	**20**

Computer and Communication Networks

Institute Core

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

1. **Course Objectives:**

   The objective of this course is to impart knowledge of layered network architecture design and its services. This course will familiarise the students with understanding of standard protocols and its implementations.

2. **Syllabus:**

   Unit – 1 [6 Hours]: Guided transmission media: twisted pair, coaxial cable, fibre optic cable; Multiplexing: FDM and TDM: Packet switching and circuit switching: Internet protocol stack: ISO OSI reference model, Delay, loss and throughput in packet switched networks.

   Unit – 2 [10 Hours]: The web and HTTP; FTP; Electronic mail: SMTP; Domain name systems; Peer-to-peer networks.

   Unit – 3 [10 Hours]: Transport layer services; Multiplexing and demultiplexing; Principles of reliable data transfer: Go-Back-N and Sliding window, TCP, UDP, Congestion control.

   Unit – 4 [6 Hours]: Network Layer: Services of network layer, Virtual circuit and datagram networks, Internet protocol

   Unit – 5 [6 Hours]: Link-state routing and distance vector routing. Hierarchical routing, Routing in the internet, broadcast and multicast routing. Duration:

   Unit – 6 [10 Hours]: Link layer services, Error detection and correction; Multiple access protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Ethernet; WiFi. Next generation wireless networks, Intro to self optimization networks (SON).

3. **Course Outcomes:**

   At the end of the course, students should have the ability:

   i) To analyse new physical layer designs by demonstrating the understanding of the fundamentals in transmission media and layered network architecture.

   ii) To analyse and evaluate the network application by adopting applications layer protocols and transport layer services and propose modifications for performance improvement of industrial applications

   iii) To design and evaluate the topological and routing strategies for latest network architecture designs.

   iv) To demonstrate the link layer concepts using simulation skill and propose modifications for the performance improvements

4. Text Books:

a) Computer Networking: A Top-Down Approach, James F. Kurose and Keith W. Ross, 6th Edition, Addison Wesley . . ISBN-13: 978-0-13-285620-1

b) Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition pearson 2002 : ISBN:9788131731864.

5. Reference Books:

a) Andrew Tanenbaum , Davis Wetherall, Computer Networks 5th Edition, Pearson ISBN: 978-8131770221

b) Bobbi Sanberg, Networking the complete reference, 3rd Edition, Mc Graw Hills, ISBN: 978-0-07-182765-2

Fundamentals of Full Stack Development
(Course 1/3 under Full-Stack Development Track)

Program Core
L-T-P-C: 2-1-1-4

1. **Course Objectives:**

   The objective of this course is to teach the fundamentals of a web application and to introduce the basic frameworks and tools, using which the students can develop robust end-to-end web applications.

2. **Revised Syllabus:**

   Unit – 1 [6 Hours]: Introduction, What is a web application? History, What is a webserver, browser, HTTP/HTML/CSS

   Unit – 2 [8 Hours]: JavaScript and Browser, Browser internals: Rendering engine, JavaScript engine, etc; JavaScript introduction

   Unit – 3 [8 Hours]: JavaScript and Node, Introduction to Node, Tooling & Setup, JavaScript in Node

   Unit – 4 [6 Hours]: Introduction to MVC Frameworks: MVC pattern, Building MVC application with express

   Unit – 5 [6 Hours]: Introduction to Database. In-memory databases, RDMS and NoSQL Databases, Database integration (SQL): example: MariaDB/MySQL/PostgreSQL, Database integration (NoSQL) example: MongoDB

   Unit – 6 [14 Hours]: Project 1 (The industry members will be part of the panel evaluating projects.)

3. **Course Outcomes (Unit wise):**

   At the end of the course, students should have the ability:

   i) To describe how a web application works including the inner working of the related components/applications.

   ii) To demonstrate and design simple interactive webpage using Node.js

   iii) To demonstrate basics of integrating databases to the server side applications (backend)

   iv) To build and demonstrate an end to end web application

4. Text Books:

a) Herron, David. Node.js Web Development – 5th Edition: Server-side Web Development Made Easy with Node 14 Using Practical Examples. United Kingdom, Packt Publishing, 2020, ISBN: 9781838987572

5. Reference Books:

a) Crockford, Douglas. JavaScript: The Good Parts. United States, O'Reilly Media, 2008, ISBN: 9780596554873

b) Brown, Ethan. Web Development with Node and Express: Leveraging the JavaScript Stack. United States, O'Reilly Media, 2014, ISBN: 9781491902295

Theory of Computation

Program Core

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

1. **Course Objectives:**

   The objective of this course is a) to introduce basic concepts of the formal language theory and its applicability to decision problems; b) To make students to appreciate the theoretical concept called "undecidability"; c) To introduce how the difficulty of a solution can be measured by using the time complexity theory and thus make the student to appreciate and understand the NP-Completeness property of a class of problems.

2. **Syllabus:**

   Unit – 1 [8 Hours]: Introduction - Alphabets, Strings and Languages, Automata and Grammars; Deterministic finite Automata (DFA) - Formal Definition, Simplified notation, State transition graph, Transition table, Language of DFA; Nondeterministic finite Automata (NFA) - NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other

   Unit – 2 [8 Hours]: Regular Expression (RE) - Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions; Relation with FA - Regular expression to FA, DFA to Regular expression; Non Regular Languages - Pumping Lemma for regular Languages, Application of Pumping Lemma; Properties - Closure properties of Regular Languages, Decision properties of Regular Languages, Applications and Limitation of FA

   Unit – 3 [8 Hours]: Context Free Grammar (CFG) - Definition, Examples, Derivation, Derivation trees; Ambiguity in Grammar - Inherent ambiguity, Ambiguous to Unambiguous CFG; Normal forms for CFGs - Useless symbols, Simplification of CFGs, CNF and GNF; Context Free Languages (CFL) - Closure properties of CFLs, Decision Properties of CFLs, Emptiness, Finiteness and Membership, Pumping lemma for CFLs

   Unit – 4 [8 Hours]: Push Down Automata (PDA) - Description and definition, Instantaneous Description, Language of PDA; Variations of PDA - Acceptance by Final state, Acceptance by empty stack, Deterministic PDA; Equivalence of PDA and CFG - CFG to PDA and PDA to CFG

   Unit – 5 [8 Hours]: Turing machines (TM) - Basic model, definition and representation, Instantaneous Description; Variants of Turing Machine - TM as Computer of Integer functions, Universal TM; Church's Thesis; Language acceptance by TM - Recursive and recursively enumerable languages;

   Unit – 6 [8 Hours]: Decidability - Halting problem, Introduction to Undecidability, Undecidable problems about TMs; Complexity - Time Complexity, Problem classes - P, NP, NP-Hard, NP-Complete.

3. Course Outcomes:

At the end of the course, students should have the ability:

i) To design finite automata that solves the given problem
ii) To represent regular languages through finite automaton and regular expression.
iii) To generate the context free language from the given contex free grammar.
iv) To implement the Push Down Automata to recognize a given context free language along with the applicability of the theory in Compilers.
v) To learn the importance of Turing Machines and how it is related to the computable functions.
vi) To equip with theoretical understanding on how to show that some problems are not computable like the Halting problem. Student understands the NP-Compleness property of a class of problems.

4. Text Books:

a) John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Education, 3rd edition, 2014, ISBN: 978-0321455369
b) Michael Sipser, Introduction to the Theory of Computation, Cengage Learning, 3rd Edition, 2014, ISBN: 978-8131525296

5. Reference Books:

a) John C. Martin, Introduction to Languages and the Theory of Computation, McGraw-Hill Education, 4th edition, 2010, ISBN: 978-0073191461
b) Bernard M. Moret, The Theory of Computation, Pearson Education, 2002, ISBN: 978-8131708705

Artificial Intelligence

Program Core

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

1. **Course Objectives:**

   The objective of this course is to teach students to Identify, apply and solve problems using the AI tools, algorithms and techniques. Additionally, the course will expose students to real world problems from various domains and the contemporary AI tools that are used for solving those problems.

2. **Syllabus:**

   Unit – 1 [4 Hours]: Introduction- Definition and history of AI, Introduction to Intelligent agents

   Unit – 2 [8 Hours]: Problem solving by Searching - Uninformed search algorithms, Informed (Heuristic) search algorithms

   Unit – 3 [10 Hours]: Beyond Classical Search- Local Search algorithms, Adversarial Search, Constraint Satisfaction Problems

   Unit – 4 [8 Hours]: Logical Agents & Propositional Logic- Introduction to logical agents, Propositional logic, Propoitional inference mechanisms

   Unit – 5 [10 Hours]: First Order Logic & Inference- First Order Logic, Resolution - theorem proving, Rete algorithm for Forward chaining

   Unit – 6 [8 Hours]: Planning- Planning via searching, Classical planning algorithms, GraphPlan algorithm

3. **Course Outcomes:**

   At the end of the course, students should have the ability:

   i) To explain Artificial Intelligence and describe the fields and sub fields of Artificial Intelligence.

   ii) To employ suitable tree and graph search algorithms in the process of building an intelligent agent.

   iii) To build intelligent agents which is capable of operating in adversarial multi-agent (game-playing) environment and to also represent various problems as constraint-satisfaction problems, so that they can be solved using Constraint Satisfaction or SAT/SMT solvers.

   iv) To represent a problem in logic and utilize inference algorithms to power knowledge based intelligent agents

v) To build intelligent agents which can make effective use of automated planning algorithms for their planning needs.

4. Text Books:

a) Norvig, P., and Russell, S. J. (2016). Artificial Intelligence: A Modern Approach. United Kingdom: Pearson., ISBN-13: 978-0136042594

5. Reference Books:

a) Brachman, R. J., Levesque, H. J., and Reiter, R. (Eds.), (1992), Knowledge Representation, MIT Press, ISBN-13: 978-1558609327

b) Forbus, K. D., and De Kleer, J. (1993). Building problem solvers (Vol. 1). MIT press, ISBN-10: 0262061570

ECE Syllabus

Semester: 4

Type	Course Name	L-T-P-C
Institute Core	Computer and Communication Networks	3-1-0-4
Program Core	Fundamentals of Communication	3-0-1-4
Program Core	Analog Circuits	2-1-1-4
Program Core	Electromagnetics and Transmission Lines	3-1-0-4
SSHAM 6	Advanced Communication Skills	1-1-0-2
SSHAM 7	SSHAM 7	x-x-0-2
	Total Credits	**20**

Computer and Communication Networks

Institute Core

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

1. **Course Objectives:**

   The objective of this course is to impart knowledge of layered network architecture design and its services. Course will familiarise the students with understanding of standard protocols and its implementations

2. **Syllabus:**

   Unit – 1 [6 Hours]: Guided transmission media: twisted pair, coaxial cable, fibre optic cable; Multiplexing: FDM and TDM: Packet switching and circuit switching: Internet protocol stack: ISO OSI reference model, Delay, loss and throughput in packet switched networks.

   Unit – 2 [10 Hours]: The web and HTTP; FTP; Electronic mail: SMTP; Domain name systems; Peer-to-peer networks.

   Unit – 3 [10 Hours]: Transport layer services; Multiplexing and demultiplexing; Principles of reliable data transfer: Go-Back-N and Sliding window, TCP, UDP, Congestion control.

   Unit – 4 [6 Hours]: Network Layer: Services of network layer, Virtual circuit and datagram networks, Internet protocol

   Unit – 5 [6 Hours]: Link-state routing and distance vector routing. Hierarchical routing, Routing in the internet, broadcast and multicast routing. Duration:

   Unit – 6 [10 Hours]: Link layer services, Error detection and correction; Multiple access protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Ethernet; WiFi. Next generation wireless networks, Intro to self optimization networks (SON).

3. **Course Outcomes:**

   At the end of the course, students should have the ability:

   i) To analyse new physical layer designs by demonstrating the understanding of the fundamentals in transmission media and layered network architecture.

   ii) To analyse and evaluate the network application by adopting applications layer protocols and transport layer services and propose modifications for performance improvement of industrial applications

   iii) To design and evaluate the topological and routing strategies for latest network architecture designs.

   iv) To demonstrate the understanding of the link layer concepts using simulation skill and propose modifications for the performance improvements

4. Text Books:

a) James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 6th Edition, Addison Wesley, ISBN-13: 978-0-13-285620-1

b) Theodore S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition pearson 2002, ISBN:9788131731864.

5. Reference Books:

a) Andrew Tanenbaum, and Davis Wetherall, Computer Networks, 5th Edition, Pearson ISBN: 978-8131770221

b) Bobbi Sanberg, Networking the complete reference, 3rd Edition, Mc Graw Hills, ISBN: 978-0-07-182765-2

Fundamentals of Communication

Program Core

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

1. **Course Objectives:**

   The objectives of this course are to introduce fundamentals of analog and digital communication systems and detail into the techniques of transmitting and receiving information signals using analog and Digital modulation techniques. This is a lab-based course wherein the different theoretical concepts would be practiced through Lab experiments.

2. **Syllabus:**

   Unit – 1 [4 Hours]: Communication system and Noise: Introduction to Transmitter, Receiver, Channel, Introduction to Noise, Types of Noise, Measurement of Noise, Noise in devices, cascaded effect of Noise

   Unit – 2 [4 Hours]: Radio Transmitter and Receiver: Basic blocks in Transmitter and Receiver - Frequency of operation - Range of frequencies and effect on communication

   Unit – 3 [12 Hours]: Analog modulation techniques: Amplitude modulation (Transmitter), Concept of modulation Index, Maths behind the AM technology, Frequency (Modulation) Transmitter) and Demodulation (Receiver), Maths behind the FM technology

   Unit – 4 [8 Hours]: Demodulation techniques (Receiver): Receiver types and details, Superheterodyne receiver and workflow, Maths behind the receiver Control: AFC, AGC concepts

   Unit – 5 [14 Hours]: Introduction to Digital Modulation: Why Digital Modulation
   Pulse Modulation techniques (PAM, PWM, PPM), Sampling and Quantization, PCM, Quantization error, DPCM, DM, ADM

   Unit – 6 [6 Hours]: Multiplexing and Multiple access techniques: Multiplexing - TDM, FDM, Multiple Access (TDMA, FDMA, CDMA), Why CDMA is different than TDMA and FDMA? Applications to different wireless and communication

3. **Course Outcomes:**

   At the end of the course, Students should have the ability:

   v) To comprehend and express the different components in a communication system, detailing into noise

   vi) To understand different blocks involved in transmitter, receiver, frequency of operation, and importance of design of a wireless system

   vii) To have good understanding and hands-on experience of Analog communication, especially, AM, FM and PM

viii) To clearly articulate how the signal is demodulated and decoded at the receiver of the communication system

ix) To clearly articulate advantages of Digital modulation over analog modulation and be able to Implement Digital Modulation techniques over Matlab or any software in the 10 Lab sessions

x) To relate the concepts to real world implementation of 2G and 3G system; and explain how these components are used in today's wireless system

4. Text Books:

a) Kennedy, Davis, Electronic Communication Systems, 4th Edition, TMH, India

5. Reference Books:

a) T. Rappaport , Wireless Communication, 4th Edition, Pearson Publishers, 2016

b) A. Goldsmith, Wireless Communication, Cambridge University Press, 2012

Analog Circuits

Program Core

L-T-P-C: 2-1-1-4

6. **Course Objectives:**

   The main objective of the course is to introduce students to the design and analysis of small signal-based amplifier circuits with BJT and MOSFETs.

7. **Syllabus:**

   Unit – 1 [9 Hours]: Semiconductor Materials and Properties, The p-n Junction, The ideal diode, Terminal characteristics of junction diodes, Modeling diode forward characteristics - Exponential model, PWL, CVD, Ideal model, Reverse breakdown region – Zener diode, Rectifier circuits, Limiting and clamping circuits, Physical operation of diodes, Special diodes

   Unit – 2 [6 Hours]: Device structure and physical operation, current – voltage characteristics, the BJT as an amplifier and a switch, DC Analysis of BJT Circuits, Biasing BJT Amplifier Circuits- voltage divider, fixed bias, swamping circuits

   Unit – 3 [9 Hours]: Small Signal operations and models, transconductance, input resistances, voltage gain, hybrid- model, T-model, Small Signal equivalent circuit, Early effect, Single stage BJT amplifiers CE, CB, CC, Comparison, Darlington amplifier, Voltage follower, frequency response, No Load, Load, Load with source resistance gain comparison

   Unit – 4 [9 Hours]: Device structure and physical operation, current – voltage characteristics, the MOSFET as an amplifier and a switch, DC Analysis of MOSFET Circuits, Biasing MOSFET Amplifier Circuits

   Unit – 5 [9 Hours]: Small Signal operations and models, transconductance (gm), T equivalent circuit model, Body effect, Single stage MOS amplifiers Amplifier Configuration, Common Source, Source Follower, Common Gate Configuration, Summary and Comparison of the three Basic Amplifier Configurations, Summary and comparison

   Unit – 6 [6 Hours]: Multi-stage amplifier circuits, Power Amplifiers: Class A, B, AB, C and D amplifiers

8. **Course Outcomes:**

   At the end of the course, Students should have the ability:

   i) To understand the physical and electrical conducting properties of semiconductors.

   ii) To analyze the working of diode circuits

   iii) To comprehend the working and design and BJT and MOSFET amplifiers.

iv) To design amplifier circuits using BJTs and MOSFETs and analyze the frequency responses of amplifier circuits

v) To design amplifieAble to build power amplifier circuitsr circuits using BJTs and MOSFETs and analyze the frequency responses of amplifier circuits

vi) To analyze, troubleshoot power amplifier circuits.

9. Text Books:

a) Adel S. Sedra, Kenneth C. Smith & Arun N. Chandorkar, Microelectronic Circuits, Theory and Applications, 7th edition, Oxford press.
b) D. A. Neamen, Electronic Circuit Analysis and Design, latest edition, Tata McGraw-Hill, New Delhi, 2007.

10. Reference Books:

a) Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education
b) Electronic Devices and Circuits theory– Robert L. Boylestad, Louis Nashelsky, 11th Edition, 2009, Pearson.

Electromagnetics and Transmission Lines

Program Core

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

1. Course Objectives:

The objective of this course is to provide basic understanding about the static and time varying fields thereby studying the concepts of wave propagation in different types of material media.

2. Syllabus:

Unit – 1 [8 Hours]: Basics of Vector algebra, Coordinate transformation, Vector calculus – Differential parameters; Line surface and volume integrals; Del operator – Gradient of a scalar, Divergence of a vector and divergence theorem, Curl of a vector and Stoke's Theorem.

Unit – 2 [8 Hours]: Coulomb's Law, Electric field and Electric Flux density, Gauss's Law and its applications, boundary conditions, Poission's and Laplace's equations. Ampere's law and its applications, Magnetic fields, Magnetic Flux density. Magnetic boundary conditions.

Unit – 3 [8 Hours]: Faraday's law, Displacement current, Maxwell's equations – final form, time-harmonic fields.

Unit – 4 [8 Hours]: Traveling waves vs Standing waves, wave propagation in lossy dielectrics/ in lossless dielectrics/ in free space/ in good conductors, Wave polarization, Power and the Poynting vector, Reflection of a plane wave at normal incidence.

Unit – 5 [8 Hours]: transmission line parameters, Transmission line equations (Lossy, lossless and distortionless), input impedance, Standing wave ratio, power, Smith Chart, Applications of Transmission lines.

Unit – 6 [8 Hours]: Antennas, Antenna parameters, Antenna types, Arrays, FRIIS Transmission Model and Basics of Radar: Range equation.

3. Course Outcomes:

At the end of the course, Students should have the ability:

vii) To recognize and classify the Electric and Magnetic fields for both static and time varying cases.

viii) To demonstrate the conceptual understanding of the behavior of fields at the interface/boundaries.

ix) To evaluate wave propagation characteristics in various types of material media.

x) To analyse the waves (propagating and standing) in the bounded and unbounded media.

xi) Ability to apply the fundamental concepts in the application areas like antennas and Radar.

4. Text Books:

a) M. N. O. Sadiku, and S V Kulkarni, Principles of electromagnetics, sixth edition, Oxford University Press, 2016.

b) J. D. Kraus, and D. A. Fleisch, Electromagnetics with Applications, fifth edition, McGraw Hill Education, Indian Edition, 2010, (thirteenth reprint 2018).

5. Reference Books:

a) W.H.Hayt, Engineering Electromagnetics, (7/e), McGraw Hill, 2006.

b) E.C. Jordan & G. Balmain, Electromagnetic Waves and Radiating Systems, PHI, 1

SSHAM Courses

Advanced Communication Skills

L-T-P-C: 1-1-0-2

1. **Course Objectives:**

   - To develop learners' lateral thinking ability and to promote interpersonal oral and written communication
   - To enhance their professional communication skills to prepare them for the communicative demands of the industry

2. **Syllabus:**

   Unit – 1 [4 Hours]: Understanding cross cultural communication, Assertive and aggressive communication, Managing emotional steadiness in aggressive communication contexts

   Unit – 2 [4 Hours]: Body language in various contexts, Culture and body language Proximity, Do's and Don'ts

   Unit – 3 [4 Hours]: Critical Thinking and Creative Writing, Introduction to critical Thinking, Benefits, Barriers, Reasoning, Deductive and inductive Arguments, inferential comprehension, Critical thinking and academic writing

   Unit – 4 [4 Hours]: Differentiating arguments and opinions, Exploratory writing and argumentative writing

   Unit – 5 [4 Hours]: Understanding the contexts and needs for the technical reports Reading and analysing sample technical reports, Understanding the components of a technical reports, Writing technical reports

   Unit – 6 [4 Hours]: Basic presentation skills, Choosing the medium, structuring presentation, Clarity, brevity, interaction

3. **Course Outcomes:**

   a) Learners will be able to demonstrate competence in cross cultural communication
   b) Learners will be able to use gestures and other non-verbal communication strategies effectively in formal and informal contexts
   c) Learners will be able to critically analyse and evaluate situations and communicate proficiently
   d) Learners will be able to argue their case following the etiquettes
   e) Learners will be able to write and analyse technical reports
   f) Learners will be able to make short academic presentations with clarity using various medium and persuade in speaking contexts

4. Text Books:

a) Talbot, Marianne and Chris Wood, Critical Reasoning: A Romp Through the Foothills of Logic for Complete Beginners, 2014, OUP, UK.

b) Gill Hasson, Brilliant Communication Skills: What the Best Communicators Know, Do and Say, 2012, Ft Pr.

5. Reference Books:

a) Dwyer, J., Communication for Business and the Professionals: Strategies and Skills, 2015, Pearson Education, Melbourne.

b) Kerry Patterson, Joseph Grenny, Ron McMillan and Al Switzler, Crucial Conversations: Tools for Talking When Stakes Are High, 2013, Brilliance Audio.

Foundations in Human Values and Ethics

L-T-P-C: 2-0-0-2

1. **Course Objectives:**

To equip students with life skills (as defined by WHO and UNICEF) which are vital to effectively tackle the challenges of 21st century and with soft skills such as interpersonal relations, decision making, time management, team skills, communication and leadership which raises the employability factor and also the skills which will make them more dynamic and entrepreneurial in nature. To equip students with practical tools and techniques that will make them more creative, efficient, confident, clear minded , stress free, joyful and energetic and come out of depression, suicidal tendencies, addictions, anger. aggression, violent tendencies, anxiety and fear. To instil human values, ethics, moral values and integrity.

2. **Syllabus:**

Unit – 1 [4 Hours]: Self-awareness / Mindfulness and Mind Management: The Seven Levels of Existence - Sources of Energy - Prana and the Breath-Energy and the Mind - Focus and Concentration - Sleep and Its Effect on the Body/Mind Complex - Bringing the Mind to the Present - Discipline and the Mind - The Tendencies of the Mind - Dealing with regret in the past and anxiety in the future - Importance of Being 100%-Inevitability of the Present Moment - Focus and Commitment

Unit – 2 [4 Hours]: Coping with Stress and Coping with Emotions / Emotional Intelligence: Sources of Stress - Stress and the Body-Stress and the Mind-Stress and the Emotions - What is Stress? - Physiology and Stress - Overview of Techniques for Stress Reduction - Techniques and their Effect on Physiology and Psychology - The Role of the Breath-Rhythms of the Breath and their Relation to Emotions - Emotions and the Sympathetic and Parasympathetic Nervous System - Techniques to manage emotions by managing the breath

Unit – 3 [4 Hours]: Interpersonal Relationship Skills and Effective Communication Skills: The Modes of Acceptance - Advantages/Disadvantages - The Complementary Nature of Opposite Values - Judgement and Acceptance - Dealing with People's Opinions - Roles in Life - Responsibility - Service – Impacting our Communities and the World - Being sensitive & Sensible - Your state of mind matters - Humor coupled with care & concern - Types of communication - Communication beyond words - Being a good listener.

Unit – 4 [4 Hours]: Health & Nutrition - Lifestyle & Environment: Wellness Guide-Aligning with Nature - Physical & Mental Health - Food: Types of Food and Its Effect on the Body and Mind - Science of Meditation and its Impact on Mental Wellness - Nature of Habits-How to Develop Good Habits/Break Bad Habits - Dealing with Parents, Society and Peer Pressure - Sex and Its Impact on the Body, Mind and Emotions - Drugs and Alcohol and their Effects on the Body, Mind, and Emotions - Life Choices and the Environment - Direct Application: Life Choices and Team Dynamics - Direct Application: Break Your Own Bad Habits

Unit – 5 [2 Hours]: Ethics, Morality and Integrity: Difference between Ethics, Morals and Integrity - Convergence of Sensibility and Sensitivity - Ethics as a Fundamental Necessity in Society- Case Study - Non-adherence leading to major Economic Crises worldwide- Case Study - Successful Role Models who have integrated Ethics as a way of life-Role of ethical youth as future Leaders in shaping the Nation

Unit – 6 [6 Hours]: Time Management and Goal Setting - Active Learning & Learning Strategies - Decision Making: Types and Characteristics of activities - Typical nature of reaction to various activities - Planning and Discipline – Urgent and Important Time Matrix-Activity to review participants time spent on various activities - The 5 aspects of learning - Lifelong learning-Learning & Mistakes - 3 Levels of knowledge-Role of Intuition - Barriers to Learning - The Art of making Correct Decisions - Long term vs. Short term Planning - Clarity of Mind – Dealing with Confusion - Decision making and Intuition - Goal-setting and Prioritization

3. Course Outcomes:

At the end of the course, students should have the ability:

a) To maintain high energy levels, bring the mind to present moment, concentrate with a relaxed and happy state of mind resulting in increased levels of efficiency.
b) To handle the mind, manage the emotions, eliminate stress and maintain healthy body & mind.
c) To maintain equilibrium in adverse situations, deal with people and situations without losing peace of mind, increase the horizons of responsibility with the vision of one world family, making communication more effective with humour and being a good listener.
d) To develop a wellness guide thereby regularizing biological clock, follow an appropriate diet suitable to one's nature, become aware of the various aspects to be healthy, choose life choices so as to contribute positively to the environment, gives an understanding on how to deal with parents and also to handle peer pressure.
e) To play the role of future leaders in shaping the nation and also brings the ability to be both sensible and sensitive.
f) To prioritize the activities, identify time wasters and barriers to learning, manage the time effectively, set the goals, understand any concept through active learning, use intuitive power for an effective decision making.

4. Text Books:

a) Ravi Shankar, Wisdom for the New Millennium, 2006, Jaico Publishing House, ISBN: 978-8179923702
b) Stephen R. Covey , A. Roger Merrill, First Things First – Time Management, 1996, ISBN: 978-0684802039

5. References:

1. http://web.mit.edu/yesplus/www/Home.html
2. https://www.researchgate.net/publication/279753401_Anti-anxiety_efficacy_of_Sudarshan_Kriya_Yoga_in_general_anxiety_disorder_

A_multicomponent_yoga_based_breath_intervention_program_for_patients_suffering_from_generalized_anxiety_disorder_with_or_witho

3. https://www.artofliving.org/wisdom/emotion al-intelligence
4. https://online.hbs.edu/blog/post/leadership-communication
5. https://www.indeed.com/career-advice/career-development/covey-time-management-matrix
6. https://hbr.org/2020/01/time-management-is-about-more-than-life-hacks
7. https://hbr.org/topic/decision-making
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3573542/

6.

Personal Growth Programme

L-T-P-C: 1-1-0-2

1. **Course Objectives:**

   To increase awareness about one's own behaviour and its impact on interpersonal effectiveness in the fast-paced dynamic environment. To provide insights into the needs and emotions of people and offer knowledge, skills and techniques to build relationships, collaborate and adapt to demanding situations while pursuing goals. To explore various behavioural concepts and its applications that set an agenda for self-development.

2. **Syllabus:**

   Unit – 1 [4 Hours]: Personal Growth, Scope, Personal Change, Self-esteem, SMART Goals, Intrinsic and Extrinsic motivation, life roles, balancing life roles.

   Unit – 2 [4 Hours] Communication styles, Dimensions of Normal Behaviour, Characteristics, strengths and development needs, identifying my effective and ineffective styles reflection and action planning.

   Unit – 3 [4 Hours]: Ego States, types, interpersonal transactions, strokes, Johari Window, self-disclosure and giving feedback, applications, reflection and action planning

   Unit – 4 [4 Hours]: Emotional Intelligence (EQ) VS Intelligence Quotient, dimensions of EQ, managing emotions, Interpersonal relationships and its dimensions, reflection and action planning.
   Unit – 5 [4 Hours]: Conflict styles, sources of conflict, conflict resolution techniques, building Trust, Elements of Self Trust, Relationship trust, trust building behaviours.

   Unit – 6 [4 Hours]: Managing Time, planning and prioritization, Creating Win-Win situations, problem solving and idea generation technique, blocks to creativity. Action planning

3. **Course Outcomes:**
   a) Ability to understand and realise that personal growth starts from "with-in", identify drivers for personal change, understand SMART goals, balance life roles and identify barriers in achieving goals.
   b) Ability to understand effective and ineffective communication and behavioural styles, its characteristics, strengths and improvement areas to develop self
   c) Ability to understand ego states, its impact on interpersonal relationships, develop knowledge and skills to give feedback and disclose information to others in a group.
   d) Ability to understand the impact of emotions on behaviour and performance, learn empathetic communication and apply transactional analysis technique to building rapport.
   e) Ability to understand conflict styles, identify sources of conflict and to resolve them. Awareness of how lack of self-trust strains relationships and apply critical behaviours that build trust.

f) Ability to analyse how procrastination, lack of planning and prioritization defeat attaining goals. Ability to separate emotions from facts and apply creative thinking in problem solving situations.

4. Text Books:

a) Covey, Stephen M. R., The Speed of Trust. London, 2008, England: Simon & Schuster

b) Covey, S., The seven habits of highly effective people: Restoring the character ethic, 1989, New York: Simon and Schuster

c) Goleman, D., Emotional intelligence: Why it can matter more than IQ, 1995, New York: Bantam Books

5. Reference Books:

a) Edward De Bono, Six Thinking Hats, 2017, Penguin Books

b) Berne, E. (1964). Games people play: The psychology of human relationships., 1964

c) Frankl, V., Man's search for meaning, 2006, Boston: Beacon Press.

d) Anisa Marku, The Art of Setting Smart Goals: Set winning goals and live a life of abundance, success, and achievement. 2019, Google Digital Version

e) William Moulton Marston, Emotions of Normal People, 1979, I Edition, Persona Press

Climate Change and its Implications

L-T-P-C: 2-0-0-2

1. Course Objectives:

- To familiarize with basic concept of climate, possible natural and anthropogenic influences on climate change, and global climate models (GCMs), interpretation of GCM outputs.
- To create a general awareness of the impact of changing climate on our biodiversity, environment, and projected trends.

2. Syllabus:

Unit – 1 [5 Hours]: Introduction to climate and climate change: weather and climate, important meteorological variables, global warming, possible reasons for global warming, greenhouse gases and human contributions, black carbon and global warming, sources of GHGs and black carbon

Unit – 2 [5 Hours]: Evidence of climate change: climate since industrial revolution, climate modelling, models and future projections, representative concentration pathways, their importance.
Hands-on training: Interpretation of global climate model output, QGIS

Unit – 3 [3 Hours]: Projected future trends and impact: Impact of climate change: global & Indian scenario, surface temperature, precipitation, ocean pH, sea-level, Arctic sea-ice extent.
Tutorials: Trend analysis of climate data and its interpretation

Unit – 4 [5 Hours]: Climate change and biodiversity: biodiversity, importance of biodiversity, pressure on biodiversity from human activities, possible impact, vulnerable species and ecosystems, adaptation, and mitigation.

Unit – 5 [3 Hours]: Climate change and agriculture: Indian agriculture, impact of climate change on agriculture and models, agricultural policies in context of climate change, initiatives of Government of India for climate change adaptation.

Unit – 6 [3 Hours]: Climate change and water resources: global and national water budget; outline of impact of climate change on water, climate change-drought & flood, mitigation and adaptation measures.

3. Course Outcomes:

a) Students will understand climate and climate change, anthropogenic influences on global warming, and climate change.
b) Students will be familiar with global and regional climate models, representative concentration pathways, and their importance.
c) Students can analyse the climate model projections using QGIS, future trends in climatic variables.
d) Students can understand biodiversity, its importance, the possible impact of climate change on biodiversity, and adaptation measures.

e) Students can understand the impact of climate change on Indian agriculture and government policies to mitigate the changing climate.
f) Students will get a general awareness about the water resources of India, the impact of climate change on water, and mitigation measures.

4. Text Books:

a) Lawrence M Krauss, The physics of climate change, 2021, Post Hill Press.
b) Cynthia E. Rosenzweig, Daniel Hillel, Handbook of climate change and agroecosystems: Impacts, adaptation, and mitigation, 2010, ISBN-13 -978-1783265633

5. Reference Books:

a) IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp
b) IPCC: Climate change and biodiversity. Technical Paper V, 2002. ISBN:92-9169-104-7
c) Jan C. Van Dam. Impacts of Climate Change and Climate Variability on Hydrological Regimes, 2003, Cambridge University Press.
d) IPCC Report Technical Paper VI, 2008, Climate change and water.
e) ICAR-Policy paper. Climate Change and Indian Agriculture: Impacts, Coping Strategies, Programs and Policy, 2019

Quantum Information and Computing
Note : Detail syllabus will be communicated later.

The richness of the quantum world is yet to be explored. In this course, we attempt to understand this in the context of information processing for computation. Quantum formalism offers newer ways of processing information that is not available in the conventional Boolean framework. For instance, it is known that quantum computation offers exponential speedup in certain classes of problems that are intractable within the classical framework. Exposure to the essentials of the subject will help to appreciate and, hopefully, contribute to the field. This course is introductory in the sense that aims to familiarize students with basic notions in quantum physics and quantum computation. Building on the basic workings of quantum gates, we discuss a few quantum algorithms that have been implemented successfully.

Units:

1. Quantum Physics, Linear Algebra and Qubits

2. Quantum gates and quantum operations

3. Quantum Circuits

4. Algorithms: Factorization, Parity, Search

5. Quantum Fourier Transform

6. Quantum Error Correction