# School of Information Technology
# Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal
## New Scheme of Examination as per AICTE Flexible Curricula
## Syllabus I Semester
### B.Tech Computer Science and Engineering (Artificial Intelligence and Machine Learning)

### AL-101 (MATHEMATICAL CONCEPTS FOR AI)

**Unit I- Introduction to Statistics:** Definition of Statistics, Basic objectives, Applications in various branches of science with examples, Collection of Data: Internal and external data, Primary and secondary Data, Population and sample, Representative sample.

**Unit II- Descriptive Statistics:** Classification and tabulation of univariate data, graphical representation, Frequency curves, Descriptive measures - central tendency and dispersion, Bivariate data, Summarization, marginal and conditional frequency distribution.

**Unit III- Probability:** Concept of experiments, sample space, event, Definition of Combinatorial Probability, Conditional Probability, Bayes Theorem.

**Unit IV- Probability distributions:** Discrete& continuous distributions, Binomial, Poisson and Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions. Expected values and moments: mathematical expectation and its properties, Moments (including variance) and their properties, interpretation, Moment generating function.

**Unit V- Calculus:** Basic concepts of Differential and integral calculus, application of double and triple integral.

**Reference Books-**
1. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.
4. A first course in Probability, S.M. Ross,Prentice Hall.
5. Probability and Statistics for Engineers,(Fourth Edition), I.R. Miller, J.E. Freund and R. Johnson, PHI.
6. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill and D.C. Boes,McGraw Hill Education.
7. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning.
8. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, Pearson Education.
9. Applied Mathematics, Vol. I & II, P. N. Wartikar and J. N. Wartikar,Vidyarthi Prakashan.

**Course Outcomes-**
On successful completion of the course, the students will be able to:

CO1: Analyze data using various statistical methods
CO2: Understand graphical representation of data
CO3: Understand the concepts of probability and random variables and apply it in solving real world problems
CO4: Model and solve real life problems using various discrete and continuous distributions
CO5: Apply the knowledge of differential calculus in optimizing functions of single variables

## AL-102 (BASIC COMPUTER ENGINEERING)

**UNIT I-** Computer: Definition, Classification, Organization i.e. CPU, processor, Bus architecture, Memory Hierarchy & Storage Systems, I/O Devices, System & Application Software, Computer Application in e-Business, Bio-Informatics, health Care, Remote Sensing & GIS, Meteorology and Climatology, Computer Gaming, Multimedia and Animation etc. Operating System: Definition, Functions, Types, Introduction to MS word, MS powerpoint, MS Excel

**UNIT II-** Introduction to Algorithms, Flowchart, Introduction to Programming, Machine language, assembly language and high level language, Categories of Programming Languages, Program Design, Programming Paradigms, Procedure Oriented Programming VS object oriented Programming, Introduction to Character Set, Tokens, Precedence and Associatively, Program Structure, Data Types, Variables, Operators, Expressions, Statements and control structures, I/O operations, Functions

**UNIT III-** Introduction to Data Structures, Types of data structures and their applications

**UNIT IV-** Computer Networking: Introduction, Goals, Internetworking Concepts, Devices, Introduction to Internet, World Wide Web, IP address, LAN, MAN, WAN, Network Topology, E-commerce, Computer Security Basics: Introduction to viruses, worms, malware, Trojans, Spyware and Anti-Spyware Software, Different types of attacks like Money Laundering, Information Theft, Email spoofing, Denial of Service (DoS), Cyber Stalking, ,Logic bombs, Hacking Spamming, Cyber Defamation , pharming, Security measures Firewall, Computer Ethics & Good Practices, Introduction of Cyber Laws about Internet Fraud, Good Computer Security Habits

**UNIT V-** Data Base Management System: Introduction, File oriented approach and Database approach, Architecture of Database System, DBA, centralized and distributed database, Data definition language and Manipulation Languages. Cloud computing: definition, cloud infrastructure, cloud segments or service delivery models (IaaS, PaaS and SaaS), cloud deployment models/ types of cloud (public, private, community and hybrid clouds), Pros and Cons of cloud computing

**Reference Books-**
1. Fundamentals of Computers : E Balagurusamy, TMH
2. Fundamentals of Computers : V Rajaraman, PHI
3. Information Technology Principles and Application: Ajoy Kumar Ray & Tinku Acharya PHI.
4. Introduction of Computers : Peter Norton, TMH
5. Object Oriented Programming with C++ :E.Balagurusamy, TMH
6. Concepts in Computing: Kenneth Hoganson, Jones & Bartlett.
7. Operating Systems – Silberschatz and Galvin - Wiley India
8. Computer Networks:Andrew Tananbaum, PHI
9. Data Base Management Systems, Korth, TMH
10. Cloud Computing, Kumar, Wiley India

**Course Outcomes-**
On successful completion of the course, the students will be able to:
CO1: Explain the components of a computer system
CO2: Develop algorithms and flowcharts for given problems
CO3: Understand the application of data structures in various problems
CO4: Apply the knowledge of computer networking and Network security while using computers
CO5: Create databases for given attributes

**Suggested List of Experiments-**
1. Demonstration of Computer Hardware
2. Installation of various software
3. Algorithm and flowcharts of simple problems
4. Structured code writing

## AL-103 (PRINCIPLES OF ELECTRONICS)

**Unit I-** Semiconductors: Crystalline material: Mechanical properties, Energy band theory, Fermi levels, Conductors, Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, P-type and N-type semiconductors, drift and diffusion carriers.

**Unit II-** Diodes and Diode Circuits: Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model, Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation

**Unit III-** Bipolar Junction Transistors: Formation of PNP / NPN junctions, energy band diagram, transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor
Field Effect Transistors: Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type, CS, CG, CD configurations, CMOS: Basic Principles

**Unit IV-** Feed Back Amplifier, Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors, topologies of feedback amplifier, effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability, effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplified and its terminal properties, Application of operational amplifier, inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator

**Unit V-** Digital Electronics: Introduction to binary number, Basic Boolean algebra, Logic gates and function realization with OPAMPs

**Reference Books-**
1. Adel S. Sedra and Kenneth C. Smith, ―Microelectronic Circuits: Theory and Application‖, 7th Edition, Oxford University Press, 2017.
2. Jacob millman, christoshalkiaschetanparikh,"Millman's Integrated Electronics "McGraw Hill education (India) private limited, 2009
3. M. Morris Mano," Digital Logic & Computer Design" Pearson India Educational Services PvT. Limited, 2016
4. Robert L. Boylestad, Louis Nashelsky,"Electronic Devices and Circuit Theory", Pearson India Educational Services PvT. Limited, 2015
5. Ben Streetman, Sanjay Banerjee," Solid State Electronic Devices",6th Edition, Prentice Hall of India, 2005
6. NPTEL online Course on ―Fundamentals of Semiconductor devices, Course Link: https://onlinecourses.nptel.ac.in/noc19_ee04/
7. https://www.electronics-tutorials.ws/ 8. https://circuitverse.org/

**Course Outcomes-**
On successful completion of the course, the students will be able to:
CO1: Understand the fundamentals of semiconductors.
CO2: Learn the principles of diodes and diode circuits.
CO3: Understand the principles of bipolar junction transistors and field effect transistors.
CO4: Learn the working principles of feedback amplifiers and oscillators.
CO5: Understand the working of operational amplifiers and digital electronic fundamentals

**Suggested List of Experiments-**

1. Study of V-I Characteristics of Diodes.
2. Applications of Diodes and their verification.
3. Transistor applications as amplifier and switch.
4. Verification of truth table for various gates, Flip-Flops.
5. Realizations of Various gates, Flip-Flops etc.
6. Verification of De Morgan's theorems.

## AL-104 (FUNDAMENTALS OF PHYSICS)

**Unit I-** Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring mass system. Resonance-definition., damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

**Unit II-** Interference-principle of superposition-young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Diffraction-Two kinds of diffraction-Difference between interference and diffraction-Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. Temporal and Spatial Coherence.

**Unit III-** Polarization of light:Polarization - Concept of production of polarized beam of light from two SHM acting at right angle, plane, elliptical and circularly polarized light, Brewster's law, double refraction.

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

**Unit IV-** Quantum Mechanics: Introduction- Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrödinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box, Heisenberg Picture.

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices,dspacing, Atomic packing factor for SC, BCC, FCC and HCP structures.

Semiconductor Physics: Conductor, Semiconductor and Insulator, Basic concept of Band theory.

**Unit V-** Laser and Fiberoptics: Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, different types of lasers: Ruby Laser, $CO_2$ and Neodymium lasers, Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in engineering.Fiber optics and Applications, Types of optical fibers.

Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of 1st law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

**Reference Books-**
1. Concepts of Modern Physics, (Fifth Edition) A Beiser, McGraw Hill International.
2. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, Wileyplus.
3. Optics, (Fifth Edition)AjoyGhatak, Tata McGraw Hill.
4. Sears &Zemansky University Physics, Addison-Wesley.
5. Fundamentals of Optics, (Third Edition)Jenkins and White, McGraw-Hill.

**Course Outcomes-**
On successful completion of the course, the students will be able to:
CO1: Understand the principles of interference and polarization of light.
CO2: Understand the principles lying behind crystallography and oscillations.
CO3: Understand the basics of electromagnetism and thermodynamics.
CO4: Learn the principles of semiconductor physics and quantum mechanics.
CO5: Learn the fundamentals of lasers and Fiber Optics principles.

**Suggested List of Experiments-**
1) Magnetic field along the axis of current carrying coil – Stewart and Gee
2) Determination of Hall coefficient of semi-conductor
3) Determination of Plank constant

4) Determination of wave length of light by Laser diffraction method
5) Determination of wave length of light by Newton's Ring method
6) Determination of laser and optical fiber parameters
7) Determination of Stefan's Constant.

# AL-105 (COMMUNICATION SKILLS)

**Unit I-** Overview of LOL (include activity on introducing self), Class activity – presentation on favorite cricket captain in IPL and the skills and values they demonstrate Self-work with immersion – interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them, Overview of business communication
Activity: Write a newspaper report on an IPL match
Activity: Record a conversation between a celebrity and an interviewer
Quiz, Self-awareness – identity, body awareness, stress management

**Unit II-** Essential Grammar – I: Refresher on Parts of Speech – Listen to an audio clip and note down the different parts of speech followed by discussion, Tenses: Applications of tenses in Functional Grammar – Take a quiz and then discuss, Sentence formation (general & Technical), Common errors, Voices. Show sequence from film where a character uses wrong sentence structure (e.g. Zindagi Na Milegi Dobara where the characters use 'the' before every word)

**Unit III-** Communication Skills: Overview of Communication Skills, Barriers of communication, Effective communication, Types of communication- verbal and non – verbal – Role-play based learning, Importance of Questioning, Listening Skills: Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening, Expressing self, connecting with emotions, visualizing and experiencing purpose
Activity: Skit based on communication skills, Evaluation on Listening skills – listen to recording and answer questions based on them.

**Unit IV-** Email writing: Formal and informal emails, activity, Verbal communication: Pronunciation, clarity of speech, Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant abbreviations formal business vocabulary – Read Economic Times, Reader's Digest, National Geographic and take part in a GD, using the words you learnt/liked from the articles.
Group discussion using words learnt, Practice: Toastmaster style Table Topics speech with evaluation, Written Communication: Summary writing, story writing, Build your CV – start writing your comprehensive CV including every achievement in your life, no format, no page limit
Project: Create a podcast on a topic that will interest college students
Life skill: Stress management, working with rhythm and balance, colors, and teamwork
Project: Create a musical using the learnings from unit

**Unit V-** Understanding Life Skills: Movie based learning – Pursuit of Happiness. What are the skills and values you can identify, what can you relate to Introduction to life skills, What are the critical life skills, Multiple Intelligences, Embracing diversity – Activity on appreciation of diversity, Life skill: Community service – work with an NGO and make a presentation, Life skill: Join a trek – Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation.

**Reference Books-**
1. English vocabulary in use – Alan Mc'carthy and O'dell
2. APAART: Speak Well 1 (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Business Communication – Dr.Saroj Hiremath

**Course Outcomes-**
On successful completion of the course, the students will be able to:
CO1: Comprehend conversations and talks presented in English.
CO2: Use the acquired knowledge of essential grammer in forming sentences
CO3: Understand the basic tenets of communication
CO4: Demonstrate skills in email writing and verbal communication
CO5: Apply the life skills to diff erent situations.

**Suggested List of Experiments-**
Various activities like Quiz, Skits, GD

## AL-106 (COMPUTER PROGRAMMING I)

**Unit I** Introduction to Programming, Machine Level Languages, Assembly Level Languages, High Level Languages, Program Execution and Translation Process, Problem solving using Algorithms and Flowcharts. Introduction to C Programming: Data Types, Constants, Keywords, Operators & Expressions, Precedence of operators and input/output functions.

**Unit II** Control Statements and Decision Making: The goto statement, The if statement, The if-else statement, Nesting of if statements, The conditional expression, The switch statement, The while loop, The do…while loop, The for loop, The nesting of for loops, The break and continue statement.

**Unit III** Arrays, Strings & Pointers: One dimensional Arrays, Passing Arrays to Functions, Multidimensional Arrays, Strings, Basics of Pointers & Addresses, Pointer to Pointer, Pointer to Array, Array of Pointers, Types of pointers, Pointer to Strings.

**Unit IV** Functions & Structures: Function Basics, Function Prototypes, Passing Parameter by value and by reference, Passing string to function, Passing array to function, Function returning address, Recursion, Structures & Union, Pointer to Structure, Self-Referential Structures, Dynamic memory allocation by malloc/calloc function, Storage Classes.

**Unit V** File Handling: Defining and Opening a file, Closing Files, Input/output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Command Line Arguments.

**Reference Books-**
1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Paul Deitel and Harvey M. Deitel, How to Program, Pearson Publication.
3. YashavantKanetkar , Let Us C, BPB publication.
4. E. Balagurusamy, Programming in ANSI C, Tata McGraw-Hill.
5. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

**Course Outcomes-**
After completion of the course students would be able to:
CO1. Identify situations where computational methods and computers would be useful.
CO2. Describe the basic principles of imperative and structural programming.
CO3. Develop a pseudo-code and flowchart for a given problem.
CO4. Analyze the problems and choose suitable programming techniques to develop solutions.
CO5. Design computer programs to solve real world problems.

**Suggested List of Experiments-**
1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
    i. Small but tricky codes
    ii. Proper parameter passing
    iii. Command line Arguments
    iv. Variable parameter
    v. Pointer to functions
    vi. User defined header
    vii. Make file utility
    viii. Multi file program and user defined libraries
    ix. Interesting substring matching / searching programs
    x. Parsing related assignments