



**Scheme of Instruction & Syllabi  
of  
Bachelor of Technology  
(Computer Science and Engineering)  
With specialization in Artificial Intelligence  
(With effective from academic session 2023-24)**

**(Dr. Gaurav Agarwal)  
HOD CSE**

**(Prof. R.K. Shukla)  
Dean Engineering & Technology**

**(Prof. Y D S Arya)  
Vice- Chancellor**

**Department of Computer Science and Engineering  
INVERTIS UNIVERSITY  
Invertis Village, Bareilly-Lucknow NH-24, Bareilly,  
243123 U. P.**

**STUDY AND EVALUATION SCHEME**  
**(With effective from academic session 2023-2024)**  
**B. Tech. in Computer Science & Engineering**  
**with specialization in Artificial Intelligence**  
**YEAR I, SEMESTER I**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Ability Enhancement	ENG 105	English Communication	2	1	0	25	50	75	3
2	Engineering Science Course	BCSAI 101	Engineering Mathematics	3	0	0	25	50	75	3
3	Engineering Science Course	BCSAI 102	Elements of Computing System	3	0	0	25	50	75	3
4	Engineering Science Course	BEE 101	Introduction to Electrical and Electronics Engineering	3	0	0	25	50	75	3
5	Engineering Science Course	BCSAI 103	Programming in C	3	0	0	25	50	75	3
6	Engineering Science Course	IOT1	Fundamentals of IOT Development	4	0	0	30	70	100	4
<b>PRACTICALS AND PROJECTS</b>										
6	Engineering Science Course	BCSAI 104	Computing Systems Lab	0	0	4	15	35	50	2
7	Engineering Science Course	BEE 102	Basic Electrical and Electronics Engineering Lab	0	0	4	15	35	50	2
8	Engineering Science Course	BCSAI 105	Programming in C Language Lab	0	0	4	15	35	50	2
9	Skill Enhancement	ENG 113	Communications-I Lab	0	0	4	15	35	50	2
<b>TOTAL</b>				<b>18</b>	<b>1</b>	<b>16</b>	<b>215</b>	<b>460</b>	<b>675</b>	<b>27</b>

L-Lecture, T- Tutorial , P- Practical ,CA- Continuous Assessment, EE- End Semester Examination

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**YEAR I, SEMESTER II**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Engineering Science Course	BCSAI 201	Discrete Mathematics	3	0	0	25	50	75	3
2	Engineering Science Course	BCSAI 202	Statistical Learning	3	0	0	25	50	75	3
3	Science	CHY 103	Environmental Studies	2	0	0	15	35	50	2
4	Engineering Science Course	BCSAI 203	Design Thinking	3	0	0	25	50	75	3
5	Engineering Science Course	BCSAI 204	Operating System-Building Blocks	3	0	0	25	50	75	3
6	Engineering Science Course	BCSAI 205	Digital Electronics	3	0	0	25	50	75	3
7	Engineering Science Course	I IOT2	Industrial Communication Protocols & Connectivity	4	0	0	30	70	100	4
<b>PRACTICALS AND PROJECTS</b>										
7	Engineering Science Course	BCSAI 206	Digital Electronics Lab	0	0	4	15	35	50	2
8	Engineering Science Course	BCSAI 207	Computer Aided Graphics & Drafting (Lab)	0	0	4	15	35	50	2
9	Skill Enhancement	ENG 114	Business & Technical Communication (Lab)	0	0	4	15	35	50	2
			<b>TOTAL</b>	<b>21</b>	<b>0</b>	<b>12</b>	<b>215</b>	<b>460</b>	<b>675</b>	<b>27</b>

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**YEAR II, SEMESTER III**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Engineering Science Course	BCSAI 301	Computer Networks	3	0	0	25	50	75	3
2	Science	BCSAI 302	Probability and Random Variables	3	0	0	25	50	75	3
3	Engineering Science Course	BCSAI 303	Data Structures & Algorithms	3	0	0	25	50	75	3
4	Engineering Science Course	BCSAI 304	Object Oriented Programming with Java	3	0	0	25	50	75	3
5	Engineering Science Course	BCSAI 305	Cloud Computing	3	0	0	25	50	75	3
6	Engineering Science Course	BCSAI 306	Computational Systems Biology	2	0	0	15	35	50	2
7	Engineering Science Course	IOT3	Introduction to Data Analytics	4	0	0	30	70	100	4
<b>PRACTICALS AND PROJECTS</b>										
7	Engineering Science Course	BCSAI 307	Computer Networks Lab	0	0	4	15	35	50	2
8	Engineering Science Course	BCSAI 308	Data Structures & Algorithms Lab	0	0	4	15	35	50	2
9	Engineering Science Course	BCSAI 309	Object Oriented Programming with Java Lab	0	0	4	15	35	50	2
			<b>TOTAL</b>	<b>21</b>	<b>0</b>	<b>12</b>	<b>215</b>	<b>460</b>	<b>675</b>	<b>27</b>

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**YEAR II, SEMESTER IV**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Engineering Science Course	BCSAI 401	Design and Analysis of Algorithms	3	0	0	25	50	75	3
2	Engineering Science Course	BCSAI 402	Robotic Operating Systems & Robot Simulation	3	0	0	25	50	75	3
3	Engineering Science Course	BCSAI 403	Database Management System	3	0	0	25	50	75	3
4	Engineering Science Course	BCSAI 404	Software Engineering	3	0	0	25	50	75	3
5	Engineering Science Course	BCSAI 405	AI and Intelligent Agents	3	0	0	25	50	75	3
6	Engineering Science Course	ILOT4	Machine Learning	4	0	0	30	70	100	4
<b>PRACTICALS AND PROJECTS</b>										
6	Engineering Science Course	BCSAI 406	Database Management System with SQL Lab	0	0	4	15	35	50	2
7	Engineering Science Course	BCSAI 407	Robotic Operating Systems & Robot Simulation (Lab)	0	0	4	15	35	50	2
8	Engineering Science Course	BCSAI 408	Online Social Network Analysis Lab	0	0	4	15	35	50	2
9	Engineering Science Course	BCSAI 409	Shell Scripting Lab			4	15	35	50	2
			<b>TOTAL</b>	<b>19</b>	<b>0</b>	<b>16</b>	<b>215</b>	<b>460</b>	<b>675</b>	<b>27</b>
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**YEAR III, SEMESTER V**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Professional Core	BCSAI 501	Ethics in Computer Science	3	0	0	25	50	75	3
2	Professional Core	BCSAI 502	Prolog Programming	3	0	0	25	50	75	3
3	Professional Core	BCSAI 503	Signal & Image Processing	3	0	0	25	50	75	3
4	Professional Core	BCSAI 504	Data Mining & ML	3	0	0	25	50	75	3
5	Professional Core	BCSAI 505	Formal Language & Automata	3	0	0	25	50	75	3
6	Professional Elective	BCSAI 506, BCSAI 507, BCSAI 508	Elective-I	2	0	0	15	35	50	2
7	Engineering Science Course	ILOT5	Deep Learning	4	0	0	30	70	100	4
<b>PRACTICALS AND PROJECTS</b>										
7	Engineering Science Course	BCSAI 509	Data Mining & ML using Python Lab	0	0	4	15	35	50	2
8	Engineering Science Course	BCSAI 510	Signal & Image Processing Lab	0	0	4	15	35	50	2
9	Engineering Science Course	BCSAI 511	Prolog Programming Lab	0	0	4	15	35	50	2
10	Skill Enhancement	BCSAI 512	Anandam –I (Happiness Curriculum)	0	0	1	10	15	25	1
			<b>TOTAL</b>	<b>21</b>	<b>0</b>	<b>13</b>	<b>225</b>	<b>475</b>	<b>700</b>	<b>28</b>
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<b>COURSE CODE</b>		<b>Elective – I</b>								
BCSAI 506		Information Security								

BCSAI 507	Database Security
BCSAI 508	Business Intelligence

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**YEAR III, SEMESTER VI**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Professional Core	BCSAI 601	Big Data Analytics	3	0	0	25	50	75	3
2	Professional Core	BCSAI 602	Compiler Design	3	0	0	25	50	75	3
3	Professional Core	BCSAI 603	Advanced Machine Learning	3	0	0	25	50	75	3
4	Professional Core	BCSAI 604	Natural Language Processing	3	0	0	25	50	75	3
5	Professional Core	BCSAI 605	Graphical Model	3	0	0	25	50	75	3
6	Professional Elective	BCSAI 606, BCSAI 607, BCSAI 608	Elective-II	2	0	0	15	35	50	2
7	Engineering Science Course	IIoT6	Advanced Artificial Intelligence	4	0	0	30	70	100	4
<b>PRACTICALS AND PROJECTS</b>										
7	Engineering Science Course	BCSAI 609	Digital Electronics Lab	0	0	4	15	35	50	2
8	Engineering Science Course	BCSAI 610	Computer Aided Graphics & Drafting (Lab)	0	0	4	15	35	50	2
9	Skill Enhancement	BCSAI 611	Business & Technical Communication (Lab)	0	0	4	15	35	50	2
10	Skill Enhancement	BCSAI 612	Anandam-II(Happiness Curriculum)	0	0	1	10	15	25	1
<b>TOTAL</b>				<b>21</b>	<b>0</b>	<b>13</b>	<b>225</b>	<b>475</b>	<b>700</b>	<b>28</b>



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<b>Course code</b>	<b>Elective – II</b>
BCSAI 606	Blockchain
BCSAI 607	Internet of Things
BCSAI 608	Management information system

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**YEAR III, SEMESTER VII**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY</b>										
1	Professional Core	BCSAI 701	Fuzzy Logic & Application	3	0	0	25	50	75	3
2	Professional Core	BCSAI 702	Supervised & Unsupervised Learning	3	0	0	25	50	75	3
3	Professional Core	BCSAI 703	Online Machine Learning	3	0	0	25	50	75	3
4	Professional Core	BCSAI 704	R Programming	3	0	0	25	50	75	3
5	Project	MGT 103	Project Formulation and Appraisal	3	0	0	25	50	75	3
6	Professional Elective		Electives-III	2	0	0	15	35	50	2
<b>PRACTICALS AND PROJECTS</b>										
7	Professional Core	BCSAI 705	Fuzzy Logic & Application Lab	0	0	4	15	35	50	2
8	Project	BCSAI 706	Mini Project	0	0	4	15	35	50	2
9	Professional Core	BCSAI 707	Campus Recruitment Training	0	0	4	15	35	50	2
10	Skill Enhancement	BCSAI 708	Anandam-III (Happiness Curriculum)	0	0	1	10	15	25	1
			<b>TOTAL</b>	<b>17</b>	<b>0</b>	<b>13</b>	<b>195</b>	<b>405</b>	<b>600</b>	<b>24</b>

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**YEAR III, SEMESTER VIII**

Sl. No.	Category	Course Code	Course Title/ Subjects	Hours per week			Evaluation Scheme		Total	Credits
				L	T	P	CA	EE		
<b>THEORY/ PRACTICALS AND PROJECTS</b>										
1	Summer Training	BCSAI 801	Industrial Training/Internship	0	0	12	50	100	150	6
2	Project	BCSAI802	Project	0	0	12	50	100	150	6
3	Professional Elective	BCSAI803- BCSAI805	Elective IV	3	0	0	25	50	75	3
			<b>TOTAL</b>	<b>3</b>	<b>0</b>	<b>24</b>	<b>125</b>	<b>250</b>	<b>375</b>	<b>15</b>
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Course code	Electives– III
MGT 201	Orientation program in Entrepreneurship
MBA 204	Research Methodology
	<b>Elective-IV</b>
BCSAI803	Agile Technology
BCSAI804	Metaverse
BCSAI805	Blockchain Technology

# **Syllabus**

## **Semester-I**

**ENG 105: ENGLISH COMMUNICATION**

**2L + 1T + 0P + 3C**

**MM 100**

**Unit 1: Prose-** A Cup of Tea by Katherine Mansfield, The Piece of String by Guy De Maupassant, Text of Steve Jobs' Commencement address -2005.

**Poems:** Ode to the skylark – by P B Shelley, Where the Mind Is Without Fear – by Rabindranath Tagore, The Road Not Taken- Robert Frost.

**Unit 2: Grammar & Vocabulary-** Tenses and the concept of time, Verb Types, Active and Passive Voice, Narration, Prepositions, Conditionals, Modal Auxiliaries, Conjunctions, One- word substitutions, Synonyms and Antonyms.

**Unit 3: Writing Skills-** Writing Paragraph, Essay, Writing Articles for Newspapers & Magazines, Writing Applications, Resumé Writing.

**Unit 4: Reading Skills-** Reading Comprehension, Summarizing and Note making.

**Unit 5: Speaking Skills-** Conversations- Introduction, Purpose, Features, Delivering Speeches- Welcome, Introductory, Vote of Thanks, Farewell Speech, Indianism.

**Text/Reference Books**

1. Communication Skills, Pushp Lata & Sanjay Kumar, Oxford Higher Education/Oxford University Press.
2. Technical Communication; Principles and Practice, Meenakshi Raman & Sangita Sharma, Oxford University Press.
3. Effective Technical Communication, M Ashraf Rizvi, Tata Mcgraw Hill.

**BCSAI 101: ENGINEERING MATHEMATICS**

3L + 0T + 0P + 3 C

MM 100

**Unit 1: Differential Equation** - Differential equations of first order and first degree - Linear differential equations, Reducible to linear form, Exact Form, Reducible to Exact Form, Second order ordinary differential equations with variable coefficients- Homogeneous form, Exact form, Series Solutions of Second Order Linear Differential Equations with Variable Coefficients (complementary functions only), Partial Differential Equations of First Order: Lagrange's Form, Standard Forms.

**Unit 2: Differential Calculus** -Partial Differentiation, Euler's Theorem on Homogeneous Functions, Approximate Calculations, Maxima and Minima of two and more independent variables, Lagrange's Method of Multipliers, Asymptotes (Cartesian co-ordinates only), Curve Tracing (Cartesian and Standard Polar Curves).

**Unit 3: Integral Calculus**- Area of Curves, Rectification, Surface and Volume of Solids of Revolution, Double and Triple Integrals, Double Integral by changing into polar form, Area and Volume by Double Integration, Change of Order of Integration, Beta Function and Gamma Function (Simple Properties).

**Unit 4: Matrices**- Rank of a matrix, Rank of matrix by reducing to normal forms, Consistency and redundancy of systems of simultaneous linear equations and its solution, Eigen values and Eigen vectors, Cayley- Hamilton theorem (without proof), Diagonalization of matrix.

**Unit 5: Vector Calculus**- Scalar and vector fields, Differentiation and Integration of vector functions, Directional derivatives, Gradient, Divergence and Curl.Line, Surface and volume Integrals. Green's theorem in a plane, Gauss's and Stoke's theorem (without proof) and their applications

**Text/Reference Books**

1. Higher Engineering Mathematics, B.V. Ramana, Tata McGraw Hill.
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley 9<sup>th</sup> Edition
3. Calculus and Analytical Geometry, Thomas and Finney, Narosa Publishing House(New Delhi)
4. Integral Calculus, Shanti Narayan, S. Chand.
5. Differential Calculus, Shanti Narayan, S. Chand.
6. Ordinary and Partial differential equations, M. D. Raisinghania, S. Chand.
7. Calculus, Thomas & Finney, Narosa Publishing House(New Delhi).

**BCSAI 102: ELEMENTS OF COMPUTING SYSTEM****3L + 0T + 0P + 3C****MM 100****Unit 1: Register Transfer and Micro-operation**

Register Transfer Language, Register Transfer, Bus and Memory Transfer: Three state bus buffers, Memory Transfer. Arithmetic Micro-operations: Binary Adder, Binary Adder- Subtractor, Binary Incrementor, Logic Micro-operations.

**Unit 2: Basic Computer Organization and Control Unit**

Instruction Codes, Computer Registers: Common bus system, Computer Instructions: Instruction formats, Instruction Cycle: Fetch and Decode. Control Memory, Address Sequencing, Conditional branching, Mapping of instruction, Subroutines, Design of Control Unit, Central Processing Unit: Introduction, General Register Organization, Stack Organization stack; Instruction Formats, Addressing Modes

**Unit 3: Computer Arithmetic**

Introduction, Addition and Subtraction, Multiplication Algorithms (Booth algorithm), Division Algorithms, Input – Output Organization: Peripheral devices, Input – Output interface, Introduction of Multiprocessors: Characteristics of multi-processors

**Unit 4: Modes of Data Transfer and Memory Organization**

Modes of Data Transfer: Priority Interrupt, Direct Memory Access, Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory

**Unit 5: Introduction to Information Storage:** Information Storage, Evolution of Storage Architecture

**Data Center Environment:** Application, Host (Computer), Connectivity, Storage, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application

**Data Protection (RAID):** RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison

**Text /Reference Books:**

1. Computer System Architecture by Morris Mano, PHI
2. Computer Organization and Architecture by William Stallings, PHI
3. Information Storage and Management (Storing Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments) 2nd Edition by Somasundaram Gnanasundaram Alok Shrivastava.
4. Digital Computer Electronics: An Introduction to Microcomputers by Malvino, TMH
5. PC Hardware in a Nutshell by Barbara Fritchman Thompson, Robert Bruce Thompson, O'Reilly, 2<sup>nd</sup> Edition , 2010
6. Fundamentals of Computer Organization and Architecture by Mostafa AB-EL-BARR and Hesham EL-REWNI, John Wiley and Sons
7. Storage Management in Data Centers: Understanding, Exploiting, Tuning, and Troubleshooting Veritas Storage Foundation by Volker Herminghaus and Albrecht Scriba.

**BEE 101: INTRODUCTION TO ELECTRICAL AND ELECTRONICS  
ENGINEERING****3L + 0T + 0P + 3 C****MM 100**

**Unit 1: Basic Electrical Quantities:** -Basic concept of charge, current, voltage, resistance, power, energy and their units, Conversion of units of work, power and energy from one form to another. Electrical Energy: Difference between ac and dc and their applications, Classification of two terminal elements, Energy Sources, Source Transformation, ideal independent two terminal electrical sources.

**DC Networks:** Ohm's law, resistances, capacitances & inductors in series and parallel, Kirchhoff's laws and their applications in solving electrical network problems, Node Voltage and Mesh Current Analysis, Star-delta transformation.

**Unit 2: Network theorems:** Thevenin Theorem, Norton Theorem and Superposition Theorem, Statement and applications including dependent sources.

**Transformer:** Faraday's Law of Electromagnetic Induction, Construction and Operation of Single-Phase Transformer, EMF Equation, Voltage & Current Relationship and Phasor Diagram of Ideal Transformer.

**Unit 3: AC Fundamentals:** Concept of alternating current and voltage, Generation of Single-Phase AC Voltage, EMF Equation, Average, RMS and Effective Values Representation of alternating sinusoidal quantities by vectors, Phasor algebra (addition, subtraction, multiplication and division of complex quantities). RL, RC & RLC Series-Parallel Circuits, Complex Representation of Impedances, Reactance, Phasor Diagram, Power and Power Factor.

**Unit 4: Review of Semiconductors:** Semiconductors, conductors and insulators, intrinsic and extrinsic semiconductors and conduction in semiconductors.

**Semiconductor Physics:** Basic material properties of semi-conductors, governing factors for Fermi-level, carrier concentration and carrier mobility, recombination and carrier lifetime, carrier drift, diffusion, Hall effect and continuity equation.

**Unit 5: Junction Diodes:** Introduction, forward and reverse biasing of diode, voltage current characteristic of diode, diode models, half wave rectifier, full wave rectifier, Zener diode and its application.

**Bipolar Transistor:** Transistor structure, basic transistor operation, common base configuration and its characteristics, transistor amplifying action, common emitter configuration and its characteristics, common collector configuration, limit of operation, the dc operating point and biasing techniques (fixed bias, voltage divide bias, voltage feedback type, current feedback type, and combination of voltage and current feedback types)

**Text/Reference Books**

1. Integrated Electronics Analog and Digital Circuits & Systems, J. Millman & C.C. Halkias, McGraw Hill.
2. Electronic Devices and Integrated Circuits, B. P. Singh & Rekha Singh, Pearson Education.
3. Theory and problems of Basic Electrical Engineering, D.P. Kothari & I. J. Nagrath, PHI.
4. Basic Electrical Engineering, V.N. Mittal & A. Mittal, TMH.
5. Solutions of problems in Electrical Engineering, Smith Parker, CBS Publisher.
6. Electronics Devices & Circuit Theory, Boylestad & Nashelsky, Prentice Hall of India.



**BCSAI 103: PROGRAMMING IN C****3L + 0T + 0P + 3C****MM 100**

**Unit 1: Introduction:** -What is a program? What is a programming language? Steps in Programming, Skills needed to do programming, A little introduction to C, writing a Program, Fundamentals of a Programming Language, Different Programming Techniques, Procedural Programming, Modular Programming, Object Oriented Programming, Getting started with compiler. Words and Sentences in C Language: Alphabets in C, Keywords in C, Rules of forming Words in C language, Data Variables, Data Types and Rules for naming and declaring data, variables, Basic Data Types in C, Constants, Comments in C.

**Unit 2: Instructions and Rules for Writing:** -Types of instructions, Data Manipulation Instructions, Input/output Instructions, Flow Control Instructions: Decision Control Instructions, If, if-else, If-else-if, Nested if-else, Loop Control Instructions, For Loop, While Loop, Do While, Selection Instructions.

**Unit 3: Functions:** -Why use Functions, Components of Function, Name of a function, Body of a function, Local variables of a function, Parameters or Arguments to a function, Return Values, Prototype of a function.  
**Arrays:** What is an array? Array Declaration, Array Initialization, accessing individual elements of an array, Two Dimensional Arrays, passing an array element to a function, Rules of using an array.

**Unit 4: Pointers:** -What is a pointer? Declaring a Pointer variable, initializing a pointer variable, Using a Pointer Variable, Pointer Arithmetic, Pointers and array, passing an entire array to a function.  
Strings: What are strings? String I/O, String Manipulation Functions.

**Unit 5: Structures:** -Declaring and Accessing Structure, variables Uses of Structures, Unions Storage Classes and Scoping: Automatic, Register, External, Static, Scope of a Variable File Input/Output: Command-line arguments, File Input and Output, Combining Command-line Arguments and File I/O.

**Text/Reference Books**

1. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Prentice-Hall (New Delhi).
2. C Programming: A Modern Approach, K. N. King, Prentice-Hall (New Delhi).
3. C Primer Plus, Stephen Prata, Sams.
4. Practical C Programming, Steve Oualline, O'Reilly Media.
5. Let us C, Yashwant Kanetkar, BPB Publications.
6. Pointers in C, Yashwant Kanetkar, BPB Publications.

**BCSAI 104: COMPUTING SYSTEM LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. Given a PC, name its various components and list their functions
2. Identification of various parts of a computer and peripherals
3. DOS Basic Commands
4. Exercises on entering text and data (Typing Practice)
5. Installation of Windows Operating System using pen- drive, CD & Virtual Machine
6. Configuring the Directly Attached Disks for Basic and Dynamic Disks
7. Creating and configuring the disk partitions and volumes for the disk in Windows/Linux System
8. Creating and Configuring the RAID 0, 1 and RAID5 in windows server 2012 R2
9. Configuring the Network Share using Windows Server 2012 R2
10. Configuring the File Server in Windows Server 2012 R2
11. Configuring NFS in Linux Server
12. Configuring the iSCSI in Windows Server 2012 R2
13. Configuring FCOE in Windows Server 2012 R2
14. Creating a System Backup and Restoring in Windows Server and Linux System
15. Creating and Restoring the Snapshot for Virtual Machines in Hyper-V

**BEE 102: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**Electrical Lab:**

1. To verify Ohm's Law
2. Verification of Kirchoff's Law applied to the DC circuits.
  - (a) Parallel and Series combination
  - (b) Identification of node points
  - (c) Algebraic sum of current at node points
  - (d) Algebraic sum of e.m.f.s and voltage drops.
3. To construct a RLC series circuit and measure its impedance, inductive ( $X_L$ ) and capacitive reactance ( $X_C$ ), measure phase angle between voltage and current.
4. Make house wiring including earthing for 1-phase energy meter, MCB, ceiling fan, tube light, three pin socket and a lamp operated from two different positions.
5. Study the construction & basic working of ceiling fan. Connect ceiling fan along with regulator through auto-transformer to run and vary speed.
6. Study the construction and connection of single-phase transformer and auto-transformer. Measure input and output voltage and fin turn ratio.
7. Study the construction, circuit, working and application of the following lamps.
  - (a) Fluorescent Lamp, (b) Sodium Vapour Lamp (c) Mercury vapour lamp (d) Halogen Lamp

**Electronics Lab:**

1. Study the following devices:
  - (a) Analog & digital multimeters
  - (b) Function/ Signal generators
  - (c) Regulated d. c. power supplies (constant voltage and constant current operations)
  - (d) Study of analog CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
2. Identification, testing and applications of Resistors, Inductors, Capacitors, PN-diode, SCR, TRIAC, Photo Diode, Zener diode, LED, LCD, BJT, Photo Transistor.
3. Plot V-I characteristic of P-N junction diode & Zener diode & calculate cut-in voltage, reverse Saturation current and static & dynamic resistances. Application of Diode as clipper & clamper.
4. Plot input and output characteristics of BJT in CE configurations. Find its h parameters. Plot gain- frequency characteristic of emitter follower & find out its input and output resistances.
5. Study half wave rectifier and bridge rectifier and effect of filters on wave. Also calculate theoretical & practical ripple factor.

**BCSAI 105: PROGRAMMING IN C LANGUAGE LAB****0L + 0T + 4P + 2C****MM 100****Basic Calculation:**

1. Write a c program to display your Name, address and city in different lines.
2. Write a c program to perform all arithmetic operations.
3. Write a c program to convert the Fahrenheit into centigrade. Formula  $c = (F-32)/1.8$
4. Write a c program to calculate the simple interest.
5. Write a c program to calculate the compound interest.
6. Write a program in C to display sum of first N natural numbers.
7. Write a c program to find the roots of the quadratic equation.

**Conditional Statements**

1. Write a C – program which used to determine type of triangle based on sides. Measure of sides input by the user. To check whether the triangle is isosceles, scalene or equilateral triangle. Hint: If all the sides are equal than equilateral, If any two sides are equal than isosceles otherwise scalene.
2. Write a program in C to which allow user to enter any arithmetic operator (+ - \* /) and two integer values and display result according to selection of operator.
3. Write a program in C to calculate gross salary of employee using : 1. Gross Salary = Basic Pay + DA + HRA – PF. 2. DA = 30% If Basic Pay < 5000 otherwise DA = 45% of the Basic Pay. 3. HRA = 15% of Basic Pay. 4. PF = 12% of Basic Pay. Only basic pay will input by the user. Display Gross salary – DA – HRA – PF and basic salary
4. Student should fulfill the following criteria for admission: Mathematics  $\geq 50$  Physics  $\geq 45$  Chemistry  $\geq 60$  Total of all subject  $\geq 170$  OR Total of Mathematics + Physics  $\geq 120$  Accept the marks of all the three subjects from the user and check if the student is eligible for admission.
5. Write a program in C for grade calculation using if...else if ladder and switch Statement. Accept marks of 3 subjects calculate total and based on it calculate Grade.

**Loop Programs**

1. Program to display first N prime numbers. N is input by the user.
2. Program to display A to Z in upper case or lower case according to user selection.
3. Program which used to print A to Z and Z to A.
4. Program which ask for party to user until the user say yes
5. Program which ask for party to user until the user say yes
6. Program which check that whether the given number is palindrome or not.
7. Program to check that the given number is Armstrong or not.
8. Program which will display next nearest prime number of given integer number. For example next nearest prime of 5 is 7, for 8 is 11, for 7 is 11 (Using Do while)

ENG 113: COMMUNICATIONS-I LAB

0L + 0T + 4P + 2C

MM 100

**1. Self-Awareness**

What is Self-Awareness? Introspection, Guide to Self-Awareness and Self Analysis, SWOT Analysis on self

**2. Confidence Building**

What is Confidence? Important of Confidence Building, 6-steps guide on building Self – Confidence

**3. Goal Setting**

Purpose of Goal Setting, Importance of Goal Setting, SMART Goals, Performance Goals and Result Goals

**4. Professional Grooming and Basic Etiquette**

First Impressions, Importance of Professional Grooming, Grooming Guide – Men/ Women, Introduction to Basic Etiquette, Classroom Etiquette/Restroom Etiquette/Telephone Etiquette, General Etiquette

**Sentence Formation:** Using Noun/Types of Noun, Verbs & its usage, Tense chart using Verbs, Subject-Verb Agreement

**Paragraph Writing:** Three Essential Elements, Illustration & Application of the Three Elements, how to write an effective paragraph

**Rapid Reading:** What is Rapid Reading? Importance of Rapid Reading, Simplifying Rapid Reading, Rapid Reading Passages

**Public Speaking:** Why is Public Speaking important? Three parts to Public Speaking explained, Guide to successful Public Speaking

**Time Management:** What is Time Management? Importance of Time Management, Managing Time Effectively, Blocks to Effective Time Management

**Stress Management:** Stress and its Causes, Symptoms of Unmanaged Stress, Managing Stress, Benefits of Stress Management

**Presentation Skills:** Types of Presentation Communication, A Beginner's Guide to PowerPoint 2013, 4 P's, Delivering Effective Presentation

**The Colorful World of Adjectives:** Types of Adjectives, Use of Adjective in Sentences, Descriptive Adjective for You.

# **Syllabus**

## **Semester-II**

**BCSAI 201 : DISCRETE MATHEMATICS**

**3L+0T+0P+3C**

**MM: 100**

**Unit 1: Formal Logic** - Statement, Symbolic Representation and Tautologies, Quantifiers, Predicate and validity, Normal form. Propositional Logic, Predicate Logic, Logic Programming and Proof of correctness.

**Unit 2: Proof, Relation And Analysis Of Algorithm Techniques For Theorem Proving** - Direct Proof, Proof by Contra position, Proof by exhausting cases and proof by contradiction, principle of mathematical induction, principle of complete induction. Recursive definitions, solution methods for linear, first-order recurrence relations with constant coefficients.

**Unit 3: Graph Theory** - Graphs - Directed and Undirected, Eulerian chains and cycles Hamiltonian chains and cycles, Trees, chromatic number, connectivity and other graphical parameters Applications. Polya's Theory of enumeration and its applications.

**Unit 4: Sets And Functions** - Sets, relations, functions, operations, equivalence relations, relation of partial order, partitions, binary relations. Transforms: Discrete Fourier and Inverse Fourier Transforms in one and two dimensions, discrete Cosine transform.

**Unit 5: Monoids And Groups** - Groups, Semi groups and Monoids cyclic semi groups and sub monoids, Subgroups and cosets. Congruence relations on semi groups. Morphism, Normal sub groups. Structure off cyclic groups, permutation groups and dihedral groups elementary applications in coding theory.

Text/Reference Books:

1. C.I.Liu; elements of Discrete Mathematics Tata McGraw Hill publishing Company Ltd., 2000
2. Richard Johnsonbaugh discrete mathematics Pearson Asia 2001.
3. John Truss: Discrete Mathematics for Computer Scientists, Pearson Education, Asia, 2001.
4. Robert J. Mc Eliece: Introduction to Discrete Mathematics, Tata Mc. Graw Hill, India.
5. Lipschutz: Discrete Mathematics, Tata Mc. Graw Hill India.
6. Kenneth H. Rosen, Discrete mathematics and Applications, Tata Mc. Graw Hill

**BCSAI 202: STATISTICAL LEARNING****3L + 0T + 0P + 3C****MM 100**

**Unit 1: Introduction to Statistics-**History and evolution of statistics, types of data, important terminologies, contingency table, frequency and cross table, graphs, histogram and frequency polygon, Random variables, statistical properties of random variables, Expectation, , jointly distributed random variables, moment generating function, characteristic function, limit theorems.

**Unit 2: Measures of Central Tendency and Dispersion-** Descriptive Statistics, Mean: Arithmetic, Geometric and Harmonic means, mathematical relationship among different means, median for raw data and grouped data, mode for raw data and grouped data, relationship among mean, median and mode, measure of dispersion – standard deviation, variance, covariance and its properties, coefficient of variation, quartiles, quartile deviation and mean deviation, Mean absolute deviation.

**Unit 3: Testing of Hypothesis-** Introduction to testing of hypothesis, Statistical assumptions, Level of significance, confidence level, Type I Error, Type II error, Critical value, power of the test, Application of small sample test – t and F test, Large Sample test – Z test in Data Science Industry with small use cases (application oriented).

**Unit 4: Analysis of Variance (ANOVA)-** Introduction to general linear model, assumptions of ANOVA, factors and levels in ANOVA, layout of one way ANOVA, skeleton of one way ANOVA, multiple comparison of sample means, one way analysis of variance with unequal sample sizes, two factor analysis of variance – introduction and parameter estimation, two way analysis of variance with interaction, Post ANOVA: testing of hypothesis for significance of mean using Fishers Least Significance Difference test (lsd), Tukeys test, Dunnet test, Duncan Multiple Rangetest.

**Unit 5: Regression and Correlation-** Introduction to linear model, concepts of factor, effect, residuals, dependency, independency, assumptions of linear model, estimation of parameters using OLS, properties of regression coefficients, Spurious regression concepts, significance of regression coefficients using t test and F test, concepts of auto correlation, multiple linear regression analysis, multi collinearity, heteroscedasticity, significance of estimated parameters in multiple linear regression, partial test for the individual significance, correlation analysis, properties of correlation coefficients, significance of single correlation coefficient, significance of multiple correlation coefficients, concepts of multiple correlation and partial correlation.

**Text /Reference Books:**

1. Fundamentals of mathematical statistics – SC Gupta and VK Kapoor, Sultan Chand & Sons Publication, New Delhi
2. Introduction to Probability and Statistics for Engineers and Scientists, Third Edition - Sheldon M. Ross, Elsevier Publication, Academic Press, UK.
3. An introduction to Probability and Statistical Inference – George Roussas, Academic Press.



**CHY 103: ENVIRONMENTAL STUDIES**

2L + 0T + 0P + 2C

MM 100

**Unit 1: Introduction and natural resources:** Multidisciplinary nature and public awareness, renewable and nonrenewable resources and associated problems, forest, water, mineral, food, energy and land resources. Introduction to natural resources, conservation of natural resources and human role.

**Unit 2: Ecosystem:** Ecological concepts, concept of ecosystems, types of ecosystems, ecosystem structure and functioning, energy flow, food chains and food webs, ecological pyramids.

**Unit 3: Biodiversity and Conservation:** Definition, genetic species and ecosystem diversity biogeographically, classification of Indian value of biodiversity at national and local levels, India as a mega-diversity nation, treats to biodiversity and endangered and endemic species of India, need for conservation of biodiversity.

**Unit 4: Environmental pollution:** Definition, causes, effect and control of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, electromagnetic pollution, nuclear hazards, human role in prevention of pollution, solid waste management, disaster management, floods, earthquake, cyclone, and landslide

**Firework Safety:** Combustion of firework and pollution (noise, smoke, fireworks fallout and residue pollution), heavy metal toxicity due to fireworks and associated health effects.

**Unit 5: Social Issue and Environment:** Unsuitable to suitable development, urban problem related to energy and water conservation, environment protection act, wild life protection act, forest conservation act, environmental issues, population explosion, and family welfare programme. Environmental and human health HIV, women and child welfare, role of information technology on environment and human health.

**Corruption:** definition and reasons, details of organizations/agencies working against corruption, role of individual against corruption and mode of action.

**Ethics :** Meaning , nature, determinants and objectives of ethics, ethics and its relation to values norms and morals, Indian ethos, Swami Vivekananda and ethics.

**Text/Reference Books**

1. Fundamentals of Environmental Biology, K. C. Agrawal, Nidhi Publishers(Bikaner).
2. Fundamentals of Ecology, E.P. Odum, W.B. Saunders Co. (USA).
3. Fundamentals of Ecology, E. P. Odum, Natraj Publisher (Dehradun).
4. Ecology: Principles and Applications, J. L. Chapman & , M. J. Reiss, Cambridge University Press.
5. Atmospheric pollution, W. Buch , Tata McGraw Hill(TMh)
6. Professional Ethics and Human Values, M. Govindarajan, PHI Learning Private Limited (Delhi).

**BCSAI 203: DESIGN THINKING**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Design Thinking:** Foundations of Human Centered Design, Barriers to Innovation and Adoption, Learning by Doing, Understanding Needs in Context.

**Unit 2: Design Needs and Interventions:** The Ethics of Design Interventions, Design Needs in Education, Engineering and Health & Society.

**Unit 3: Empathy in Design:** Discovering Explicit and Latent Needs, Qualitative Research: Watching and Listening, Point of View & Problem Reframing, Developing Grounded Theory, Design for Usability.

**Unit 4: Ideation, Experimentation and Evolution:** Generating and Developing Ideas, Creativity as Teaching and Learning, Prototyping and testing Learning Through Things & Interactions, Express, Test, Cycle

**Unit 5: Design Documentation:** Representing Design Knowledge, Diffusion of Innovation, Design as research

Text/Reference books:

1. Design Thinking: Integrating Innovation, Customer Experience, and Brand Value, by [Thomas Lockwood](#), Allworth Press, 2010.
2. 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization Book by Vijay Kumar.
3. Design Thinking: Understand – Improve – Apply edited by Hasso Plattner, Christoph Meinel, Larry Leifer, Springer Science & Business Media, 201

**BCSAI 204: OPERATING SYSTEM-BUILDING BLOCKS****3L + 0T + 0P + 3C****MM 100**

**Unit 1: Introduction to Operating System:** Introduction, Objectives and Functions of OS, Evolution of OS, OS Structures, OS Components, OS Services, System calls, System programs, Virtual Machines.

**Unit 2: Process Management:** Process concept, Process scheduling, Co-operating processes, Operations on processes, Inter process communication, Communication in client-server systems. **Threads:** Introduction to Threads, Single and Multi-threaded processes and its benefits, User and Kernel threads, Multithreading models, threading issues. **CPU Scheduling:** Basic concepts, Scheduling criteria, Scheduling Algorithms, Multiple Processor Scheduling, Real-time Scheduling, Algorithm Evaluation, Process Scheduling Models. **Process Synchronization:** Mutual Exclusion, Critical – section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical Regions, Monitors, OS Synchronization, Atomic Transactions **Deadlocks:** System Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

**Unit 3: Storage Management: Memory Management:** Logical and physical Address Space, Swapping, Contiguous Memory Allocation, Paging, Segmentation with Paging. **Virtual Management:** Demand paging, Process creation, Page Replacement Algorithms, Allocation of Frames, Thrashing, Operating System Examples, Page size and other considerations, Demand segmentation **File-System Interface:** File concept, Access Methods, Directory structure, File-system Mounting, File sharing, Protection and consistency semantics.

**Unit 4: File-System Implementation:** File-System structure, File-System Implementations, Directory Implementation, Allocation Methods, Free-space Management, Efficiency and Performance, Recovery **Disk Management:** Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Attachment, stable-storage Implementation

**Unit 5: Protection and Security: Protection:** Goals of Protection, Domain of Protection, Access Matrix, and Implementation of Access Matrix, Revocation of Access Rights, Capability- Based Systems, and Language – Based Protection. **Security:** Security Problem, User Authentication, One – Time Password, Program Threats, System Threats, Cryptography, Computer – Security Classifications.

**Text/REFERENCE BOOKS:**

1. Milan Milonkovic, Operating System Concepts and design, II Edition, McGraw Hill 1992.
2. Tanenbaum, Operation System Concepts, 2nd Edition, Pearson Education.
3. Silberschatz / Galvin / Gagne, Operating System, 6th Edition, WSE (WILEY Publication)
4. William Stallings, Operating System, 4th Edition, Pearson Education.
5. H.M.Deitel, Operating systems, 2nd Edition, Pearson Education

**BCSAI 205: DIGITAL ELECTRONICS****3L+0T+0P+3C****MM 100**

**Unit 1: Number Systems And Codes:** Introduction to number systems, weighted and non-weighted codes, 1's complement, 2's complement, complement arithmetic  
Introduction to Boolean algebra: Postulates and theorems of Boolean algebra, Boolean functions, canonical and standard form, simplification of Boolean function using Boolean laws and theorems

**Unit 2: Logic Gates:** Diode and transistor as a switch, basic logic gates, derived logic gates, block diagrams and truth tables, logic diagrams from Boolean expression and vice versa, converting logic diagram to universal logic, positive logic, negative logic and mixed logic

**Unit 3: Simplification Of Boolean Functions:** K-map representation, incompletely specified functions, simplification realization with gates, Quine-McCluskey method  
Combinational Logic: Analysis and design of combinational circuits, half adder and full adder, half subtractor and full subtractor, binary serial and parallel adder, BCD adder, binary multipliers, magnitude comparator, decoders, encoders, multiplexers, de-multiplexers

**Unit 4: Sequential Circuits:** Latches, flip-flops, triggering of the flip-flops, master-slave flip-flop, excitation tables, conversion of the flip-flops, analysis and design of clocked sequential circuits, shift registers, counters

**Unit 5: Logic Families:** Logic gate characteristics (propagation delay, speed, noise margin, fan-in, fan-out, power dissipation), standard logic families (RTL, DCTL, DTL, TTL, ECL, MOS), tri-state devices  
Programmable Logic: Introduction to programmable logic array (PLA) & programmable array logic (PAL)

**Text/Reference Books:**

1. Digital Design, Moris Mano, Pearson Education
2. Digital Fundamental, Floyd and Jain, Pearson Education
3. Digital System: Principles and Applications, Tocci, Pearson Education
4. Digital Electronics, B. P. Singh, DhanpatRai& Sons
5. Modern Digital Electronics, R. P. Jain, Tata McGraw-Hil

**BCSAI 206: DIGITAL ELECTRONICS LAB**

**0L+0T+4P+2C**

**MM:100**

**List of Experiments:**

1. To study and perform the following experiments:
  - (a) Operation of digital multiplexer and demultiplexer.
  - (b) Binary to decimal encoder.
  - (c) Characteristics of CMOS integrated circuits.
2. To study and perform experiment - Compound logic functions and various combinational circuits based on AND/NAND and OR/NOR Logic blocks.
3. To study and perform experiment - Digital to analog and analog to digital converters.
4. To study and perform experiment - Various types of counters and shift registers.
5. To study and perform experiment - Interfacing of CMOS to TTL and TTL to CMOS ICs.
6. To study and perform experiment- BCD to binary conversion on digital IC trainer.
7. To study and perform experiment -
  - (a) Astable (b) Monostable (c) Bistable Multivibrators and the frequency variation with different parameters, observe voltage waveforms at different points of transistor.
8. To study and perform experiment -Voltage comparator circuit using IC-710.
9. To study and perform experiment- Schmitt transistor binary circuit.
10. Design 2 bit binary up/down binary counter on bread board.

**BCSAI 207: COMPUTER AIDED GRAPHICS & DRAFTING LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**Introduction:** Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning, Computer aided drafting: Introduction to computer aided drafting, advantages and applications of CAD, concepts of computer aided drafting using AutoCAD, basic drawing and modify commands.

[Discussion on AutoCAD software and drawing in Sketch book]

**Isometric Projections:** Isometric projection of planes and solids.

[At least 3 Problems in AutoCAD and 3 problems in Sketch book]

**Orthographic Projection:** Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection.

[At LEAST 4 problems on AutoCAD and 4problems in sketch book]

**Section of solids:** Introduction to sectional views, Section of right solids by normal and inclined planes.

[At least 2 problems on AutoCAD and 2problems in sketch book]

**Conventional representation of materials:** Common features, Springs, Gear Assemblies, Materials, Interrupted views and Braking of Shaft, Pipe, Bar, Surface finishing & Machining Symbols

[At least 2 problems on AutoCAD and 2 problems in sketch book]

**Miscellaneous:** Welded joints, riveted joints, Belt and pulleys, screw fasteners, Bearings; Ball, roller, needle, foot step bearing Belt and pulleys, pipe joints.

[At least one problem from each on AutoCAD and sketch book preparation of all topics]

**Text/Reference Books**

1. N.D. Bhatt, Elementary Engg. Drawing, Chartor Pub. House, Anand, India.
2. D. N. Johle, Engineering Drawing, Tata Mcgraw-hill Publishing Co. Ltd..
3. P.S. Gill, Engineering Graphics.
4. N.D. Bhatt, Machine Drawing, Chartor Publishing house, Anand, India.
5. Warren J. Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi.
6. Fredderock E. Giesecke, Alva Mitchell & others, Principles of Engineering Graphics, Maxwell McMillan Publishing.

**ENG 114: BUSINESS AND TECHNICAL COMMUNICATION LAB**

**0L + 0T + 4P + 2C**

**MM 100**

1. Phonetic Symbols and Transcriptions
2. Methods of Word Formation
3. Reading, Listening and Speaking Skills
4. Seminar Presentation
5. Group Discussion
6. Job Interview

**Text / Reference Books**

1. Advanced Manual for Communication Laboratories and Technical Report Writing, D.Sudha Rani, Pearson,(New Delhi)
2. A Course in Phonetics and Spoken English, J. Sethi & P.V. Dhamija, PHI Learning Pvt. Ltd.
3. English Language Laboratories: A Comprehensive Manual, Nira Konar, PHI Learning Pvt. Ltd.
4. Oxford English Learning Package ( with CDs: Headway Series)
5. Tata McGraw Hills English Learning Package ( with CDs)
6. Oxford Advanced Learners' Dictionary, Oxford University Press (New Delhi)

# **Syllabus**

## **Semester-III**



**BCS AI 301: COMPUTER NETWORKS****3L + 0T + 0P + 3C****MM 100****Unit 1: Networking Fundamentals**

Basics of Network & Networking, Advantages of Networking, Types of Networks, Types of Network Architecture, Workgroup Vs. Domain. Network Topologies, Types of Topologies, Logical and physical topologies, selecting the Right Topology, Types of Transmission Media, Communication Modes, Wiring Standards and Cabling, media connectors, Introduction of OSI model, Functions of the seven layers, Introduction of TCP/IP Model, Comparison between OSI model & TCP/IP model.

**Unit 2: Basics of Network Devices**

Network Devices- NIC- functions of NIC, installing NIC, Hub, Switch, Bridge, Router, Gateways, And Other Networking Devices, Repeater, CSU/DSU, Modem, Ethernet standards, Ethernet Components, Point-to-Point Protocol, Address Resolution Protocol, Message format, transactions, Benefits of Wireless Technology, Types of Wireless Networks, Wireless network Components, wireless LAN standards, wireless security Protocols.

**Unit 3: Basics of Network, Transport and Application Layers**

Network Layer: Internet Protocol (IP), IP standards, versions, functions, The IPv4 and IPv6 Datagram Format, IPv4 addressing, IPv4 Subnetting, CIDR and VLSM, IPv6 Addressing, , Internet Control Message Protocol , Internet Group Management Protocol ,Introduction to Routing and Switching concepts, Transport Layer: Transmission Control Protocol(TCP), User Datagram Protocol (UDP), Overview of Ports & Sockets, Application Layer Protocols

**Unit 4: WAN Technology**

Introduction to WAN, WAN Switching techniques, connecting to the Internet, Satellite-Based Services, Cellular Technologies, Technologies used for Connecting LANs, Remote Access Connections and technologies, Authentication and Authorization, Tunnelling and Encryption Protocols, Security Appliances and Security Threats.

**Unit 5: Troubleshooting Network**

Trouble Shooting Networks: Command-Line Interface Tools, Network and Internet Troubleshooting, Troubleshooting Model, identify the affected area, probable cause, implement a solution, test the result, recognize the potential effects of the solution, document the solution, Using Network Utilities: ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat, Hardware trouble shooting tools, system monitoring tools.

**Text/ Reference Books:**

1. Data Communication And Networking (Sie), Forouzan, TMH
2. Computer Network, Tanenbaum, Pearson
3. CCNA Cisco Certified Network Associate: Study Guide (With CD) 7th Edition (Paperback), Wiley India, 2011
4. CCENT/CCNA ICND1 640-822 Official Cert Guide 3 Edition (Paperback), Pearson, 2013
5. Routing Protocols and Concepts CCNA Exploration Companion Guide (With CD) (Paperback), Pearson, 2008
6. CCNA Exploration Course Booklet: Routing Protocols and Concepts, Version 4.0 (Paperback), Pearson, 2010.

**BCSAI 302: PROBABILITY AND RANDOM VARIABLES**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Probability And Random Variables**

Probability – Axioms of probability – Conditional probability – Baye’s theorem – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**Unit 2: Two – Dimensional Random Variables**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

**Unit 3: Random Processes**

Classification – Stationary process – Markov process – Markov chain – Poisson process – Random telegraph process.

**Unit 4: Correlation And Spectral Densities**

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

**Unit 5: Linear Systems With Random Inputs**

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output

**Text /Reference Books:**

1. Ibe, O.C.,” Fundamentals of Applied Probability and Random Processes “, 1st Indian Reprint, Elsevier, 2007.
2. Peebles, P.Z., “Probability, Random Variables and Random Signal Principles “, Tata McGraw Hill, 4th Edition, New Delhi, 2002.
3. Cooper. G.R., McGillem. C.D., “Probabilistic Methods of Signal and System Analysis”, Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
4. Hwei Hsu, “Schaums Outline of Theory and Problems of Probability, Random Variables and Random Processes “, Tata McGraw Hill Edition, New Delhi, 2004.

**BCSAI 303: DATA STRUCTURES & ALGORITHMS****3L + 0T + 0P + 3C****MM 100****Unit 1: Introduction to Data structures**

Definition, Classification of data structures: primitive and non-primitive, Elementary data organization, Time and space complexity of an algorithm (Examples), String processing. Dynamic memory allocation and pointers: Definition of dynamic memory allocation, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointer, Meaning of static and dynamic memory allocation, Memory allocation functions: Malloc(), Calloc(), free() and realloc(). Recursion: Definition, Recursion in C (advantages), Writing Recursive programs – Binomial coefficient, Fibonacci, GCD.

**Unit 2: Searching and Sorting**

Basic Search Techniques: Sequential search: Iterative and Recursive methods, Binary search: Iterative and Recursive methods, Comparison between sequential and binary search. Sort: General background and definition, Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort.

**Unit 3: Stack and Queue**

Stack – Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations, Conversion of an arithmetic expression from Infix to postfix, Applications of stacks. Queue: Definition, Array representation of queue, Types of queue: Simple queue, Circular queue, Double ended queue (deque), Priority queue, Operations on all types of Queues.

**Unit 4: Linked List**

Definition, Components of linked list, Representation of linked list, Advantages and Disadvantages of linked list. Types of linked list: Singly linked list, doubly linked list, Circular linked list, Operations on singly linked list: creation, insertion, deletion, search and display.

**Unit 5: Tree Graphs and their Applications:**

Definition: Tree, Binary tree, Complete binary tree, Binary search tree, Heap Tree terminology: Root, Node, Degree of a node and tree, Terminal nodes, Non-terminal nodes, Siblings, Level, Edge, Path, depth, Parent node, ancestors of a node. Binary tree: Array representation of tree, Creation of binary tree. Traversal of Binary Tree: Preorder, Inorder and postorder. Graphs, Application of Graphs, Depth First search, Breadth First search.

**Text /Reference Books:**

1. Weiss, Data Structures and Algorithm Analysis in C, II Edition, Pearson Education, 2001
2. Lipschutz: Schaum's outline series Data structures Tata McGraw-Hill
3. Robert Kruse Data Structures and program designing using 'C'
4. E. Balaguruswamy Programming in ANSI C.
5. Bandyopadhyay, Data Structures Using C Pearson Education, 1999
6. Tenenbaum, Data Structures Using C. Pearson Education, 200
7. Kamthane: Introduction to Data Structures in C. Pearson Education 2005.
8. Hanumanthappa M., Practical approach to Data Structures, Laxmi Publications, Fire Wall media 2006

**BCSAI 304: OBJECT ORIENTED PROGRAMMING USING JAVA**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit: 1**

**Introduction to Java**

Introduction, installing java, JRE and JDK, Byte Code, JVM; Simple Java program. Creating Objects, Data types, Operators: Arithmetic Operators, Bitwise operators, Relational operators, Logical Operators, The Assignment Operator, ternary operator; Operator Precedence, Access specifiers. Type casting; Strings. Control Statements: conditional statements, looping statements, jumping statements, methods, static methods, and static block, Arrays

**Unit: 2**

**Classes, Inheritance, package and Interface**

Classes: Classes in Java; declaring a class; constructors, method overloading, Object Class.

Inheritance: Simple Inheritance, Super class and sub class, super keyword multiple, and multilevel inheritance; Overriding.

Packages and Interfaces: Packages, Defining Packages, access protection, Importing Packages. Abstract Methods, Abstract Classes, Defining Abstract Classes, Extending Abstract Classes, Defining Interfaces, Implementing Interfaces

**Lambda Expressions**

Introducing Lambda Expressions, Lambda Expression Fundamentals, Functional Interfaces, Some Lambda Expression Examples, Block Lambda Expressions, Generic Functional Interfaces, Passing Lambda Expressions as Arguments

**Unit: 3**

**Thread Programming, Exceptions and I/O**

Thread Programming: What are threads? Thread life cycle, Extending Thread class, implementing runnable interface, Synchronization, Deadlock, Manipulation Thread states.

Exception Handling: Fundamentals, Exception Types, try and catch, multiple catch clauses, nested try statements, throw, and throws, finally, built in exceptions, user defined exceptions and chained exceptions. I/O: Introduction, stream classes, Byte Streams, Character Streams, Reading Data from

Keyboard, Folders and Folder Operations, Files and File Operations, Serialization and Deserialization

**Unit: 4**

**Networking and JDBC**

Networking: Introduction, Socket, Client/Server architecture, Reserved Sockets, Proxy Servers, Internet Addressing, Factory Methods, Instance Methods, TCP/IP Client Sockets : URL,URL Connection, TCP/IP Server Sockets, Datagrams, Datagram Sockets, Inet4Address and Inet6Address, RMI: Stub, Skelton

Database connectivity – JDBC architecture and Drivers. JDBC API - loading a driver, connecting to a database, creating and executing JDBC statements, handling SQL exceptions. Accessing result sets: types and methods. An example - JDBC application to query a database

## **Unit: 5**

### **GUI Programming with AWT and JavaFX**

AWT: GUI Programming, AWT Basics, AWT package: Layouts, Label, Text Field, Button, Events, Text Area, Checkbox, Checkbox Group, List, Canvas, Menus, Pop Menus, Panel, And Dialog. Listeners: Action Listener, Mouse Listener, Item Listener, Key Listener, Window Listener

JavaFX: Basic Concepts, JavaFX Packages, Stage and Scene Classes ,Nodes and Scene Graphs, Layouts, Application Class and the Lifecycle Methods, Compiling and Running a JavaFX Program, JavaFX Control: Label, Buttons and Events, Event Handling, Button, ToggleButton, RadioButton, Image, ImageView, ListView, ComboBox, Menus, Toolbar, Case Study .

### **Text/Reference Books:**

1. Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007
2. Jim Keogh: J2EE The Complete Reference, Tata McGraw Hill, 2007
3. Y. Daniel Liang: Introduction to JAVA Programming, 6th Edition, Pearson Education, 2007
4. Stephanie Bodoff et al: The J2EE Tutorial, 2nd Edition, Pearson Education, 2006

**BCSAI 305: CLOUD COMPUTING**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Understanding cloud computing**

Introduction to Cloud Computing -Benefits and Drawbacks - Types of Cloud Service Development - Deployment models

**Unit 2: Cloud Architecture Technology and Architectural Requirements**

The Business Case for Clouds -Hardware and Infrastructure – Accessing the cloud – Cloud Storage – Standards- Software as a Service – Discovering Cloud Services Development tools. Three Layered Architectural Requirement - Provider Requirements - Service Centric Issues - Interoperability – QoS.

**Unit 3: Fault Tolerance**

Fault Tolerance - Data Management Storage and Processing – Virtualization Management - Scalability - Load Balancing - Cloud Deployment for Enterprises - User Requirement - Comparative Analysis of Requirement.

**Unit 4: Security Management in Cloud**

Security Management Standards - Security Management in the Cloud Availability Management – SaaS Availability Management - PaaS Availability Management – IaaS Availability Management - Access Control - Security Vulnerability, Patch, and Configuration Management – Privacy in Cloud- The Key Privacy Concerns in the Cloud - Security in Cloud Computing

**Unit 5: Virtualization**

Objectives - Benefits - Virtualization Technologies – Data Storage Virtualization – Storage Virtualization – Improving Availability using Virtualization - Improving Performance using Virtualization Improving Capacity using Virtualization.

**Text /Reference Books:**

1. David S Linthicum, “Cloud Computing and SOA Convergence in your Enterprise A Step by Step Guide”, Addison Wesley Information Technology Series.
2. Anthony T Velte, Toby J.Velte, Robert Elsenpeter, “Cloud computing A Practical Approach “, Tata McGraw Hill Publication
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy
4. An Enterprise Perspective on Risks and Compliance” , O’Reilly Publications, First Edition
5. Michael Miller, “Cloud Computing – Web-Based Applications that Change the Way You Work and Collaborate Online”, Pearson Education, New Delhi, 2009.
6. Cloud Computing Specialist Certification Kit – Virtualization Study Guide

**BCSAI 306: COMPUTATIONAL SYSTEMS BIOLOGY**

2L + 0T + 0P + 2C

MM 100

**Unit 1: Introduction to Mathematical Modelling**

Collection, Classification and Tabulation of data, Bar diagrams and Pie diagrams, Histogram, Frequency curve and frequency polygon, Ogives. Mean, median, mode, Standard deviation.

**Unit 2: Introduction to Static Networks**

Graph Theory, Overview of types of Graphs-cyclic/acyclic, complete bipartite, Graph Terminology, Representation of Networks, Sparse Matrices, Basic Network parameters

**Unit 3: Network Biology and Applications**

Biological Problems map to graph problems, Networks Jargons-Node, Density, Degree, Clustering Co-efficient, Closeness, Connected Component, Motifs

**Unit 4: Reconstruction of Biological Networks**

Random Networks, Small-world networks, power law networks, Centrality-lethality Analysis, Assortativity, Community Detection, Protein Network, Gene Regulatory networks

**Unit 5: Dynamic Modelling of Biological systems**

Introduction, Biochemical Network Model-Michaelis-Menten Kinetics, Non-biological network model-planetary motion, stock-market behavior

**Text/Reference Books**

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley and Sons, 2001.
2. Computational Cell Biology, Christopher Fall, Springer, 2000.
3. Mathematical models in biophysics, Ruzhichenko Galina Yur'evna, Book Online, Biophysical society.
4. Voit E (2012) A First Course in Systems Biology. Garland Science, 1/e. ISBN 0815344678
5. Klipp E (2009) Systems biology: a textbook. Wiley-VCH, 1/e. ISBN 9783527318742
6. Newman MEJ (2011) Networks: an introduction. Oxford Univ. Press. ISBN 9780199206650

**BCSAI 307: COMPUTER NETWORKS LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. Switch Configuration - Basic Commands and Switch Port Security.
2. Router – Configuration and Setting up of Passwords.
3. PPP Encapsulation, PPP PAP Authentication, PPP CHAP Authentication.
4. A configuration of default, Static and Dynamic Routing.
5. VLAN Configuration.
6. Configuration of Access-lists - Standard and Extended ACLs.
7. DHCP, DHCP Relay and DHCP Exclusions.
8. Configuring Logging to a Remote Syslog Server.
9. Design and analyse network with a router, Switch and Hub to find the number of broadcast domains and collision domain using packet tracer.
10. Configure a wireless network for ad-hoc and infrastructure mode.
11. Configure point to site and site to site VPN.
12. Perform network troubleshooting using ping, traceroute, tracert, ipconfig, arp, nslookup, netstat, nbtstat.



**BCSAI 308: DATA STRUCTURES AND ALGORITHMS LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

**Part A**

1. Use a recursive function to find GCD of two numbers.
2. Use a recursive function to find the Fibonacci series.
3. Use pointers to find the length of a string and to concatenate two strings.
4. Use pointers to copy a string and to extract a substring from a given a string.
5. Use a recursive function for the towers of Hanoi with three discs.
6. Insert an integer into a given position in an array.
7. Deleting an integer from an array.
8. Write a program to create a linked list and to display it.
9. Write a program to sort N numbers using insertion sort.
10. Write a program to sort N numbers using selection sort.

**Part B**

1. Inserting a node into a singly linked list.
2. Deleting a node from a singly linked list.
3. Pointer implementation of stacks.
4. Pointer implementation of queues.
5. Creating a binary search tree and traversing it using in order, preorder and post order.
6. Sort N numbers using merge sort.

**List of Experiments:**

**Part A**

1. Write a program to check whether two strings are equal or not.
2. Write a program to display reverse string.
3. Write a program to find the sum of digits of a given number.
4. Write a program to display a multiplication table.
5. Write a program to display all prime numbers between 1 to 1000.
6. Write a program to insert element in existing array.
7. Write a program to sort existing array.
8. Write a program to create object for Tree Set and Stack and use all methods.
9. Write a program to check all math class functions.
10. Write a program to execute any Windows 95 application (Like notepad, calculator etc)
11. Write a program to find out total memory, free memory and free memory after executing garbage Collector (gc).

**Part B**

1. Write a program to copy a file to another file using Java to package classes. Get the file names at run time and if the target file is existed then ask confirmation to overwrite and take necessary actions.
2. Write a program to get file name at runtime and display number of lines and words in that file.
3. Write a program to list files in the current working directory depending upon a given pattern.
4. Create a text field that allows only numeric value and in specified length.

# **Syllabus**

## **Semester-IV**

**BCSI 401: DESIGN AND ANALYSIS OF ALGORITHMS**

3L + 0T + 0P + 3C

MM 100

**Unit 1:**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

**Unit 2:**

Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch- and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack TSP. Heuristics – characteristics and their application domains.

**Unit 3:**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

**Unit 4:**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

**Unit 5:**

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

**Text/Reference books:**

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.  
Algorithm Design, 1ST Edition, Jon Kleinberg and Éva Tardos, Pearson.
1. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
2. Algorithms—A Creative Approach, 3RD Edition, Udi Manber, Addison-Wesley, Reading, MA.

**Semester IV**

**B. Tech CSE (AI)**

**BCSAI 402: ROBOTIC OPERATING SYSTEMS & ROBOT SIMULATION**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit-1: Introduction**

Understanding ROS, ROS Environment, Installation and Configuration of ROS Environment, ROS Filesystem, ROS package:create and build.

**Unit-2: ROS Design:** Graph concepts, Nodes, topic, messages, command line tools: roscore, rosnodetop, roslaunch, rostopic, rqt\_plot

**Unit-3: ROS services:** connections and parameters; system dependencies and roslaunch, debugging, visualizing

**Unit-4: ROS Standards:** coding style, package layout, naming conventions, common procedures

**Unit-5: Coordinate frames and transforms:** actions/tasks, message ontology, client libraries: main and experimental

**Text/Reference Books:**

1. Morgan Quigley, Brian Gerkey, William D. Smart, "Programming Robots with ROS", O'Reilly Media, 2015
2. Low K. H., "Industrial Robotics: Programming, Simulation and Applications", I-Tech, 2007.
3. John J. Craig, "Introduction to Robotics Mechanics and Control", 3rd edition, Pearson, 2008.
4. B. Siciliano and K.P. Valavanis, "Control problems in Robotics and Automation", Springer, 1998.

**BCSAI 403: DATABASE MANAGEMENT SYSTEM****3L + 0T + 0P + 3C****MM 100****Unit 1: Introduction**

Purpose of Database System — Views of data – Data Models – Database Languages — Database System Architecture – Database users and Administrator – Entity– Relationship model (E-R model ) – E-R Diagrams -- Introduction to relational databases.

**Unit 2: Relational Model-I**

The relational Model – The catalog- Types– Keys - Relational Algebra – Domain Relational Calculus – Tuple Relational Calculus - Fundamental operations – Additional Operations- SQL fundamentals. Oracle data types, Data Constraints, Column level & table Level Constraints, working with Tables. Defining different constraints on the table, Defining Integrity Constraints in the ALTER TABLE Command, Select Command, Logical Operator, Range Searching, Pattern Matching, Oracle Function, Grouping data from Tables in SQL, Manipulation Data in SQL

**Unit 3: Relational Model-II**

Joining Multiple Tables (Equi Joins), Joining a Table to itself (self Joins), Sub queries Union, intersect & Minus Clause, Creating view, Renaming the Column of a view, Granting Permissions, - Updating, Selection, Destroying view Creating Indexes, Creating and managing User Integrity – Triggers - Security – Advanced SQL features –Embedded SQL– Dynamic SQL- Missing Information– Views – Introduction to Distributed Databases and Client/Server Databases.

**Unit 4: Database Design**

Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form-Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

**Unit 5: Transactions**

Transaction Concepts - Transaction Recovery – ACID Properties – System Recovery – Media Recovery – Two Phase Commit - Save Points – SQL Facilities for recovery –Concurrency – Need for Concurrency – Locking Protocols – Two Phase Locking – Intent Locking – Deadlock- Serializability – Recovery Isolation Levels – SQL Facilities for Concurrency.

**Text/Reference Books:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Fifth Edition, Tata McGraw Hill, 2006
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Fourth Edition, Pearson/Addision Wesley, 2007.
3. Raghu Ramakrishnan, “Database Management Systems”, Third Edition, McGraw Hill, 2003.

**BCSAI 404: SOFTWARE ENGINEERING****3L + 0T + 0P + 3C****MM 100**

**Unit 1: Introduction:** Introduction to software Engineering, Software characteristics, Software components, Software applications, Software Engineering Principles, Software metrics and measurement, monitoring and control. Software development life-cycle, Water fall model, prototyping model, Incremental model, Iterative enhancement Model, Spiral model.

**Unit 2: Software Requirement Specification:** Requirements Elicitation Techniques, Requirements analysis, Models for Requirements analysis, requirements specification, requirements validation.

**Unit 3: System Design: Design Principles:** Problem partitioning, abstraction. Top down and bottom up – design, structured approach. Functional versus object oriented approach of design, design specification, Cohesiveness and Coupling. Overview of SA/SD Methodology, structured analysis, data flow diagrams, extending DFD to structure chart.

**Unit 4: Testing:** Verification and validation, code inspection, test plan, test case specification. Level of testing: Unit, Integration Testing, Top down and bottom up integration testing, Alpha and Beta testing, System testing and debugging. functional testing, structural testing, Software testing strategies. Software Maintenance: Structured Vs unstructured maintenance, Maintenance Models, Configuration Management, Reverse Engineering, Software Re-engineering

**Unit 5: Software Project Management:** Project planning and Project scheduling. Software Metrics: Size Metrics like LOC, Token Count, Function Count. Cost estimation using models like COCOMO. Risk management activities. Software Reliability and Quality Assurance: Reliability issues, Reliability metrics, reliability models, Software quality, ISO 9000 certification for software industry, SEI capability maturity model.

**Text / Reference Books:**

1. R.S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill, Ed 7, 2010.
2. P. Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, Edition 3, 2011.
3. R. Mall, Fundamentals of Software Engineering, Prentice-Hall of India, 3<sup>rd</sup> Edition, 2009.
4. I. Sommerville, Software engineering (9th edition), Addison Wesley, 2010

**BCSAI 405: AI AND INTELLIGENT AGENTS**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Introduction** - What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

**Unit 2: Informed Search Strategies** - Best first search, A\* algorithm, heuristic functions, Iterative deepening A\*(IDA), small memory A\*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning

**Unit 3: Uncertainty** - Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decision- theoretic expert systems.

**Unit 4 : Learning** Forms of Learning, Inductive Learning: - Learning Decision Trees, Statistical learning methods: - Naïve Bayes models, Bayesian network, EM algorithm, HMM, Instance based learning:-nearest neighbour models.

**Unit 5 : Intelligent Systems**

Expert System- Stages in the Development of an Expert System, Difficulties in Developing Expert System, Application of Expert System, Introduction to Evolutionary Programming, Swarm Intelligent Systems.

**Text / Reference Books:**

1. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
3. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
4. Mils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.



**BCSAI 406: DATABASE MANAGEMENT SYSTEMS WITH SQL LAB**

0L + 0T + 4P + 2C

MM 100

**List of Experiments:**

1. Perform following actions using SQL statements
  - a. Create a new user with name “shiva” and password “kumar@1”
  - b. Assign the following privileges
    - i. Create and drop tables
    - ii. Create and drop users
    - iii. Allow to assign above privileges to new users
    - iv. List all tables in the database
    - v. List all users in the database
    - vi. Logout from current user and log in as “shiva”
2. Create following tables and insert minimum 10 rows in to each table
  - a. Department table with following columns with appropriate data types
    - i. DeptId
    - ii. DeptName
    - iii. DeptLoc
  - b. Employee table with following columns with appropriate data types
    - i. EmpId
    - ii. EmpName
    - iii. DOB
    - iv. DOJ
    - v. Job
    - vi. Salary
  - c. Product table with following columns with appropriate data types
    - i. ProdId
    - ii. ProdName
    - iii. Price
  - d. Sales table with following columns with appropriate data types
    - i. SalesId
    - ii. Date
    - iii. Quantity
3. Update above tables with following features using SQL statements
  - a. Make DeptId in Department table as Primary Key
  - b. Make EmpId in Employee table as Primary Key
  - c. Add DeptId column to the Employee table and make it foreign key from Department table and update the values
  - d. Add EmpId and ProdId to the Sales table and make them foreign key from Employee and Product table and update the values
  - e. Update all columns in all tables with appropriate constraint such as not null, check and so on

4. Perform the following SQL statements
  - a. Create a view “EmpDeptView” from Employee and Department table which contains following columns
    - i. EmpName
    - ii. DOB
    - iii. Salary
    - iv. DeptId
    - v. DeptName
    - vi. Loc
  - b. Retrieve all employees whose salary between 25,000 to 30,000
  - c. Retrieve all employees who is working in Accounts department (If it is not there add this row to Department table)
  - d. Retrieve all employees who is working other than Accounts department
  - e. Retrieve all employee who is working in Sales department and Bangalore location
  - f. Retrieve all employees who completed minimum 5 years
  - g. Retrieve all employees who completed minimum 5 years and salary less than 30,000
5. Perform the following SQL statements
  - a. Retrieve all employees whose salary more than 30,000
  - b. Retrieve employee details who is getting maximum salary
  - c. Retrieve employee details who is getting minimum salary
  - d. Retrieve employee details who is getting 3<sup>rd</sup> maximum salary
  - e. Retrieve employee details who is getting 5<sup>th</sup> minimum salary
  - f. Retrieve total number of employees in each department in Bangalore location
  - g. Retrieve total number of employees in each location
  - h. Retrieve total number of employees in each location in Accounts department
  - i. Retrieve total number of employees who complete more than 10 years in each department
6. Write a PL/SQL Procedure to find prime number from 1 to n, n is a user input or parameter
7. Write a PL/SQL Functions to return number of days an employee working using EmpId
8. Write a PL/SQL Procedure to find sum of salaries of all employee working in a particular location
9. Write a PL/SQL Function to return sum of sales by ProdId
10. Write a PL/SQL Function to return sum of sales by EmpId
11. Write a PL/SQL Procedure to generate Employee Report department wise as follows

DeptName	EmpName	Job	Location	Salary	Cumulative_Salary
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12. Write a PL/SQL Trigger to insert row into OldEmployee table when a employee deleted from Employee table (Create OldEmployee table)
13. Write a PL/SQL Trigger not to delete more than 2 employees at a time
14. Write a PL/SQL Trigger not to update employee salary if it cross 67000
15. Write a PL/SQL Package with following procedures and functions
  - a. Procedures
    - i. Print Total Quantity Sales Summary Report(SalesId, Date, Quantity and Total Quantity)
    - ii. Print Total Quantity Sales Summary Report by Date wise
  - b. Functions
    - i. Return employee name who made maximum sales till date
    - ii. Return product name soled maximum quantity till date

**Semester IV**

**B. Tech (AI)**

**BCSAI 407: ROBOTIC OPERATING SYSTEMS & ROBOT SIMULATION (LAB)**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. Understand Basic System Requirements
2. Installation of ROS
3. System and Utility files configuration
4. Tools commands roscore, rosnodet, roslaunch, rostopic, rqt\_plot
5. Commandline tools interfaces packages

**Semester IV**

**B. Tech (AI)**

**BCSAI 408: ONLINE SOCIAL NETWORK ANALYSIS LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. Social Media need and applications
2. Understanding various social media platforms
3. Distinction and varied uses.
4. Network Graphs.
5. Implementation with tree structures.

**Semester IV**

**B. Tech (AI)**

**BCSAI 409: SHELL SCRIPTING LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

**To gain the knowledge of Linux for penetration testing and vulnerability assessment in database, network, operating systems.**

1. Introduction to backtrack and kali Linux operating system.
2. Introduction to virtualization, Installation of Backtrack and Kali operating system through VMware and Virtual box tools.
3. Basic commands of Linux to familiar with Backtrack for eg.
4. Information gathering through Kali Linux or Backtrack.
5. Vulnerability analysis through kali Linux or Backtrack.
6. Exploitation tools of Kali Linux and Backtrack.
7. Forensic tools of Kali Linux and Backtrack.
8. Sniffing & Spoofing tools of Kali Linux and Backtrack.
9. Reverse Engineering tools of Kali Linux and Backtrack.
10. Reporting tools of Kali Linux and Backtrack.

# **Syllabus**

## **Semester-V**

**BCSAI 501: ETHICS IN COMPUTER SCIENCE**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: An overview of Ethics**

Ethics in business world, Ethics in IT, Ethics for IT professionals and IT users, IT professionals, Ethical behavior, IT professional malpractices, IT users.

**Unit 2: Computer and Internet Crime**

IT security incidents: Increasing Complexity Increases Vulnerability, Higher Computer user Expectations, Expanding and changing systems. Introduces new risks, Increased Reliance on Commercial Software with known Vulnerabilities, Types of Exploits, Perpetrators, Reducing Vulnerabilities, Risk Assessment, Establishing a Security Policy, Educating Employees, contractors and part-time Workers, Prevention, Detection, Response.

**Unit 3: Privacy**

The right of Privacy, Recent History of Privacy Protection, Key Privacy and Anonymity issues, Governmental Electronic Surveillance, Data Encryption, Identity Theft, Consumer Profiling, Treating Consumer Data Responsibility, Workplace Monitoring, Advanced surveillance Technology, Defamation, Freedom of Expression: Key issues, Controlling Access to Information on the Internet, Anonymity, National, Security Letters, Defamation and Hate Speech.

**Unit 4: Intellectual Property**

Copyrights, Patents, Trade Secret Laws, Key Intellectual Property Issues, Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence, Cyber squatting, Software Development, Strategies to Engineer Quality Software, The Importance of Software Quality, Software Development Process, Capability Maturity Model Integration for Software, Key Issues in Software Development, Development of Safety-Critical Systems, Quality Management Standards.

**Unit 5: Ethics of IT Organization**

Need for Nontraditional Workers, Contingent Workers H-IB Workers, Whistle-blowing, Protection for Whistle-Blowers, Dealing with Whistle-Blowing Situation.

**Text/ Reference Books:**

1. Deborah G.Johnson,"Computer Ethics",3/e Pearson Education.
2. Sara Baase, "A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet," PHI Publications.
3. Richard A.Spinello, "Case study in Information Technology Ethics", second Edition PHI Publications.
4. Duncan Lanford "Internet Ethics".
5. D. Micah Hester and Paul J. Ford "Computer and Ethics in the Cyber age".

**BCSAI 502: PROLOG PROGRAMMING**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: An overview of Prolog**

An overview of Prolog, components of a Prolog program, syntax of Prolog, meaning of a Prolog program, Clauses, Programs and Queries

**Unit 2: Working with Lists, Numbers and Operators**

Notation, Head and Tail, Some Built-in Predicates for List Manipulation, working with numbers: The is-Operator for Arithmetic Evaluation, Predefined Arithmetic Functions and Relations, working with operators: Precedence and Associativity, Declaring Operators with op/3.

**Unit 3: Backtracking, Cuts and Negation**

Backtracking and Cuts: Backtracking Revisited, Problems with Backtracking, Introducing Cuts, Problems with Cuts, Negation as Failure: The Closed World Assumption, Horn Formulas and Resolution.

**Unit 4: Logic Foundations of Prolog**

Translation of Prolog Clauses into Formulas, Horn Formulas and Resolution.

**Unit 5: Recursive Programming**

Induction in Mathematics, The Recursion Principle, What Problems to Solve Debugging .

**Text Books:**

1. PROLOG Programming for Artificial Intelligence Bratko I., Addison-Wesley, Reading, MA, 1986

**Reference Books:**

1. Programming in Prolog, Clocksin W.F. & Mellish C.S., Springer-Verlag, Berlin, 1981, A good introduction to programming in PROLOG
2. Foundations of Logic Programming, Lloyd J.W., Springer-Verlag, Berlin, 1984, Logic programming is a theory behind the PROLOG. You can find introduction to this topic here.



**Semester V**

**B. Tech CSE (AI)**

**BCSAI 503: SIGNAL AND IMAGE PROCESSING**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Introduction**

Fundamental steps in DIP, elements of DIP, Simple image model, sampling & quantization, basic relationships between pixels, colour image model.

**Unit 2: Image Transforms**

One-dimensional & two-dimensional DFT, cosine, sine, Hadamard, Haar, and Slant & KL transforms. Image Enhancement: Introduction, point operations, histogram modelling, spatial operations, Transform operations.

**Unit 3: Image Restoration**

Introduction, image observation models, Inverse & Wiener filtering, difference between enhancement & restoration Restoration-spatial filtering, Noise reduction in frequency domain.

**Unit 4: Image Compression**

Introduction, Pixel coding, Predictive coding, Transform coding, Inter-frame coding

**Unit 5: Image Segmentation**

Introduction, Spatial feature extraction, Transforms features, Edge detection, Boundary extraction, Segmentation techniques.

**Text/Reference Books:**

1. Digital Image Processing Using MATLAB, Gonzalez, Woods and Eddins, Gatesmark Publishing
2. Applications of Pattern Recognition, Fu, K.S., CRC Press
3. Digital Image Restoration, Andrews, H.C. Hunt, B.R., Prentice Hall, Englewood Cliffs.
4. Applications of Digital Signal Processing, Oppenheim, A.V., Prentice Hall Englewood Cliffs.
5. Digital Image Processing, Gonzalez, R.C. & Wintz, P.A., Reading, Addison-Wesley.

**BCSAI 504: DATA MINING AND ML**

3L + 0T + 0P + 3C

MM 100

**Unit 1: Introduction to Machine Learning and Data Mining**

Introduction to modern data analysis, Machine Learning, supervised and unsupervised learning, Data mining definition and motivation, data mining functionalities Concept of interesting patterns, Data mining tasks, current trends, major issues and ethics in data mining, Data Mining and Knowledge Discovery in Databases.

**Unit 2: Statistical Concepts & Linear Regression:**

Probability Distributions, Statistical Inferences, Level of Significance, Type I and Type II Error, One Sample, Paired Samples, Independent Samples T Tests, One Way ANOVA, Chi-Square Test. Linear Regression, Scatter Plot, Correlations, R Square and Adjusted R Square, Testing of Slope, Standard Error of Estimate.

**Unit 3: Logistic Regression & Decision Trees**

Logit Function, Odds versus Probabilities, Nagelkerke R Square, Classification Matrix, Cut-Offs, ROC Curve. Classification & Regression Trees, Information Gain, Gain Ratio, Gini Index, Mean Squared Error, Pruning of Tree, Bagging, Random Forest, Adaptive Boosting, XG Boosting, Model Overfitting.

**Unit 4: kNN& Naïve Bayes Classifiers, Association Rules Mining and Cluster Analysis**

kNN as a lazy learner, Similarity Quantification, Appropriate k, Rescaling Data. Probabilistic Learning, Joint Probability, Conditional Probability, Laplace Estimator. Market Basket Analysis, Support, Confidence, Lift, Association Rules. Clustering Methods, Dendogram, Profiling of Cluster, Cluster Evaluation.

**Unit 5: Dimensionality Reduction, Support Vector Machines and Text Mining**

Principal Component Analysis, Eigen Values & Eigen Vectors, Singular Value Decomposition. Decision Boundaries for Support Vector Machine, Hyperplanes, Linear & Non-Linear Cases, Kernel Function, Kernel Trick, Kernel Hilbert Space, Model Evaluation. Text Data, Sentiment Analysis, Word Clouds, Term Frequency, Tokening.

**Text Books:**

1. Mitchell (2013). Machine Learning. McGraw Hill.
2. Han, Jiawei and Kamber, Micheline. (2012). Data Mining: Concepts and Techniques. Morgan Kaufman Publishers.
3. Tang, P.N., Steinback, M. and Kumar, V. (2014). Introduction to Data Mining. Pearson.

**Reference Books:**

1. Myatt, Glenn and Johnson, Wayne. (2009). Making Sense of Data II. Wiley.
2. Kassambara. (2017). Practical Guide to Cluster Analysis in R. STHDA
3. Silge& Robinson. (2017). Text Mining With R. SPD.

**BCSAI 505: FORMAL LANGUAGE AND AUTOMATA**

3L + 0T + 0P + 3C

MM 100

**Unit 1: Finite Automata & Regular Expression**

Basic Concepts of finite state system, Deterministic and non-deterministic finite automation and designing regular expressions, relationship between regular expression & Finite automata minimization of finite automation mealy & Moore Machines.

**Unit 2: Regular Sets Of Regular Grammars**

Basic Definition of Formal Language and Grammars, Regular Sets and Regular Grammars, closure proportion of regular sets, Pumping lemma for regular sets, decision Algorithms for regular sets, Myhell\_Nerod Theory & Organization of Finite Automata.

**Unit 3: Context Free Languages& Pushdown Automata**

Context Free Grammars – Derivations and Languages – Relationship between derivation and derivation trees – ambiguity – simplification of CEG – Greiback Normal form – Chomsky normal forms – Problems related to CNF and GNF Pushdown Automata: Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Pushdown automata and CFL - pumping lemma for CFL - Applications of pumping Lemma.

**Unit 4: Turing Machines**

Turing machines – Computable Languages and functions – Turing Machine constructions – Storage in finite control – multiple tracks – checking of symbols – subroutines – two way infinite tape. Undecidability: Properties of recursive and Recursively enumerable languages – Universal Turing Machines as an undecidable problem – Universal Languages – Rice’s Theorems.

**Unit 5: Linear Bounded Automata Context Sensitive Language**

Chomsky Hierarchy of Languages and automata, Basic Definition& descriptions of Theory & Organization of Linear bounded Automata Properties of context-sensitive languages.

**Text/Reference Books:**

1. Hopcroft, Ullman, “Introduction to Automata Theory, Language and Computation”,Nerosa Publishing House
2. K.L.P. Mishra and N.Chandrasekaran, “Theory of Computer Science (Automata,Languages and Computation)”, PHI
3. Martin J. C., “Introduction to Languages and Theory of Computations”, TMH
4. Hopcroft, Ullman, “Introduction to Automata Theory, Languages and Computation”, Pearson Education
5. Papadimitrou, C. and Lewis, C.L., “Elements of the Theory of Computation”, PHI

**Semester V**

**B. Tech CSE (AI)**

**BCSAI 509: DATA MINING AND ML USING PYTHON LAB**

**0L + 0T + 4P + 2C**

**MM 100**

List of Experiments:

1. Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets
2. Demonstrate performing classification on data sets
3. Demonstrate performing clustering on data sets
4. Demonstrate performing Regression on data sets
5. Write a program to implement the naïve Bayesian classifier for a sample data set.
6. Write a program to construct a Bayesian network considering any data set.
7. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
8. Implement K-means on .CSV file using python.
9. Implementing Logistic Regression in Python for classification

**Semester V**

**B. Tech CSE (AI)**

**BCSAI 510: SIGNAL AND IMAGE PROCESSING LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. To study the Image Processing concept.
2. To obtain histogram equalization image.
3. To Implement smoothing or averaging filter in spatial domain.
4. Program for opening and closing of the image.
5. To fill the region of interest for the image.
6. Program for edge detection algorithm.
7. Program of sharpen image using gradient mask.
8. Program for morphological operation: erosion and dilation
9. Program for DCT/IDCT computation.

**BCSAI 511: PROLOG PROGRAMMING LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. Write a prolog program to calculate the sum of two numbers.
2. Write a prolog program to find the maximum of two numbers.
3. Write a prolog program to calculate the factorial of a given number.
4. Write a prolog program to calculate the nth Fibonacci number.
5. Write a prolog program, insert\_nth(item, n, into\_list, result) that asserts that result is the list into\_list with item inserted as the n<sup>th</sup> element into every list at all levels.
6. Write a Prolog program to remove the Nth item from a list.
8. Write a Prolog program to implement append for two lists.
9. Write a Prolog program to implement palindrome(List).
10. Write a Prolog program to implement max(X,Y,Max) so that Max is the greater of two numbers X and Y.
11. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List.
12. Write a Prolog program to implement sumlist(List,Sum) so that Sum is the sum of a given list of numbers List.
13. Write a Prolog program to implement two predicates evenlength(List) and oddlength(List) so that they are true if their argument is a list of even or odd length respectively.
14. Write a Prolog program to implement reverse(List,ReversedList) that reverses lists.
15. Write a Prolog program to implement maxlist(List,Max) so that Max is the greatest number in the list of numbers List using cut predicate.

**Semester V**

**B. Tech CSE (AI)**

**BCSAI 512: ANANDAM-I HAPPINESS CURRICULUM**

**0L + 0T + 1P + 1C**

**MM 100**

**List of Experiments:**

1. Strategies for Happiness : Loving Yourself (Self-motivation, Self-worth, Self-respect, Self-care, and Self-purpose)
2. Appreciate Your Life
3. Finding Your Passion (a Vision Board, and an Inspirational Toolkit)
4. Practicing Your Creativity

**BCSAI 506: INFORMATION SECURITY****2L + 0T + 0P + 2C****MM 100****Unit 1: Introduction to Information Security**

Overview of Information security, Threats, Type of Vulnerabilities and Risk, Business Requirements, Information Security Definitions – Security Policies – Tier 1 (origination Level), Tier 2 (Functional Level), Tier 3 (Application or Device Level), Procedures, Standards, Guidance. Role of Governance in Information Security, Develop a Risk Management Program, Risk Management Process, Best Practices for IT Governance, Case study.

**Unit 2: Information Asset Classification**

Classification of Information, Information Assets – Owner, Custodian, User, Information Classification in terms of Secret, Confidential, Private and Public, Declassification. Retention and Disposal of Information Assets. Provide Authorization for Access – Owner, Custodian and User, Case study.

**Unit 3 : Access Control**

User Identity and Access Management- Account Authorization, Access and Privilege Management, System and Network Access Control. Operating Systems Access Controls, Monitoring Systems Access Controls, Intrusion Detection System, Event logging, Cryptography. Physical Security: Identify Assets to be Protected, Perimeter Security, Firewalls, Prevention and Detection Systems, Safe Disposal of Physical Assets. Email Security: PGP, MIME, IP Security: IP security overview, Case study.

**Unit4: Introduction to Cryptography**

Introduction to Advanced Cryptography and Cryptanalysis, Classical Encryption Techniques – Substitution Techniques, Transposition Techniques, Permutation Method. Advanced Encryption Techniques and Security Issues – RC4, One-time Pad, RSA, DES, Triple DES, AES and Diffie Hellman, Case study.

**Unit 5: Conventional Encryption**

Confidentiality using conventional encryption – Placement of Encryption, Traffic Confidentiality, Key Distribution and Random Number Generation. Key management – Generating Keys, Nonlinear Keyspaces, Transferring Keys, Verifying Keys, Using Keys, Updating Keys, Storing keys, Backup keys, Compromised Keys, Lifetime of Keys, Destroying Keys and Public-Key Management, Case study.

**Text Book/Reference books:**

1. Mark Stamp's Information Security: Principles and Practice (WIND) Paperback – 2009 by Deven N. Shah, Wiley (2009)
2. Cryptography and Information Security by V. K. Pachghare, Prentice-Hall of India Pvt.Ltd; 2nd Revised edition edition (30 March 2015)
3. Information Security Risk Analysis - Thomas R. Peltier, Third Edition, Pub: Auerbach, 2012
4. Cryptography and Network Security Principles and Practices, by William Stallings, Pearson Education; Seventh edition (30 June 2017)



**BCSAI 507: DATABASE SECURITY**

2L + 0T + 0P + 2C

MM 100

**Unit 1: Security Architecture & Operating System Security Fundamentals**

Security Architecture: Introduction-Information Systems- Database Management Systems-Information Security Architecture- Database Security-Asset Types and value-Security Methods. Operating System Security Fundamentals: Introduction-Operating System Overview-Security Environment – Components-Authentication Methods-User Administration-Password Policies Vulnerabilities-E-mail Security

**Unit 2 : Administration Of Users & Profiles,Password Policies, Privileges And Roles**

Administration of Users: Introduction-Authentication-Creating Users, SQL Server User-Removing, Modifying Users-Default, Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices Profiles, Password Policies, Privileges and Roles: Introduction-Defining and Using Profiles-Designing and Implementing Password Policies-Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices

**Unit 3: Database Application Security Models & Virtual Private Databases**

Database Application Security Models: Introduction-Types of Users-Security Models- Application Types-Application Security Models-Data Encryption Virtual Private Databases: Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle-Implementing Oracle VPD- Viewing VPD Policies and Application contexts using Data Dictionary, Policy Manager Implementing Row and Column level Security with SQL Server

**Unit 4: Auditing Database Activities**

Auditing Database Activities: Using Oracle Database Activities-Creating DLL Triggers with Oracle Auditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000-Security and Auditing Project Case Study.

**Unit 5: Privacy Preserving Data Mining Techniques**

Privacy Preserving Data Mining Techniques: Introduction- Privacy Preserving Data Mining Algorithms General Survey-Randomization Methods-Group Based Anonymization-Distributed Privacy Preserving Data Mining-Curse of Dimensionality-Application of Privacy Preserving Data Mining

**Text/Reference Books:**

1. Hassan A. Afyouni, "Database Security and Auditing", Third Edition, Cengage Learning, 2009
  2. Charu C. Aggarwal, Philip S Yu, "Privacy Preserving Data Mining": Models and Algorithms, Kluwer Academic Publishers, 2008
  3. Ron Ben Natan, "Implementing Database Security and Auditing", Elsevier Digital Press, 2005.
1. <http://charuaggarwal.net/toc.pdf>

**BCSAI 508: BUSINESS INTELLIGENCE**

**2L + 0T + 0P + 2C**

**MM 100**

**Course Objective:**

- To understand information Systems with comprehensive and in-depth knowledge of Business Intelligence
- To provide expose to students about the frontiers of BI-intensive BIG data computing and information systems

**Unit 1: Introduction to Business Intelligence**

Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities.

**Unit 2: Basics of Data Integration (Extraction Transformation Loading)**

Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL, Introduction to data quality, data profiling concepts and applications.

**Unit 3: Introduction to Multi-Dimensional Data Modeling**

Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS.

**Unit 4: Basics of Enterprise Reporting**

Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, and overall architecture.

**Unit 5: Data Mining Functionalities**

Association rules mining, Mining Association rules from single level, multilevel transaction databases, Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods.

**Text/ ReferenceBooks:**

1. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India, First Edition, 2011
2. J.Han and M. Kamber: Data Mining: Concepts and Techniques By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition
3. David Loshin: Business Intelligence: The Savvy Manager's Guide., Latest Edition By Knowledge Enterprise.
4. Larissa Terpeluk Moss, Shaku Atre: Business Intelligence roadmap by Addison Weseley
5. Cindi Howson: Successful Business Intelligence: Secrets to making Killer BI Applications by Tata McGraw Hill
6. Mike Biere: Business intelligence for the enterprise by Addison Weseley, August 2010

# **Syllabus**

## **Semester-VI**

**BCSAI 601: BIG DATA ANALYTICS****3L + 0T + 0P + 3C****MM 100****Unit 1: Introduction to Big Data**

Introduction to Big Data, Characteristics of Data, and Big Data, Evolution of Big Data, Definition of Big Data, Challenges with big data, Why Big data? Complexity of Big Data, Big Data Processing Architectures, Big Data Technologies, Data Warehouse, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Big Data Analytics, Introduction to big data analytics, Classification of Analytics, Challenges of Big Data, Importance of Big Data, Big Data Technologies, Data Science, Responsibilities, Soft state eventual consistency, Data Analytics Life Cycle.

**Unit 2: Analytical Theory and Methods**

Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models

**Unit 3: Advanced Analytics Technology And Tools**

Analytics for Unstructured Data, Use Cases, MapReduce, Apache Hadoop, The Hadoop Ecosystem, Pig, Hive, Hbase, Mahout, NoSQL, SQL Essentials Joins, Set Operations, Grouping Extensions, In-Database Text Analysis, Advanced SQL, Window Functions, Userdefined Functions and Aggregates, Ordered Aggregates, MADlib

**Unit 4: Hadoop Distributed File System Architecture**

HDFS Architecture, HDFS Concepts, Blocks NameNode, Secondary NameNode, DataNode, HDFS Federation, HDFS High Availability, Basic File System Operations, Data Flow, Anatomy of File Read, Anatomy of File Write, Anatomy of a MapReduce Job Run

**Unit 5: Processing Your Data With Mapreduce**

Getting to know MapReduce, MapReduce Execution Pipeline, Runtime Coordination and Task Management, MapReduce Application, Hadoop Word Count Implementation

**Text /Reference Books**

1. Data Warehousing in the Age of Big Data by Krish Krishnan, Morgan Kaufmann.
2. A.Ohri, "R for Business Analytics", Springer, 2012.
3. Big Data Analytics with R and Hadoop by Vignesh Prajapati
4. Principles of Big Data Preparing, Sharing, and Analyzing Complex Information, 1st Edition, by J Berman, published by Morgan Kaufmann
5. "Big Data Analytics - From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph" By David Loshin, Morgan Kaufmann

**BCSAI 602: COMPILER DESIGN****3L + 0T + 0P + 3C****MM 100**

**Unit 1: Overview Of Compilation** - The structure of a compiler and applications of compiler technology; Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, hand-written lexical analyzers, LEX, examples of LEX programs.

Introduction to syntax analysis -Role of a parser, use of context-free grammars (CFG) in the specification of the syntax of programming languages, techniques for writing grammars for programming languages (removal left recursion, etc.), non- context-free constructs in programming languages, parse trees and ambiguity, examples of programming language grammars.

**Unit 2: Top-Down Parsing** - FIRST & FOLLOW sets, LL(1) conditions, predictive parsing, recursive descent parsing, error recovery. LR-parsing - Handle pruning, shift-reduce parsing, viable prefixes, valid items, LR (0) automaton, LR-parsing algorithm, SLR(1), LR(1), and LALR(1) parsing. YACC, error recovery with YACC and examples of YACC specifications. Syntax-directed definitions (attribute grammars)-Synthesized and inherited attributes, examples of SDDs, evaluation orders for attributes of an SDD, dependency graphs. S-attributed and L-attributed SDDs and their implementation using LR-parsers and recursive- descent parsers respectively.

**Unit 3: Semantic Analysis** - Symbol tables and their data structures. Representation of “scope”. Semantic analysis of expressions, assignment, and control-flow statements, declarations of variables and functions, function calls, etc., using S- and L-attributed SDDs (treatment of arrays and structures included). Semantic error recovery.

**Unit 4: Intermediate Code Generation** - Different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses. Translation of expressions (including array references with subscripts) and assignment statements. Translation of control-flow statements – it- then-else, while-do, and switch. Short-circuit code and control-flow translation of Boolean expressions. Back patching. Examples to illustrate intermediate code generation for all constructs.

**Unit 5: Run-Time Environments** - Stack allocation of space and activation records. Access to non-local data on the stack in the case of procedures with and without nesting of procedures. Introduction to machine code generation and optimization- Simple machine code generation, examples of machine-independent code optimizations.

**Text / Reference Books:**

1. Compilers: Principles, Techniques, and Tools , by A.V. Aho, Monica Lam, Ravi Sethi, and J.D. Ullman, (2<sup>nd</sup> ed.), Addison-Wesley, 2007 (main text book, referred to as ALSU in lab assignments).
2. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2004.
3. K.C. Louden, Compiler Construction: Principles and Practice, Cengage Learning, 1997.
4. D. Brown, J. Levine, and T. Mason, LEX and YACC, O’Reilly Media, 1992.

**BCSAI 603: ADVANCED MACHINE LEARNING**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Introduction**

Bayesian Machine Learning: Machine Learning Paradigms, types of machine learning approaches, delineating between supervised and unsupervised learning, and between discriminative and generative approaches.

**Unit 2: Bayesian Modelling**

Bayesian Modelling: assumptions and processes of constructing a Bayesian model, dependency relationships in Bayesian models, graphical models and probabilistic programming.

**Unit 3: Bayesian Inference**

Bayesian Inference: approaches for estimating Bayesian posteriors, marginal likelihoods, and expectations. Monte Carlo sampling, Markov chain Monte Carlo (MCMC) sampling and variational inference.

**Unit 4: Natural Language Processing:**

Challenge of Natural Language Processing (NLP), Embeddings : methods to create embeddings, disadvantages and advantages, Classification and neural networks: classification task, tasks arises in NLP problems, Language models.

**Unit 5: Deep Learning**

Motivation for deep learning, basic supervised classification task, optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method.

**Text and Reference Books:**

1. Jeff Heaton, Deep Learning and Neural Networks, Heaton Research Inc, 2015.
2. Ethem Alpaydin, Introduction to Machine Learning, Second Edition
3. Stephen Marsland, Machine Learning: An Algorithmic Perspective.
4. Tom Mitchell, Machine Learning

**BCSAI 604: NATURAL LANGUAGE PROCESSING**

**3L + 0T + 0P + 3C**

**MM 100**

**Unit 1: Overview And Morphology**

Introduction, Models -and Algorithms , Regular Expressions Basic Regular Expression Patterns, Finite State Automata Morphology, Inflectional Morphology, Derivational Morphology, Finite-State Morphological Parsing , Porter Stemmer

**Unit 2: Word Level And Syntactic Analysis**

N-grams Models of Syntax, Counting Words, Unsmoothed N-grams, Smoothing, Back off Deleted Interpolation, Entropy , English Word Classes , Tag sets for English, Part of Speech Tagging, Rule Based Part of Speech Tagging, Stochastic Part of Speech Tagging, Transformation-Based Tagging

**Unit 3: Context Free Grammars**

Context Free Grammars for English Syntax, Context- Free Rules and Trees, Sentence- Level Constructions, Agreement, Sub Categorization, Parsing, Top-down, Early Parsing, feature Structures Probabilistic Context, Free Grammars

**Unit 4: Semantic Analysis**

Representing Meaning, Meaning Structure of Language, First Order Predicate Calculus, Representing Linguistically Relevant Concepts –Syntax, Driven Semantic Analysis, Semantic Attachments, Syntax, Driven Analyzer, Robust Analysis, Lexemes and Their Senses, Internal Structure, Word Sense Disambiguation, Information Retrieval

**Unit 5: Language Generation And Discourse Analysis**

Discourse -Reference Resolution , Text Coherence, Discourse Structure, Coherence, Dialog and Conversational Agents , Dialog Acts, Interpretation, Conversational Agents, Machine Translation Transfer Metaphor, Interlingua, Statistical Approaches

**Text /Reference Books:**

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Prentice Hall, 2nd Edition, 2008.
2. C. Manning and H. Schutze, "Foundations of Statistical Natural Language Processing", MIT Press. Cambridge, MA:,1999
3. James Allen, Benjamin/cummings, "Natural Language Understanding", 2nd edition, 1995

**BCSAI 605: GRAPHICAL MODEL****3L + 0T + 0P + 3C****MM 100****Unit 1: Fundamentals**

Fundamentals of Probability Theory - Views of Probability, Random Variables and Joint Distributions, Conditional Probability, Conditional Independence, Expectation and Variance, Probability Distributions - Conjugate Priors, Introduction to Exponential Family; Fundamentals of Graph Theory - Paths, Cliques, Subgraphs, Cycles and Loops.

**Unit 2: Graphical Models: Introduction**

Directed Models (Bayesian Network), Undirected Models (Markov Random Fields), Dynamic Models (Hidden Markov Model & Kalman Filters) and Factor Graph; Conditional Independence (Bayes Ball Theorem and D-separation), Markov Blanket, Factorization (Hammersley-Clifford Theorem), Equivalence (I-Maps & Perfect Maps); Factor Graphs - Representation, Relation to Bayesian Network and Markov Random Field.

**Unit 3: Inference in graphical models**

Exact Inference - Variable Elimination, Elimination Orderings, Relation to Dynamic Programming, Dealing with Evidence, Forward-Backward Algorithm, Viterbi Algorithm; Junction Tree Algorithm; Belief Propagation (Sum Product); Approximate Inference - Variational Methods (Mean Field, Kikuchi & Bethe Approximation), Expectation Propagation, Gaussian Belief Propagation;

**Unit 4: MAP Inference** - Max-Product, Graph Cuts, Linear Programming Relaxations to MAP (Tree-Reweighted Belief Propagation, MPLP); Sampling - Markov Chain Monte Carlo, Metropolis Hastings, Gibbs (Collapsing & Blocking), Particle filtering.

**Unit 5: Learning in Graphical Models**

Parameter Estimation - Expectation Maximization, Maximum Likelihood Estimation, Maximum Entropy, Pseudolikelihood, Bayesian Estimation, Conditional Likelihood, Structured Prediction; Learning with Approximate Inference; Learning with Latent Variables; Structure Learning, Structure Search, L1 priors.

**Text / Reference Books:**

1. Jensen, F. V. and Nielsen, T. D. (2002). Bayesian Networks and Decision Graphs. Information Science and Statistics. Springer, 2nd edition.
2. Kevin P. Murphy (2013) Machine Learning: A Probabilistic Perspective. 4th Printing. MIT Press.
3. Barber, D. (2011). Bayesian Reasoning and Machine Learning. Cambridge University Press, 1st edition.
4. Bishop, C. M. (2011). Pattern Recognition and Machine Learning (Information Science and Statistics). Springer, 2nd printing.
5. Wainwright, M. and Jordan, M. (2008). Graphical Models, Exponential Families, and Variational Inference. Foundations and Trends in Machine Learning.



**BCSAI 609: BIG DATA ANALYTICS LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments:**

1. To draw and explain Hadoop Architecture and Ecosystem with the help of a case study using WorkCount example.
2. To understand the overall programming architecture using Map Reduce API
3. Implement word count / frequency programs using MapReduce
4. To implement the following file management tasks in Hadoop System (HDFS): Adding files and directories, Retrieving files, Deleting files
5. To perform NoSQL database
6. To study and implement basic functions and commands in R Programming.
7. Implement Linear and Logistic Regression
8. Develop Map Reduce Work Application
9. Creating the HDFS tables and loading them in Hive and learn joining of tables in Hive
10. Visualize data using any plotting framework

**BCSAI610: ADVANCED MACHINE LEARNING LAB****0L + 0T + 4P + 2C****MM 100****List of Experiments**

1. Implement and demonstrate the FIND-S Algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

**Semester VI**

**B. Tech CSE (AI)**

**BCSAI 611: NATURAL LANGUAGE PROCESSING LAB**

**0L + 0T + 4P + 2C**

**MM 100**

List of Experiments

1. Overview of NLP
2. NLP Toolkit
3. Installation of NLPTK
4. Determination of Statistical Word frequency
5. Handling Stop words
6. Use of NLTK Tokenize text
7. Non-English Tokenize
8. Synonym Processing

**Semester VI**

**B. Tech CSE (AI)**

**BCSAI 612 : Anandam-II Happiness Curriculum**

**0L + 0T + 1P + 1C**

**MM 100**

**List of Experiments:**

1. A Healthy Life-style
2. The Power of Resilience
3. Getting Out of Your Comfort Zone
4. Creating More Time and Capacity Your Life to Increase Productivity

**BCSAI 606: BLOCKCHAIN****2L + 0T + 0P + 2C****MM 100****Unit 1: Introduction to Cryptography**

Introduction to Advanced Cryptography and Cryptanalysis, Classical Encryption Techniques – Substitution Techniques, Transposition Techniques, Permutation Method. Advanced Encryption Techniques and Security Issues – RC4, One-time Pad, RSA, DES, Triple DES, AES and Diffie Hellman, Case study.

**Unit 2: Conventional Encryption**

Confidentiality using conventional encryption – Placement of Encryption, Traffic Confidentiality, Key Distribution and Random Number Generation.

**Unit 3: Key management** – Generating Keys, Nonlinear Keyspaces, Transferring Keys, Verifying Keys, Using Keys, Updating Keys, Storing keys, Backup keys, Compromised Keys, Lifetime of Keys, Destroying Keys and Public-Key Management, Case study.

**Unit 4: Introduction to Blockchain and Crypto-currency Basics**

What is Blockchain, Blockchain Technology and Mechanisms, Challenges, Centralized Servers and Trusted Third Party, Shift from gold standard to fiat currency to Hash cash/Digital, Trust less System, Transactions and Blocks, Digital Signatures

Discussion on Bitcoin and Ethereum, Significance, Security, The Bitcoin Mining Network, Mining Developments, Decentralization and Hard Forks, Ethereum Eco-System

**Unit 5: Working of Blockchain and Hyper Ledger**

Technology behind Blockchain-Consensus Building, Proof of Work, Byzantine Generals. Distributed Consensus, Cryptography, Hashing, Data Integrity, Public vs. Private Key Cryptography, Merkle Trees. Crypto-currency and Mining, Proof of Work vs. Stake, Business Model.

What is Hyper Ledger, Distributed Ledger Technology, Hyper Ledger Fabric and Composer, Assets, Chaincode and Ledger/Transactions, Permission Network, Member Services, Nodes and Channels, Development Machine Specifications and IDE.

**Text/ Reference Books:**

1. Imran Bashir. (2018). Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts explained, Import.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder. (2016). Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton University Press.
3. Alex Tapscott and Don Tapscott. (2016). Blockchain Revolution: How the Technology behind Bitcoin Is Changing Money, Business, and the World, Portfolio.
4. Dr. Gavin Wood. (2014) Ethereum: A Secure Decentralized Transaction Ledger. Yellow Paper.
5. Chris Dannen. (2017). Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners. Apress.
6. William Mougayar, Vitalik Buterin. (2016). The Business Blockchain: Promise, Practice and Application of the Next Internet Technology. Wiley.

**BCSAI 607: INTERNET OF THINGS****2L + 0T + 0P + 2C****MM 100****Unit 1: Introduction to IoT**

Defining IoT, Characteristics, Physical Design, Logical Design, Functional Blocks, Communication Models and APIs, Computer Networks, Internet of Everything (IOE), Distributed Computing, Industrial Automation, Understanding IT and OT Convergence, Evolution of IIoT, Machine to Machine Communication, Difference between IoT and M2M, Software Define Network.

**Unit 2: Concept of Data, Information, Knowledge and Wisdom**

Knowledge Discovery Process, DIKW Pyramid and Relevance with IoT, Microcontrollers, Cost, Performance and Power Consumption, Commercial Microcontroller Based Development Boards, Selection Criteria and Trade-Offs.

**Unit 3: Network and Communication Aspects**

Wireless Medium Access Issues, Mac Protocol Survey, Survey-Routing Protocols, Sensor Deployment Basics & Node Discovery, Data, Aggregation & Dissemination. Sensor Node Architecture, WSN/M2M Communication Technologies, Bluetooth, Zigbee, Wifi. Cellular Communication and LpWAN (Lora and LoraWAN Technologies), Topologies, Applications.

**Unit 4: Design and Development of IoT Systems**

IoT Reference Architectures, Standardization Initiatives and Interoperability Issues. IoT Design Considerations, Architecture (Devices, Networks and Cloud). Network, Communication Technologies and Protocols, Smart Asset Management: Connectivity, Visibility, Analytics and Alerts.

**Unit 5: Domain Specific Applications of IoT and its Challenges**

Home Automation, Industry Applications, Surveillance Applications, Other IoT Applications, Design Issues and Challenges in IoT, Security, Development, Deployment, Usage. Security Standards, Vulnerabilities, Attack Surfaces, Hardware and Software Solutions, Open Source Initiatives.

**Text/ Reference Books:**

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle. (2014). From Machine-To-Machine to the Internet of Things: Introduction to a New Age of Intelligence. Academic Press.
2. Francis Dacosta. (2013). Rethinking the Internet of Things: A Scalable Approach to Connecting Everything. Apress.
3. Vijay Madiseti and ArshdeepBahga. (2014). Internet of Things: A Hands-On-Approach. Orient Blackswan.
4. Adrian Mcewen, HakinCassimally. (2015). Designing the Internet of Things. Wiley.
5. Peter Waher. (2018). Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3. Packt
6. Rolf H. Weber, Romana Weber. (2010). Internet of Things: Legal Perspectives. Springer.

**BCSAI 608: MANAGEMENT INFORMATION SYSTEM**

**2L + 0T + 0P + 2C**

**MM 100**

**Unit 1: Managing Information Systems in Organization**

Introduction, Definition, Need of MIS, Managing in the Internet Era, Managing Information Systems in Organization-the IT interaction model, Challenges for the manager-what information to build?-how much to spend on information systems?-what level of capabilities should be created with information systems?-how centralized should the services be?-what security levels are required?-what is technology road map for the organization?

**Unit 2: Data and Information**

Introduction, data and information- measuring data, information as a resource, information in organizational functions, types of information technology, types of information systems- transaction processing systems- management information systems

**Unit 3: Decision making and communication**

Introduction, Decision making with MIS-Tactical decisions-operational decisions-strategic decisions, communication in organizations- types of communication- examples of communications in organizations- decision making with communication technology, Decision Support Systems: Introduction, Understanding DSS- MIS and DSS-Decision making-types of decisions, Analytics and Business Intelligence- BI techniques

**Unit 4: SCM, CRM and International Systems**

Introduction, Supply Chain Management Systems, Customer Relationships Management Systems, Challenges of Enterprise Systems Implementations- Managing the implementation, International Information Systems-Outsourcing and off-shoring

**Unit 5: Managing Social Media**

Introduction, Social Dynamics of the Internet, Services of the Internet- Blogs-Social Networks, Technology of the Internet- Twitter-Rating-Tagging/folksonomies, Social issues-Media impact- Collaboration-Emergence of order, Social Networks in the Enterprise Managing IT Function: Introduction, Challenges of Managing the IT function- Modern IT environment-Centralization versus Decentralization-IT security-Technology selection, Vendor Management- vendor selection-vendor contracts and service levels-Ongoing relationship management- vendor retention or termination

**Text/ ReferenceBooks:**

1. Management Information Systems, Jawadekar, Tata McGraw Hill
3. Management Information Systems, Davis and Olson, Tata McGraw Hill
4. Analysis and Design of Information Systems, Rajaraman, Prentice Hall
5. Decision Support Systems and Intelligent Systems, Turban and Aronson, Pearson Education Asia
6. Management Information Systems, Schulthesis, Tata McGraw Hill
7. Management Information Systems - Sadagopan, Prentice Hall

# **Syllabus**

## **Semester-VII**



**Semester VII**

**B. Tech CSE (AI)**

**BCSAI 701 FUZZY LOGIC AND APPLICATION**

**3L+0T+0P+3C**

**MM:100**

**Unit1: Introduction**

Classical Set Theory, Fuzzy set theory, membership function, predicate logic, approximate reasoning

**Unit2: Approximate Reasoning**

categorical , qualitative, syllogistic reasoning, dispositional reasoning, rule base, linguistic variable, quantifiers

**Unit 3: Inference System**

characteristics, MAMDANI FIS, functional blocks: database, decision making, fuzzification, defuzzification

**Unit 4: Quantification**

Database and queries, Fuzzy Events, Means, variances, decision making: types, multi-person, multi-objective, multi-criteria

**Unit 5: Control System**

Adaptive controller, operational concepts ,neural networks fuzziness.

**Text/Reference Books**

1. Fuzzy logic with Engineering applications by Timothy J Ross
2. fuzzy Sets and Fuzzy Logic: Theory and Application by George J Klir, Bo Yuan
3. Neural Networks,Fuzzy Logic and Genetic Algorithms : Synthesis and Applications byGA Vijayalakshmi Pai

**Semester VII**

**B. Tech CSE (AI)**

**BCSAI 702: SUPERVISED AND UNSUPERVISED LEARNING**

**3L+0T+0P+3**

**MM:100**

**Unit 1: Overview**

Classification, Clustering, Constraints, One-pass learn concepts, Discard after learn concept

**Unit 2: Supervised Learning**

Logistic Regression, PERCEPTRONS, Neural Networks, Gaussian processes, Support Vector Machines

**Unit 3: UnSupervised Learning**

Identification, characterization and modeling ,clustering structure, quantum computing, cognitive techniques

**Unit 4: Reinforced Learning**

Environment, State, reward,policy, multi-task agents,state abstractions

**Unit 5: Deep Reinforcement Learning**

Continuity analysis, Monte Carlo Tree search , Gradient methods

**Text/Reference Books**

1. Machine Learning Algorithms for Supervised and Unsupervised Learning: The Future is Here by William Sullivan, Create space independent publishing platform, 2018
2. A systematic Review on Supervised and Unsupervised Machine Learning Algorithms for Data Science, Alloghani, Mohamed(et al.)
3. The elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman; Springer

**BCSAI 703: ONLINE MACHINE LEARNING**

**3L+0T+0P+3C**

**MM:100**

**Unit 1: Introduction**

Introduction to Bandit Algorithms, Language , Probabilty spaces, Independence, Integration and Expectation, batch to online setting,

Adversarial setting with full information, Halving algorithm, WM Algorithm, Regret Lower Bounds

**Unit 2: Stochastic Setting**

STOCHASTICS processes, Markov Chains, Martingales, Stopping Times, Regret notions, concentration inequalities, Stochastic Bandit Algorithms, UCB, KL-UCB

**Unit 3: Contextual Bandits**

Overview, Regret Analysis, Stochastic Linear Bandits, Method of Mixtures, Kiefer-Wolfowitz Theorem, Sparse Stochastic Linear Bandits

**Unit 4: Pure Explorations**

Fixed confidence, budget, pure exploration setups, Best Arm identification, Bayesian Bandits, Gittins Index, Thompson Sampling

**Unit 5: Pure Explorations Algorithms**

LUCB, KL-LUCB, lil'UCB, Partial Monitoring, Optimal Policy, Proof of Upper and Lower Bound

Text/Reference Books

1. Bandit Algorithms by Tor Lattimore and Csaba Szepesvari, Cambridge University Press
2. Bandit Algorithms for Website Optimization by John Myles White, O'Reilly Media
3. Regret Analysis of Stochastics and nonstochastic multi-armed bandit problems by Nicolo Cesa-bianchi and Sebastien Bubeck
4. J.A. Tropp, Foundations and Trends in Machine Learning

**BCSAI 704: R PROGRAMMING LANGUAGE**

2L + 0T + 0P + 2C

MM 100

**Unit 1: Introduction to R Environment**

History and development of R Statistical computing programming language, installing R and R studio, getting started with R, creating new working directory, changing existing working directory, understanding the different data types, installing the available packages, calling the installed packages, arithmetic operations, variable definition in R, simple functions, vector definition and logical expressions, matrix calculation and manipulation using matrix data types, workspace management.

**Unit 2: Data Structures, Looping and Branching**

Introduction to different data types, vectors, atomic vectors, types and tests, coercion, lists, list indexing, function applying on the lists, adding and deleting the elements of lists, attributes, name and factors, matrices and arrays, matrix indexing, filtering on matrix, generating a covariance matrix, applying function to row and column of the matrix, data frame – creating, coercion, combining data frames, special types in data frames, applying functions: `lapply()` and `sapply()` on data frames, control statements, loops, looping over non vector sets, arithmetic and Boolean operators and values, branching with **if**, looping with **for**, **if-else** control structure, looping with **while**, vector based programming.

**Unit 3: R - Object Oriented Programming**

Introduction to object oriented concepts in R, basics of S3 classes – S3 Generic functions, OPP in linear model functions, writing S3 classes, using inheritance, introduction to S4 classes, writing S4 Classes, implementing a generic function on an S4 Classes, comparison of S3 and S4 classes, management of objects – listing objects, removing specific objects from the existing function and working directory, saving the collection of objects with `save()` function.

**Unit 4: R for Statistics**

Descriptive statistics – mean (arithmetic, geometric and harmonic), median, mode for raw and grouped data, measure of dispersion – range, standard deviation, variance, coefficient of variation, testing of hypothesis – small sample test, large sample test – for comparing mean, proportion, variance, correlation and regression – significance of correlation and regression coefficients, chi-square test, non-parametric test, Analysis of Variance for one way variation and two variation – with and without interaction.

**Unit 5: R with C, C++ and Python**

Introduction to C and C++ programming concepts, writing C/C++ functions to be called from R, preliminaries of R to C and C++ programming languages, some mathematical programming example with R and C/C++, compiling and running the code, debugging R/C code, introduction to Python and its components, installing packages related with python in R, syntax of RPy packages.

**Text Book**

1. The art of R programming – Norman Matloff, no starch Press, San Francisco.
2. R in Action – Robert I. Kabacoff, Second Edition, Dreamtech Press.
3. Introduction to Scientific Programming and Simulation using R – Owen Jones, Robert Maillardet and Andrew Robinson, CRC Press
4. Advanced R – Hadley Wickham, CRC Press.

**MGT 103 PROJECT FORMULATION AND APPRAISAL**

**3L+0T+0P+3C**

**MM:100**

**Unit 1:Introduction**

Project attributes; project life cycle; role of managers; Management – scheduling; Gantt charts; CPM; PERT; crashing; Generation of project ideas – resource allocation; environment analysis PEST analysis porter’s model; analysis of strategic capabilities – value chain, BCG matrix, Flexibility.

**Unit 2: Appraisal Methods In Project Scanning And Selection** – market appraisal; technical appraisal; environmental appraisal; evaluating intangibles, social appraisal – SCBA, UNIDO, LM, CSR

**Unit 3: Total quality management**

**Unit 4: Financial Appraisal**

Time value of money; cost of capital – equity, debt, preference; weighted average cost; marginal And average cost; Capital budgeting – investment appraisal techniques; NPV; IRR; Payback period; replacement decisions; selection of exact discount factor – problems, inflation, taxation

**Unit 5: Risk Analysis Models**

Single probability analysis; sensitivity analysis; break even analysis; certainty equivalent; Uncertainty analysis, simulation; decision tree model; risk and utility.

**References & Text Books**

1. Khatua Sitangshu. *Project Management and Appraisal*, Oxford University Press
2. Pandey, I.M. *Financial Management*. Vikas Publishing House
3. Prasanna, Chandra. *Financial Management*. Tata McGraw-Hill
4. Maheshwari, S .N. & Maheshwari, S. K. *Advanced Management Accounting Vol.1 & Vol.2*. Vikas Publishing House
5. Paresh Shah. *Management Accounting*. Oxford University Press

**Semester VII**

**B. Tech CSE (AI)**

**BCSAI 705: FUZZY LOGIC AND APPLICATIONS LAB**

**0L + 0T + 4P + 2C**

**MM 100**

**List of Experiments**

1. Overview of Fuzzy Set
2. Implementation of Membership functions
3. Design of Fuzzy Rule Base
4. Defining the entire Fuzzy Inference System
5. Fuzzy Control System design and implementation

**BCSAI 706: MINI PROJECT****0L+0T+4P+2C****MM: 100**

The objective of Project Work is to enable the student to take up investigative study in the broad field of Computer Science & Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

- Survey and study of published literature on the assigned topic;
- Working out a preliminary Approach to the Problem relating to the assigned topic;  
Conducting preliminary Analysis/Modeling/Simulation/Experiment/Design/ Feasibility;
- Preparing a Written Report on the Study conducted for presentation to the Department;
- Final Seminar, as oral Presentation before a Departmental Committee.

**BCSAI 707: CAMPUS RECRUITMENT TRAINING**

**0L+0T+4P+2C**

**MM:100**

**Unit 1: Quantative Apttitude:** Numbers Theory, Averages, Ratio, Proportion & Variation, Percentages, Mixtures & Allegation, Time and Work, Speed, Time and Distance, Pipes & Cisterns, Clocks and Calendars, Profit and Loss, Interest and Discount, Partnership, Progressions, Logarithm, Quadratic Equations, Inequalities, Functions, Basic Geometry, Menstruation, Co-ordinate Geometry, Permutation and Combination, Probability.

**Unit 2: Verbal Ability And Reading Comprehension:** Fill in the blanks, Synonyms and Antonyms, Analogies.

**Unit 3: Data Interpretation & Data Sufficeincy:** Tables, Graphs, Pie-Charts, Bar Charts, Mixed Charts, Data Sufficiency Statements.

**Unit 4: Analytical And Logical Reasoning:** Puzzle Test, Coding- Decoding, Blood Relations, Day Sequence, Directional Sense Test, Symbol based problems, Syllogism, Cubes and Dices.

**Unit 5: General Knowledge**

**Text/Reference Books:**

1. R.S. Aggarwal, A Modern Approach to Verbal and Non-Verbal Reasoning, S. Chand Publication
2. Wren & Martin, High School English Grammar, S.Chand Publication
3. Nem Singh, Reasoning & Aptitude 2015, Made Easy Publication.



**Semester VII**

**B. Tech CSE (AI)**

**BCSAI 708: Anandam-III Happiness Curriculum**

**0L + 0T + 1P + 1C**

**MM 100**

**List of Experiments:**

1. Practicing Gratitude, Giving and Celebrating your Successes and Achievements
2. The importance of Human Connections, Selective Relationships and a Supportive Network
3. The Art of Influence, Persuasion and Negotiation
4. Saying Goodbye to Stress and Anxiety and Hello to a Happy Life

**MGT 201: Orientation Program in Entrepreneurship**

2L + 0T + P + 2C

MM 100

**OBJECTIVE:** The goal of this programme is to inspire students and help them imbibe an entrepreneurial mindset. Student will learn what entrepreneurship is and how it has impacted the world and their country. They will introduce to the key traits and the DNA of an entrepreneur. This certificate program focuses on a specific Entrepreneurial knowledge or skill requirement such as creative thinking, communication, risk taking and resilience.

**Unit 1:**

Entrepreneurship; Concept, functions, Need, Characteristics and competency. How has entrepreneurship change the world? Process of Entrepreneurship development , Idea Generation exercises.

**Unit 2:**

Entrepreneurial DNA, Traits Gaps and Gap Analysis. Relevance of Entrepreneurship in Socio-Economic development. Barriers to Entrepreneurship. Case studies.

**Unit 3:**

Entrepreneurial Pursuits and Human Activities; nature, purpose and pattern of Human activities: Economic and non-economic, need for innovation. Creativity. Case studies

**Unit 4:**

Entrepreneurial Values, Attitudes and Motivation-Meaning and concept. Developing entrepreneurial Motivation -concept and process of achievement motivation. Leadership, Communication and influencing ability. Success stories.

**Unit 5:**

**Enterprise and Environment:** Environmental function, Critical factors for launching of a new enterprise, Understanding a market, Competitive analysis of the market.

**Text/Reference Books:**

Online course through massive open online classes (MOOC), classroom learning through an experienced facilitator/faculty on campus (games, video, and practical experience

1. Vasanta Desai: Dynamics of entrepreneurial development and management;
2. Vasanta Desai: Entrepreneurial development;
3. Peter F. Drucker: Innovation and development;
4. M.V. Deshpande: Entrepreneurship of small scale industries;
5. Balakrishnan, G. Financing of small scale industries.

**MBA 204: RESEARCH METHODOLOGY**

2L+0T+0P+2C

MM:100

**Unit 1: Meaning And Importance Of Research**

Review of Literature, Objectives of the research, Types of Research- Exploratory Research – Descriptive Research – Casual Research - Research Approaches- Research Process —Defining Research Problem- Selection and necessity of defining the problem.

**Unit 2: Research Design**

meaning, need and features of good research design- Important concepts related to research design. Experimental research designs: Before and After without control design, After only with control design, Before and after with control design, Completely randomized design (C.R Design).

**Sampling and Sampling Design** – Sampling Methods – Simple Random Sampling – Stratified Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling, Non-Probability Sampling – Convenience Sampling – Judgment Sampling – Quota Sampling- Snowball sampling.

**Unit 3: Data Collection**

Primary and Secondary Data – Designing of Questionnaire –**Measurement and Scaling** – Nominal Scale – Ordinal Scale – Interval Scale – Ratio Scale –Guttman Scale – Likert Scale – Schematic Differential Scale. Descriptive statistics- Measures of central tendency- Dispersion- Skewness -Correlation and Regression Analysis.

**Unit 4: Editing**

Coding – Classification of Data – Tables and Graphic Presentation –Basics of inferential statistics- Types of Errors- **Hypothesis testing** -Parametric test - T-test, Z test, Chi Square test- ANOVA Test. Introduction of SPSS.

**Unit 5 : Non Parametric Tests**

Kolmogorov – Smirnov Test – Runs Test for Randomness. Sign Test – Median Test –Factor Analysis.

**Preparation and Presentation of Research Report**- Types of reports- Layout of Research Report- Bibliography-References writing- Precautions for writing Research Report.

**Text/ Reference Books:**

1. Mark Saunders, Philip Lewis, Adrian Thornbill, Research Methods for Business Students, Pearson,ND
2. Churchill, Iacobucci & Israel, Marketing Research: A South Asian Perspective, Cengage, New Delhi
3. C.R. Kothari, Research Methodology, New Age International.
4. Carver & Nash, Data Analysis with SPSS, Cengage, New Delhi
5. Alan Bryman & Emma Bell, Business Research Methods, Oxford University Press.
6. Donald R. Cooper & Pamela S. Schindler, Business Research Methods 8th Edition, Tata McGraw Hill.
7. K.V.S. Sarma, Statistics made sample, do it yourself on PC, Prentice Hall.
8. V P Michael, Research Methodology in Management, Himalaya, Mumbai

# **Syllabus**

# **Semester-VIII**

**BCSAI 801: INDUSTRIAL TRAINING/INTERNSHIP INDUSTRY  
(ONE SEMESTER)****0L+0T+0P+10C****MM:100**

To improve the professional competency and research aptitude by touching the areas which otherwise not covered by theory or laboratory classes. The practical training aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real life problems related to industry and current research.

The purpose of practical training is not only to get acquainted with the culture of companies, but also to realize something of importance for the company visited. By working in a group within the company, it is expected that the trainee gets a better insight in the practical aspects of the industry. This is intended to facilitate the transition from the thorough theoretical education, dispensed at our University, into an industrial professional career.