SISTER NIVEDITA UNIVERSITY

SYLLABUS

FOR

THREE YEARS BACHELOR OF SCIENCE HONOURS DEGREE COURSE IN COMPUTER SCIENCE (ARTIFICIAL INTELLIGENCE & ROBOTICS)

UNDER UGC-CBCS SYSTEM

2020

School of Engineering & Technology

B.Sc. (Hons) in Computer Science (Artificial Intelligence & Robotics)

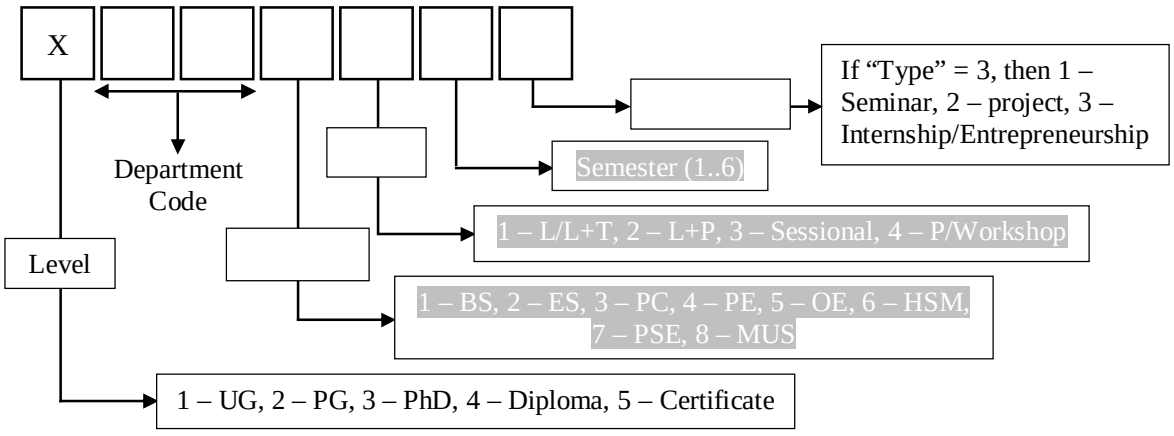
Credit Definition

Type	Duration (in Hour)	Credit
Lecture (L)	1	1
Tutorial (T)	1	1
Practical (P)	2	1

Category Codification with Credit Break up

Definition of Category	Code	No	Credit
Basic Science	BS	1	XX
Engineering Science	ES	2	XX
Professional Core	PC	3	XX
Professional Elective (Discipline Specific)	PE	4	XX
Open Elective (General Elective)	OE	5	XX
Humanities & Social Science including Management	HSM	6	XX
Project Work / Seminar / Internship / Entrepreneurship	PSE	7	XX
Mandatory / University Specified (Environmental Sc. / Induction Training / Indian Constitution / Foreign language)	MUS	8	XX
Total			**XXX**

Subject Codification Nomenclature



School of Engineering & Technology

B.Sc. (Hons) in Computer Science (Artificial Intelligence & Robotics)

SEMESTER: I

Mandatory Induction Program – Duration 3 weeks

Sl No	Course Title	Code	Credit	Type		
				L	T	P
1	Digital Electronics	1203211	6	3	1	4
2	Introduction to C-Programming	1203212	6	4	0	4
3	Mathematics- I	1191111	4	3	1	0
4	Generic Elective	*	4	3	1	0
5	Communicative English	1216115	2	2	0	0
6	Mentored Seminar – I	1207311	1	1	0	0
7	Foreign Language – I (German /Spanish /Japanese)	1278111/ 1278112/ 1278113	2	2	0	0
Total Credit			25			

SYLLABUS OUTLINE:

PAPER NAME: Digital Electronics

UNIT I: TOPICS	Number Systems & Codes (6L) Decimal Number, Binary Number, Octal Number, Hexadecimal Number, Conversion – Decimal to Binary, Binary to Decimal, Octal to Binary, Binary to Octal, Hexadecimal to Binary, Binary to Hexadecimal, Octal to Binary to Hexadecimal, Hexadecimal to Binary to Octal; Floating Point Number Representation, Conversion of Floating Point Numbers, Binary Arithmetic, 1's and 2's Complement, 9's and 10's Complement, Complement Arithmetic, BCD, BCD addition, BCD subtraction, Weighted Binary codes, Non-weighted codes, Parity checker and generator, Alphanumeric codes
UNIT II:	Logic Gates (2L)

TOPICS	OR, AND, NOT, NAND, NOR, Exclusive – OR, Exclusive – NOR, Mixed logic
UNIT III: TOPICS	Boolean Algebra (4L) Boolean Logic Operations, Basic Law of Boolean Algebra, Demorgan's Theorem, Principle of Duality
UNIT IV: TOPICS	Minimization Techniques (5L) Sum of Products, Product of Sums, Karnaugh Map (up to 4 variables)
UNIT V: TOPICS	Multilevel Gate Network (3L) Implementation of Multilevel Gate Network, Conversion to NAND-NAND and NOR-NOR Gate Networks
UNITVI: TOPICS	Arithmetic Circuits (5L) Half Adder, Full Adder, Half Subtractor, Full Subtractor, Carry Look Ahead Adder, 4-Bit Parallel Adder
UNITVII: TOPICS	Combinational Circuits (5L) Basic 2-input and 4-input multiplexer, Demultiplexer, Basic binary decoder, BCD to binary converters, Binary to Gray code converters, Gray code to binary converters, Encoder
UNITVIII: TOPICS	Sequential Circuits (5L) Introduction to sequential circuit, Latch, SR Flip Flop, D Flip Flop, T Flip Flop, JK Flip Flop, Master Slave Flip Flop
UNITIX: TOPICS	Basics of Counters (2L) Asynchronous (Ripple or serial) counter, Synchronous (parallel) counter
UNIT X: TOPICS	Basics of Registers (3L) SISO, SIPO, PISO, PIPO, Universal Registers

Suggested Books:

1. Digital Circuit & Design, Salivahan,VIKAS
2. Digital Design, M. Morris. Mano & Michael D. Ciletti, PEARSON
3. Fundamentals of Digital Circuits; Anand Kumar; PHI
4. Digital Electronics; Tokheim; TMH
5. Digital Electronics; S. Rangnekar; ISTE/EXCEL

PAPER NAME: Introduction to C-Programming

UNITI: TOPICS	Overview of C: History of C, Importance of C, Structure of a C Program. Elements of C: C character set, identifiers and keywords, Data types, Constants and Variables, Assignment statement, Symbolic constant. Input/output: Unformatted & formatted I/O function in C, Input functions viz. scanf(), getch(), getche(), getchar(), gets(), output functions viz. printf(),putch(), putchar(), puts().
UNITII: TOPICS	Operators & Expression: Arithmetic, relational, logical, bitwise, unary, assignment, conditional operators and special operators. Arithmetic expressions, evaluation of arithmetic expression, type casting and conversion, operator hierarchy & associativity. Decision making & branching: Decision making with IF statement, IF-ELSE statement, Nested IF statement, ELSE-IF ladder, switch statement, goto

	statement
UNITIII: TOPICS	Decision making & looping: For, while, and do-while loop, jumps in loops, break, continue statement. Functions: Definition, prototype, passing parameters, recursion. The C Preprocessor.
UNITIV: TOPICS	Storage classes in C: auto, extern, register and static storage class, their scope, storage, & lifetime. Arrays: Definition, types, initialization, processing an array, passing arrays to functions, Strings & arrays. Pointers: Pointers and address, Pointers and function arguments, Pointers and arrays, Address arithmetic, Character pointer arrays, Pointers and functions, Pointer arrays, Pointers to pointers, Multidimensional arrays, initialization of pointer arrays, Pointer vs. Multi-dimensional arrays, Command-line arguments, Pointer to functions.
UNITV: TOPICS	Structures and I/O: Basic of structures, Structures and functions, Arrays of structures, Pointers to structures, Self- referential structures, Table lookup, Type of, unions and bit-fields. Input and Output: Standard input and output, formatted output-Print, Variable length argument lists, File access, File descriptor, Low level I/O- Read and Write, Open, Create, Close.

Suggested Books:

1. Programming with C, Gottfried, TMH
2. Practical C Programming, Oualline, SPD/O'REILLY
3. Let us C-YashwantKanetkar.
4. Programming in C- Ashok N Kamthane
5. The C Programming Lang., Pearson Ecl – Dennis Ritchie.

DSE – 1: Mathematics –I

UNIT I (10 lectures)

Matrix Algebra- Introduction & definition, properties of matrix, special type of matrices, arithmetic of matrices, symmetric & skew-symmetric matrices, orthogonal matrices, singular and non-singular matrices with their properties, Trace of a matrix, Eigen value and Eigen vector computation, Inverse of a matrix and related properties, numerical problems solving.

UNIT II (10 lectures)

Differential Calculus: Review of limit, continuity and differentiability, L-Hospital rule, Leibnitz rule, successive differentiation, Rolle's theorem, Mean value theorem, Taylor series expansion, Function of several variables, Euler's theorem on homogeneous function, Partial differentiation, Jacobian, Maxima and Minimum of functions of one and two variables.

UNIT III (10 lectures)

Integral Calculus: Review of integration and definite integral. Differentiation under integral sign, double integral, change of order of integration, transformation of variables. Beta and Gamma functions: properties and relationship between them.

UNIT IV (10 lectures)

Differential Equations: Exact differential equations, integrating factors, change of variables, Total differential equations, Differential equations of first order and first degree, Differential equations of first order but not of first degree, Equations solvable for x, y, q, Equations of the first degree in x and y, Clairaut's equations. Higher Order Differential Equations: Linear differential equations of order n, Homogeneous and non-homogeneous linear differential equations of order n with constant coefficients.

SUGGESTED READING:

- Lay David C: Linear Algebra and its Applications, Addison Wesley, 2000.
- Schaum's Outlines: Linear Algebra, Tata McGraw-Hill Edition, 3rdEdition, 2006.
- Searle S.R: Matrix Algebra Useful for Statistics. John Wiley &Sons., 1982.
- Gorakh Prasad: Differential Calculus, PothishalaPvt. Ltd., Allahabad (14th Edition - 1997).
- Gorakh Prasad: Integral Calculus, PothishalaPvt. Ltd., Allahabad (14th Edition - 2000).
- David C. Lay: Linear Algebra and Its Applications, 3rdEdn, Pearson Education, Asia.

SEMESTER: II

Sl No	Course Title	Code	Credit	Type		
				L	T	P
1	Computer Architecture	1201221	6	3	1	4
2	Data Structures with Python	1201222	6	4	0	4
3	Mathematics II	1192121	4	3	1	0
4	Generic Elective	*	4	3	1	0
5	Environmental Science	1154121	2	2	0	0
6	Mentored Seminar – II	1205121	1	1	0	0
7	Foreign Language – II (German /Spanish /Japanese)	1276121/ 1276122/ 1276123	2	2	0	0
Total Credit		25				

SYLLABUS OUTLINE:

PAPER NAME: Computer Architecture

UNITI: TOPICS:	1.Number Systems – decimal, binary, octal, hexadecimal, alphanumeric representation, 2.Complements – 1's complement, 2' complement, 9's complement, 10' complement, (r-1)'s complement, r's complement, 3. Fixed point representation – Integer representation, arithmetic addition, arithmetic subtraction, overflow, decimal fixed point representation, 4. Floating point representation, 5. IEEE 754 floating point representation
UNITII: TOPICS:	Computer arithmetic (5L) 1. Addition algorithm of sign magnitude numbers, 2. Subtraction algorithm of

	sign magnitude numbers, 3. Addition algorithms of signed 2's complement data, 4. Subtraction algorithms of signed 2's complement data, 5. Multiplication algorithm, Booth's algorithm, 6. Division algorithm
UNITIII: TOPICS	Register transfer and micro-operations (5L) 1. Register transfer language, 2. Register transfer, 3. Bus system for registers, 4. Memory transfers– memory read, memory write, 5. Micro operations – register transfer micro operations, arithmeticmicro operations, logic micro operations, shift micro operations, 6. Binary adder, binary adder, subtractor, binary incrementer, arithmetic circuit for arithmetic micro operations, 7. One stage logic circuit, 8. Selective set, Selective complement, Selective clear, Mask, Insert, Clear
UNITIV: TOPICS	Basic Computer organization and design (4L) 1. Instruction codes, 2. Direct address, Indirect address & Effective address, 3. List of basic computer registers, 4. Computer instructions: memory reference, register reference & input – output instructions, 5. Block diagram & brief idea of control unit of basic computer, 6. Instruction cycle
UNITV: TOPICS	Micro programmed control (2L) 1. Control memory, 2. Address sequencing, 3. Micro program examples
UNITVI: TOPICS	Central processing unit (5L) 1. General register organization, 2. Stack organization, Register stack, Memory stack, Stack operations – push & pop, 3. Evaluation of arithmetic expression using stack, 4. Instruction format, 5.Types of CPU organization (single accumulator, general register & stack organization) & example oftheir instructions, 6. Three, two, one & zero address instruction, 7. Definition and example of data transfer, data manipulation & program control instructions, 8. Basic idea of different types of interrupts (external, internal & software interrupts), 9. Difference between RISC & CISC
UNITVII: TOPICS	Pipeline and vector processing (3L) 1. Parallel processing, 2. Flynn's classification, 3. Pipelining, Example of pipeline, space time diagram, speedup, 4. Basic idea of arithmetic pipeline, example of floating point addition/ subtraction using pipeline
UNITVIII: TOPICS	Input – output organization (6L) 1. Peripheral devices, 2. Input – output interface, 3. Isolated I/O, Memory mapped I/O, 4.Asynchronous data transfer: strobe & handshaking, 5. Programmed I/O, 6. Interrupt initiated I/O, 7.Basic idea of DMA & DMAC 8. Input – output processor
UNITIX: TOPICS	Memory organization (6L) 1. Memory hierarchy, 2. Main memory definition, types of main memory, types of RAM, ROM, difference between SRAM & DRAM, 3. Cache memory, Cache memory mapping – Direct, Associative, Set Associative, 4. CAM, hardware organization of CAM, 5. Virtual memory, mapping using pages, page fault, mapping using segments, TLB, 6. Auxiliary memory, diagrammatic representation of magnetic disk & hard disk drive, 7. Definitions of seek time, rotational delay, access time, transfer time, latency

Suggested Books:

1. Computer System Architecture, M. Morris Mano, PEARSON

2. Computer Organization & Architecture –Designing For Performance, William Stallings, PEARSON
3. Computer Architecture & Organisation, J.P. Hayes, TATA MCGRAW HILL
4. Computer Organization and Architecture, T. K. Ghosh, TATA MCGRAW-HILL
5. Computer Architecture, BehroozParhami, OXFORD UNIVERSITY PRESS

PAPER NAME: Data Structure with Python

UNITI: TOPICS	Introduction to Python (12L) Introduction to Python Python variables, expressions, statements: Variables,Keywords,Operators&operands,Expressions ,Statements, Orderof operations, String operations, Comments, Keyboard input, Example programs Functions: Type conversion function, Math functions, Composition of functions, Defining own function, parameters, arguments, Importing functions, Example programs
UNITII: TOPICS	Conditions & Iterations (8L) Conditions: Modulus operator, Boolean expression, Logical operators, if, if-else, if-elif-else, Nested conditions, Example programs. Iteration: while, for, break, continue, Nested loop, Example programs
UNITIII: TOPICS	Recursion, Strings, List, Dictionaries, Tuples Recursion:Python recursion, Examples of recursive functions, Recursion error, Advantages & disadvantages of recursion Strings:Accessing values in string, Updating strings, Slicing strings, String methods – upper(), find(), lower(), capitalize(), count(), join(), len(), isalnum(), isalpha(), isdigit(), islower(),isnumeric(), isspace(), isupper() max(), min(), replace(), split(), 2.5 Example programs List:Introduction, Traversal, Operations,Slice, Methods, Delete element, Difference between lists and strings. Dictionaries: Introduction, Brief idea of dictionaries & lists Tuples: Introduction, Brief idea of lists & tuples, Brief idea of dictionaries & tuples.
UNIT IV: TOPICS	Data Structure using Array (4L) Stack, queue, circular queue, priority queue, dequeue and their operations and applications.
UNITV: TOPICS	Searching and Sorting (6L) Searching: linear search, Binary search, their comparison, Sorting: insertion sort, Selection sort.Quick sort, Bubble sort Heap sort, Comparison of sorting methods , Analysis of algorithm,complexity using big 'O' notation
UNITVI: TOPICS	Linked List (4L) Linear link lists, doubly linked lists, stack using linked list, queue using linked list, circular linked listand their operations and applications.
UNITVII: TOPICS	Trees (5L) Binary trees, binary search trees, representations and operations, thread representations, sequentialrepresentations, B tree , B+ tree,
UNITVIII: TOPICS	Graphs (5L) Introduction to graphs, Definition, Terminology, Directed, Undirected &

	Weighted graph, Representation of graphs, Graph Traversal: Depth first search and Breadth first search. SpanningTrees, minimum spanning Tree, Shortest path algorithm
UNITIX: TOPICS	Hashing (4L) Definition, Hashing functions, Load factor and collision, open addressing (linear probing) andchaining method to avoid collision

Suggested Books:

1. Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser
2. Data Structures and Algorithmic Thinking with Python, NarasimhaKarumanchi
3. Python Data Structures and Algorithms: Benjamin Baka

SEMESTER: III

Sl No	Course Title	Code	Credit	Type		
				L	T	P
1	Artificial Intelligence	1202231	6	3	1	4
2	Database Management System	1201232	6	4	0	4
3	Operating System & System Programming	1202233	6	3	1	4
4	Machine learning	1202134	6	3	1	4
5	Generic Elective	*	4	3	1	0
Total Credit		28				

SYLLABUS OUTLINE:

PAPER NAME: Artificial Intelligence

UNIT I: TOPICS	Overview of Artificial intelligence- Problems of AI, AI technique, Tic – Tac – Toe problem.
UNIT Ⅱ: TOPICS	Problems, Problem Space & search. Heuristic Search Techniques, Knowledge representation issues. Representing knowledge using rules.
UNIT III: TOPICS	Symbolic reasoning under uncertainty. Statistical reasoning. Weak slot & filler structures. Strong slot & filler structures.
UNIT IV: TOPICS	Game planning –Minimax search procedure, adding alpha beta cut-off's, iterative deepening, Planning.
UNIT V: TOPICS	Natural language processing, Understanding. Learning – induction & explanation based learning. Expert systems- expert system shells, knowledge acquisition. Basic knowledge of programming language like Prolog & Lisp.

Suggested Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI

3. Logic & Prolog Programming, Saroj Kaushik, New Age International

PAPER NAME: Database management System

UNITI: TOPICS	Database System Concepts & Architecture: Data Independence, Schemas, Instances, Database Languages, Database System Environments Data Models, Basic Structure of Oracle System, Storage Organization in Oracle.
UNITII: TOPICS	Data Modelling: Use of High –level Conceptual Data Models, ER Diagrams, Subclasses, Super classes and Inheritance, Specialization & Generalization, Conceptual Object Modelling using UML Class Diagrams, Knowledge Representation Concepts, Exercises.
UNITIII: TOPICS	Relational Data Model: Relational constraints, domain constraints, key constraints referential integrity Constraints, relational algebra, fundamental operations of relational algebra & their Implementation, interdependence of operations, example queries.
UNITIV: TOPICS	ER and EER to Relational Mapping: Mapping EER model concepts to relation, tuple relational calculus, domain relational Calculus queries.
UNITV: TOPICS	Database Design: Functional dependencies, irreducible sets of dependencies, loss less decomposition, 1st, 2^{nd}& 3^{rd} NF, dependency preservation, Boyce Codd NF, Multivalued Dependency & 4th NF, join Dependency & 5 NF, domain key normal form, restriction –union normal form, Denormalization.
UNITVI: TOPICS	Query Processing And Optimization: SQL Basic Queries in SQL, Sub queries, Retrieving a Query Plan – Table Space Span & I/O, Index Scan, Equal Unique Index Lookup, Clustered vs. Non Clustered Indexing, Index Only Scan, Methods for Joining Tables –Nested Loop Join Merge Join, Hybrid Join, Multiple table Join, Transforming Nested Queries to Joins, Object Relational SQL, Procedural SQL, Introduction to Embedded SQL.
UNITVII: TOPICS	Transaction: Schedules, Serializability, Precedence Graph, Concurrency Control Techniques, Implementation of Transaction in Programs, Cursors and Transaction, Dynamic SQL, Locking Levels of Isolation, Recovery, Checkpoints.

Suggested Books:

1. Fundamental of Database Systems- Elmasri Navathe- Pearson Education Asia
2. Database- Principles, Programming and Performance- Parick O' Neil Elizabeth O'Niel, Harcort Asia PTE Limited
3. An Introduction to Database Systems- C. J. Date, Addison Wesley, Pearson Education Press
4. Database System Concepts- Abraham Silberschat, Henry F. Korth, S.Sudarshan, Tata McGraw Hill.

DSE – 3: Operating System & System Programming

UNITI: TOPICS	Introduction (3L) Importance of OS, Basic concepts and terminology, Types of OS, Different views, Journey of a command execution, Design and implementation of OS
UNITII: TOPICS	Process (10L) Concept and views, OS view of processes, OS services for process management, Scheduling algorithms, Performance evaluation; Inter-process communication and synchronization, Mutual exclusion, Semaphores, Hardware support for mutual exclusion, Queuing implementation of semaphores, Classical problem of concurrent programming, Critical region and conditional critical region, Monitors, Messages, Deadlocks
UNITIII: TOPICS	Storage Management (8L) Memory Management- Backward, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging.
UNITIV: TOPICS	File-System Interface and Implementation (6L) File Concept, Access Methods, Directory Structure, Protection, File-System Structure, File-System Implementation, Directory Implementation; Allocation Methods, Free-Space Management.
UNITV: TOPICS	Mass-Storage Structure (4L) Disk Structure; Disk Scheduling; Disk Management; Swap-Space Management
UNITVI: TOPICS	Assemblers: Elements of Assembly Language Programming, Design of the Assembler, Assembler Design Criteria, Types of Assemblers, Two-Pass Assemblers, One-Pass Assemblers, Single pass Assembler for Intel x86 , Algorithm of Single Pass Assembler, Multi-Pass Assemblers
UNITVII: TOPICS	Compilers: Causes of Large Semantic Gap, Binding and Binding Times, Data Structure used in Compiling, Scope Rules, Memory Allocation, Compilation of Expression, Compilation of Control Structure, Code Optimization

Suggested Books:

1. Operating Systems, Galvin, John Wiley
2. Operating Systems, Milankovic, TMH
3. An Introduction to Operating System, Bhatt, PHI
4. Modern Operating System, Tannenbaum, PHI
5. Guide to Operating Systems, Palmer, VIKAS
6. Operating Systems, Prasad, Scitech

B.Sc. (Hons) in Computer Science (Artificial Intelligence & Robotics)

SEMESTER: IV

Sl No	Course Title	Code	Credit	Type		
				L	T	P
1	Computer Graphics & Multimedia	1201241	6	4	0	4
2	Software Engineering	1201141	4	3	1	0
3	Numerical Analysis	1192241	6	4	0	4
4	Natural language processing with Python	1201242	6	3	1	4
Total Credit		22				

SYLLABUS OUTLINE:

PAPER NAME: Computer Graphics & Multimedia

UNITI: TOPICS	Overview of Graphics Systems: Video Display Devices, Refresh Cathode Ray Tubes, Raster-Scan and Random-Scan Systems, Input Devices, Hard-Copy Devices and Graphics Software.
UNITII: TOPICS	Output Primitives: Points, Line Drawing Algorithms (DDA and Bresenham's Line Drawing Algorithm), Circle- Generating Algorithms (Bresenham's and Midpoint Circle Algorithms), Ellipse-Generating Algorithms(Midpoint Ellipse Algorithm only), Filled- Area Primitives: Scan –Line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm.
UNITIII: TOPICS	Two Dimensional Geometric Transformations: Basic Transformations, Matrix Representations and Homogeneous Coordinates, Composite Transformations, Reflection and Shear, Transformations between Coordinates Systems, Raster Methods for Transformations.
UNITIV: TOPICS	Two-Dimensional Viewing: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window-to-View Port Coordinate Transformation, Clipping- Point, Line(Cohan-0Sutherland Line Clipping and Liang –Barsky Line Clipping) and Polygon Clipping(Sutherland-Hodgeman Polygon Clipping).
UNITV: TOPICS	Multimedia Systems Design: Multimedia Elements, Multimedia Applications, Multimedia System Architecture, Evolving Technologies for Multimedia Systems, Multimedia Data Interface Standards, the Need for Data Compressions, Multimedia Database.
UNIT VI: TOPICS	Data & File Format Standards: Rich –Text Format, TIFF File Format, RIFF, MIDI File Format, JPEG DIB File Format, MPEG Standards.

Suggested Books:

1. D.Hearn & M. P. Baker -Computer Graphics C Version, 2nd Edition Pearson Education, New Delhi, 2006
2. J. F. Koegel Buferd -Multimedia Systems, Pearson Education, New Delhi, 2006

3. R.A. Plastock et.al. - Computer Graphics (Schaums Outline Series), 2nd Edition, TMH, New Delhi, 2006.
1. J.D.Foley- Computer Graphics, 2nd Edition, Pearson Education, New Delhi, 2004

PAPER NAME: Software Engineering

UNITI: TOPICS	(12L) Overview of Computer Based Information System- TPS, OAS, MIS, DSS, KBS Development Life Cycles- SDLC and its phases Models- Waterfall, Prototype, Spiral, Evolutionary Requirement Analysis and Specification, SRS System analysis- DFD, Data Modeling with ERD
UNITII: TOPICS	(9L) Feasibility Analysis System design tools- data dictionary, structure chart, decision table, decision tree. Concept of User Interface, Essence of UML. CASE tool.
UNITIII: TOPICS	(9L) Testing- Test case, Test suit, Types of testing- unit testing, system testing, integration testing, acceptance testing Design methodologies: top down and bottom up approach, stub, driver, black box and white box testing.
UNITIV: TOPICS	(10L) ERP, MRP, CRM, Software maintenance SCM, concept of standards (ISO and CMM)

Suggested Books:

1. System analysis and design, Igor Hawryszkiewycz, Pearson
2. Analysis and design of Information System, V Rajaraman, PHI
3. Software Engineering, Ian Sommerville, Addison-Wesley.

DSE4 – Numerical Analysis

Unit 1: Representation of numbers:

Round-off error, truncation error, significant error, error in numerical computation.

Unit 2: Solution of transcendental and algebraic equations:

Bisection, Regula-falsi, Fixed point, Newton Rephson.

Unit 3: Interpolation:

Newton’s forward, backward, Lagrange’s and divided differences.

Unit 4: Numerical differentiation:

Methods based on interpolations.

Unit 5: Numerical Integration:

Trapezoidal, Simpson’s 1/3 rd. rule.

Unit 6: Solution of linear equations:

Direct methods – Gauss elimination, LU decomposition, Iteration methods- Jacobi, Gauss-Seidel.

Unit 7: Ordinary differential equations:

Single step method - Euler method, Runge-Kutta Method, multistep method.

Unit 8: Approximations:

Least square polynomial approximation.

Reference Books:

1. A. Gupta and S.C. Bose: Introduction to Numerical Analysis, Academic Publisher 3rd ed, 2013
2. M.K. Jain, S.R.K.Iyenger and R.K. Jain: Numerical methods for scientific and Engineering Computations, New Age Internationals (P) Ltd, 1999.

Component: Lab Numerical Analysis Credits: 2

List of practical (using C/ C++)

1. **Solution of transcendental and algebraic equations:**
   a) Bisection method
   b) Newton Raphson method
2. **Numerical Integration**:
   a) Trapezoidal Rule
   b) Simpson's one third rule
3. **Solution of ordinary differential equations:**
   a) Euler method
   b) RungeKutta method (order 4)

PAPER NAME: Natural language processing with Python

UNIT I: TOPICS	Introduction and Overview What is Natural Language Processing, Ambiguity and uncertainty in language. The Turing test. Course outline and logistics. Regular Expressions Chomsky hierarchy, regular languages, and their limitations. Finite-state automata. Practical regular expressions for finding and counting language phenomena. A little morphology.
UNIT Ⅱ: TOPICS	String Edit Distance and Alignment Key algorithmic tool: dynamic programming, first a simple example, then its use in optimal alignment of sequences. String edit operations, edit distance, and examples of use in spelling correction, and machine translation.

UNIT Ⅲ: TOPICS	Context Free Grammars Constituency, CFG definition, use and limitations. Chomsky Normal Form. Top-down parsing, bottom-up parsing, and the problems with each. The desirability of combining evidence from both directions.
UNIT IV: TOPICS	Non-probabilistic Parsing Efficient CFG parsing with CYK, another dynamic programming algorithm. Also, perhaps, the Earley parser. Designing a little grammar, and parsing with it on some test data.
UNIT V: TOPICS	String Edit Distance and Alignment Key algorithmic tool: dynamic programming, first a simple example, then its use in optimal alignment of sequences. String edit operations, edit distance, and examples of use in spelling correction, and machine translation.
UNIT VI: TOPICS	Information Theory What is information? Measuring it in bits. The "noisy channel model." The "Shannon game"--motivated by language! Entropy, cross-entropy, information gain. Its application to some language phenomena.
UNIT VII: TOPICS	Language modelling and Naive Bayes Probabilistic language modelling and its applications. Markov models. N-grams. Estimating the probability of a word, and smoothing. Generative models of language. Their application to building an automatically-trained email spam filter, and automatically determining the language

Suggested Books:

SEMESTER: V

Sl No	Course Title	Code	Credit	Type		
				L	T	P
1	Introduction to Robotics	1203151	4	3	1	0
2	Embedded System Programming	1203252	6	4	0	4
3	Computer Networks	1203252	6	3	1	4
4	Intelligent agents and Smart Systems	1203153	4	3	1	0
5	Project – I on Robotics	1201451	6	0	0	12
Total Credit		26				

SYLLABUS OUTLINE:

PAPER NAME: Robotics

Foundations of Robotics are a challenging introduction to basic computational concepts used broadly in robotics. Topics include simulation, kinematics, control, optimization, and probabilistic inference. The mathematical basis of each area is

emphasized, and concepts are motivated using common robotics applications and programming exercises.

Suggested Books:

PAPER NAME: Computer Networks

UNITI: TOPICS	Data Transmission Basic Concepts and Terminology: Data Communication Model, Communication Tasks, Parallel & Serial Transmission, Transmission Models, Transmission Channel, Data Rate, Bandwidth Signal Encoding Schemes, Data Compression, Transmission Impairments, Layering and Design Issues, OSI Model, Services and Standards.
UNITII: TOPICS	Computer Network: Network Topology, Performance of Network, Network Classification, Advantages & Disadvantages of Network, Transmission Media (guided and unguided), Network Architecture, OSI Reference Model, TCP/IP, SNA and DNA.
UNITIII: TOPICS	Data Line Devices: Modems, DSL, ADSL, Multiplexer and Different Multiplexing Techniques: (FDM, TDM).
UNITIV: TOPICS	Data Link Layer: Need for Data Link Control, Frame Design Consideration, Flow Control &Error Control (Flow control mechanism, Error Detection and Correction techniques) Data Link Layer Protocol, HDLC.
UNITV: TOPICS	Network Layer: Routing, Congestion control, Internetworking principles, Internet Protocols (IPv4 packet format, Hierarchal addressing sub netting, ARP, PPP), Bridges, Routers.
UNITVI: TOPICS	Physical Layer: Function and interface, physical layer standard, null modem.
UNITVII: TOPICS	Local Area Network: Definition of LAN, LAN topologies, Layered architecture of LAN, MAC, IEEE standard. Ethernet LAN, CSMA, CSMA/ CD, Token passing LAN.
UNITVIII: TOPICS	Network Security: Security Requirement, Data encryption strategies, authentication protocols, Firewalls.
UNITIX: TOPICS	Basic Applications: Telnet, FTP, NFS, SMTP, SNMP and HTTP.

Suggested Books:

1. B. Fourauzan, “Data Communications and Networking”, 4th Edition, Tata McGraw-Hill
2. William Stallings- Data & Communications, 6th Edition, Pearson Education
3. Tanenbaum- Computer Networks, 3rd Edition, PHI, New Delhi.

School of Engineering & Technology

B.Sc. (Hons) in Computer Science (Artificial Intelligence & Robotics)

PAPER NAME: Embedded System Programming

UNIT I: TOPICS	INTRODUCTION TO EMBEDDED SYSTEM: History & need of Embedded System Basic components of Embedded System Programming Language Classification of Embedded System Advantage & Disadvantage
UNIT II: TOPICS	MICROPROCESSOR & MICROCONTROLLER CLASSIFICATION • Difference between Microprocessor & Microcontroller • Classification based on architecture • Memory Classification
UNIT III: TOPICS	REGISTERS & MEMORY OF AT89C51 • Description of RAM • Description of CPU Registers • Functions of SFR
UNIT IV: TOPICS	INTRODUCTION OF EMBEDDED C • Introduction to Embedded C • Difference between C & Embedded C • Programming style • Basic structure of C program
UNIT V: TOPICS	CONSTANTS, VARIABLES & DATA TYPES • Keywords & Identifiers • Data type & its memory representation • Arrays and strings
UNIT VI: TOPICS	OPERATORS • Types of Operators • Bitwise Operators explained
UNIT VII: TOPICS	CONTROL STRUCTURES & LOOPS •Decision making with if statement • If….else statement • Switch statement, and GOTO statement • The While and Do – While statements • For statement
UNIT VIII: TOPICS	FUNCTIONS • Why Functions • Types of Functions • A Multi functional program • Return values & their types
UNIT IX: TOPICS	INTERFACING OF LED • Introduction of LED's • Interfacing Circuit Description of LED's • Programming of LED's Interfacing
UNIT X: TOPICS	INTERFACING OF SEVEN SEGMENT DISPLAY • Introduction to 7 Segment Display • Types of 7 Segment Display • Interfacing Circuit Description of 7 Segment Display • Programming of 7 Segment Display Interfacing
UNIT XI: TOPICS	INTERFACING OF LCD • Introduction to 16 x 2 LCD • Commands of 16 x 2 LCD

	• Interfacing Circuit Description of 16 x 2 LCD • Programming of 16 x 2 LCD
UNIT XII: TOPICS	INTERFACING OF SWITCHES & KEYBOARD MATRIX • Introduction to Switches & Keyboard Matrix • Interfacing Circuit of Switches & Keyboard Matrix • Programming of Keyboard Matrix & Switches • Controlling of LED's by using Switches • Key board Matrix & LCD Interfacing Program

Suggested Books:

PAPER NAME: Project – I on Robotics

SEMESTER: VI

Sl No	Course Title	Code	Credit	Type		
				L	T	P
1	Elective -I	1202261	4	3	1	0
2	Elective -II	1202262	4	3	1	0
3	Project Work II/ Dissertation	1201461	8	0	0	16
Total Credit		16				

Elective -I

- Big data
- Cyber security
- System Architecture and Internet of Things
- Cloud Computing
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Elective -II

- Deep Learning
- Parallel Computing for AI & ML
- Machine Vision
- Mechatronics