NATIONAL UNIVERSITY

First Year Syllabus
Department of Computer Science and Engineering

Four Year B.Sc. Honours Course
Effective from the Session: 2017–2018

National University

Subject: Computer Science and Engineering
Syllabus for Four Year B.Sc. Honours Course
Effective from the Session: 2017-2018

Year wise courses and marks distribution

FIRST YEAR

Semester I

Course Code	Course Title	Credit Hours
510201	Structured Programming Language	3.0
510202	Structured Programming Language Lab	1.5
510203	Electrical and Electronic Circuit	3.0
510204	Electrical and Electronic Circuit Lab	1.5
510205	Calculus	3.0
510207	Physics	3.0
510209	English	3.0
	Total Credits in 1st Semester	**18.0**

Semester II

Course Code	Course Title	Credit Hours
510221	Digital Systems Design	3.0
510222	Digital Systems Lab	1.5
510223	Discrete Mathematics	3.0
510225	Linear Algebra	3.0
510227	Statistics and Probability	3.0
510229	History of the Emergence of Independent Bangladesh	3.0
	Total Credits in 2nd Semester	**16.5**

Detailed Syllabus

First Semester

Course Code : 510201	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Structured Programming Language		

Computer Programming Techniques:

Overview of Structured Programming Language concept; algorithm , flowchart and pseudo code; Constants, variables and data types; Operator & Expression; Managing Input & Output Operations; Decision making and branching; Looping; Arrays; Handling of character strings; User-defined functions; parameter passing conventions, scope rules and storage classes, recursion; Structure and union; Pointers; File management; header files; preprocessor; library functions; error handling;

Reference language: *C*

Reference Books:

1) *Shaum's Outline of Theory and Problems of Programming with C,* B. S. Gottfried, McGraw Hill, 3rd Edition.
2) *Teach Yourself C,* Herbert Schildt, Published by Osborne, 3rd Edition.

Course Code : 510202	Marks : 40	Credits : 1.5	Class Hours : ---
Course Title :	Structured Programming Language Lab		

Objectives: Laboratory classes are based on course CSE 510201. The goal of this lab is to provide students with the skills needed to effectively design, develop, implement, debug, test, and maintain programs and more generally to solve problems in C programming language using a computer. Students will be asked to solve various problems in a regular basis to increase their programming ability. At the end of the course, students will have to develop a simple real-life programming project.

Course Code : 510203	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Electrical and Electronic Circuit		

AC Fundamentals : Basic Principles of AC Generators, Alternating Voltages and Currents, Frequency, Amplitude and Phase, RMS and Average Value, Form Factor, Resistance, Inductance, Capacitance, RLC Series Connection and Resonance, Parallel Resonance.
Network theorem: KVL, KCL, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.

Introduction to Semiconductors: Semiconductors and their properties, Intrinsic and extrinsic semiconductors.

Semiconductor Diodes and Special Purpose Diodes: The p-n junction formation, properties and V-I characteristics, Basic constructions, characteristics, operations and uses of special diodes, Light emitting diode (LED), Zener diode.

Regulated Power Supply: Voltage regulation, rectifiers, half-wave and full-wave rectifiers, Voltage regulator circuits- Zener diode and transistor voltage regulator.

Bipolar Junction Transistors: npn and pnp transistors, Amplifying and switching actions of transistor, Transistor characteristics in CB, CE and CC configurations, Operating point, Transistor load line analysis, BJT Biasing.

Field Effect Transistors: Classification of FET, Construction, operation and characteristics of JFET, Operation and characteristics curves of MOSFET, DC biasing of JFET.

Feedback Techniques and Op-amps: Negative and positive feedback, characteristics and gain with negative voltage and current feedback**,** Emitter Follower, Basic Op-amps- characteristics, inverting, non-inverting, integrators, differentiators, summing amplifiers.

Reference Books:

1) *A Textbook of Electrical Technology,* Volume I, B.L. Theraja and A.K. Theraja

2) *Electronic Devices and Circuit Theory,* Robert L. Boylestead and Louis Nashelsky

Course Code : 510204	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Electrical and Electronic Circuit Lab**		

Objectives: Laboratory classes are based on CSE 510203. Verification of ohm's law and measurement of Resistivity of a Metallic wire, To verify Kirchhoff's Current law and kirchhoff's Voltage law, To verify Thevenen's theorem, To verify Norton's theorem, To verify Superposition theorem, To study R-C circuit and to find out the time constant, To study the R-L-C series Resonance circuit. I-V Characteristics of diode, Input and Output Characteristics of BJT: Common-Base Configuration(CB), Common-Emitter Configuration (CE), I-V characteristic of Zener diode.

Course Code : 510205	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Calculus**		

Differential Calculus

Function and their graphs (polynomial and rational functions, logarithmic and exponential functions, trigonometric functions and their inverses, hyperbolic functions and their inverses, combination of such functions).

Limits of Functions: Definition. Basic limit theorems with proofs: limit at infinity and infinite limits, Continuous functions. Algebra of continuous functions. Properties Continuous functions on closed and boundary intervals (no proof required).

Differentiation : Tangent lines and rates of change. Definition of derivative. One-sided derivatives. Rules of differentiation (proofs and applications). Successive differentiation.
Leibnitz theorem. Related rates. linear approximations and differentials.

Rolle's theorem: Lagrange's and Cauchy's mean value theorems. Extrema of functions. problems involving maxima and minima. Concavity and points of inflection.

Taylor's theorem with general form of the remainder ; Lagrange's and Cauchy's forms the remainder. Taylor's series. Differentiation and integration of series. Validity of Taylor expansions and computations and computations with series. indeterminate forms. L-Hospital's rules.

Integral Calculus

Integrals: Antiderivatives and indefinite-integrals. Techniques of Integration. Definite Integration using antiderivatives. Definite Integration using Riemann sums.
Fundmental theorems of Calculus, Basic properties of Integration. Integration by reduction.
Application of Integration: Plane areas. Solids of revolutions. Volumes by cylindrical shells volumes by cross-sections. Arc length and Surface of revolution.
Improper integrals. Gamma and Beta functions.
Graphing in polar co-ordinates. Tangents to polar curves. Area and length in polar coordinates.

Reference Books:

1) *Differential Calculus,* B. C. Das, B. N. Mukherjee
2) *Integral Calculus,* Dr. Abdul Matin
3) *A Text Book on Differential Calculus,* Mohammad, Bhattacharjee and Latif

Course Code : 510207	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Physics**		

Charge, Electric field & Gauss's Law: Simple phenomena in electrostatics; Electrostatic induction and charge density; Coulomb's law; Electric field & field strength; Point charge in an electric field; dipole in an electric field; Electric flux; Gauss's law and some applications; Electric potential; Potential due to a point charge; Equipotential surfaces; Potential energy; Potential gradient; Capacitance and its calculation; Parallel plate capacitor with dielectric; Dielectric & Gauss's law; Electric vectors; Energy stored in an electric field.

Electric current, Simple circuits and Electrical Measurements: Current and Ohm's law; E.M.F. and potential difference; Whetstone bridge; Simple RC and RL circuits, The potentiometer; Moving coil galvanometer; Ammeter; Voltmeter; Multimeter; Wattmeter.

Magnetic Field & force on Current: Coulomb's law; Magnetic field and field strength; Magnetic force on current; Directions of current and field; Maxwell's screw rule; Fleming's left hand rule; Magnetic field near long wire; Magnetic field for solenoid; Fleming's right hand rule;

Magnetic properties of matter: Poles and dipoles; Coulomb's law for magnets & Gauss's theorem of magnetism; Dia-magnetism, Para-magnetism and Ferro-magnetism. Magnetomotive force and field intensity; concept of self and mutual inductance; The coefficient of magnetic coupling; Rise of current and decay of current in inductive circuit; Energy in magnetic field; Inductance in series and parallel; Hysteresis and eddy current losses.

Reference Books:

1. David Halliday and Robert Resin, Physics Part-II
2. Boylested, Introductory Circuit Analysis
3. B. L. Theraja, A Text book of Electrical Technology

Course Code : 510209	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**English**		

This course adopts an integrative approach to teaching the four basic skills: speaking, listening, reading and writing. Special emphasis will be given to the development of reading and writing skills. To ensure maximum benefit from this course, 30% of the total marks will be allotted to class work in reading and writing. **Speaking:** Students will focus on developing speaking which will include strategies for communication and an acquaintance with phonetics. Effective oral presentation. Tasks will include making statements, requests, inquiries, disagreeing, complaining and apologizing, discussing, and other oral presentations. **Listening:** Students will practice listening to spoken English and taking useful notes. **Reading:** Extracts from literary and general essays will be used to develop comprehension as well as an understanding of the nature of literary communication. Students will develop the following reading strategies: **Grammar in Use:** While grammar will generally be taught in context, some attention to grammar may be necessary a this stage. The following aspects may be taught: articles, verb patterns, sentence combining-subordination and coordination, conditional sentences, the infinitive, gerund, and participle, subject-verb agreement. **Writing:** Paragraph, précis and analytical writings, writing on current affairs, Scientific writing. **Commercial Correspondences:** Defining context, feedback and semantic gap. Different types of commercial and business letter writing, tender-notice and pre-qualification notice writing. Writing of different types of reports on specific topics.

Reference Books:

1) *College Writing Skills with Readings,* John Langan.
2) *The Craft of Business Letter Writing*, Matthew M Monippally, Tata McGraw-Hill Publishing Company Limited.
3) *Advanced Learners' Degree General English,* Chowdhury and Hossain.

Second Semester

Course Code : 510221	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Digital Systems Design		

Introduction: Introductory concepts, Number System and code, Logic gates and Boolean algebra.

Combinatorial Logic: Combinational Circuits design using logic gates, universal gates. Minimization of switching functions, algebraic simplification, the Karnaugh map, Prime Implement.

Sequential Logic: NAND and NOR latches. Clocked SR. JK D and T flip-flops. FF timing consideration. Master-slave FF.

Complex Sequential logic: Frequency division and counting troubleshooting. Asynchronous ripple up and down counters, counters with any MOD numbers asynchronous IC counters, propagation delay. Parallel up down and up/down counters. Presentable counters. The 74193 counter. Decoding a counter. Cascading counters. Shift registers, IC shift, digital clock, troubleshooting case studies. MSI logic circuits: BCD-to-Decimal decoders, BCD-to-7 segment decoder/drivers. Encoders.

Multiplexer and Demultiplexer: Multiplexer and their applications, Demultiplexers, Troubleshooting case studies, Analog-to-Digital conversion, digital-ramp, successive approximation, flash ADC, Digital-to-Analog conversion: circuits, specifications, Sample and hold circuits, Analog multiplexers, Data acquisition, digital voltmeter.

Memory Devices: Semiconductor memory technologies ROM architecture timing and type of ROM, EPROM, EEPROM, ROM applications. RAM architecture static and dynamic RAM, DRAM structure operation and refreshing. Expanding word size and capacity. Magnetic bubble and CCD memories trouble shooting case studies. Introduction to sequential circuits, formal representation of sequential circuits.

Arithmetic circuits: The half-adder, full adder, parallel adders, 2's complement addition and troubleshooting case studies.

Reference Books:

1) *Digital Systems: Principles and Applications,* Ronald J. Tocci, Neal S. Wildmer.
2) *Hand Book of Modern Digital Electronics,* G. Moazzam and M. Shorif Uddin.
3) *Modern Digital Electronics*, R P Jain.
4) *An Engineering Approach to Digital Design*, William I. Fletcher.

Course Code : 510222	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Digital Systems Lab		

Objectives: Minimize and Implementation of Boolean Functions Using Logic Gates, Design Half Adder and Full Adder, Design Half Subtractor and Full Subtractor, Verify the Truth Table of S-R, T, D Flip-Flop, Verify the Truth Table of J-K, Prepare Different Type Shift Resister and Check Its Operation, Design Synchronous Counter, Design Asynchronous Counter, Design Ripple Counter, Design Johnson and Ring counter, Verify the Operation of Encoder and Decoder, Verify the Operation of Multiplexer, De-Multiplexer, Verify the Operation of D/A and A/D Converter.

Course Code : 510223	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Discrete Mathematics**		

Set Theory, Relations, Functions, Graph Theory, Planer Graph and Trees, Direct graphs and Binary Trees, Algebraic Systems, Ordered sets and lattices, Propositional Calculus, Boolean Algebra, Lattices, group theory, cyclic groups, permutation groups, symmetry groups, quotient, homomorphism, Basic structure theory, Prepositional and Predicate logic, Mathematical reasoning and program techniques. Theories with induction. Counting and countability. Graph and trees. Morphisms, Algebraic structures.

Reference Books:

1) *Discrete Mathematics And Its Applications,* Kenneth H. Rosen
2) *Theory and Problems of Discrete Mathematics, Schaum's Outlines,* Lipschutz S., Lipson M., TATA McGraw-Hill.
3) *O. Nicodemi*, Discrete Mathematics CBS, 1989
4) *J. C. Molluzzo and F.Buckley*(Waveland Press, reprinted 1997) ISBN 0-8833-9407

Course Code : 510225	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Linear Algebra**		

Vectors in R^n and C^n. Review of Geometric vectors on R^2 and R^3 space. Vectors in R^n and C^n. Inner product. Norm and distance in R^n and C^n.

Matrices and Determinants: Notion of matrix, Types of matrices, Matrix operation of matrix Algebra, Determinant function, Properties of determinants, Minors, Cofactors, Expansion and evaluation of determinants, Elementary row and column operation and row-reduces echelon matrices, Invertible matrices, Block matrices.

System of Linear Equations: Linear equations, System of linear equations (homogeneous and non-homogeneous) and determinants for solving system of linear equations.

Linear Transformations: Linear transformation, Kernel and image of a linear transformation and their properties, Matrix representation of linear transformation, Change of basis.

Eigenvalues and Eigenvectors : Eigenvalues and eigenvectors, Diagonalization and application.

Reference Books:

1) *Elementary Linear Algebra,* Howard Anton, Chris Rorres
2) *Linear Algebra,* Abdur Rahman

Course Code : 510227	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Statistics and Probability**		

Statistics – Definition and scope: past and present, its nature and characteristics, population and sample, descriptive and inferential statistics, scope and applications of statistics, abuse of statistics, sources of statistical data, primary and secondary sources. Data collection tools, types, etc. Construction of questionnaire and other field problems of data collection. Types of data, cross sectional, longitudinal, follow-up and panel data.

Processing of data: measurement scales, variables, attributes, classification, characteristic and basis of classification, array formation, tabulation, different types of tables, frequency distribution.
Presentation of data: graphical presentation of data, details of different types of graphs and charts with their relative merits and dements, concept of explorative data analysis, stem-and-leaf plot, schematic plots, extremes and median, hinges, outliers and 5 number summaries.
Characteristics of statistical data: measures of location, dispersion, skewness, kurtosis and their properties, moments, box -and- whiskers plots, trimean, trimmed mean, interpretation of data with these measures.
Correlation analysis: bivariate data, scatter diagram, simple correlation, rank correlation, correlation ratio, multiple and partial correlations, intraclass and biserial correlation.
Regression analysis: basic concept of regression, regression model, estimation of parameters (OLS method) in regression model, properties of estimators, interpreting the constants, some ideas of polynomial regression, 3-variable regression, estimation of parameters, standard error and other properties.
Association of attributes: concepts of independence, association and disassociation, contingency table, measure of association for nominal and data in contingency tables, partial association: different forms of correlation table.

Reference Books:

1) *Statistics for Business and Economics,* Paul Newbold, William Carlson, Betty Thorne.
2) *Business Statistics,* Md. Abdul Aziz.
3) *An Introduction to Statistics,* M. Nurul Islam.

Course Code : 510229	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**History of the Emergence of Independent Bangladesh**		

Introduction: Scope and description of the emergence of Independent Bangladesh.

1. Description of the country and its people.
a. Geographical features and their influence.
b. Ethnic composition.
c. Language.
d. Cultural syncretism and religious tolerance.
e. Distinctive identity of Bangladesh in the context of undivided Bangladesh.

2. Proposal for undivided sovereign Bengal and the partition of the Sub Continent, 1947.
a. Rise of communalism under the colonial rule,
b. Lahore Resolution 1940.
c. The proposal of Suhrawardi and Sarat Bose for undivided Bengal : consequences
d. The creation of Pakistan 1947.

3. Pakistan: Structure of the state and disparity.
a. Central and provincial structure.
b. Influence of military and civil bureaucracy.
C. Economic, social and cultural disparity

4. Language Movement and quest for Bengali identity

a. Misrule by Muslim League and struggle for democratic politics.
b. Foundation of Awami League, 1949
c. The Language Movement: context and phases.
d. United front of Haque – Vasani – Suhrawardi: election of 1954, consequences.

5. Military rule: the regimes of Ayub Khan and Yahia Khan (1958-1971)

a. Definition of military rules and its characteristics.
b. Ayub Khan's rise to power and characteristics of his rule (Political repression, Basic democracy, Islamisation)
c. Fall of Ayub Khan and Yahia Khan's rule (Abolition of one unit, universal suffrage, the Legal Framework Order)

6. Rise of nationalism and the Movement for self-determination.

a. Resistance against cultural aggression and resurgence of Bengali culture.
b. The Six Point Movement of Sheikh Mujibur Rahman
c. Reactions, importance and significance of the Six Point Movement.
d. The Agortola Case 1968.

7. The mass-upsurge of 1969 and 11 Point Movement:

a. Background
b. Program significance and consequences.

8. Election of 1970 Non-cooperation movement of March 1971 and the Declaration of Independence by Bangabondhu

a. Election result and centres refusal to comply
b. The Non Co-operation Movement, the 7th March Address of Bangabondhu, Operation Searchlight
c. Declaration of Independence by Bangobondhu and his arrest

9. The War of Liberation 1971

a. Genocide, repression of women, refugees
b. Formation of Bangladesh government and proclamation of Independence
c. The spontaneous early resistance and subsequent organized resistance (MuktiFouz, Mukti Bahini, guerillas and the frontal warfare)
d. Publicity Campaign in the war of Liberation (Shadhin Bangla Betar Kendra, the Campaigns abroad and formation of public opinion)
e. Contribution of students, women and the masses (Peoples war)
f. The role of super powers and the Muslim states in the Liberation war.
g. The Anti-liberation activities of the occupation army, the Peace Committee, Al- Badar, Al-Shams, Rajakars, pro Pakistan political parties and Pakistani Collaborators, killing of the intellectuals.
h. Trial of Bangabondhu and reaction of the World Community.
i. The contribution of India in the Liberation War

j. Formation of joint command and the Victory
k. The overall contribution of Bangabondhu and his leadership in the Independence struggle.

10. **The Bangabondhu Regime 1972-1975**
a. Homecoming
b. Making of the constitution
c. Reconstruction of the war ravaged country
d. The murder of Bangabondhu and his family and the ideological turn-around.

Reference Books:

1) *History of the Emergence of Independent Bangladesh,* Professor Dr. Muntasir Mamun

2) *History of the Emergence of Independent Bangladesh, Professor Md. Mozammel Haque*

3) *History of the Emergence of Independent Bangladesh, Md. A Salam, S M Nasir, Md. Nazrul Islam.*

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Second Year Syllabus
Department of Computer Science and Engineering

Four Year B.Sc. Honours Course
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National University

Subject: Computer Science and Engineering
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Year wise courses and marks distribution

SECOND YEAR

Semester III

Course Code	Course Title	Credit Hours
520201	Data Structure	3.0
520202	Data Structure Lab	1.5
520203	Object Oriented Programming	3.0
520204	Object Oriented Programming Lab	1.5
520205	Computer Architecture	3.0
520207	Ordinary Differential Equation	3.0
520209	Fundamental of Business Studies	3.0
	Total Credits in 3rd Semester	**18.0**

Semester IV

Course Code	Course Title	Credit Hours
520221	Database Management System	3.0
520222	Database Management System Lab	1.5
520223	Microprocessor and Assembly Language	3.0
520224	Microprocessor and Assembly Language Lab	1.5
520225	Design and Analysis of Algorithms	3.0
520226	Design and Analysis of Algorithms Lab	1.5
520227	Numerical Analysis	3.0
	Total Credits in 4th Semester	**16.5**

Detailed Syllabus

Third Semester

Course Code : 520201	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	**Data Structure**		

Introduction: Basic Terminology; Elementary Data Organization; Data Structures; Data Structure Operations; Control Structures; Algorithms: Complexity, Time-Space Tradeoff, Mathematical Notation and function, String Processing: String Operations, word processing, and Pattern Matching Algorithms.
Arrays, Records and Pointers: Linear Arrays; Representation of linear array in memory; Traversing linear arrays, Inserting and Deleting; Sorting; (Bubble sort), Searching (linear, binary), Multidimensional Arrays; Pointer Arrays; Record Structures; Matrices.

Linked lists: Representation of Linked lists in memory, Traversing a linked list, Searching a linked list, insertion, deletion; Header and two-way lists.
Stacks, Queues, Recursion: Array Representation of Stacks, Polish Notation; Quicksort, Recursive definition; Towers of Hanoi, Implementation of Recursive procedures, Queue Dequeue, Priority Queues.
Trees: Binary Trees; Representing Binary Trees in memory, traversing binary tree, Header Nodes; Threads , binary search trees, Heap tree, heap sort, Huffman's Algorithm.
Graphs: Sequential Representation of Graph; Adjacency Matrix; Path Matrix; Warshall's Algorithm; Linked representation of Graphs.

Reference languages: *C/C++.*

Reference Books:

1) *Seymour Lipschutz* (Schaum's outline series), Data Structure (International Edition)
2) *Ellis Horowitz & Sartaj Sahni*, Data Structure and Algorthm.
3) *Robers L Kruse*, Data Structure & Programming Design, 2nd Ed.
4) Nell Dale*, C++ Plus Data Structure, Published by Jones and Bartlett Publishers Inc, 5th Edition.*
5) Seymour Lipschutz*, Theory and Problems of Data Structure, Published by McGraw Hill Inc.*

Course Code : 520202	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	**Data Structure Lab**		

Laboratory classes are based on course CSE 520201. Students will be able to implement different data structures, like array, string, linked list, tree and graph using C/C++ programming language. They will be introduced with different sorting algorithms and advanced data structures such as heap, Fibonacci heap, storage management.

Course Code : 520203	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Object Oriented Programming		

Principles of Object-Oriented Programming; Beginning with C++; Tokens, Expressions and Control Structure; Functions in C++; Classes and objects; Constructors and Destructors; Operator Overloading and Type conversions; Inheritance: Extending classes; Pointers, Virtual Functions and Polymorphism; Managing console I/O operations; Working with Files; Exception Handling; Template functions and classes; Multi-threaded Programming.
Introduction to java, comparison between java and c++, Applets and Servlets, basic of java.lang, java.util and java.io;.

Reference languages: *C++ or Java.*

Reference Books:

1) *E Balagurusamy* "Object- oriented programming with C++"

2) Robert Lafore, *Object Oriented Programming*, Published by MacMillan Computer Publishing, 3rd Edition.
3) Herbert Schildt, *Teach Yourself C++*, Published by McGraw Hill, 3rd Edition.
4) Paul Deitel and Harvey Deitel, *JavaTH How to Program*, Published by Prentice Hall, 9th Edition.
5) Cay S. Horstmann and Gary Cornell, *Core JavaTH Volume* 1 & 2, Published by Prentice Hall, 9th Edition.

Course Code : 520204	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Object Oriented Programming Lab		

Laboratory classes are based on course CSE 520203. The goal of this lab is to provide students with the skills needed to effectively design, develop, implement, debug, test, and maintain object oriented programs and more generally to solve problems using C++ or Java programming languages. They will exercise different advanced programming techniques of C++ and JAVA, like swing, socket programming, and windows programming. At the end of the course, students will have to develop a simple real-life programming project.

Course Code : 520205	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Computer Architecture		

Introduction: Organisation and Architecture, Instruction sets- formats, cycle, timing etc; Addressing modes; Types of Instruction; RISC characteristics; CISC characteristics.
Computer System: System Buses, Components, Functions, Bus Interconnection,
Computer Arithmetic: Different types of data representation; Addition and Subtraction; Multiplication Algorithms; Division Algorithms.
Memory Organization: Main memory, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory management requirements and hardware.

Input-Output Organization: Input-Output Interfaces; Data transfer, Interrupts; Direct Memory Access (DMA); Input-Output channel.
Central Processing Unit(CPU): ALU, CPU structure and Functions
Control Unit: Control Unit operation, Micro-operation, Control of processor, Hardwired Implementation.

Fundamentals of parallel processing: Parallel processing; Pipelining; Vector processing; Multiprocessors; Array processor, Bit-slice processor Interconnection structures

Reference Books:

1. William Stallings, Computer Organisation and Architecture
2. V. Hamcher, Z.Vranesic and S.Zaky, Computer Organisation
3. J.P. Hayes, Computer Architecture and Organisation
4. Dr. M. Rafiquzzaman, Fundamentals of Computer System Architecture

Course Code : 520207	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Ordinary Differential Equation**		

Ordinary differential equations and their solutions : Classification of differential equations. Solutions. Implicit solutions. Singular solutions. Initial value problems, boundary value problems. Basic existence and uniqueness theorems (statement and illustration only). Direction fields. phase line.
Solution of first order equations : Separable equations and equations reducible to this form. Linear equations, exact equations, Special integrating factors, Substitutions and transformations.
Modeling with first order differential equations: Constructions of differential equations as mathematical models (exponential growth and decay, heating and cooling, mixture of solutions, series circuit, logistic growth, chemical reaction, falling bodies). model solutions and interpretation of results. orthogonal and oblique trajectories.
Solutions of higher order linear differential equations : Linear differential operators. Basic theory of linear differential equations. Solution space of homogeneous systems. Reduction of order. Homogeneous linear equations with constant coefficient. Non homogeneous equation. Method of undetermined coefficient. Variation of parameters. Euler-cauchy differential equations.
Modeling with second-order equations: Vibration of a mass on a spring, free and undamped motion, free and damped motion, forced motion, resonance phenomena, electric problems, motion of a rocker.

Reference Books:

1. Abu Yusuf, *Differential Equations.*
2. Dr. Abdul Matin, *Differential Equations.*
3. Kuddus, Hafiz, *Ordinary Differential Equation*, Titas Publications.

Course Code : 520209	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Fundamental of Business Studies		

The Business Enterprise: Foundation of Business, Forms of Business Ownership, Entrepreneurship, Franchising and Small Business, International Business.

The Environment of Business: Social responsibility and Business Ethics, Business Law and Government.

Management and Organization: Fundamentals of Management, Organization of Business, Managing production and operation.

Human Resources: Human Relations and Motivation, Managing Human Resources, Labor Management Relations.

Marketing: Marketing Strategies, Product and Price, Distribution and Promotion,

Financial Management: Money and Banking, Financial Management, Investment and Personal Finance, Risk Management and Insurance.

Accounting and Information Systems: Accounting Fundamentals, Computer and Management Information Systems.

Reference Books:

1. Harman, Edwards and Maher, *Accounting a Business Perspective.*
2. Prof. Md. Khalequzzaman and Prof. Mosharraf H Chowdhury, *Introduction to Business.*
3. Md. Hafiz Uddin, *Basic Accounting* (English Version), The Angel Publications.

Fourth Semester

Course Code : 520221	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Database Management System		

Introduction: Database system concept, Purpose of Database system; View of data: Data abstraction; Data models: Relational model, Network model, Hierarchical model; Database languages: DDL, DML; Conventional file processing; Transaction management; Storage management; Database Administrator; Database users; Overall system structure.
Database model: Entity-Relationship model; Attributes; Mapping Cardinalities; Existence Dependencies; Weak entity set & Strong entity set; Relational model and its language (Relational algebra and SQL).
Database design: Decomposition; Normalization; Object-oriented Databases; Centralized systems; Distributed Databases; Data Fragmentation; Parallel Databases.
Integrity Constraints: Domain constraints, Referential constraints, Functional Dependencies.
Indexing: Basic concept; Ordered index; Primary index; Dense index and Sparse index; Multilevel index; Secondary index.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts.*
2. R. Ramakrishnan, *Database Management System.*
3. James Martin, *Principles of Database Management*.

Course Code : 520222	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Database Management System Lab		

Objectives: Database labs are based on the theory course CSE 520208. One large or several small database applications will be developed in the lab. Student will be given the ER model or description of a real problem. Based on the description they will design the ER model or convert the ER model to relational model using the features of relational database design(such as functional dependency, normalization etc) and finalize the relational model. After finalizing the relational model, student will go for implementation. In the implementation phases they should design the sql statements, stored procedure, trigger, views etc. whatever is required to complete the implementation. In the implementation phase should also be the main concern about query optimization, transaction, recovery and backup. Any database such as Oracle/MySql/PostGress SQL can be used.

Course Code : 520223	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Microprocessor and Assembly Languages		

Microprocessors: Evolution of microprocessors, register base and accumulator based microprocessor, programmable logic devices; main memory array design, memory management concepts, input/ Out techniques, internal architecture of microprocessor: 8085, 8086, addressing mode, instruction format, instruction set, pin configuration and function, maximum/ minimum mode, read/write cycle, memory bank, interrupt and interrupt handling, interrupt controller, DMA.

Advanced microprocessors:Internal architecture, memory management, protection, an overview of Intel 80186, 80286, 80386, 80486, Pentium microprocessors, RISC processor, Coprocessor, Alpha processor.

Assembly Language: Programming with 8086 instruction, conditional and unconditional jump, string instruction, stacks operation, procedure, reentrant and recursive procedure, macro.

Reference Books:

1. D.V Hall, *Microprocessors and Interfacing*, McGraw-Hill
2. M. Rafiquzzaman, *Microprocessors and Microprocessor Based System Design*
3. Y. Liu and G.A. Ginson, *Microcomputer System: 8086/8088 Family*

Course Code : 520224	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Microprocessor and Assembly Languages Lab		

Objectives: Laboratory classes are based on **CSE 520210**. Firstly, students will be introduced with Assembly Language and Assembler (NASM, TASM and/or MASM). Several experiments will be performed with the assemblers: I/O operations, Integer programming, String programming, Graphics programming, etc.

Display message (n) times in different line; simple arithmetic operation; Convert a lowercase letter to an uppercase letter and vice versa; Display all alphabetic characters; Input two numbers, compare them and display the smaller one and vice versa; Accept a string from keyboard and display the string in reverse order; Find the largest element from an array and vice versa; perform bubble sort; display first ten numbers by Fibonacci Series; Calculate sum and average of few numbers; Convert hexadecimal number to binary equivalent; If a character is "y" or "Y", Display it, otherwise terminate; Calculate the following expression=M+N-P+1(Using Subroutine); Calculate following operation: if x>y then (M/N) +P else (M-N)*P ;(IF-ELSE Statement).

Reference Books:

1. Marut, *Assembly Language Programming*
2. Richard C. Detmer, *Assembly Language Programming*
3. Vanugopal, *Assembly Language Programming*
4. Alan R. Miller, *Techniques for the IBM PC*

Course Code : 520225	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Design and Analysis of Algorithms		

Introduction to algorithm: Analysis of algorithm, design of algorithm, mathematical foundation of algorithm, asymptotic notations, summations, recurrences, sets etc.

Divide and Conquer: General method, Binary Search, Finding the Maximum and Minimum, Quick Sort, Selection.
The Greedy method: General method, Knapsack problem, Minimum cost spanning trees, Single Source Shortest path.
Dynamic programming: General method, Multistage Graphs, All pair's shortest paths, Single Source Shortest path, Knapsack problem, Optimal Binary search Tree, Traveling salesperson.
Basic Traversal & Search technique: Techniques for Binary trees, Techniques for Graphs
Backtracking: General method, The 8-Queens problem, Sum of subsets, Graph Coloring
Branch and Bound: The method, 0/1 Knapsack problem, Traveling salesperson
NP-hard and NP-complete problems: Basic concept, NP-hard graph problems, NP-hard scheduling problems, NP-hard code generation problems.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, *Fundamentals of Computer Algorithms*, Published by Galgotia Publications Pvt. Ltd, 2nd Edition.
2. How to Solve it by Computer, R.G.Dromey.
3. Data Structure & Programming Design, Robert L. Kruse.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, *Introduction to Algorithms*, Published by The MIT Press, 3rd Edition.

Course Code : 520226	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Design and Analysis of Algorithms Lab		

Laboratory classes are based on the course **CSE 520212**. Students will be given various algorithmic problems on different domains. By solving those problems students will gain knowledge on algorithmic techniques and their relative performances.

Divide and conquer: Binary Search, finding the maximum and minimum.
Performance measurement using time Function: quick sort and marge sort, marge sort and Bubble sort, Quick sort and Heap sort.
Greedy Method: Knapsack problem, Minimum cost spanning tree, Prim's algorithm, Single source shortest path.
Dynamic Programming: All pair shortest path, 0/1 kanpsack problem, the traveling salesperson problem.
Backtracking: the 8 Queens Problem, Graph coloring problem.

Course Code : 520227	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Numerical Analysis		

Solutions of equation in one variable: Bisection algorithm. Method of false position. Fixed point iteration, Newton-Raphson method, Error Analysis iteration for iterative method, Accelerating limit of convergence.
Interpolation and polynomial approximation : Taylor polynomial, interpolation and Lagrange polynomial. Iterated Interpolation. Extrapolation.
Differentiation and Integration : Numerical differentiation. Richardson's extrapolation. Elements of Numerical integration. Adaptive quadrature method, Romberg's integration, Gaussian quadrature.
Solutions of linear system, pivoting strategies, L U decomposition method.

Reference Books:

1) Vatista, *Numerical Analysis*
2) S. S. Sastry, *Introductory Methods of Numerical Analysis*
3) J.H. Mathews, *Numerical Methods for Computer Science, Engineering and Mathematics, Prentice-Hall, 1987*.
4) B. Irons and N.G. Shrive, *Numerical Methods in Engineering and Applied Science, Ellis Horwood, 1987*.

NATIONAL UNIVERSITY

Third Year Syllabus
Department of Computer Science and Engineering

Four Year B.Sc. Honours Course
Effective from the Session: 2017–2018

National University

Subject: Computer Science and Engineering
Syllabus for Four Year B.Sc. Honours Course
Effective from the Session: 2017-2018

Year wise courses and marks distribution.

THIRD YEAR

Semester V

Course Code	Course Title	Credit Hours
530201	Peripheral and Interfacing	3.0
530202	Peripheral and Interfacing Lab	1.5
530203	Data and Telecommunications	3.0
530204	Data and Telecommunications Lab	1.5
530205	Operating System	3.0
530206	Operating System Lab	1.5
530207	Economics	3.0
	Total Credits in 5th Semester	**16.5**

Semester VI

Course Code	Course Title	Credit Hours
530219	Software Engineering	3.0
530220	Software Engineering Lab	1.5
530221	Computer Networking	3.0
530222	Computer Networking Lab	1.5
530223	Embedded System Programming	3.0
530224	Embedded System Programming Lab	1.5
530225	Theory of Computation	3.0
	Total Credits in 6th Semester	**16.5**

Detailed Syllabus

Fifth Semester

Course Code : 530201	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Peripheral and Interfacing		

Interfacing techniques: Interfacing for Memory; Communication system; System overhead (DMA and Programmed data transfer); I/O ports and Control; Parallel and Serial Interfacing devices; Timing considerations; Noise considerations; Application of PPI, PIC, DMAC, PCI etc.
Digital Interfacing: Programmable parallel ports and handshake input/output (IC 8255), Interfacing a Microprocessor to keyboards, X-lat, Display-Alphanumeric and multiplexed LED (Interfacing with IC 7447), Relay, Stepper motor, Incremental Encoder, Optical motor shaft encoder.
Modern data-entry devices: Scanners overview; Bar code reader; Optical mark reader (OMR); Optical Character Reader (OCR); Tape Reader; Digitizer: Reading technique, Capacitive Electrostatic scanning digitizer.
Display devices: CRT; Basic CRT operations; Timing and frequencies; CRT controller ICs; LCD technologies; Passive and active matrix; LCD reliability; Electroluminescent display.
Printers: Impact printers; Serial and line printing; Laser printing; Ink-Jet printing; Color printing; Plotters.
Storage devices: Floppy disk; Floppy disk controller (IC 8272) ; Magnetic hard disk and controller; Compact disk, magnetic tape storage.

Data Communication and Network: Introduction to asynchronous serial data communication, RS-232 C serial data standard, USART(IC 8251A) word format, Null Modem configuration, The GPIB, HPIB, IEEE 488 Bus.

Reference Books:

1. Microprocessor and Interfacing by Andrew Hall
2. Computer Peripherals (Part B) by Barry Wilkinson

Course Code : 530202	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Peripheral and Interfacing Lab		

Laboratory works based on **CSE 530201.**Understand SDK 86 board, write and execute a program in an SDK 86, Understand RS-232 standard, Connections and Cabling. Communicate between two Computers using parallel ports (Printer Port). Observe and manipulate Null modem Configuration. Communicate between two Computers using serial ports. Drive a single 7 segment LED display with 7447. Understand the basic characteristics of IC 8255.

Course Code : 530203	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Data and Telecommunications		

Data communication model: TCP/IP and OSI; data communication network components; different types of networks: circuit switching, packet switching networks, ATM, HDLC and X.25; signal and random processes; review of Fourier transformation and Hilbert transformation;

Introduction to modulation techniques; continuous wave modulation: AM, PM, FM; sampling theorem; pulse modulation: PAM, PDM, PPM, PCM; companding; delta modulation; different PCM; multiple access techniques: TDM, FDM; quantization; digital modulation: ASK, FSK, PSK, BPSK, QPSK; constellation; bit error rate (BER), noise; echo cancellation; intersymbol interference; probability of error for pulse systems; concepts of channel coding and capacity; asynchronous and synchronous communications; hardware interfaces, multiplexers, concentrators and buffers; communication media; fiber optics; wireless transmission: propagation, path loss, fading, delay spread; spread spectrum: frequency hopping spread spectrum and direct sequence spread spectrum; CDMA; High speed digital access: DSL, SONET, SDH; error detection and correction techniques: parity check, CRC, block code and hamming code; flow and error control techniques: sliding window, stop and wait, ARQ and HDLC protocols; modes of communications: simplex, half-duplex and full duplex.

Reference Books:

1) Behrouz A. Forouzan, *Data Communications and Networking*, 4th Edition.

2) William Stallings, *Data and Computer Communications*, Published by Pearson, 8th Edition.

Course Code : 530204	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Data and Telecommunications lab**		

Laboratory classes are based on the course **CSE 530203**. Upon successful completion of this laboratory, students should have knowledge about various communication protocols in physical layers, be able to identify different transmission media based on their characteristics and can apply different signal encoding schemes and analyze their performance. They can handle different error detection and error control mechanism as well as different flow control mechanism and quantitatively analyze their performance. Having experience on serial communication, they can also implement the NULL modem communication. They can also use different types of multiplexing in a real or simulated environment.

Course Code : 530205	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Operating System**		

Introduction: Operating system overview, computer system structure, structure and components of an operating system. **System calls:** class of system calls and description. **Process and threads:** process and thread model, process and thread creation and termination, user and kernel level thread, scheduling, scheduling algorithms, dispatcher, context switch, real time scheduling. **Concurrency and synchronization:** IPC and inter-thread communication, critical region, critical section problems and solutions. **Resource management:** introduction to deadlock, ostrich algorithm, deadlock detection and recovery, deadlock avoidance, deadlock prevention, starvation. **File management:** File Naming and structure, file access and attributes, system calls, file organization: OS and user perspective view of file, memory mapped file, file directories organization, **File System Implementation:** implementing file, allocation strategy, method of allocation, directory implementation, UNIX i-node, block management, quota. **Memory management:** basic memory management, fixed and dynamic partition, virtual memory, segmentation, paging and swapping, MMU. **Virtual memory management:** paging, page table structure, page replacement, TLB, exception vector, demand paging and segmentation, thrashing and performance. **Disk I/O management:** structure, performance, low-level disk formatting, Disk arm scheduling algorithm, error handling, stable storage.

Reference Books:

1) Andrew S. Tanenbaum, *Modern Operating Systems*,

2) Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, *Operating System Concepts*.

Course Code : 530206	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Operating System Lab		

Lab based on the course CSE 530205. Source code of OS161 operating system and required tools developed by Harvard University, based on R3000 architecture will be used in the lab. Students will be asked to add operating system module such as memory management, system call, file system, drivers etc. In the lab for such modules problems will defined elaborately. The laboratory also train students in debugging using gdb based on R3000.

Course Code : 530207	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Economics		

Introduction: Definition, Microeconomics vs. macroeconomics, scope of economics, meaning of economic theory, some basic concepts- product, commodity, want, utility, consumption, factors of production.
Demand: Law of demand, factors determining demand, shifts in demand, demand functions, deriving demand curves, substitution and income effects, deriving aggregate demands, various concepts of demand elasticity and measurements, discussion on the method of estimating demand functions and demand functions and demand forecasting.
Supply: Law of supply and supply function, determination of supply, shifts in supply, elasticity of supply, market equilibrium.
Economic Theory of Consumer Behavior: reasons for consumption, Principle of diminishing marginal utility, indifference Curves, Budget Constraint, Utility Maximization and Consumer Equilibrium.
Consumer Demand: Change in Budget Constraints, Price Consumption Curve, Income Consumption Curve, Consumer Demand, market Demand, Engel Curve.
Production: Production functions, total, average and marginal products, law of diminishing marginal physical products, production isoquants, marginal rate of technical substitution (MRTS), optimal combination of inputs, expansion path, returns to scale, estimation of production function and estimation of cost function.
Cost: concepts of cost, short-run costs, relation between short-run costs and production, long run costs, economies and diseconomies of scale, relation between short run and long run costs, cost function and estimation of cost function.
Markets and Revenue: Meaning of market, different forms of market, concepts of total, average and marginal revenue, relation between average revenue and marginal revenue curves, relation between different revenues and elasticity's of demand, equilibrium of the firm.
Price and Output: Price and output determination under perfect competition, monopoly, monopolistic competition and oligopoly, profit maximization, price discrimination, plant shut down decision, barriers to entry.

Reference Books:

1. Samuelson and Nordhaus : *Economics*.
2. Bilsa: *Microeconomic Theory*.
3. Koutsoyiannis: *Modern Micro-economics*.
4. Dornburg and McDougall: *Macro-economics*.

Sixth Semester

Course Code : 530219	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Software Engineering		

Software Engineering Paradigms: Definition of S/W Eng.; The classical life cycle; Prototyping fourth generation technique; The product and the process model, Generic view of software engineering, Boehm's spiral model, Measurement and Matrices.

Requirements Analysis Fundamentals: Analysis principle; Feasibility Study, Software Prototyping Specification; Requirement Analysis Methodologies; Structured and object oriented analysis; Data Flow-oriented analysis methods.

Software Design Fundamentals: Design process; Design fundamentals: S/W architecture, Program structure, Data structure, S/W procedure, Modularity, abstraction; Effective modular design; Procedural design; Data flow-oriented Design; Top-down and bottom-up design; Design process considerations; Transform analysis; Transaction analysis; Data structure-oriented design: Logical construction of programs and systems, Data structured systems development; Object-oriented design; Design concepts; Methods; strategy. Real-time Design; Coding style: Code documentation, Data declaration, statement construction, Input/output, Software reliability.

Software Testing Techniques and Strategies: Software Testing method, Testing fundamentals & strategies; White box testing; Basis path testing; Loop testing; Black Box testing. Verification and validation; Organization for software testing; Defect testing; Integration testing; Validation testing; System testing; The art of debugging.

Software Management and Maintenance Technique: Maintenance process, System documentation, Maintenance cost, Configuration management & planning, Change management, person & release management, Software cost estimation technique, Algorithmic cost modeling, The COCOMO model, Software quality assurance & activities, McCall's quality factor, Software reuse, Software re-engineering, Computer Aided Software Engineering (CASE) tool.

Reference Books:

1) Ian Sommerville, *Software Engineering.*
2) Roger S. Pressman, *Software Engineering: A Practitioner's Approach.*
3) Martin L. Shooman, *Software Engineering*

Course Code : 530220	Marks : 40	Credits :1.5	Class Hours : --
Course Title :	Software Engineering Lab		

(Based on Software Engineering Theory Course CSE 530208)

Course Code : 530221	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Computer Networking		

Introduction: Basic computer network concept; Network structure; Network software; Reference model; Example networks; OSI Model, TCP/IP Model, X.25 Networks.
Frame Relay: Introduction to frame relay, advantages and disadvantages, role of frame relay, frame relay operations, virtual circuits, DLCIs inside the network, ,frame relay layers; physical layer , data link layer.
ATM Network: Packet networks, mixed network traffic, cell networks, asynchronous TDM,virtual connection, identifiers, cell, connection establishment and release, Application Adoptions Layer(AAL),ATM layers, Physical layer, ATM WANs, ATM LANs.
Medium Access sub-layer: Multiple Access Protocols: ALOHA; CSMA/CD Protocol; Collision-Free protocols;CDMA Limited contention protocol; Wavelength division multiple access protocols; Wireless LAN protocols; IEEE standard 802 for LANs and MANs; Bridges; High-speed LANs;Wireless LANs,Mobile telephony and Satellite Networks.
Network Layer: Network layer design issues; Routing algorithms; Congestion control Algorithms; Inter networking; Network layer in the internet; IPv4 and introduction to IPv6.
Transport Layer: The transport service; Elements of transport protocols; The internet transport protocols; The ATM AAL layer protocols;
Optical Fiber Network: SONET and SDH.
Application Layer: Network security; DNS-Domain Name system; SNMP: Simple Network Management protocol; Electronic Mail; The World Wide Web; Multimedia.

Reference Books:

1. Tannenbaum ,Computer Networks.
2. W. Stallings, Data & Computer Communication.
3. Behrouz & Forouzen, Data Communication & Networking.

Course Code : 530222	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Computer Networking Lab		

Laboratory classes are based on course CSE 530210. Starting with application layer, students will configure different services at different layers and examine their messaging techniques. Students will also develop some experiments to work transport layer services such as TCP and UDP.

Course Code : 530223	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Embedded System Programming		

Concept of visual programming; system programming concepts; general machine structures; Internet programming; environments; multiple document interfaces; ActiveX controls and ActiveX components; API; apache server; OLE automation; database programming and Active data objects; introduction to the web; scripting objects; active server pages; database connectivity to web applications; adding dynamic content to web applications; programming common gateway interfaces; programming the user interface for the web applications; programming with concurrency and multithreading; service-oriented software development; XML and related technologies: XML schema XSLT, XPath, DOM, SAX; web-based application development and state management; Kernel programming; programming for memory management; VFS handling; interrupt handling; Linux module programming; assembler: basic functions, machine dependent and independent assembler, one vs. multipass assembler; linker: dynamic lining and linking editors, loaders: machine dependent and independent loader, bootstrap loaders, development of system software and web-based applications for different devices.

Reference Languages: Android, J2ME, C++.

Reference Books:

1. William Green and John D. Olson, *PowerBuilder 9: Internet and Distributed Application Development*, Published by Sams Publishing.
2. Randall A. Maddox, *Distributed Application Programming in C++*, Published by Prentice Hall.
3. Luke Welling and Laura Thomson, *PHP and MySQL Web Development*, Published by Addison-Wesley Professional, 4th Edition.
4. Robin Nixon, *Learning PHP, MySQL, JavaScript an CSS: A Step-by-Step Guide to Creating Dynamic Websites*, Published by O'Reilly Media, 2nd Edition.

Course Code : 530224	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Embedded System Programming Lab**		

Laboratory classes are based on course CSE 530212. Students will get knowledge for developing some system tools based on various system calls. Linux module programming will be an important part of this lab. They will be asked to develop device drivers and applications programs for different devices.

Course Code : 530225	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Theory of Computation**		

Language theory; finite automata: deterministic finite automata, nondeterministic finite automata, equivalence and conversion of deterministic and nondeterministic finite automata, pushdown automata; regular expressions and its properties: Chomsky hierarchy, regular grammar and regular language; context free languages; context free grammars; Pumping lemma and its applications; Turing machines: basic machines, configuration, computing with Turing machines, combining Turing machines; Mealy machine and Moore machine; undecidability: diagonalization method, halting problem, undecidable problems from language theory and reducibility; recursive theorem;

Reference Books:

1) Michael Sipser, *Introduction to Theory of Computation*, Published by Thomson, 2nd Edition.
2) John C. Martin, *Introduction to Languages and Theory of Computation*, Published by McGraw-Hill, 3rd Edition.

NATIONAL UNIVERSITY

Fourth Year Syllabus
Department of Computer Science and Engineering

Four Year B.Sc. Honours Course
Effective from the Session: 2017–2018

National University

Subject: Computer Science and Engineering
Syllabus for Four Year B.Sc. Honours Course
Effective from the Session: 2017-2018

Year wise courses and marks distribution

FOURTH YEAR

Semester VII

Course Code	Course Title	Credit Hours
540201	Artificial Intelligence	3.0
540202	Artificial Intelligence Lab	1.5
540203	Compiler Design and Construction	3.0
540204	Compiler Design Lab	1.5
540205	Computer Graphics	3.0
540206	Computer Graphics Lab	1.5
540207	E-Commerce and Web Engineering	3.0
540208	E-Commerce and Web Engineering Lab	1.5
	Total Credits in 7th Semester	**18.0**

Semester VIII

Course Code	Course Title	Credit Hours
	Major Theory Courses	
540219	Network and Information Security	3.0
540220	Network and Information Security Lab	1.5
540221	Information System Management	3.0
	Project/Industry Attachment	
540222	Project/Industry Attachment	6.0
	Optional Course (any one)	3.0
540223	Simulation and Modeling	
540225	Parallel and Distributed Systems	
540227	Digital Signal Processing	
540229	Digital Image Processing	
540231	Multimedia	
540233	Pattern Recognition	
540235	Design and Analysis of VLSI Systems	
540237	Micro-controller and Embedded System	
540239	Cyber Law and Computer Forensic	
540241	Natural Language Processing	
540243	System Analysis and Design	
540245	Optical Fiber Communication	
540247	Human Computer Interaction	
540249	Graph Theory	

	Optional Course Lab (Any one)	1.5
540224	Simulation and Modeling Lab	
540226	Parallel and Distributed Systems Lab	
540228	Digital Signal Processing Lab	
540230	Digital Image Processing Lab	
540232	Multimedia Lab	
245034	Pattern Recognition Lab	
540236	Design and Testing of VLSI Systems Lab	
540238	Micro-controller and Embedded System Lab	
540240	Cyber Law and Computer Forensics Lab	
540242	Natural Language Processing Lab	
540244	System Analysis and Design Lab	
540246	Optical Fiber Communication Lab	
540248	Human Computer Interaction Lab	
540250	Graph Theory Lab	
	Total Credits in 8th Semester	**18.0**

Detailed Syllabus

Seventh Semester

Course Code : 540201	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Artificial Intelligence		

Overview of AI, AI programming language: Prolog, Environment Types, Agent Types, Agent Model, Reactive Agents, Problem solving and searching: 8-puzzle problem, N-queen problem, general search, Review of Uninformed Search Strategies: breadth first search, uniform cost search, depth-first search, iterative deepening, bidirectional search; Informed search algorithms: best-first search, A* search, Heuristic searching, Memory Bounded Search (e.g. IDA*); Local Searches: Hill Climbing, Simulated Annealing, Constraint Satisfaction Problems. Genetic Algorithm. Motion planning: motion planning search, configuration, action and obstacle, Road map, Game Theory: motivation, minmax search, resource limits and heuristic evaluation, α-β pruning, stochastic games, partially observable games, Perceptron: Neurons – Biological and Artificial, Perceptron Learning, Linear Separability, Multi-Layer Neural Networks, Backpropagation, Variations on Backprop, Cross Entropy, Weight Decay, Momentum, Machine Learning: Supervised Learning, Reinforcement Learning, General concepts of Knowledge, Knowledge representation, frame problem, representing time, events and actions, Logic in general—models and entailment, Propositional (Boolean) logic, Equivalence, validity, satisfiability, Inference rules and theorem proving, forward chaining, backward chaining, resolution, First Order Logic: Universal and Existential Quantifiers, Keeping Track of Change, Inference in first order logic Planning.

Reference Books:

1. Stuart J. Russel, Peter Norvig, *Artificial Intelligence: A Modern Approach,*
2. Stamations V. Katalopoulos, *Understanding Neural Networks and Fuzzy Logic.*
3. Barr and Feigenbaum, *Handbook of Artificial Intelligence Vol. I , William Kaufmann*
4. Ivan Bratko, *Programming for Artificial Intelligence.*

Course Code : 540202	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Artificial Intelligence Lab		

Objectives: Laboratory assignments will be based on the Course CSE 540201. Lab assignments include basic AI technologies and algorithms using non procedural programming languages, e.g., LISP and/or PROLOG.

Course Code : 540203	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Compiler Design and Construction		

Introduction to compiler: Compiler, Analysis of the source Program, the phases of compiler, of the compiler, compiler construction tools.
A simple one pass compiler: syntax definition, CFG, parse tree, ambiguity, associativity of operators, lexical analysis.
Lexical analysis: the role of the lexical analyzer, input buffering, specification tokens, finite automaton, Thompson's construction, conversion of regular expression to DFA.

Basic parsing technique: Parser Bottom-up parsing, operator precedence parsing, operator precedence grammar, Top down parsing, Predictive parsing, LL1 grammar, LR parser (SLR, LALR).
Intermediate code generation: Intermediate languages, three address code.
Code generation: issues in the design of a code generator, target machine, basic block flow graph, code generator algorithm, DAG, peephole optimization.
Code optimization: Function preserving optimization, optimization of basic block loop optimization.
Error detection: reporting errors, Sources of error, syntactic error, semantic error, dynamic error, plan of error diction.

Reference Books:

1. Alfred V. Aho, Ravi Sethi, Jeffery D. Ullman, Compilers, Techniques and tools.
2. Alfred V. Aho, Jeffery D. Ullman, Principles of Compiler Design.
3. A.J Holub, Compiler Design in C.

Course Code : 540204	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Compiler Design Lab**		

Laboratory classes will be based on the Course CSE 540203.
Lex specification to recognize the following verb: is, am, are ,were, was, be, being,been,do,does,did,will,would,should,can,could,has,have,had,go. Lex specification to recognize the following words as different parts of speech: is, am, are,were,go,very,simply,quickly, gently,to,from,behind,between,if,then. Lex specification to recognize different keyword. Lex specification to recognize the identifier. Lex specification to recognize real numbers. Lex specification to recognize integer. Lex specification to recognize float. Lex specification to recognize for the positive and negative integer and float number. Lex specification to recognize different punctuation symbol. Lex specification to recognize digit. Lex program to eat up comments. Lex program to find out user name. Lex program to recognize different types of operator. Checking the validity of an arithmetic expression using CFG. Converting Regular Grammar into Regular expression. Parsing any string using a CFG

Course Code : 540205	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Computer Graphics**		

Graphics Input, storage, Output and Communications: Graphics input, storage, Communication Devices, Common Display devices, Raster Scan CRT.
Scan Conversion: Scan converting a Point, Line, Circle, Ellipse, Arcs, Rectangle, Region filling, Side Effects of Scan Conversion.

Two-dimensional and three-dimensional Graphics Transformation: Geometric Transformations, Co-ordinate Transformations, Composite Transformations, and Instance Transformation.
Two-dimensional and three-dimensional Viewing and Clipping: Viewing Transformations, Clipping Algorithms.
Mathematics of Projection: Perspective projection, Parallel projection.
Geometric representations: Wire frame model, Curve Design, Interpolation and Approximation.
Hidden Surfaces: Depth comparisons, Z-Buffer algorithm, The Painter's algorithm, Scan line algorithm.
Color and Shading models: Light and color, the phong model, Interpolative shading methods, texture.

Reference Books:

1) Roy A. Plastock and Gordon Kalley, *Schaum's Outline of Theory and Problems of Computer Graphics*, published by McGraw-Hill, 2nd Edition.

2) Foley and VanDam, *Computer Graphics Principles and Practice*, Published by Pearson, 2nd Edition.

3) *Schaum's Outline series*, Computer graphics

4) *Steven and Harrington*, Computer graphics: a programming approach.

Course Code : 540206	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Computer Graphics Lab**		

Laboratory classes will be designed based on CSE 540205 course.

Scan Convention Lines, Scan Converting Circles, Scan Converting Ellipses, Filling Rectangles, Filling Polygons, Filling Ellipse Arcs, Pattern Filling, Clipping Lines, Clipping Circles and Ellipses, Clipping Polygons 2D Transformation, the window to View port Transformation Computer Graphics Programming: Open GL.

Course Code : 540207	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**E-Commerce and Web Engineering**		

Introduction to e-commerce: E-commerce Business Models and Concepts , E-Commerce Payment Systems, E-Commerce Marketing Techniques, E-Commerce Applications: Business-to-Consumer (B2C), Consumer-to-Consumer (C2C), Business-to-Business(B2B), Digital Government, Vision and mission of e-Government Web Security.

Introduction to Web Engineering : Web Browser and Web Server, Google, Basic concepts of Google products: Search, Maps, Translate, Chrome, YouTube, Android Phones, Gmail, Google Allo, Google Duo, Google+, Contacts, Calendar, Drive, Docs, AdWords, AdSense, Analytics, Google Classroom. Basic concepts of Google Algorithms: Hummingbird, Panda, Pigeon, Pirate and Penguin, etc. Basic concepts of SEO: on-page SEO, off-page SEO.

HTML and HTML5: HTML tag syntax, Basic HTML tags: !DOCTYPE, Title , Meta tags, Heading tags, Link, API, Image, Table, List, Audio, Video, iframe, Form and Form elements, Text Formatting tags.

CSS and CSS3: Basic concepts of CSS, CSS syntax, CSS Colors, CSS Box Model,
Java Scripts: Basic Java Scripts variable, array, object, functions.
PHP and MySQL: PHP programming basics: variables, array, decisions making, looping, function. PHP scripts to inputs in forms. PHP Connect to MySQL, MySQL query and functions, PHP Queries: Create Database, Create Tables, Insert Data, Select Data, Update Data, Delete Data in MySQL, using PHP Forms to manipulate data in the database, Data Validation, Session, Security.

Reference Books:

1. Dave Chaffey, *E-Business and E-Commerce Management: Strategy, Implementation and Practice*, published by Prentice Hall, 5th Edition.

2. Efraim Turban, David King and Judy Lang, *Introduction to Electronic Commerce*, published by Prentice Hall, 3rd Edition.

3. Beginning Php 5 (Programmer to Programmer) by Chris Lea, Wankyu Choi,Allan Kent,Ganesh Prasad,Chris Ullman.
4. Surid Sharkar, CSS/Java Script.
4. Web Design Complete Reference by Thomas A. Powell
5. Creating Web Pages with HTML Simplified
   Sherry Willard Kinkoph
6. Web Design in a Nutshell (O'RELLY)
   Jennifer Niederst

Course Code : 540208	Marks : 40	Credits : 3	Class Hours : --
Course Title :	E-Commerce and Web Engineering Lab		

Introduction:
Introduction to CPanel, Introduction to WHM, SSL, DNS: Primary DNS server and Secondary DNS server, Domain registration and Hosting.

HTML:

1. HTML editor, HTML Layouts,
2. Designing a simple HTML Document to show an article (using html, body head/title, meta content tags, different HTML tags to format Body contents).
3. Text alignment in table, introduction to form elements (textbox, checkbox, radio, submit, password, color, date, date time-local, email, month, number, range, search, tel, time, url, week, etc.), input restrictions and designing simple feedback/contact forms.

CSS and CSS3:

1. CSS website layout and responsive layout.
2. Using CSS to apply formatting text, forms, tables and link styles.

Java Scripts:

3. Use Java Scripts to create web pages containing custom welcome message (Date-time).
4. Use different control statements in Java Scripts to execute simple mathematical expressions (if-else, Switch-case, for, while, do-while).
5. Java Scripts form validation.

PHP and MySQL:

6. Installing Apache (XAMPP), PHP 4/5 and integrating into windows platform, creating PHP documents with simple tags, installing My-SQL and connection between PHP and My-SQL.
7. Inserting data into My-SQL database using PHP forms.
8. PHP form validation.

Project: Design and develop a Complete Dynamic website with HTML, PHP and My-SQL having forms and also a flexible navigation menu which has links to all available section on the site.

Eighth Semester

Course Code : 540219	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Network and Information Security		

Fundamentals on information system security; **Remote access technologies and vulnerabilities**; a**ccessibility**; security for communication protocols; security for operating systems and mobile programs; security for electronic commerce, passwords and offline attacks; AAA, cryptography; network security applications: authentication, e-mail, IP and web; system security: intruders, malicious software and firewalls; PKI, smart cards, secure multipurpose internet mail extensions; security models; wireless security, sandboxing, router security strategies; security standards: data encryption standard (DES), RSA, digital signature algorithm (DSA), SHA, secure sockets layer(SSL), CBC, IPSec, AES and SET; denial of service (DOS) and distributed DOS attacks; steganography; implementing VPN; Security policy and management; network security assessment.

Reference Books:

1. William Stallings, *Network Security Essentials Applications and Standards*, published by Prentice Hall, 5th Edition.
2. Eric Cole, *Network Security Bible*, published by Wiley.

Course Code : 540220	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Network and Information Security Lab		

(As per theory course)

Course Code : 540221	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Information System Management		

Information systems management: importance of information systems (IS) management, key trends that impacts IS Management, changes in organizational environment, changes in technology environments, IS organizational models, IS management's leadership role, New Roles of IT, Cox Model for IT management, Roger Woolfe's Federal Model for outsourcing, CIO roles in leading, governing, investing and managing, strategic uses of IT in B2E, B2C, B2B, G2P, IS planning, IS planning paradox, differences between strategic, tactical and operational planning, today's sense and response strategy, different planning techniques including stages of growth, critical success factors, competitive forces model, value chain analysis, internet value matrix, linkage analysis planning and scenario planning;

Managing essential technologies: attributes of distributed systems, different types of distributed systems including host-based hierarchy, decentralized standalone systems, peer-to-peer system, hybrid enterprise wide systems, client-server systems, internet based computing and web services, Four levels of IT infrastructure, managing telecommunications, changes of infrastructure in telecommunications, transformation of telecommunication industries, wireless technology, managing information resources, managing data, giving shape to corporate data, enterprise resource planning, managing information resources, types of information, data warehouses, document management, content management, managing operations, outsourcing IS functions, information security, business continuity planning;

Managing system development: foundation of system development, structured development, fourth generation language, software prototyping, computer-aided software engineering, object oriented development, ERP systems integration, middleware inter-organizational system

development, project management, key issues of IS system management, designing motivational works, rethinking maintenance works, improving legacy systems, measuring benefits of IS system as investment;
Systems for supporting knowledge work: supporting decision-making, decision support systems, data mining, executive information systems, expert systems, real customer relationship management, real-time enterprise management, managing different types collaboration, groupware, virtual workforce, virtual organizations, knowledge management, intellectual capital issues, computer ethics and legal jurisdiction, information privacy, online contracting;

Acquisition of hardware, software, networks, and services: request for proposal, acquisition methods (buy, rent, or lease) of software acquisition and analysis of alternatives among in-house development, outsourcing, purchasing and renting;

People and technology: new work environment, organizing principles including self-organizing rather than designed, processes rather than functions, communities rather than groups, virtual rather than physical, learning organization, Internet mindset, value of role of networks, rules of networks, understanding users, executives understanding of IT, Technology camel.

Reference Books:

1. *Information Systems Management in Practice,* 8th Edition, B McNurlin, R Sprague and T Bui.

Course Code : 540222	**Marks : 200**	**Credits : 6**	**Class Hours :--**
Course Title :	**Project/Industry Attachment**		

Course Code : 540223	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Simulation and Modeling**		

Systems- System environment and System components; **System models and Simulation** - types of System model and simulation – Discrete and Continues, Static and Dynamic, Deterministic and Stochastic; **Discrete Event driven simulation** – Components and Organization, Event Scheduling/ Time Advance approach and Process Interaction approach, Event lists and List processing. Basics of Parallel and Distributed Simulation; **Simulation Languages and Packages – Process approach to simulation**, application oriented and general purpose simulation language and software: GPSS, SSF API for JAVA and C++, Arena, Extend, SIMUL8 etc. **Probability and Statistical concepts in simulation** – Random variable and its probability distributions, Stochastic process – e.g. Poisson process, Non stationary Poisson process, Compound Poisson process and their properties. Basics of Estimation, Hypothesis tests: Confidence Intervals and t-distribution. **Queuing Models** – Queuing Systems, Queuing behavior (e.g. balk, renege and jockey) and Queuing disciplines, Arrival process, Inter-arrival time distributions and Service time distributions. Long run measures of performance, Little's formula, Analysis of different Single-server and Multi-Server queuing systems, Queuing networks and their analysis, Jackson's theorem; **Inverse transformation technique for generating random variables**, other techniques: Acceptance–Rejection, Special properties, Convolution etc. **Random Number generation**: Linear Congruent method, composite generators, Random number streams; Testing for random numbers – frequency test and test for autocorrelation; **Input modeling**: identifying input model with data – Histograms, Q-Q plots, selecting the family of distribution, parameter estimation and Goodness-of-fit tests; selecting input model without data, multivariate and time-series input models, Models of arrival processes. **Verification and Validation of simulation models** – face validity, validation of model assumptions, input-out transformation and input output validation using historical input data. **Output data analysis** – types of simulation with respect to output analysis, stochastic nature of output data, measure of performance and their estimators, output analysis for terminating the

simulation and for steady state simulations. Techniques for comparison of alternative system design through simulation. **Simulation and queuing models of computer systems**: CPU, memory simulation; Traffic modeling and simulation of computer networks and network protocols, using queuing network analysis.

Reference Books:

1. *System Simulation* by Geoffery Grodon, Prentice Hall
2. *Discrete-event System Simulation* by Banks J and Carson JS, Prentice Hall.
3. *Simulation Modeling with Pascal*, Prentice Hall.
4. *System Simulation with Digital Computer*, Narsing Deo.

Course Code : : 540224	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Simulation and Modeling Lab**		

(As per theory course)

Course Code : 540225	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Parallel and Distributed Systems**		

Parallel Processing: Parallel Computer Models: The state of computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI Models; Program and Network Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architecture; Processors and Memory Hierarchy: Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Distributed Systems : Fundamentals**:** Definitions of Distributed Computing Systems, Evolution of Distributed Computing System, Distributed Computing System Models, Why are Distributed Computing Systems Gaining Popularity, Definition of Distributed Operating System, Issues in Designing a Distributed Operating System; Synchronization: Introduction, Clock Synchronization , Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms; Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism; Distributed File System: Introduction, Features of Distributed File System, File Services Interface, Directory Server Interface, Semantics of File Sharing, File Systems Implementation, Caching, Stateful File Server, Stateless File server, NFS Architecture; Fault Tolerance: Component Faults, System Failures, Use of Redundancy, Fault Tolerance Using Active Replication, Fault Tolerance Using Primary Backup;

Reference Books:

1. Advanced Computer Architecture- Kai Hwang
2. Distributed Operating Systems, Concepts and Design- P.K. Sinha
3. Distributed Operating System- Andrew S. Tanenbaum

Course Code : : 540226	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Parallel and Distributed Systems Lab**		

(As per theory course)

Course Code : 540227	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Digital Signal Processing		

Introduction to Digital Signal Processing (DSP): Introduction; Digital Signal Processing; Sampling and Analog-to-Digital Conversion; Discrete Time Signals; Ambiguity in Digital signals; Discrete Time Systems; Application areas for DSP; Keys of DSP operations: Convolution, Correlation, Digital Filtering, Discrete Transformation, Modulation; System Design: Methodology & Implementation Methodology.
Discrete Fourier transform: Fourier series, one dimensional Fourier transforms, discrete Fourier Transform (DFT) and its properties, Fast Fourier Transform (FFT) and its algorithm, Inverse discrete Fourier transformation.
The Z-Transform : Introduction to z-Transform; General Results of z-transform; Inverse z-Transform: Partial Fraction Expansion, Power Series Expansion, Contour Integration; Comparison of inverse z-transform method; Properties of z-transform; Complex Convolution Theorem and Parseval's Relation.
Implementation of Discrete-Time Systems: Introduction; Block Diagram and Signal Flow Graph Representation of Digital Networks; Matrix Representation of Digital Networks; Basic Structures of IIR Systems: Direct Form, Cascade forms, Parallel Form; Transposed Forms; Basic Structures of FIR Systems; Finite Precision Effects.
Design of Digital Filters: Introduction to Digital Filters; Types of Digital Filters: FIR and IIR; Choosing between FIR and IIR Filters: Digital Filter Design Steps; Design of FIR Filters: Design of FIR Filters by Windowing, Design of Optimum Equiripple Linear-Phase FIR Filters, Design of IIR Filters: Classical Continuous-Time Low-Pass Filter Approximations, Conversion of Transfer Functions from Continuous to Discrete Time, Frequency Transformations of Low pass Filters, Adaptive digital filters: concepts of adaptive filtering, basic wiener filter theory, the basic LMS adaptive algorithm, recursive least square algorithm.

Reference Books:

1. Emmanuel C. Ifeachor, Barrie W. Jervis, *Digital Signal Processing.*
2. John G. Proakis, Dimitris G. Manolakis, *Digital Signal Processing – Principles, Algorithms and Applications.*
3. Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, *Discrete-Time Signal Processing.*

Course Code : : 540228	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Digital Signal Processing Lab		

(As per theory course)

Course Code : 540229	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Digital Image Processing		

Introduction to image processing: Representation of image, A basic image processing system, Relationship to human visual system, Example of fields that use digital image processing,
Digital Image Fundamentals: Image formation in the eye, Light and electromagnetic spectrum, Image sensing and acquisition, Image sampling, Image quantization, Some basic relationships between pixels Neighbors of a pixel, Adjacency, connectivity, region, Boundaries, Distance measures

Image enhancement: Some basic gray level transformations, Histogram processing, Histogram equalization, Histogram matching, Image negatives, log transformation, Power law transformation, Basics of spatial filtering, Smoothing spatial filters, Homomorphic filtering, Correspondence between the spatial and frequency domain filtering.

Image Restoration: A model of the image degradation/ Restoration process, Noise models, Restoration in the presence of noise only spatial filtering.

Color Image processing: Color fundamentals, Color models, the RGB color model The CMY, CMYK color Model, HIS color Model, Basics of full-color transformation, Color transformations, formulation.

Image Compression: Image compression fundamentals, Coding redundancy, Inter pixel redundancy

Psychovisual redundancy, Image compression models, The source encoder and decoder, The channel encoder and decoder.

Image Segmentation: Edge detection, line detection, point detection, Boundary Detection, Thresholding, Region based segmentation.

Reference Books:

1. Rafael C. Gonzalez, Richard E. Woods, *Digital Image Processing.*
2. Anil K. Jain, *Fundamentals of Digital Image Processing.*
3. M A Sid-Ahmed, *Image Processing Theory, Algorithms and Architectures.*

Course Code : 540230	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Digital Image Processing Lab		

(As per theory course)

Course Code : 540231	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Multimedia		

Introduction to Multimedia**:** Design Concepts, Preproduction and Presentation Graphics: Presentation Graphics Design, Preproduction, Typefaces and Graphics. Desktop Publishing, Production Planning and Design, User Interface Design, Hypermedia Authoring Concepts, Multimedia Sound, File Compression**,** Video Production, Digital Video, Animation, HTML & Web-Based Multimedia, Designing Web-based Multimedia, Producing Multimedia**,** Content & Legal Considerations for Multimedia, Content & Legal Considerations for Multimedia, Multimedia Distribution, Networking Multimedia.

Reference Books:

1. Olu Lafe,"*Cellular Automata Transforms: Theory and Applications in Multimedia Compression, Encryption, and Modeling",* Kluwer Academic Publishers, 1st edition, 2000.
2. Barry G. Haskell, Atul Puri, Arun N. Netravali,"*Digital Video : An introduction to MPEG-2 (Digital Multimedia Standards Series)"*, Springer, 1st edition, 1996.

Course Code : 540232	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Multimedia Lab		

(As per theory course)

Course Code : 540233	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Pattern Recognition		

Introduction to Pattern Recognition: Classification Statistical Methods, Structural Methods and Hybrid method. Introduction to passen grammar and languages. Applications to character recognition medical imaging area. feature detection, classification, Review of probability and some linear algebra. Bayesian Decision Making, linear discriminants, separability, multi-class discrimination; quadratic classifiers, Fisher discriminant, sufficient statistics, coping with missing or noisy features, Bayesian estimation; non-parametric estimation; Non-parametric classification, density estimation, Parzen estimation, training methods, maximum likelihood, Bayesian parameter estimation, MAP. Linear discriminant functions.. Template-based recognition, eigenvector analysis, feature extraction, Eigen vector analysis. Clustering, unsupervised learning, vector quantization, K-means and E/M, neural nets. Sequence analysis, HMMs. k-nearest-neighbor classification, Mixture modeling, Optimization by Expectation, Maximization, Hidden Markov models, Viterbi algorithm, Baum-Welch algorithm, Linear dynamical systems, Kalman filtering and smoothing, Bayesian networks, independence diagrams, Decision trees, Multi-layer Perceptrons.

Reference Books:

1. Richard O. Duda, Peter E. Hart, David G. Stork,"*Pattern Classification"*, Wiley-Interscience, 2nd edition, 2000.

Course Code : 540234	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	Pattern Recognition Lab		

(As per theory course)

Course Code : 540235	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Design and Analysis of VLSI Systems		

Introduction to MOS technology: POMS, NMOS and CMOS, transistors, CMOS Fabrication **Design Approaches:** Fabrication steps, steps stick diagrams, design rules and layout, contact cuts, double metal MOS process rules. MOS circuits, **Delay Analysis**: Inverter delay and its analysis, delay of different sequential and combinational circuit. **Sequential System:** Super buffer, Dynamic MOS circuits, Scaling of MOS circuits. Scaling factors and device parameters. **Subsystem design and layout**. **Switch logic**: pass transistors and transmission gates. Gate logic: The inverter, Two input nMOS, CMOS and BiCMOS gate design. Design of parity generator and multiplexers. Registers, Counters and memory realizations, One transistor and three transistors dynamic RAM cell design. **Hierarchical view of VLSI System Design**: Behavioral description High level Synthesis Scheduling, allocation and data path synthesis. **Logic synthesis**: multilevel minimization, PLA reduction regular structure circuits, Synthesis of FSM-ASM chart representation and realization, Layout synthesis, Placement and routing, Testing of VLSI, Testing of stuck-at fault, Testing of PLAs RAM. **Introduction to Reversible Logic:** Theory of reversibility, Reversible gates, reversible circuits, reversible logic synthesis. **FPGA:** Introduction to

FPGA and FPGA programming using VHDL.

Reference Books:

1. *Basic VLSI Design System and Circuits*, Douglas A. Pucknell, KAMRAN Eshraghiam, Prentice Hall International Inc. Second Edition.
2. *Modern VLSI Design* by Wayne Wolf.

Course Code : 540236	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Design and Testing of VLSI Systems Lab**		

(As per theory course)

Course Code : 540237	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Microcontroller and Embedded System**		

Introduction to the Embedded Systems, Embedded System Design Specifications, Embedded System Hardware and Hardware/Software Co-design, 8051/8052 family of Microcontrollers, C programming for Microcontrollers, I/O ports Programming, Timer/Counter hardware and Its Device Driver, Serial communication interface and Its Device Driver, Interrupts Programming, Embedded Software Development Cycle and the Integrated Development Environment, Debugging Techniques for Embedded Software and the Role of Cross Simulators, Real World Interfacing Case Studies: LCD, Sensors, stepper motor, keyboard, PC, Design of Device Driver for Serial Devices, Concept of Finite State Machines and Examples - Stop Watch, Stepper Motor Control through PC, Remote Control of Systems using IR Remotes Used in Commercial TV Remote Control Modules, Simple Multi Drop Communication Networks With Examples, Simple Wireless Communication With Examples.

Reference Books:

1. *Introduction to Embedded Systems Using Microcontrollers and the MSP430* : Jiménez, Manuel, Palomera, Rogelio, Couvertier, Isidoro
2. *The 8051 Microcontrollers and Embedded Systems* : Muhammed Ali Mazidi
3. *The 8051 Microcontrollers Architecture, Programming & Applications* : Kenneth J. Ayala

Course Code : 540238	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Micro-controller and Embedded System Lab**		

(As per theory course)

Course Code : 540239	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Cyber Law and Computer Forensic**		

Overview of Cybercrime: Samples of cybercrime, Unique Characteristics of Cybercrime, Cyber-attacks and attackers. Cybercrime Law. Computer Intrusions and Attacks: computer trespass, unauthorized access, relationship between acceptable use policies ("AUP"), terms of service ("TOS"), and criminal law. Hacking: Hacking for Grades, Hacking for harrassment ("swatting"), URL hacking, WiFi Mooching. Computer Viruses, Time Bombs, Trojans, Malicious Code, malware, Spam, Botnets, Logic Bomb, Rootkits. Online Fraud and Identity Theft: Intellectual

Property Theft; Virtual Crime. Online Vice: Gambling; Pornography; Child Exploitation. International Aspects and Jurisdiction, Infrastructure and Information Security; Risk Management, Investigating Cybercrime: Interception: Search and Seizure, and Surveillance. Information Warfare: Cyberterrorism and Hacktivism. Terrorism, Radicalization, and the War of Ideas. Trade Secret Theft and Economic Espionage. National Security. Computer Forensic: overview of the forensic relevance of encryption, the examination of digital evidence for clues, and the most effective way to present evidence and conclusions in a court of law.

Reference Books:

1. *Computer Forensics and Cyber Crime*: An Introduction, 3rd Edition, Marjie T. Britz
2. *Digital Evidence and Computer Crime*, 3rd Edition, Eoghan Casey

Course Code : 540240	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Cyber Law and Computer Forensics Lab**		

(As per theory course)

Course Code : 540241	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Natural Language Processing**		

Words, Parts of Speech, Syntax, Grammars, Semantics, Language Modeling in General and the Noisy Channel Model**,** Linguistics: Phonology and Morphology Word Classes and Lexicography. Mutual Information. The t-score. The Chi-square test. Hidden Markov Models (HMMs). The Trellis & the Viterbi Algorithms. HMM Tagging (Supervised, Unsupervised). Evaluation methodology (examples from tagging). Precision, Recall, Accuracy. Statistical Transformation Rule-Based Tagging. Maximum Entropy Tagging. Feature Based Tagging. Results on Tagging Various Natural Languages. Non-statistical Parsing Algorithms (An Overview). Simple top-down parser with backtracking. Probabilistic Parsing. Introduction. Statistical Machine Translation (MT).

Reference Books:

1. Daniel Jurafsky, James H. Martin,"*Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition*", Prentice Hall, 1st Edition, 2000.

2. Christopher D. Manning, Hinrich Schtze,"*Foundations of Statistical Natural Language Processing*", The MIT Press; 1st edition, 1999.

Course Code : 540242	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Natural Language Processing Lab**		

(As per theory course)

Course Code : 540243	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	System Analysis and Design		

Introduction to general systems theory, Players in the Systems Game, Information Systems Building Blocks. Information Systems Development, Project Management. Systems Analysis, Requirements Discovery, Deliverables, Data Modeling and Analysis, Process Modeling, Feasibility Analysis and System Proposal, Systems Design, Applications Architecture and Modeling, Database Design, Output Design and Prototyping, Input Design and Prototyping, User Interface Design, Systems Construction and Implementation, Systems Operations and Support, Object-Oriented Analysis and Modeling, Object-Oriented Design and Modeling.

Reference Books:

1. *Modern Systems Analysis and Design*, Jefrey A. Hoffer, Pearson Education Asia.
2. *Systems Analysis and Design*, Shin Yen Wu, West Publishing Company.

Course Code : 540244	Marks : 40	Credits : 1.5	Class Hours : --
Course Title :	System Analysis and Design Lab		

(As per theory course)

Course Code : 540245	Marks : 80	Credits : 3	Class Hours : 45
Course Title :	Optical Fiber Communication		

History of optical communication, advantages and limitations of fiber communication. Theory of light: reflection, refraction, critical incident angle, total internal reflection. Electromagnetic waves, Maxwell's equation, damping waves, wavefront, propagation constant, phase velocity, group velocity. Basics of optical fiber: acceptance angle, numerical aperture, fiber structure, comparison with copper, meridional rays, skew rays, v number of a fiber, modes in a planar guide, Evanescent field, single mode fiber, multimode fibers. Fabrication of optical fibers: Vapor phase deposition techniques: OVD, MCVD, PCVD, VAD, coating. Optical sources: requirements , energy band diagram, LED: (principle of action, internal quantum efficiency, homostructure and heterostructure of LEDs), Laser: (principle of action, properties of stimulated radiation, positive feedback, population inversion, lasing effect, properties of laser beam, types of lasers: QW, Fabry-Perot, DFB, VCSEL), Superluminescent diodes (SLD), blocks of optical transmitter. Photo detectors: principle of action, responsivity, quantum efficiency, modes of operation, advantages of reverse biasing, sensitivity, efficiency of light-current conversion, p-i-n photodiodes: (features, types, advantages), avalanche photodiode: working principle, noise sources in photodiode, blocks of receiver. Losses in fiber: Material absorption loss, Linear scattering loss, Nonlinear scattering loss, Fiber bend loss, Coupling loss, Dispersion, Polarization loss. Fiber optic cables, optical connectors: (basic structure, preparation, types, characteristics), fiber splices: (splicing procedure, mechanical splice, fusion splice, PAS, PAT). Optical network: OTDM, WDM and DWDM: (lasers, transmitter requirements, receiver requirements, add/drop problem, repeaters), Tunable lasers: (characteristics, external cavity, DBR, integrated cavity lasers). Optical amplifiers: advantages, types, SOA: (types: FPA and TWA, principle of operation, advantages, and disadvantages). EDFA: (principle of operation, characteristics, structure, advantages, noise, DBFA, EBFA). Optical switches, Wavelength converters, Couplers/splitters, WDM mux and demux, filters, Isolators, Circulators, Attenuators. Optical layer: sections, sublayers, services. Protection and restoration techniques.

Reference Books:

1. *Fiber-Optic Communications Systems*, Third Edition. Govind P. Agrawal, John Wiley & Sons, Inc.
2. *Optical Fiber Communications*, Fourth Edition, Gerd Keiser, Tata McGraw Hill.

Course Code : 540246	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Optical Fiber Communication Lab**		

(As per theory course)

Course Code : 540247	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Human Computer Interaction**		

Foundations of Human Computer Interaction: Humans and Machines, Interaction, Collaboration. Models in HCI: Cognitive Models, Socio-organizational Issues and Stakeholder Requirements. Importance of cognitive abilities. Design Process: Interaction Design Basics, HCI in Software Process, Design Rules, Universal Design, User Center Design. Design. Prototyping, Task Analysis, GOMS and other key HCI methods. Lifecycle Models. User Interfaces: Interfaces Basics, Interaction Techniques, System Control of Interfaces, Human Factors and Strategies in Designing Interfaces. Evaluation and User Support: Evaluation, Evaluation of Interfaces, User Support. Tasks Models and Dialogs: Analysing the Task, Dialog Notations and Design. Groupware, Ubiquitous Computing, Virtual and Augmented Reality. Social-Cultural Contexts of HCI.

Reference Books:

1. Andy Downton,"*Engineering the Human-Computer Interface(Essex Series in Telecommunications and Information Systems)*", McGraw Hill, 1993.

Course Code : 540248	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Human Computer Interaction Lab**		

(As per theory course)

Course Code : 540249	**Marks : 80**	**Credits : 3**	**Class Hours : 45**
Course Title :	**Graph Theory**		

Fundamental concepts, varieties of graphs, path, cycles and components, degrees and distances, clique. Trees: Properties, spanning trees, forests, centroids, generation of trees and cycles, ent cycles and co-cycles. Connectivity: Vertex and edge connectivity, blocks, eccentricity, Menge's Theorem. Traversability: Eulerian graphs, kuratowski's theorem, embedding graphs on surfaces, genus, thickness and crossing number. Graph Coloring: Vertex coloring, edge coloring, chromatic number, five color theorem, four color conjecture, critical graph. Homomorphism Digraph: Different connectedness, oriented graphs-tournaments, network flows and related algorithms. Groups, polynomials and graph enumeration, matching and factorization, perfect graphs, Ramsey number and Ramsey theorem, forbidden graph theory, miscellaneous applications.

Reference Books:

1. V.K. Balakrishnan,"*Schaum's Outline of Graphs Theory: Including Hundreds of Solved Problems*", Schaum's.
2. Douglas B. West,"*Introduction to Graph Theory*", Prentice Hall, 2nd edition, 2000.

Course Code : 540250	**Marks : 40**	**Credits : 1.5**	**Class Hours : --**
Course Title :	**Graph Theory Lab**		

(As per theory course)