Syllabus for B.Tech(Information Technology) Second Year

Revised & Proposed Syllabus of B.Tech IT (To be followed from the academic session, July 2011, i.e. for the students who were admitted in Academic Session 2010-2011)

IT

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Points**
			L	**T**	**P**	**Total**	
1	**HU301**	Values & Ethics in Profession	3	0	0	3	3
2	**PH301**	Physics-2	3	1	0	4	4
3	**CH301**	Basic Environmental Engineering & Elementary Biology;	3	0	0	3	3
4	**CS301**	Analog & Digital Electronics	3	0	0	3	3
5	**CS302**	Data Structure & Algorithm	3	1	0	4	4
6	**CS303**	Computer Organisation	3	1	0	4	4
Total of Theory						**21**	**21**
B. PRACTICAL							
7	**PH391**	Physics-1	0	0	3	3	2
8	**CS391**	Analog & Digital Electronics	0	0	3	3	2
9	**CS392**	Data Structure & Algorithm	0	0	3	3	2
10	**CS393**	Computer Organisation	0	0	3	3	2
Total of Practical						**12**	**8**
Total of Semester						**33**	**29**

Second Year - Fourth Semester

A. THEORY							
Sl.No.	**Field**	**Theory**	**Contact Hours/Week**				**Cr. Points**
			L	**T**	**P**	**Total**	
1	**M(CS)401**	Numerical Methods	2	0	0	2	2
2	**M401**	Mathematics-3	3	1	0	4	4
3	**CS401**	Communication Engg & Coding Theory	**2**	0	0	3	3
4	**CS402**	Formal Language & Automata Theory	3	1	0	4	4
5	**IT401**	Object Oriented Programming & UML	3	1	0	4	4
Total of Theory						**17**	**17**
B. PRACTICAL							
6	**HU481**	Communication Skill & Report Writing	0	0	3	3	2
7	**M(CS)491**	Numerical Methods	0	0	2	2	1
8	**CS491**	Communication Engg & Coding Theory	0	0	3	3	2
9	**CS492**	Software Tools	0	0	3	3	2
10	**IT491**	Object Oriented Programming & UML (IT)	0	0	3	3	2
Total of Practical						**14**	**9**
Total of Semester						**31**	**26**

SEMESTER - III

Theory

VALUES & ETHICS IN PROFESSION

HU-301
Contracts:3L
Credits- 3

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development
Energy Crisis: Renewable Energy Resources
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology Movement of Schumacher; later developments
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

Code: PH-301
Contacts: 4L
Credit: 3+1

Module 1:

Vector Calculus:

1.1 Physical significances of grad, div, curl. Line integral, surface integral, volume integral- physical examples in the context of electricity and magnetism and statements of Stokes theorem and Gauss theorem [No Proof].

Expression of grad, div, curl and Laplacian in Spherical and Cylindrical co-ordinates.

2L

Module 2 :

Electricity

2.1 Coulumbs law in vector form. Electrostatic field and its curl. Gauss's law in integral form and conversion to differential form . Electrostatic potential and field, Poisson's Eqn. Laplace's eqn (Application to Cartesian, Spherically and Cylindrically symmetric systems – effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady current. 5L

2.2 Dielectrics-concept of polarization, the relation $D=\varepsilon_0 E+P$, Polarizability. Electronic polarization and polarization in monoatomic and polyatomic gases. 3L

Module 3:

Magnetostatics & Time Varying Field:

3. Lorentz force, force on a small current element placed in a magnetic field. Biot-Savart law and its applications, divergence of magnetic field, vector potential, Ampere's law in integral form and conversion to differential form. Faraday's law of electro-magnetic induction in integral form and conversion to differential form. 3L

Module 4:

Electromagnetic Theory:

4.1 Concept of displacement current Maxwell's field equations, Maxwell's wave equation and its solution for free space. E.M. wave in a charge free conducting media, Skin depth, physical significance of Skin Depth, E.M. energy flow, & Poynting Vector.

6L

Module 5:

Quantum Mechanics:

5.1 Generalised coordinates, Lagrange's Equation of motion and Lagrangian, generalised force potential, momenta and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion. 4L

Course should be discussed along with physical problems of 1-D motion

5.2 Concept of probability and probability density, operators, commutator. Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function ψ (normalization and probability interpretation), Expectation values, Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels. 9L

Module 6:

Statistical Mechanics:

3.1 Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Calculation of Fermi level in metals, also total energy at absolute zero of temperature and total number of particles, Bose-Einstein statistics – Planck's law of blackbody radiation..

7L

Basic Environmental Engineering & Elementary Biology
Code: CH301
Contacts: 3L = 3
Credits: 3

General

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

1L

Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

2L

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. 1L

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

2L

Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. 2L

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. 1L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 2L

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 1L

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). 2L

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. 2L

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. 1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). 1L

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water.

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. 2L

Lake: Eutrophication [Definition, source and effect]. 1L

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. 2L

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic 1L

Land Pollution

Lithosphere; Internal structure of earth, rock and soil 1L

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste). 2L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] 1L

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, $L_{10}(18\,\text{hr Index})$, Ld_n.

Noise pollution control. 1L

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. 2L

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

Analog & Digital Electronics
Code: CS301
Contact: 3L
Cr: 3

Module	Contents	Hrs
Pre-requisite of Analog Electronics: Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic concept of the working of P-N diodes, Schottky diodes, Basic BJTs, Basic FETs and OPAMP as a basic circuit component.		
1.	Module -1: Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, relative efficiency); Oscillators – Berkhaussen criterion revisited – Phase Shift, Wein Bridge oscillators.	5
2.	Module -2: Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.	4
[***Learning Outcome***: The learner will be trained to compare the merits and demerits of the different amplifiers and must be able to bias the transistors accordingly; ability to use OPAMPs for designing simple linear and non-linear circuits to be cultivated; the student must be able to analyse simple OPAMP circuits and comment on relative performance of the different circuits;		
Pre-requisite of Digital Electronics: Binary numbers & Basic Boolean algebra – already covered in First year; Logic gates, Truth Tables and function realization – already covered in First year upto minimisation of Logic expressions by algebraic method, K-map.		
3.	Binary Number System & Boolean Algebra; BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, Quine-McClauskey method.	4
4.	Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.	5
5.	Memory Systems: RAM, ROM, EPROM, EEROM	4
6.	Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, various types of Registers and counters and their design, Irregular counter, State table and state transition diagram, sequential circuits design methodology.	6
7.	Different types of A/D and D/A conversion techniques – Basic concepts.	4
8.	Logic families- TTL, ECL, MOS and CMOS - basic concepts	4
[***Learning Outcome***: The student must be able to convert from one number system to another, work out problems related to Boolean algebra, minimisation problems etc. The student must also learn to differentiate between the combinational and sequential circuits and design simple circuits)		

Total: 36 hours

Textbooks:

Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
Microelectronics Engineering - Sedra & Smith.
Digital Electronics – Kharate – Oxford
Digital Electronics – Logic & Systems by J.Bigmell & R.Donovan; Cambridge Learning.
Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP

Reference:

3.2 Morries Mano- Digital Logic Design- PHI
3.3 R.P.Jain—Modern Digital Electronics, 2/e , Mc Graw Hill
2. H.Taub & D.Shilling, Digital Integrated Electronics- Mc Graw Hill.
3. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
4. Givone—Digital Principles & Design, Mc Graw Hill
5. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson

6. S.K.Mandal, Digital Electronics Principles and Applications- Mc Graw Hill.
J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
7. Leach & Malvino—Digital Principles & Application, 5/e, Mc Graw Hill
8. Floyed & Jain- Digital Fundamentals-Pearson.
9. P.Raja- Digital Electronics- Scitech Publications
10. S.Aligahanan, S.Aribazhagan, Digital Circuit & Design- Bikas Publishing

Data Structure & Algorithm
Code: CS302
Contacts: 3L +1T
Credits: 4

Introduction: Why we need Data Structure? Concepts of Data Structures: a) Data and Data Structure b) Abstract Data Type and Data Type, Algorithms and Programs, Algorithm Efficiency and Analysis

Linear Data Structures – Sequential Representations: Arrays and Lists,

Stack and Queues: Stacks and Their Implementations, Application of Stack, Queues and Dequeues, Queues and Linear Implementation, Circular Implementations of Queues, Linked Queue Implementation, Applications;

Linked List: Linear Linked List, Circular Linked List, Doubly Linked List, Linked representation of Polynomial and Applications.

Recursion: –Introduce to Recursion, Principle of Recursion, Recursion and Iteration, The Tower of Hanoi, Eight Queens Puzzle

Nonlinear Data structures: Trees : Basic Terminologies; Binary trees: Binary Tree Traversal, Binary Tree Reconstruction, Threaded Binary Tree, Expression Tree, Binary search tree: Operations, Height Balanced Binary trees; M-Way Search Tree, B- Trees; Tree Representation and Forest, Huffman Tree and Coding

Heaps and Priority Queues.

Graphs: Graph Definition and Concepts, Graph Representations and Storage Implementation, Graph Traversal and Connectivity, Mini Spanning Tree, Shortest Path, Topological Sorting and Critical Path

Sets: Definition and Terminologies, Representation of Sets, Operations of sets, Applications.

Time and Space analysis of Algorithms – Order Notation.

Sorting Algorithms: Insertion sorts : Straight insertion sort, Binary insertion of sort, Shell sort; Exchange Sorts: Bubble sort, Quick sort, selection sorts: Straight Selection Sort, Heap Sort; Merge sort; Distribution Sorts : Bucket Sort, Radix Sort.

Searching: Sequential Search, Ordered Sequential Search, depth first search and breadth first search techniquesBinary Search, Interpolation Search, Hashing Searching

Computer organization
Code: CS303
Contacts: 3L +1T
Credits: 4

Pre-requisite: Concept of basic components of a digital computer as covered in Introduction to Computing, Second semester, first year. Basic concept of Fundamentals & Programme structures. Basic number systems,

Binary numbers, Boolean Algebra, Digital electronics, Gates – covered in Basic Electronics in First year, and Analog & Digital Electronics in Third semester.

Module – 1: Basic organization of the computer and block level description of the functional units as related to the execution of a program; Fetch, decode and execute cycle; role of operating systems and compilers (introduction only); Concept of operator, operand; preliminary idea about different types of instructions; (7L)

Module – 2: Assembly language programming: instruction set, instruction cycles, registers and storage, addressing modes; discussions about RISC versus CISC architectures (not in details, outline only; will be pre-requisite for computer architecture in the next semester); (6L)

Module – 3: Inside a CPU: information representation, computer arithmetic and their implementation; control and data path, data path components, design of ALU and data path, controller design; (8L)

Module – 4: Memory and IO access: Memory maps, Read Write operations, Programmed IO, Concept of handshaking, Polled and Interrupt driven IO, DMA data transfer; (8L)

Module – 5: IO subsystems: Input-Output devices such as Disk, CD-ROM, Printer etc.; Interfacing with IO devices, keyboard and display interfaces; Inside the Memory: memory organization, static and dynamic memory (8L)

(Additional tutorial hours.)

Learning Outcome:

Through this course, the students will be exposed to extensive development and use of microprocessor/ microcontroller based devices and relevant interfaces. Their knowledge in assembly programming will help them in better visualization of important course like Operating System offered in subsequent semester.

Text book:

Practical

Code: PH-391
Contacts: (3P)
Credit: (2)

Group 1: Experiments on Electricity and Mangentism

1. Determination of dielectric constant of a given dielectric material.
3. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
4. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
5. Determination of specific charge (e/m) of electron by J.J. Thomson's method.

Group 2: Quantum Physics

6. Determination of Planck's constant using photocell.
7. Determination of Lande'g factor using Electron spin resonance spetrometer.
8. Determination of Stefan's radiation constant
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum

Group 3: Modern Physics

11. Determination of Hall co-efficient of semiconductors.
12. Determination of band gap of semiconductors.

13. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

a) A candidate is required to perform 3 experiments taking one from each group. Initiative should be taken so that most of the Experiments are covered in a college in the distribution mentioned above. Emphasis should be given on the estimation of error in the data taken.

b) In addition a student should perform one more experiments where he/she will have to transduce the output of any of the above experiments or the experiment mentioned in c] into electrical voltage and collect the data in a computer using phoenix or similar interface.

c) Innovative experiment: One more experiment designed by the student or the concerned teacher or both.

Note:

i. Failure to perform each experiment mentioned in b] and c] should be compensated by two experiments mentioned in the above list.
ii. At the end of the semester report should sent to the board of studies regarding experiments, actually performed by the college, mentioned in b] and c]
iii. Experiment in b] and c] can be coupled and parts of a single experiment.

Recommended Text Books and Reference Books:
For Both Physics I and II
1. B. Dutta Roy (Basic Physics)
2. R.K. Kar (Engineering Physics)
3. Mani and Meheta (Modern Physics)
4.. Arthur Baiser (Perspective & Concept of Modern Physics)

Physics I (PH101/201)
Vibration and Waves
4. Kingsler and Frey
5. D.P. Roychaudhury
6. N.K. Bajaj (Waves and Oscillations)
7. K. Bhattacharya
8. R.P. Singh (Physics of Oscillations and Waves)
9. A.B. Gupta (College Physics Vol.II)
10. Chattopadhya and Rakshit (Vibration, Waves and Acoustics)

Optics
1. Möler (Physical Optics)
2. A.K. Ghatak
3. E. Hecht (Optics)
4. E. Hecht (Schaum Series)
5. F.A. Jenkins and H.E. White
6. 6. Chita Ranjan Dasgupta (Degree Physics Vol 3)

Quantum Physics
1. Eisberg and Resnick
2. A.K. Ghatak and S. Lokenathan
3. S.N. Ghoshal (Introductory Quantum Mechanics)
4. E.E. Anderson (Modern Physics)
5. Haliday, Resnick and Crane (Physics vol.III)
6. Binayak Dutta Roy [Elements of Quantum Mechanics]

Crystallography

1. S.O. Pillai (a. Solid state physics b. Problem in Solid state physics)
2. A.J. Dekker
3. Aschroft and Mermin
4. Ali Omar
5. R.L. Singhal
6. Jak Tareen and Trn Kutty (Basic course in Crystallography

Laser and Holography

1. A.K. Ghatak and Thyagarajan (Laser)
2. Tarasov (Laser)
3. P.K. Chakraborty (Optics)
4. B. Ghosh and K.G. Majumder (Optics)
5. B.B. Laud (Laser and Non-linear Optics)
6. Bhattacharyya [Engineering Physics] Oxford

Physics II(PH 301)

Classical Mechanics (For Module 5.1 in PH 301)
H. Goldstein
A.K. Roychaudhuri
R.G. Takwal and P.S. Puranik
Rana and Joag
M. Speigel (Schaum Series)
J.C. Upadhya (Mechanics)

Electricity and Magnetism

11. Reitz, Milford and Christy
12. David J. Griffith
13. D. Chattopadhyay and P.C. Rakshit
14. Shadowitz (The Electromagnetic Field)

Quantum Mechanics

7. Eisberg and Resnick
8. A.K. Ghatak and S. Lokenathan
9. S.N. Ghoshal (Introductory Quantum Mechanics)
10. E.E. Anderson (Modern Physics)
11. Haliday, Resnick and Crane (Physics vol.III)
12. Binayak Dutta Roy [Elements of Quantum Mechanics]

Statistical Mechanics

1. Sears and Sallinger (Kinetic Theory, Thermodynamics and Statistical Thermodynamics)
2. Mondal (Statistical Physics)
3. S.N. Ghoshal (Atomic and Nuclear Physics)
4. Singh and Singh
5. B.B. Laud (Statistical Mechanics)
6. F. Reif (Statistical Mechanics)

Dilectrics

7. Bhattacharyya [Engineering Physics] Oxford

Analog & Digital Electronics
Code: CS391
Contact: 3
Cr: 2

ANALOG:
Experiment -1: Study of a Class A amplifier
Experiment-2: Design of a Phase-Shift Oscillator
Experiment-3: Design of a Schmitt Trigger
Experiment – 4: Study of 555 timer.

DIGITAL:
Experiment-5: Design a Half
Experiment – 6: Design of Full Adder
Experiment-7: Design a JK
Experiment – 8: Design of RS Filp-flop.

Two experiments to be suggested by each college.

Data Structure & Algorithm
Code: CS392
Contacts: 3
Credits: 2

Experiments should include but not limited to :
Implementation of array operations:
Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements Merging Problem : Evaluation of expressions operations on Multiple stacks & queues :
Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists:
Polynomial addition, Polynomial multiplication
Sparse Matrices : Multiplication, addition.
Recursive and Nonrecursive traversal of Trees
Threaded binary tree traversal. AVL tree implementation
Application of Trees. Application of sorting and searching algorithms
Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Computer organization
Code: CS393
Contacts: 3
Credits: 2

Practical:[Emphasis of Assembly Language Programming in Microprocessor / Micro-controller]

1. Realization of all the basic gates(AND, OR, NOT, NOR, NAND, XOR).
2. Realization of all the basic gates and universal gates (AND, OR, NOT, NOR) with minimum number of NAND gates.
3. Realization of all the basic gates and universal gates (AND, OR, NOT, NAND) with minimum number of NOR gates.
4. Design a BCD to Excess -3 code conversion circuit using basic gates and verify its output.

5. Design a Excess -3 to BCD code conversion circuit using basic gates and verify its output.
6. Design a Full Adder circuit using basic gates and verify its output.
7. Design a Half Adder and Half Subtractor circuit using basic gates and verify its output.
8. Design a Gray to Binary code conversion circuit using basic gates and verify its output.
9. Design a Binary to Gray code conversion circuit using basic gates and verify its output.
10. Design a Full Subtractor circuit using basic gates and verify its output.
11. Realization of 3:8 decoder using 2:4 decoder
12. Realization of BCD adder circuit..
13. Design a 4:1 MUX with basic gates.
14. Realization of 8:1 MUX by using 4:1 MUX.
15. Realization of Master-Slave J-K flip-flop by using basic gates.
16. Realization of Master-Slave J-K , D and T flip-flops by using 7476 IC.
17. Realization of S-R flip-flop (with clock and without clock) by using basic gates.
18. Realization of Serial-in-Serial-Out shift register.
19. Realization of Serial-In-Parallel Out Shift register.
20. Realization of Parallel-In-Parallel-Out Shift register.
21. Realization of 2 bit Carry Look- Ahead Adder.
22. Realization of 4 bit UP counter with and without load using IC 74193.
23. Realization of 4 bit UP counter with and without load using IC 74193.
24. Program controlled I/O device like keyboard
25. Interfacing I/O devices like keyboard, monitor etc. and microprocessor/ microcontroller controlled device like motor, timer dependent devices etc.
26. Simulation of a miniature instruction set using microprocessor.

SEMESTER - IV

Theory

NUMERICAL METHODS
Code: M (CS) 401
Contacts: 2L
Credits: 2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)

Interpolation: Newton forward & backward interpolation, Lagrange's and Newton's divided difference Interpolation.
(5)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. (3)

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Jacobi and Gauss-Seidel iterative methods.
(6)

Numerical solution of Algebraic equation:
Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Taylor's series method, Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method.
(6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

Subject Name: MATHEMATICS

Code: M 401

Contacts: 3L +1T = 4

Credits: 4

Note 1: The whole syllabus has been divided into five modules.

Note 2: Structure of the question paper

There will be three groups in the question paper. In Group A, there will be one set of multiple choice type questions spreading the entire syllabus from which 10 questions (each carrying one mark) are to be answered. From Group B, three questions (each carrying 5 marks) are to be answered out of a set of questions covering all the five modules. Three questions (each carrying 15 marks) are to be answered from Group C. Each question of

Group C will have two or three parts covering not more than two modules. Sufficient questions should to be set covering the whole syllabus for alternatives.

Module I

Theory of Probability: Axiomatic definition of probability. Conditional probability. Independent events and related problems. Bayes theorem (Statement only) & its application. One dimensional random variable. Probability distributions-discrete and continuous. Expectation. Binomial, Poisson, Uniform, Exponential, Normal distributions and related problems. t, χ^2 and F-distribution (Definition only). Transformation of random variables. Central Limit Theorem, Law of large numbers (statement only) and their applications. Tchebychev inequalities (statement only) and its application. **(14L)**

Module II

Sampling theory: Random sampling. Parameter, Statistic and its Sampling distribution. Standard error of statistic. Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.

Estimation of parameters: Unbiased and consistent estimators. Point estimation. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson and Normal). Confidence intervals and related problems. **(7L)**

Module III

Testing of Hypothesis: Simple and Composite hypothesis. Critical region. Level of significance. Type I and Type II errors. One sample and two sample tests for means and proportions. χ^2 - test for goodness of fit. **(5L)**

Module IV

Advanced Graph Theory: Planar and Dual Graphs. Kuratowski's graphs. Homeomorphic graphs. Eulers formula (n - e + r = 2) for connected planar graph and its generalisation for graphs with connected components. Detection of planarity. Graph colouring. Chromatic numbers of C_n, K_n , $K_{m,n}$ and other simple graphs. Simple applications of chromatic numbers. Upper bounds of chromatic numbers (Statements only). Chromatic polynomial. Statement of four and five colour theorems. **(10L)**

Module V

Algebraic Structures**:** Group, Subgroup, Cyclic group, Permutation group, Symmetric group (S_3), Coset, Normal subgroup, Quotient group, Homomorphism & Isomorphism

(Elementary properties only).

Definition of Ring, Field, Integral Domain and simple related problems. **(12L)**

Text Books:

1. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons.
2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
3. Mapa S.K. :Higher Algebra (Abstract & Linear), Sarat Book Distributors.

4. Sen M.K., Ghosh S. and Mukhopadhyay P.: Topics in Abstract Algebra, University Press.
5. West D.B.: Introduction to Graph Theory, Prentice Hall.

References:

1. Babu Ram: Discrete Mathematics, Pearson Education.
2. Balakrishnan: Graph Theory (Schaum's Outline Series), TMH.
3. Chakraborty S.K and Sarkar B.K.: Discrete Mathematics, OUP.
4. Das N.G.: Statistical Methods, TMH.
5. Deo N: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall.
6. Khanna V.K and Bhambri S.K. : A Course in Abstract Algebra, Vikas Publishing House.
7. Spiegel M R., Schiller J.J. and Srinivasan R.A. : Probability and Statistics (Schaum's Outline Series), TMH.
8. Wilson: Introduction to graph theory, Pearson Edication.

Communication Engineering & Coding Theory
Code: CS401
Contacts: 2L
Credits: 3

Module - 1. ***Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR*** **Analog-to-Digital Conversion**. (Basic ideas in brief) [8]
[Details: Introduction, Base Band transmission & Modulation, Elements of Communication system, Noise, Importance of SNR in system design; Basic principles of Linear Modulation (Amplitude Modulation), Basic principles of Non-linear modulation (Angle Modulation - FM, PM); Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing, Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM; Basic concept of Pulse Code Modulation, Block diagram of PCM]

Module - 2. **Digital Transmission:** [8]
[Details: Introduction and advantages; Quantisation, Quantisation error, Non-uniform Quantiser, A-law & □law companding; Encoding, Coding efficiency, Line coding & properties, NRZ & RZ, AMI, Manchester coding PCM, DPCM; Baseband Pulse Transmission, Matched filter, Error rate due to noise, ISI, Nyquist criterion for distortion-less base-band binary transmission, Eye pattern, Signal power in binary digital signals

Module - 3.**: Digital Carrier Modulation & Demodulation Techniques:** [8]
[Details: Introduction, Information capacity, Shanon's limit, Bit rate, Baud rate, M-ary encoding, ASK, ASK spectrum, FSK, PSK, BPSK, QPSK, 8 BPSK, 16 BPSK , QAM, 8QAM, 16 QAM; Delta modulation, Adaptive delta modulation. DPCM, Delta Modulation, Adaptive Delta modulation, Spread Spectrum Modulation.

Module - 4**: Information Theory & Coding**: [8]
[Details: Introduction, News value & Information content, Entropy, Mutual information, Information rate, Shanon-Fano algorithm for encoding, Shannon's Theorem - Source Coding Theorem, Channel Coding Theorem, Information Capacity Theorem (basic understanding only); Error Control & Coding]

Module - 5: **Multiplexing**: [4]
TDM, FDM, Multiplexing hierarchies, T1 digital carrier system, TDM & PCM hierarchy, North-American Digital Hierarchy, Bits vs words interleaving.

Text Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Data Communication and Networking by Behrouz A. Forouzan, Published by Tata McGraw-Hill

References:
1. Communication Systems 4th Edition by Simon Haykin; Published by Wiley India (Student Edition)
2. Principles and Analog and Digital Communication by Jerry D Gibson, Published by MacMillan.
3. Communication Systems by A. B. Carlson, Published by McGraw-Hill.
4. Understanding Signals and Systems by Jack Golten, Published by McGraw Hill.

Formal Language & Automata Theory
Code: CS402
Contacts: 3L +1T
Credits: 4

Fundamentals : Strings, Alphabet, Language, Operations, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, deterministic finite automaton and non deterministic finite automaton, transition diagrams and Language recognizers. [4 L]

Finite Automata : NFA with Î transitions - Significance, acceptance of languages. Conversions and Equivalence : Equivalence between NFA with and without Î transitions, NFA to DFA conversion, minimisation of FSM, equivalence between two FSM's, Finite Automata with output- Moore and Melay machines. [6 L]

UNIT III :
Regular Languages : Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Pumping lemma of regular sets, closure properties of regular sets (proofs not required). [6 L]

UNIT IV :
Grammar Formalism : Regular grammars-right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion, Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings. [5 L]

UNIT V :
Context Free Grammars : Ambiguity in context free grammars. Minimisation of Context Free Grammars. Chomsky normal form, Greiback normal form, Pumping Lemma for Context Free Languages. Enumeration of properties of CFL (proofs omitted). [6 L]

UNIT VI :
Push Down Automata : Push down automata, definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFL and PDA, interconversion. (Proofs not required). Introduction to DCFL and DPDA. [4 L]

UNIT VII :
Turing Machine : Turing Machine, definition, model, design of TM, Computable functions, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines (proofs not required). [5 L]

UNIT VIII
Computability Theory : Chomsky hierarchy of languages, linear bounded automata and context sensitive language, LR(0) grammar, decidability of, problems, Universal Turing Machine, undecidability of posts. Correspondence problem, Turing reducibility, Definition of P and NP problems, NP complete and NP hard problems. [4 L]

TEXT BOOKS :
1. "Introduction to Automata Theory Languages and Computation". Hopcroft H.E. and Ullman J. D.; Pearson Education.

2. "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson /PHI.

REFERENCES :
1. Introduction to Computer Theory, Daniel I.A. Cohen, John Wiley.
2. Introduction to languages and the Theory of Computation ,John C Martin, TMH
3. 4 Theory of Computer Science – Automata languages and computation -Mishra and Chandrashekaran, 2nd edition, PHI
5. Introduction to Theory of Computation –Sipser 2nd edition Thomson.

Object Oriented Programming & UML
Code: IT401
Contacts: 3L+1T
Credits: 4

Introduction [6 L]
Why object orientation, History and development of Object Oriented Programming language, concepts of object oriented programming language.

Object oriented design [12 L]
Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes- association, aggregation, using, instantiation, meta-class, grouping constructs.

Basic concepts of object oriented programming using Java [15 L]
Object, class, message passing, encapsulation, polymorphism, aggregation, threading, applet programming, difference between OOP and other conventional programming-advantages and disadvantages.

Fundamentals of Object Oriented design in UML [12 L]

Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram, UML extensibility-model constraints and comments, Note, Stereotype.

Text Books / References :

1. Ali Bahrami, - "Object –Oriented System Development" - Mc Graw Hill.
2. Rambaugh, James Michael, Blaha - "Object Oriented Modelling and Design" - Prentice Hall India
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" - Tata Mc graw Hill.
4. Page Jones, Meiler - "Fundamentals of object oriented design in UML"
5. Priestley: Practical Object Oriented Design using UML TMH
6. Roff: UML: A Beginner's Guide TMH
7. Rajaram: Object Oriented Programming and C++, New Age International
8. Mahapatra: Introduction to System Dynamic Modelling, Universities Press

Practical

Communication Skill & Report Writing
Code: HU481
Cr-2
Guidelines for Course Execution:

Objectives of this Course: This course has been designed:
1. **To inculcate a sense of confidence in the students.**
2. **To help them become good communicators both socially and professionally.**
3. **To assist them to enhance their power of Technical Communication.**

Detailed Course Outlines:

A. ***Technical Report Writing*** : 2L+6P

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. ***Language Laboratory Practice***

I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory

Practice Sessions 2L

2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P

a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed

b) Introducing Role Play & honing over all Communicative Competence

3. Group Discussion Sessions: 2L+6P

a) Teaching Strategies of Group Discussion

b) Introducing Different Models & Topics of Group Discussion

c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure

Interview Sessions; 2L+6P

a) Training students to face Job Interviews confidently and successfully

b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication

4. Presentation: 2L+6P

a) Teaching Presentation as a skill

b) Strategies and Standard Practices of Individual /Group Presentation

c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids

5. Competitive Examination: 2L+2P

a) Making the students aware of Provincial /National/International Competitive Examinations

b) Strategies/Tactics for success in Competitive Examinations

c) SWOT Analysis and its Application in fixing Target

Books – Recommended:

Nira Konar: English Language Laboratory: A Comprehensive Manual
PHI Learning, 2011

D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing
Pearson Education (W.B. edition), 2011

References:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency

A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)

B) Listening (Levels 1-4 Audio Cassettes/Handbooks)
Cambridge University Press 1998

Mark Hancock: English Pronunciation in Use
4 Audio Cassettes/CD'S OUP 2004

NUMERICAL METHODS
Code : M(CS) 491
Contacts : 2L
Credits :1

1. Assignments on Newton forward & backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Matrix inversion, Gauss-Jacobi, and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Bisection, Secant, Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Taylor series, Euler's, Runga-Kutta and Finite difference methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

Communication Engineering & Coding Theory
Code : CS 491
Contacts : 3L
Credits :2

Practical Designs & Experiments:
Module - 1: Generation of Amplitude Modulation (Design using transistor, or Balanced Modulator Chip)
Module - 2: Generation of FM using VCO chip (Example: IC566)
Module - 3: Generation of PAM
Module - 4: Generation of PWM & PPM (using IC 555 Timer)
Module - 5: Study of ASK, FSK, & BPSK.
Module 6 & 7: Any two experiments designed by the college.

Software Tools
Code : CS 492
Contacts : 3L
Credits :2

(To be implemented)

Object Oriented Programming & UML
Code: IT491
Contacts: 3
Credits: 2

1. Assignments on class, constructor, overloading, inheritance, overriding
2. Assignments on wrapper class, vectors, arrays
3. Assignments on developing interfaces- multiple inheritance, extending interfaces
4. Assignments on creating and accessing packages
5. Assignments on multithreaded programming, handling errors and exceptions, applet programming and graphics programming

Note: Use Java for programming.