Syllabus for B.Tech(Computer Science & Engineering) Up to Fourth Year

Revised Syllabus of B.Tech CSE (for the students who were admitted in Academic Session 2010-2011)

CSE

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	1	0	3	2
2	M401	Mathematics-3	3	1	0	4	4
3	CS401	Communication Engg & Coding Theory	2 1	0	0	3	3
4	CS402	Formal Language & Automata Theory	3	1	0	4	4
5	CS403	Computer Architecture	3	1	0	4	4
		Total of Theory				**18**	**17**
B.	**PRACTICAL**						
6	HU481	Technical Report Writing & Language	0	0	3	3	2
7	M(CS)491	Lab Practice	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	CS493	Computer Architectur	0	0	3	3	2
		Total of Practical				**14**	**9**
		Total of Semester				**32**	**26**

SEMESTER - IV

Theory

NUMERICAL METHODS
Code: M (CS) 401
Contacts: 2L+1T
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 Inter polation. (5)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. (3)

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

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

Numerical solution of ordinary differential equation: 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. Homeo morphic 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: 3L
Credits: 3

Module - 1**:** ***Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR*** **Analog-to-Digital Conversion**. (Basic ideas in brief) [8]

[Details: Introduction to Base Band transmission & Modulation (basic concept) ***(1L);*** Elements of Communication systems (mention of transmitter, receiver and channel); origin of noise and its effect, Importance of SNR in system design ***(1L);*** Basic principles of Linear Modulation (Amplitude Modulation) ***(1L);*** Basic principles of Non-linear modulation (Angle Modulation - FM, PM) ***(1L);*** Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing ***(1L);*** Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM ***(1L);*** Basic concept of Pulse Code Modulation, Block diagram of PCM ***(1L);*** Multiplexing - TDM, FDM ***(1L);***

Module - 2**: Digital Transmission:** [8]
[Details: Concept of Quantisation & Quantisation error, Uniform Quantiser ***(1L);*** Non-uniform Quantiser, A-law & law companding (mention only) ***(1L);*** Encoding, Coding efficiency ***(1L);*** Line coding & properties, NRZ & RZ, AMI, Manchester coding PCM, DPCM ***(1L);*** Baseband Pulse Transmission, Matched filter (mention of its importance and basic concept only), Error rate due to noise ***(2L);*** ISI, Raised cosine function, Nyquist criterion for distortion-less base-band binary transmission, Eye pattern, Signal power in binary digital signals ***(2L);***

Module - 3**: Digital Carrier Modulation & Demodulation Techniques:** [8]
[Details: Bit rate, Baud rate ***(1L);*** Information capacity, Shanon's limit ***(1L);*** M-ary encoding, Introduction to the different digital modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK ***(2L);*** Introduction to QAM, mention of 8QAM, 16 QAM without elaboration ***(1L);*** Delta modulation, Adaptive delta modulation (basic concept and importance only, no details ***(1L);*** introduction to the concept of DPCM, Delta Modulation, Adaptive Delta modulation and their relevance ***(1L);*** Spread Spectrum Modulation - concept only. ***(1L)***.

Module - 4**: Information Theory & Coding**: [8]
[Details: Introduction, News value & Information content ***(1L);***, Entropy ***(1L);***, Mutual information ***(1L);***, Information rate ***(1L);***, Shanon-Fano algorithm for encoding ***(1L);***, Shannon's Theorem - Source Coding Theorem ***(1L);***, Channel Coding Theorem, Information Capacity Theorem (basic understanding only) ***(1L);***; Error Control & Coding - basic principle only. ***(1L);***

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.

Learning Outcome: [These are the minimum competence to be developed; the students will be encouraged to learn more and acquire better understanding.]
Module -1: The student will be able to differentiate between base-band transmission and modulation and **compute antenna size** from knowledge of carrier frequency; (Tutorial: To identify different communication processes based on these two methods and appreciate their relative merit and demerit); The learner will be able to **determine the carrier and message frequencies** from the expression for AM signals and Angle modulated signals. Given an expression for a modulated signal, the student must be able to **recognize the type of modulation**. The ability to explain each and every block of the PCM system must be acquired.

Module -2: The student must be able to appreciate the importance of digital modulation over analog modulation in respect of noise immunity (concept); The student will be able to compute the coding efficiency of binary and decimal coding systems; The relative merits and demerits of the different digital modulation techniques to be understood clearly; (Tutorial: Students should be encouraged to find out where these different modulation techniques are used in everyday life); Capability to calculate signal power in digital systems to be mastered.

Module -3: Ability to compute bit rate and baud rate for different signals to be developed; the student must be able to compare between the channel capacity in case of channels of varying band-width and SNR value and predict the maximum data rate possible; The learner must be able to compare the merits and short comings of the basic digital modulation techniques. (Tutorial: Find out the area of application for each with reason for such application)

Module -4: Student will be able to calculate the information content, entropy and information rate for given situations; He/she will be able to appreciate the importance of the different line coding and error coding techniques. (Tutorial: Find out the range of applicability).

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

Prerequisites of Formal Language & Automata Theory:
Elementary discrete mathematics including the notion of set,function,relation,product,partial order,equivalence relation,graph& tree. They should have a thorough understanding of the principle of mathematical induction.

Module-1: [**13 L**]
Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model [2L]
Finite state machine: Definitions, capability & state equivalent, kth- equivalent concept [1L]
Merger graph, Merger table, Compatibility graph [1L]
Finite memory definiteness, testing table & testing graph. [1L]
Deterministic finite automaton and non deterministic finite automaton. [1L] Transition diagrams and Language recognizers. [1L]
Finite Automata: NFA with Î transitions - Significance, acceptance of languages. [1L]
Conversions and Equivalence: Equivalence between NFA with and without Î transitions. NFA to DFA conversion. [2L]

Minimization of FSM, Equivalence between two FSM's , Limitations of FSM [1L]
Application of finite automata, Finite Automata with output- Moore & Melay machine. [2L]

Learning outcome of Finite Automata:
The student will be able to define a system and recognize the behavior of a system. They will be able to minimize a system and compare different systems.

Module-2: **[8 L]**
Regular Languages : Regular sets. [1L]
Regular expressions, identity rules. Arden's theorem state and prove [1L]
Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L]
Pumping lemma of regular sets. Closure properties of regular sets (proofs not required). [1L]
Grammar Formalism: Regular grammars-right linear and left linear grammars. [1L]
Equivalence between regular linear grammar and FA. [1L]
Inter conversion, Context free grammar. [1L]
Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only) [1L]

Learning outcome of Regular Languages and Grammar:
Student will convert Finite Automata to regular expression. Students will be able to check equivalence between regular linear grammar and FA.

Module-3: **[9L]**
Context Free Grammars, Ambiguity in context free grammars.
[1L] Minimization of Context Free Grammars. [1L]
Chomsky normal form and Greibach normal form. [1L]
Pumping Lemma for Context Free Languages. [1L]
Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications [1L]
Push Down Automata: Push down automata, definition. [1L]
Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L]
Equivalence of CFL and PDA, interconversion. (Proofs not required). [1L]
Introduction to DCFL and DPDA. [1L]

Learning outcome of PDA and context free grammar:
Students will be able to minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They will be able to design Turing Machine.

Module-4: [6L]
Turing Machine : Turing Machine, definition, model [1L]
Design of TM, Computable functions [1L]
Church's hypothesis, counter machine [1L]
Types of Turing machines (proofs not required) [1 L]
Universal Turing Machine, Halting problem [2L]

Learning outcome of Turing Machine :
Students will be able to design Turing machine.

TEXT BOOKS:

"Introduction to Automata Theory Language and Compu tation", Hopcroft H.E. and Ullman J. D., Pearson Education.
"Theory of Computer Science ", Automata Languages a nd computation", Mishra and Chandrashekaran, 2 nd edition, PHI.
"Formal Languages and Automata Theory", C.K.Nagpal, Oxford

REFERENCES:

2.1 "Switching & Finite Automata", ZVI Kohavi, 2nd Edn ., Tata McGraw Hill
2.2 "Introduction to Computer Theory", Daniel I.A. Coh en, John Wiley
2.3 "Introduction to languages and the Theory of Comput ation", John C Martin, TMH
2.4 "Elements of Theory of Computation", Lewis H.P. & P apadimitrou C.H. Pearson, PHI.

Computer Architecture
Code: CS403
Contacts: 3L+1T
Credits: 4

Pre-requisite: Basic Electronics in First year, Introduction to Computing in second semester, Analog & Digital Electronics and Computer Organisation in Third semester.

Module – 1: [12 L]
Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L)
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)

Module – 2: [8L]
Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)

Module – 3: [6L]
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors. (6L)

Module – 4: [12 L]
Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L)

Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)

Learning Outcome:

This course is a formidable prerequisite for the course Operating System to be offered in the subsequent semester.
Text books:
[To be detailed]

Practical

Technical Report Writing & Language Lab Practice
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 Lab
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 and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runga-Kutta 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 (to view the wave shapes)
Module - 2: Generation of FM using VCO chip (to view the wave shapes)
Module - 3: Generation of PAM
Module - 4: Generation of PWM & PPM (using IC 555 Timer)

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

[Suggested; Feedback invited]

1. Introduction to Visual Basic/VC++ & difference with BASIC. Concept about form Project, Application, Tools, Toolbox,
   i. Controls & Properties. Idea about Labels, Buttons, Text Boxes.
   ii. Data basics, Different type variables & their use in VB,
   iii. Sub-functions & Procedure details, Input box () & Msgbox ().
   iv. Making decisions, looping
   v. List boxes & Data lists, List Box control, Combo Boxes, data Arrays.
   vi. Frames, buttons, check boxes, timer control,
   vii. Programming with data, ODBC data base connectivity.

viii. Data form Wizard, query, and menus in VB Applications,
ix. Graphics.

2. Case studies using any of the following items including relevant form design with the help of visual programming aids.
   a) Payroll accounting system.
   b) Library circulation management system.
   c) Inventory control system.
   d) University examination & grading system.
   e) Patient information system.
   f) Tourist information system.
   g) Judiciary information system.
   h) Flight reservation system.
   i) Bookshop automation software.
   j) Time management software.

Computer Architecture
Code : CS 492
Contacts : 3L
Credits :2

All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation. [Pre-requisite: The hardware based design has been done in the Analog & Digital Electronics laboratory and Computer Organisation laboratory]

1. HDL introduction
2. Basic digital logic base programming with HDL
3. 8-bit Addition, Multiplication, Division
4. 8-bit Register design
5. Memory unit design and perform memory operatons.
6. 8-bit simple ALU design
7. 8-bit simple CPU design
8. Interfacing of CPU and Mem