INDIAN INSTITUTE OF TECHNOLOGY PATNA

Programme: Bachelor of Technology in Computer Science & Engineering
Academic Year 2009-10 (Semester IV)

Fourth Semester		
HS2xx	HSS Elective	3-0-0-6
XX2xx	Science Elective	3-0-0-6
CS 204	Algorithms	3-0-0-6
CS 222	Computer Organization and Architecture	3-0-0-6
CS 223	Hardware Laboratory	0-0-3-3
CS 241	Software Engineering	2-0-3-7
CS 242	Systems Programming Laboratory	0-1-3-5
MA 225	Probability Theory and Random Processes	3-1-0-8
	Total L-T-P-C	**17-2-9-47**

Programme: Bachelor of Technology in Electrical Engineering
Academic Year 2009-10 (Semester III)

Fourth Semester		
HS 2xx	HSS Elective	3-0-0-6
XX 2xx	Science Elective	3-0-0-6
EE 203	Analog Integrated Circuits	3-0-0-6
EE 204	Analog Circuits Laboratory	0-0-3-3
MA 225	Probability and Random Processes	3-1-0-8
EE 230	Principles of Communication	3-1-0-8
EE 280	Electrical Machines	3-0-0-6
EE 281	Electrical Machines Laboratory	0-0-3-3
	Total L-T-P-C	**18-2-6-46**

Programme: Bachelor of Technology in Mechanical Engineering
Academic Year 2009-10 (Semester IV)

Fourth Semester		
HS2xx	HSS Elective	3-0-0-6
XX2xx	Science Elective	3-0-0-6
EE280	Electrical Machines	3-0-0-6
ME202	Engineering Materials	3-0-0-6
ME 203	Advanced Solid Mechanics	2-1-0-6
ME 206	Fluid Mechanics II	2-1-0-6
EE281	Electrical Machines Laboratory	0-0-3-3
ME 210	Workshop-II	0-0-6-6
ME 212	Mechanical Engineering Laboratory I	0-0-4-4
	Total L-T-P-C	**16-2-13-49**

Detailed Syllabi for B.Tech. fourth semester 2009-10

B.Tech. in Computer Science and Engineering

CS 204 ALGORITHMS (3 0 0 6)

Pre-requisites: CS201, CS203

Models of Computation: Turing machines and random access machines, space and time complexity measures, lower and upper bounds. Design and analysis techniques: the greedy method, divide-and-conquer, dynamic programming, backtracking, branch and bound, amortized analysis. Priority Queues: lists, heaps, binomial heaps, Fibonacci heaps. Sorting and order statistics: sorting algorithms (insertion-sort, bubble-sort, shell-sort, quicksort, merge-sort, heapsort and external-sort) and their analyses, selection. Graph Algorithms: connectivity, biconnectivity, topological sort, shortest paths, minimum spanning trees, maximum flow. Advanced topics: the disjoint set union problem; string matching; NP-completeness; geometric, approximation, parallel, and randomized algorithms.

Texts:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, *Introduction to Algorithms*, MIT Press, 2001.

References:

1. A. Aho, J. E. Hopcroft and J. D. Ullman, *The Design and Analysis of Computer Algorithms*, Addison-Wesley, 1974.
2. S. Sahni, *Data Structures, Algorithms and Applications in C++,* McGraw-Hill, 2001.
3. M. T. Goodrich and R. Tamassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, John Wiley & Sons, 2001.

CS 222 COMPUTER ORGANIZATION AND ARCHITECTURE (3 0 0 6)

Pre-requisites: CS221

Memory organization: hierarchical memory systems, cache memories, cache coherence, virtual memory. System buses: interconnection structures and bus interconnection. Arithmetic Logic Unit. Study of an existing CPU: architecture, instruction set and the addressing modes supported; assembly language programming. Control unit Design: instruction interpretation, hardwired and microprogrammed methods of design. RISC and CISC paradigms. I/O Transfer techniques: programmed, interrupt-driven and DMA; I/O processors and channels, mapping of I/O addresses. Advanced architectures: parallel and pipelined systems, dataflow, hypercubes, superscalar processors.

Texts:

1. A. Tenenbaum, *Structured Computer Organization*, 4th Ed, Prentice-Hall of India, 1999.
2. W. Stallings, *Computer Organization and Architecture: Designing for Performance*, 6th Ed, Prentice Hall, 2005.

References:

1. J. Hennessy and D. Patterson, *Computer Architecture A Quantitative Approach*, 3rd Ed, Morgan Kaufmann, 2002.

CS 223 HARDWARE LABORATORY (0 0 3 3)

Pre-requisites: CS221

Design of synchronous and asynchronous sequential circuits. Digital system design using RTL level functional blocks. Design of various controllers using hardwired and/or microprogrammed techniques. Design of a CPU using SSI/MSI/LSI level components: choice of word size, instruction format, I/O and memory interface, datapath, control unit. Introduction to hardware description languages such as VHDL, Verilog, etc.

References:

1. Analog and digital data manuals.

CS 241 SOFTWARE ENGINEERING (2 0 3 7)

Pre-requisites: CS201

The software life cycle, nature and qualities of software, software engineering principles. Software project management: planning, scheduling, monitoring, control, risk management. Requirements specification: specification styles (informal, formal), operational and descriptive specifications. Software Design: function-oriented and object-oriented approaches; architectural, component-level and user-Interfaces design; structured programming and implementation. Verification: testing (strategies and techniques), formal methods, validation. Advanced topics: maintenance, reengineering, product metrics. Software Engineering tools and environments. Use of some software engineering packages in laboratory assignments.

Texts:

1. R. S. Pressman, *Software Engineering: A Practioner's Approach*, 5th Ed, McGraw-Hill, 2001.

References:

1. I. Sommerville, *Software Engineering*, 7th Ed, Addison-Wesley, 2005.
2. C. Ghezzi, M. Jazayeri and D. Mandrioli, *Fundamentals of Software Engineering*, 2nd Ed, Prentice Hall of India, 2003.

CS242 SYSTEMS PROGRAMMING LABORATORY (0 1 3 5)

Pre-requisites: CS201

Linux administration: basic utilities, make, logging, backup, authentication; PERL programming; Unix system calls and shell programming; electronic mail administration; assemblers, linkers and loaders; assembly language programming; introduction to LaTeX.

References:

1. E. Nemeth, G. Snyder and T. R. Hein, *Linux Administration Handbook,* Prentice Hall PTR, 2002.
2. L. Wall, T. Christainsen and J. Orwant, *Programming PERL*, 3rd Ed, O'Reilly, 1999.
3. B. Kauler, *Windows assembly language & Systems Programming: 16- And 32-Bit Low-Level Programming for the PC and Windows*, 2nd Ed, CMP Books; August 1997.
4. D. Curry, *UNIX Systems Programming for SVR4*, O'Reilly, 1996.
5. S. Kochan and P. Wood, *Unix Shell programming*, 3rd Ed, SAMS, 2003.
6. S. Das, *Unix System V.4 Concepts and Applications*, 3rd Ed, Tata Mcgraw-Hill, 2003.
7. *Linux Manuals*.
8. A. Rubini and J. Corbet, *Linux Device Drivers*, 2nd Ed, O'Reilly, 2001.

Course common to CSE and EE

MA225 PROBABILITY THEORY AND RANDOM PROCESSES [3-1-0-8]

Prerequisites: Nil

Axiomatic construction of the theory of probability, independence, conditional probability, and basic formulae, random variables, probability distributions, functions of random variables; Standard univariate discrete and continuous distributions and their properties, mathematical expectations, moments, moment generating function, characteristic functions; Random vectors, multivariate distributions, marginal and conditional distributions, conditional expectations; Modes of convergence of sequences of random variables, laws of large numbers, central limit theorems.

Definition and classification of random processes, discrete-time Markov chains, Poisson process, continuous-time Markov chains, renewal and semi-Markov processes, stationary processes, Gaussian process, Brownian motion, filtrations and martingales, stopping times and optimal stopping.

Texts:

1. G. R. Grimmett and D. R. Stirzaker, Probability and Random Processes, Oxford University Press, 2001.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2000.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Edition, Wiley, 1968.
4. K. S. Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, Prentice Hall of India, 1998.
5. A. Papoulis and S. Unnikrishna Pillai, Probabilities, Random Variables and Stochastic Processes, 4th Edition, Tata McGraw-Hill, 2002.
6. S.M. Ross, Stochastic Processes, 2nd Edition, Wiley, 1996.
7. J. Medhi, Stochastic Processes, New Age International, 1994.

B.Tech. in Electrical Engineering

EE 203 ANALOG INTEGRATED CIRCUITS 3-0-0-6

Frequency response of amplifiers: high frequency device models, frequency response, GBW, methods of short circuit and open circuit time constants, dominant pole approximation; Feedback amplifiers: basic feedback topologies and their properties, analysis of practical feedback amplifiers, stability; Power amplifiers: class A, B, AB, C, D, E stages, output stages, short circuit protection, power transistors and thermal design considerations; Differential amplifiers: DC and small signal analysis, CMRR, current mirrors, active load and cascode configurations, frequency response; case study: 741 op-amp – DC and small signal analysis, frequency response, frequency compensation, GBW, phase margin, slew rate, offsets; CMOS realizations: current source, sink and mirrors, differential amplifiers, multistage amplifiers; Signal generation and waveform shaping: sinusoidal oscillators- RC, LC, and crystal oscillators, Schmitt trigger; Analog subsystems: analog switches, voltage comparator, voltage regulator, switching regulator, bandgap reference voltage source, analog multiplier, filter approximations: Butterworth, Chebyshev and elliptic**,** first order and second order passive/active filter realizations.

Texts:

1. S. Smith, "Microelectronics Circuits", 5/e, Oxford, 2005
2. P. Gray, P. Hurst, S. Lewis, and R. Meyer, "Analysis & Design of Analog Integrated Circuits," 4/e, Wiley, 2001.

References:

1. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill 2001.
2. D. Johns, K. Martin, "Analog Integrated Circuit Design," Wiley, 1997.
3. R. A. Gayakwad, Op-Amps and Linear Integrated Circuit, Prentice Hall of India, 2002.
4. B. Razavi, RF Microelectronics, Prentice-Hall, 1998.
5. P. E. Allen and D. R. Holberg, CMOS Analog Circuit Design, 2/e, Oxford University Press, 1997.

EE 204 ANALOG CIRCUITS LABORATORY 0-0-3-3

Experiments using BJTs, FETs, op-amps and other integrated circuits: Multistage amplifiers, automatic gain controlled amplifiers, programmable gain amplifiers; frequency response of amplifiers; voltage regulator with short circuit protection; phase-locked loop; waveform generators; filters.

Text/References:

1. A. P. Malvino, Electronic Principles, Tata McGraw-Hill, 1993.
2. R. A. Gayakwad, Op-Amps and Linear Integrated Circuits, Prentice Hall of India, 2002.

EE 230 PRINCIPLES OF COMMUNICATION 3-1-0-8

Basic blocks in a communication system: transmitter, channel and receiver; baseband and passband signals and their representations; concept of modulation and demodulation. Continuous wave (CW) modulation: amplitude modulation (AM) - double sideband (DSB), double sideband suppressed carrier (DSBSC), single sideband suppressed carrier (SSBSC) and vestigial sideband (VSB) modulation; angle modulation - phase modulation (PM) & frequency modulation (FM); narrow and wideband FM. Pulse Modulation: sampling process; pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) ; pulse code modulation (PCM); line coding; differential pulse code modulation; delta modulation; adaptive delta modulation. Noise in CW and pulse modulation systems: Receiver model; signal to noise ratio (SNR); noise figure; noise temperature; noise in DSB-SC, SSB, AM & FM receivers; pre-emphasis and de-emphasis, noise consideration in PAM and PCM systems. Basic digital modulation schemes: Phase shift keying (PSK), amplitude shift keying (ASK), frequency shift keying (FSK) and Quadrature amplitude modulation (QAM); coherent demodulation and detection; probability of error in PSK, ASK, FSK & QAM schemes. Multiplexing schemes: frequency division multiplexing; time division multiplexing.

Texts:

1. J. G. Proakis and M. Salehi, Communication system engineering, 2/e, Pearson Education Asia, 2002.
2. R. E. Ziemer, W. H. Tranter, Principles of Communications: Systems, Modulation, and Noise, 5/e, John Wiley & Sons, 2001.
3. Simon Haykin, Communication Systems, 4/e, John Wiley & Sons, 2001.

References:

1. K. Sam Shanmugam, Digital and Analog Communication Systems, John Wiley and Sons, 1979.

2. A. B. Carlson, Communication Systems,3/e, McGraw Hill, 1986.
3. B. P. Lathi, Modern Analog and Digital Communication systems, 3/e, Oxford University Press, 1998.
4. H. Taub and D. L. Schilling, Principles of Communication Systems, 2/e, McGraw Hill, 1986.

EE 280 ELECTRICAL MACHINES 3-0-0-6

Magnetic circuits and transformer including 3-phase transformers; modeling of D.C. machines; phasor diagram of cylindrical rotor and salient pole machines- electromagnetic and reluctance torque, response under short circuit conditions; modeling of induction machines- derivation of equivalent circuits, dynamics under load change, speed reversal and braking, unbalanced and asymmetrical operation; single phase induction motor and applications in domestic appliances; modeling of synchronous machines – equivalent circuit, d-q transformations, short circuit studies in synchronous machines; variable reluctance, permanent magnet, stepper motors and their applications.

Texts:

1. S. Chapman, Electric Machinery Fundamentals, McGraw-Hill, 4/e, 2003.
2. A. E. Fitzgerald, C. Kingsley, Jr. and S. D. Umans, Electric Machinery, 6/e, Tata McGraw-Hill, 2003.

References:

1. I. L. Kosow, Electrical Machinery and Transformers, 2/e, Prentice- Hall of India Pvt. Ltd., 2003.
2. D. P. Kothari and I. J. Nagrath, Electric Machines, 3e, Tata McGraw-Hill, 2004.
3. B. S. Guru and H. R. Hiziroglu, Electrical Machinery and Transformers, 3/e, Oxford University Press, 2003.
4. R. K. Rajput, Electrical Machines, 3/e, Laxmi Publications (P) Ltd., 2003.

EE 281 ELECTRICAL MACHINES LABORATORY 0-0-3-3

Open circuit and short circuit tests of single phase transformer, three phase transformer connections, open circuit test and load characteristics of DC generator, speed control and output characteristics of DC motor, no load, blocked rotor and load tests on induction motor, open circuit and short circuit tests of an alternator.

Text/References:

1. Stephen Chapman, Electric Machinery Fundamentals, 4/e, McGraw-Hill, 2003.
2. C. S. Indulkar, Laboratory Experiments in Electrical Power Engineering, Khanna Publishers, 2003.

B.Tech. in Mechanical Engineering

ME202 ENGINEERING MATERIALS (3 0 0 6)

Pre-requisites: Nil

Crystal systems and lattices. Crystallography, crystals and types, miller indices for directions and planes, voids in crystals, packing density in crystals.
Crystal imperfections: point defects, line defects, surface defects. Characteristics of dislocations, generation of dislocations. Bonds in solids and characteristics of Metallic bonding, Deformation mechanisms and Strengthening mechanisms in structural materials.
Phase diagrams: Principles and various types of phase diagrams. Iron carbon phase diagrams.
Principles of solidifications: Structural evaluation during solidification of metals and alloys. Heat treatment of steels and CCT diagrams: Pearlitic, martensitic, bianitic transformation in steel during heat treatment.
Hot working and cold working of metals: recovery, re-crystallization and grain growth. Fracture, Fatigue and creep phenomenon in metallic materials. General classifications, properties and applications of alloy steels, tool steels, stainless steels, cast irons.
Non ferrous materials like copper base alloys, aluminium base alloys, Nickel base alloys, etc.,
Miscellaneous materials viz: composites, ceramics, etc.

Texts and References:

1. William D. Callister, *Material science and Engineering and Introduction*, Wiley, 2006.
2. V. Raghavan, *Materials Science and Engineering,* Fifth Edition, Prentice Hall Of India, 2008.
3. G. E. Dieter, *Mechanical Metallurgy*, McGraw Hill, 1988.
4. W. F. Smith, Materials Science and Engineering (SIE), Tata-McGraw Hill, 2008.
5. AVNER, Introduction to Physical Metallurgy, Tata-McGraw Hill, 2008.

ME-203 ADVANCED SOLID MECHANICS (2-1-0-6)

Uniqueness of solution, Plane stress and plane strain problems, Airy's stress function. 2-D problems in polar coordinates: Thin and thick walled cylinder, Rotating disks and cylinders, Plate with circular hole, Venant's semi-inverse method, Conjugate function method, Prandtl stress function, Complex function method, Polynomial and Fourier series solutions. Elliptical and triangular shaft, shaft with cutout, rectangular shaft, Membrane analogy, narrow rectangular shaft, Hydrodynamical Saint Venants principle, Torsion of non-circular bars: Saint analogy, hollow shafts, thin tubes. Curved beam, Vertical loading on straight boundary. 2-D problems in rectangular coordinates: Cantilever with end load, uniformly loaded beam. Unsymmetrical bending: pure bending of prismatic and composite beams, bending due to terminal load, determination of shear center, bars with rectangular and elliptic sections, transverse shear - 1D shear flows. Contact Stresses, Geometry of contact surface, methods of computing contact stress, deflection of bodies in point contact and line contact with normal load, Stress Concentration. Comparison of stresses and strain energies due to bending and shear. Elastic stability: Buckling of straight and bent beam-columns. Introduction to plate theory (Kirchhoff's theory).

Texts/Reference:

1. A. P. Boresi, R. J. Schmidt and O. M. Sidebottom, *Advanced Mechanics of Materials*, 6e, John Wiley, 2002.
2. A. C. Ugural and S. K. Fenster, *Advanced Strength and Applied Elasticity*, 4e, Prentice Hall, 2003.
3. S. P. Timoshenko and J. N. Goodier, *Theory of Elasticity*, 3e, McGraw Hill International, 1970.
4. I.S. Sokolnikoff ,*Mathematical Theory of Elasticity*, 2e, McGraw-Hill, 1956.
5. Y.C. Fung*, Foundations of Solid Mechanics*, Prentice-Hall, 1965.
6. E. P. Popov*, Engineering Mechanics of Solids*, 2e, Prentice Hall, 1998.
7. I. H. Shames, *Introduction to Solid Mechanics*, 3e, Prentice Hall, 1999.
8. S. C. Crandall, N. C. Dahl, and T. J. Lardner*, An Introduction to the Mechanics of Solids*, 2e, McGraw Hill, 1999.
9. S. P. Timoshenko, *Strength of Materials*, vols. 1 & 2, CBS publ., 1986.

ME206 FLUID MECHANICS-II (2 1 0 6)

Pre-requisites: ME204 Fluid Mechanics-I

Review: Viscous flow and boundary layer theory, flow separation, turbulence.
Compressible flow:
The speed of sound; Adiabatic and isentropic steady flow - Mach-number relations, Isentropic flow with area changes; Normal-shock wave - Rankine-Hugoniot relations; Mach waves, oblique shock wave, Prandtl Meyer expansion waves; Performance of nozzles; Fanno and Rayleigh flow.
Fluid Machinery:
Euler-equation for turbo-machines; **Turbines:** Impulse turbine- Pelton wheel; Reaction turbine- Francis turbine, propeller turbine; **Pumps:** Centrifugal pump; Cavitation; Net positive suction head (NPSH); Role of dimensional analysis and similitude; Performance parameters and characteristics of pumps and turbines; Positive displacement pumps.

Texts and References

1. Frank M. White, 1999, *Fluid Mechanics*, 4e, McGraw-Hill.
2. John D. Anderson, Jr., 1990*, Modern Compressible Flow*, 2e, McGraw-Hill.
3. B.R. Munson, D.F. Young, T.H. Okiishi, 2002, *Fundamentals of Fluid Mechanics*, 4e, John Wiley.
4. R.W. Fox and A.T. McDonald, 1998, *Introduction to Fluid Mechanics*, 5e, John Wiley.
5. J.F. Douglas, J.M. Gasiorek, and J.A. Swafield, 2003, *Fluid Mechanics*, 4e, Pearson Education.
6. S.M. Yahya, 2003, Fundamentals of Compressible flow, 3rd Ed., New Age International Pvt Ltd
7. Balachandran P., 2009, Fundamentals Of Compressible Fluid Dynamics, PHI
8. Terry White, 1999, Fluid Machinery: Performance, Analysis, And Design, CRC Press.
9. B.C.S. Rao, 2008, Fluid Mechanics and Machinery, TMH
10. Round G.F., 2004, Incompressible Flow Turbomachines: Design, Selection, Applications, and Theory, Butterworth-Heinemann

ME210 WORKSHOP II (0 0 6 6)

Pre-requisites: Nil

Introduction to moulding and foundry practices
Introduction to machine tools and machining processes; types of cutting tools; selection of machining process parameters; machining operations on lathe, shaping, milling, drilling, grinding machines.
Modern manufacturing trends: CNC and CAM; Introduction to gas and arc welding processes

Texts:

1. Hajra Choudhury, Hajra Choudhury and Nirjhar Roy*, Elements of Workshop Technology*, 12th Ed, Vol. 1 & 2, Media Promoters & Publishers Pvt. Ltd. 2007.
1. W. A. J. Chapman, *Workshop Technology*, Part I, II & III, Viva Books Private Ltd, 2004.
2. P N Rao, *Manufacturing Technology*, 3rd Ed, Vol.1 &2, New Age Tata McGraw-Hill, 2009.
3. J P Kaushish, *Manufacturing Processes, Eastern Economy Edition,* Prentice Hall of India, 2008.
4. M P Grover, *Automation, Production system and Computer Integrated Manufacturing*, 2nd Edition, Prentice Hall of India, 2008.

ME-212 MECHANICAL ENGINEERING LABORATORY – I (0 0 4 4)

Strength of materials: Tensile testing of steel, hardness, torsion, and impact testing;
Fluid Mechanics and hydraulics: Flow through restrictive passages like orifice, venturi, weirs and notches, head losses in piping systems.
Data acquisition: Using data acquisition systems, programming a virtual instrument using standard interfaces.

HSS Electives

B.Tech Elective in Economics

HS 202 INTRODUCTORY MACROECONOMICS 3 0 0 6

Introduction: Alternative Economic Systems, Government and the Markets, Supply and Demand in Macroeconomics, Aggregate Demand and Supply, Macroeconomic Issues: Measuring the Economy, Economic Growth, Macroeconomics and Income, Aggregate Expenditures, Fiscal Policy, Inflation, Unemployment and Employment, Money and Banking: Money Creation, Monetary Policy, Role of Money in Macroeconomics, Commercial and Central Bank **,**International Trade**:** International Trade, Trade and International Currency, Balance of payments and exchange rate, Exchange Rates and Their Effects

Text

1. P. A. Samuelson and W. Nordhaus , *Economics*, Tata M.Hill, 2005
2. M.L. Jhingan, *Macroeconomic Theory,* Konark Publishers Pvt. Ltd, 2008

References

1. A. B. Abel, B.S. Bernanke, *Macroeconomics*, Addison Wesley, 2000
2. P.R. Krugman & M. Obstfeld*, International Economics: Theory and Policy,* Pearson Education (Singapore) Indian branch,Delhi,2008

B. Tech Elective in English

HS211 LITERATURE: VOICES AND CULTURES 3-0-0-6

Identity and diversity of culture, Concepts - ideology, power, hegemony. The voice of suppressed women in Charlotte Bronte's '*Jane Eyre*', the appearance of the independent woman in '*Jane Eyre*', woman-woman relationship in '*Kamala*', challenging patriarchy in '*Kamala*', Violence and Racism in Alice Walker's '*The Colour Purple*', Disruption of traditional roles in '*The Colour Purple*', The voice of the underdogs in '*Untouchable*', the female voice in '*Untouchable*', laws and human behaviour in '*The God of Small Things*', hierarchies in 'Indian Society' in '*the God of Small Things*', the voice of the Black women in Phillis Wheatley's '*On Being Brought from Africa to America*' and A. Ruth's '*A Black Woman, Nothing Else'*, the voice of the powerless in Langston Hughes '*Ballad of the Landlord*'.

Text

1. Charlotte Bronte,*Jane Eyre*, Macmillan India, 2000
2. Krupabai Satthianadhan, *Kamala*, OUP, 1998
3. Alice Walker,*The Colour Purple*, Houghton Miffin Harcourt, 2006
4. Mulk Raj Anand, *Untouchable*, Penguin Classics, 1990
5. Arundhati Roy, *The God of Small Things*, Penguin, 2002
6. Phillis Wheatley,*On Being Brought From Africa to America*. (Phillis Wheatley, *Poems on Various Subjects, Religious and Moral* (London: by A. Bell, for Cox and Berry, Boston, 1773): 18)
7. A.Ruth, *A Black Woman*, *Nothing Else*, Author's Den, 2002
8. Hughes Langston, *Ballad of the Landlord*, The Langston Hughes Reader, George Braziller, New York, 1958

(The poems mentioned shall be provided in the class)

Reference

1. Meenakshi Mukherjee, *Elusive Terrain: Culture and Literary Memory*, OUP, New Delhi, 2008
2. Malashri Lal,*Signifying the Self – Women and Literature*, Macmillan India, New Delhi, 2004
3. Sachchidanand Mohanty, *Gender and Cultural Identity*, Orient Black Swan, New Delhi, 2008
4. Nandy Bhatia,*Acts of Authority/ Acts of Resistance*, OUP, 2004
5. N Krishnaswamy, *Contemporary Literary Theory*, Macmillan, New Delhi, 2005

B. Tech Elective in Linguistics

HS 222 LANGUAGE, HUMAN MIND, AND INDIAN SOCIETY 3-0-0-6

Language: Form and function (Competence vs. Performance), Language as a rule-governed system, Language constitutive of being human; Languages of India: Language families (Genealogical classification of languages), India as a linguistic Area; Human mind: Cognitive language faculty, Biological foundations of language, Language acquisition, Human and non-human systems of communication, Construction of knowledge, Language processing, comprehension and production, Bilingualism and cognitive growth; Indian Society: Multilingualism vs. Bilingualism, India as a multilingual nation, Identities and language, Implications for pedagogy (Multilingual approaches to education), Language and dialect, Politics of language in India

Texts

M. Montgomery, *An introduction to language and society*, Routledge, 1986
N.Chomsky, *Language and Mind,* Cambridge University Press, 2006
V. Evans and M.C. Green, *Cognitive linguistics: an introduction,* Edinburgh University Press, 2006

References:

J.R. Searle, *Mind, language and society: philosophy in the real world*, Basic Books, 1999
A. Akmajian , R.A. Demers, A.K. Farmer, R.M. Harnish, *Linguistics: an introduction to language and communication*, Mass: MIT Press, 2001
N.Chomsky, *New horizons in the study of language and mind* Cambridge University Press, 2000
W. Corft and D. Alan Cruse, *Cognitive linguistics* Cambridge University Press, 2004

B. Tech Elective in Linguistics

HS 223 COGNITION: LANGUAGE AND COMPUTATION 3-0-0-3

Language: Study of language as a rule governed system (Structure of Language), Acquisition of language, Universal Grammar, Knowledge of Language; Cognitive Science: Introduction, Study of Human Mind, Language and Human Mind, Language as a Cognitive Behavior; Cognitive Computation: Formal Models of Computation, Church-Turing Thesis, Chomsky/Machine Hierarchy; Human Cognition as Computation: Cognitive Architecture, Production System Architecture, Problem Spaces, Protocol Analyses; Artificial Intelligence and the Design of Intelligent Systems: Physical Symbol System Hypothesis, Representation and Semantics, General Models of Search, Knowledge & Search, Computational Limits and Rationality.

Texts

N. Chomsky, *New horizons in the study of language and mind*, Cambridge University Press, 2000
N. Chomsky, *Knowledge of language: its nature, origin, and use Convergence* Greenwood Publishing Group, 1986
P. Thagard, *Mind: Introduction to Cognitive Science*, MIT Press, 2005
W. Croft and D.A. Cruse, *Cognitive linguistics*, Cambridge University Press, 2004
S. Jonathan Russell *Artificial intelligence: a modern approach,* Prentice-Hall Of India Pvt. Ltd., 2008
R. Morelli, W .Miller Brown, D. Anselmi, K. Haberiandt, and D Lloyd (Eds.) *Minds, Brains and Computers: Perspectives in Cognitive Science and Artificial Intelligence*, Intellect Books, 1992

References

W. Bechtel, G. Graham (Eds.) , *A Companion to Cognitive Science,* Wiley-Blackwell, 1999
J. Friedenberg and G. Silverman, *Cognitive Science: An Introduction to the Study of Mind*, SAGE, 2005
J .P. Heuristics, Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley Pub. Co., 1984

Science Elective

MA-251 OPTIMIZATION TECHNIQUES (3-0-0-6)

Introduction to linear and non-linear programming. Problem formulation. Geo- metrical aspects of LPP, graphical solution. Linear programming in standard form, simplex, Big M and Two Phase Methods. Revised simplex method, special cases of LP. Duality theory, dual simplex method. Sensitivity analysis of LP problem. Transportation, assignment and traveling salesman problem.
Integer programming problems-Branch and bound method, Gomory cutting plane method for all integer and for mixed integer LP.
Theory of games: Computational complexity of the Simplex algorithm, Karmarkar's algorithm for LP.
Unconstrained Optimization, basic descent methods, conjugate direction and New-
ton's methods. Acquaintance to Optimization softwares like TORA.

Texts

1. Hamdy A. Taha, Operations Research: An Introduction, Eighth edition, PHI, New Delhi (2007).
2. S. Chandra, Jayadeva, Aparna Mehra, Numerical Optimization with Applications, Narosa Publishing House (2009).
3. A. Ravindran, Phillips, Solberg, Operation Research, John Wiley and Sons, New York (2005).
4. M. S. Bazaraa, J. J. Jarvis and H. D. Sherali, Linear Programming and Network Flows, 3rd Edition, Wiley (2004).

References

1. D. G. Luenberger, Linear and Nonlinear Programming, 2nd Edition, Kluwer,
2003. S. A. Zenios (editor), Financial Optimization, Cambridge University
Press (2002).
2. F. S. Hiller, G. J. Lieberman, Introduction to Operations Research, Eighth
edition, McGraw Hill (2006).

MA214 INTRODUCTION TO COMPUTATIONAL TOPOLOGY 3-0-0- 6

1. Introduction and general notions of point set topology : Open and Closed Sets, Neighbourhoods, Connectedness and Compactness, Separation, Continuity.

2. An overview of topology and classification of surfaces : Surfaces – orientable and non-orientable, their topology, classification of closed suraces

3. Combinatorial Techniques : Simplicial complexes, and simplicial maps, triangulations, Euler characteristics, Maps on surfaces.

4. Homotopy and Homology Groups: Introducing Groups and concept of Homotopy, fundamental group and its calculations, Homology.

5. Calculating Homology : Computation of homology of closed surfaces.

6. Topics in Geometry : Delauny triangulations, Voronoi diagrams, Morse functions

Textbooks:

1. Afra Zomordian: Topology for Computing, CUP, 2005
2. H. Edelsbrunner and J. Harer. Computational Topology. An Introduction. Amer. Math. Soc., Providence, Rhode Island, 2009
3. J. J. Rotman: An introduction to Algebraic Topology, GTM- 119, Springer, 1998

Reference Books:

1. Tomasz K., K. Mischaikow and M. Mrozek, Computational Homology, Springer, 2003
2. H.Edelsbrunner, Geometry and Topology for Mesh Generation, CUP, 2001
3. D. Kozlov, Combinatorial Algebraic Topology, Springer, 2008
4. V. A. Vassiliev, Introduction to Topology, AMS, 2001
5. R. Messer and P. Straffin, Topology Now, MAA, 2006

CH 201 GREEN CHEMISTRY AND TECHNOLOGY (3-0-0-6)

Principles and Concepts of Green Chemistry: Sustainable development, atom economy, reducing toxicity. Waste: production, problems and prevention, sources of waste, cost of waste, waste minimization technique, waste treatment and recycling. Catalysis and Green Chemistry: Classification of catalysts, heterogeneous catalysts heterogeneous catalysis, biocatalysis. Alternate Solvents: Safer solvents, green solvents, water as solvents, solvent free conditions, ionic liquids, super critical solvents, fluorous biphase solvents. Alternative Energy Source: Energy efficient design, photochemical reactions, microwave assisted reactions, sonochemistry and electrochemistry. Industrial Case Studies: Greening of acetic acid manufacture, Leather manufacture (tanning, fatliquoring), green dyeing, polyethylene, ecofriendly pesticides, paper and pulp industry, pharmaceutical industry. An integrated approach to green chemical industry.

Text :

1. V. K. Ahluwalia, *Green Chemistry: Environmentally Benign Reactions,* Ane Books India, New Delhi, 2006.
2. M. M. Srivastava, R. Sanghi, , *Chemistry for Green Environment*, Narosa, New Delhi, 2005.

Reference:

1. P. T. Anastas and J.C. Warner, *Green Chemistry, Theory and Practice* Oxford, 2000.
2. M. Doble and A. K. Kruthiventi, *Green Chemistry and Engineering*, Academic Press, Amsterdam, 2007.
3. Mike Lancaster, Green Chemistry: An Introductory Text, Royal Society of Chemistry, 2002.
4. R.E. Sanders, *Chemical Process Safety: Learning from Case Histories*, Butterworth Heinemann, Boston, 1999.

INTRODUCTION TO NUMERICAL METHODS (3 - 0 - 0 - 6)

Number Representation and Errors: Numerical Errors; Floating Point Representation; Finite Single and Double Precision Differences; Machine Epsilon; Significant Digits.

Numerical Methods for Solving Nonlinear Equations: Method of Bisection, Secant Method, False Position, Newton-Raphson's Method, Multidimensional Newton's Method, Fixed Point Method and their convergence.

Numerical Methods for Solving System of Linear Equations: Norms; Condition Numbers, Forward Gaussian Elimination and Backward Substitution; Gauss-Jordan Elimination; FGE with Partial Pivoting and Row Scaling; LU Decomposition; Iterative Methods: Jacobi, Gauss Siedal; Power method and QR method for Eigen Value and Eigen vector.

Interpolation and Curve Fitting: Introduction to Interpolation; Calculus of Finite Differences; Finite Difference and Divided Difference Tables; Newton-Gregory Polynomial Form; Lagrange Polynomial Interpolation; Theoretical Errors in Interpolation; Spline Interpolation; Approximation by Least Square Method.

Numerical Differentiation and Integration: Discrete Approximation of Derivatives: Forward, Backward and Central Finite Difference Forms, Numerical Integration, Simple Newton-Cotes Rules: Trapezoidal and Simpson's (1/3) Rules; Gaussian Quadrature Rules: Gauss-Legendre, Gauss-Laguerre, Gauss-Hermite, Gauss-Chebychev.

Numerical Solution of ODE & PDE: Euler's Method for Numerical Solution of ODE; Modified Euler's Method; Runge-Kutta Method (RK2, RK4), Error estimate; Multistep Methods: Predictor-Corrector method, Adams-Moulton Method; Boundary Value Problems and Shooting Method; finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations.

Exposure to software package MATLAB.

Texts

1. K. E. Atkinson, Numerical Analysis, John Wiley, Low Price Edition (2004).

2. S. D. Conte and C. de Boor, Elementary Numerical Analysis - An Algorithmic Approach, McGraw-Hill, 2005.

References

1. J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, 2nd Edition, Texts in Applied Mathematics, Vol. 12, Springer Verlag, 2002.

2. J. D. Hoffman, Numerical Methods for Engineers and Scientists, McGraw-Hill, 2001.

3. M.K Jain, S.R.K Iyengar and R.K Jain, Numerical methods for scientific and engineering computation (Fourth Edition), New Age International (P) Limited, New Delhi, 2004.

4. S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill 2008.

MA212 Algebra and Number Theory (3-0-0-6)

Algebra: Semigroups, groups, subgroups, normal subgroups, homomorphisms, quotient groups, isomorphisms. Examples: group of integers modulo m, permutation groups, cyclic groups, dihedral groups, matrix groups. Sylow's theorems and applications. Basic properties of rings, units, ideals, homomorphisms, quotient rings, prime and maximal ideals, fields of fractions, Euclidean domains, principal ideal domains and unique factorization domains, polynomial rings. Finite field extensions and roots of polynomials, finite fields.

Number Theory: Divisibility, primes, fundamental theorem of arithmetic. Congruences, solution of congruences, Euler's Theorem, Fermat's Little Theorem, Wilson's Theorem, Chinese remainder theorem, primitive roots and power residues. Quadratic residues, quadratic reciprocity. Diophantine equations, equations $ax+by=c, x^2+y^2=z^2$ $x^4+y^4=z^2$. Simple continued fractions: finite, infinite and periodic, approximation to irrational numbers, Hurwitz's theorem, Pell's equation. Partition functions: Formal power series, generating functions and Euler's identity, Euler's theorem, Jacobi's theorem, congruence properties of p(n). Arithmetical functions: $\phi(n), \mu(n), d(n), \sigma(n)$. A particular Dirichlet series for Riemann Zeta Function.

Texts:
1. I. N. Herstein. Topics in Algebra, Wiley, 2006
2. I. Niven, H.S. Zuckerman, H.L. Montgomery. An introduction to the theory of numbers, Wiley, 2000

References:
1. D.S. Dummit & R.M. Foote. Abstract Algebra, Wiley, 1999
2. G.H. Hardy, E.M. Wright. An introduction to the theory of numbers, OUP, 2008
3. T.M. Apostol. Introduction to Analytic Number Theory, Springer, UTM, 1998

PH201 Optics & Lasers (3-0-0-6)

Pre-requisites: Nil

Review of basic optics: Polarization, Reflection and refraction of plane waves. Diffraction: diffraction by circular aperture, Gaussian beams.
Interference: two beam interference-Mach-Zehnder interferometer and multiple beam interference-Fabry-Perot interferometer. Monochromatic aberrations. Fourier optics, Holography. The Einstein coefficients, Spontaneous and stimulated emission, Optical amplification and population inversion. Laser rate equations, three level and four level systems; Optical Resonators: resonator stability; modes of a spherical mirror resonator, mode selection; Q-switching and mode locking in lasers. Properties of laser radiation and some laser systems: Ruby, He-Ne, CO_2, Semiconductor lasers. Some important applications of lasers, Fiber optics communication, Lasers in Industry, Lasers in medicine, Lidar.

Texts:
1. R. S. Longhurst, *Geometrical and Physical Optics*, 3rd ed., Orient Longman, 1986.
2. E. Hecht, *Optics*, 4th ed., Pearson Education, 2004.
3. M. Born and E. Wolf, *Principles of Optics*, 7th ed., Cambridge University Press, 1999.
4. William T. Silfvast, *Laser Fundamentals*, 2nd ed., Cambridge University Press, 2004.
5. K. Thyagarajan and A. K. Ghatak, *Lasers: Theory and Applications*, Macmillan, 2008.

PH203 Vacuum Science and Techniques (3-0-0-6)

Pre-requisites: Nil

Fundamentals of vacuum, units of pressure measurements, Gas Laws (Boyles, Charles), load-lock chamber pressures, Partial and Vapor Pressures, Gas flow, Mean free path, Conductance, Gauges, Capacitance Manometer, Thermal Gauges, Thermocouple, Pirani Gauge, Penning Gauge, High Vacuum Gauges, Leak Detection, Helium Leak Detection, Cold Cathode Gauge, Roughing (Mechanical) Pumps, Pressure ranges, High Vacuum Pumps: Oil Diffusion Pump, Tolerable fore line pressure System configuration, Oils, Traps Crossover pressure calculations, Pump usage and procedures, Turbomolecular pump, Cryopumps, Pump usages, Out gassing and Leak Testing.

Introduction to Deposition, Anti Reflection (AR) Coatings, Mono-dimensionally modulated (MDM) Filters, Vacuum Coatings, High reflectors, e-Beam deposition systems, Film Stoichiometry, Sputtering, Itching and Lithography, Chemical Vapour deposition and Pulse Laser deposition, Mass Flow control, Reactive sputtering, Film growth control.

Text Book:
1. K.L. Chopra and S.R. Das, *Thin Film Solar Cells*, Springer, 1983.
2. Nagamitsu Yoshimura, *Vacuum Technology: Practice for Scientific Instruments*, Springer, 2008.
3. Milton Ohring**,** *Materials Science of Thin Films*, Second Edition, Academic Press, 2001.

References:
1. A. Roth, *Vacuum Technology*, North Holland, 1990.
2. Donald Smith, *Thin-Film Deposition: Principles and Practice*, McGraw-Hill Professional, 1995.
3. Krishna Shesan, *Handbook of Thin Film Deposition*, William Andrew, 2002.