M.Tech. (Engineering Physics) Program

Course Contents:

1st Semester: 26 Credits

S.No.	Course Code	Title of the course	Credits	L/T/P
1.	BAEP-601	Mathematical Physics	3	3/0/0
2.	BAEP-603	Optimization Methods	3	3/0/0
3.	BAEP-605	Computational Physics-I	3	3/0/0
4.	BAEP-607	Statistical Physics	3	3/0/0
5.	ITEP-609	Concepts of OOP using C++	3	3/0/0
6.	BAEP-611	Minor Project – I	4	
7.	HSEP-621	Language Behavior & Communication Skills	2	NUES*
8.	BAEP-651	Lab-I	4	0/0/8
9.	ITEP-653	Lab-OOP	1	0/0/2

* Non-University Evaluation System

2nd Semester: 26 Credits

S.No.	Course Code	Title of the course	Credits	L/T/P
1.	BAEP-602	The physics of information technology	3	3/0/0
2.	BAEP-604	Advance Statistical Physics	3	3/0/0
3.	BAEP-606	Computational Physics-II	3	3/0/0
4.	BAEP-608	Alternate Energy Technologies	3	3/0/0
5.	ITEP-622	Concepts of DBMS	3	3/0/0
6.	BAEP-610	Minor Project - II	4	
7.	HSEP-614	Philosophy of Science & Technology	2	NUES*
8.	BAEP-652	Lab-II	4	0/0/8
9.	ITEP-654	Lab-DBMS	1	0/0/2

* Non-University Evaluation System

3rd Semester:

28 Credits

S. No.	Course Code	Title of the course	Credits	L/T/P
1.	BAEP-701	Embedded Systems	3	3/0/0
2.	BAEP-703	Photovoltaic systems Engineering	3	3/0/0
3.	BAEP-705	Nano-Science & Engineering	3	3/0/0
4.	ITEP-717	Computer Architecture	3	3/0/0
5.	SMSEP-715	Project Management Systems	2	NUES*
6.	BAEP-751	Lab-III (Simulation, Parallel & Grid Computing)	4	0/0/8
7.	BAEP-753	Training Report	3	NUES*
Elective-I			3	3/0/0
8.	BAEP-707	Introduction to Quantum Information and Computation		
9.	BAEP-709	Photonics		
10.	BAEP-711	Ion Beam Technology		
	BAEP-713	Computational Biology		
Elective-II			4**	3/0/2
12.	ITEP-721	Coding Theory		
	ITEP-761	Coding Theory Lab		
13.	ITEP-723	SE/OOSE		
	ITEP-763	SE/OOSE Lab		
14.	ITEP-725	Multimedia & Visualization Techno.		
	ITEP-765	Multimedia & Visualization Techno. Lab		
15.	ITEP-727	Computers Networks		
	ITEP-767	Computers Networks Lab		

* Non-University Evaluation System

** Elective –II is 4 credit grouped into 3 credit theory and 1 credit lab

4th Semester 25 Credits

S.No.	Course Code	Title of the course	Credits	L/T/P
1.	BAEP-702	Project Work (on site)	20	
2.	BAEP-704	Comprehensive Viva-Voce/Seminar	5	

Total Credits: 105

1. For the award of degree a student shall be required to earn a minimum of 100 credits.
2. BAEP-611 (Minor Project-I) and BAEP 610(Minor Project-II) shall be a self study in nature. Internal evaluation will be on the basis of presentation by the student before the entire physics faculty of USBAS. The end semester evaluation shall be on the basis of comprehensive viva voce and project report before a committee comprising of entire physics faculty of USBAS and an external examiner approved by BOS.
3. The student shall undergo summer training after second semester for a duration of six weeks and that will constitute BAEP – 753 course. After completion of training the student shall submit a report and give a seminar before the entire physics faculty of USBAS.

4. Internal coordinators will be decided for the students to take care of the summer training, minor and major projects.
5. Each student shall opt for two electives one each from Elective-I and Elective -II.
6. The elective courses to be offered shall be decided and students informed thereof, before the start of third semester keeping in view the availability of the expert in the field and subject to at least five students opting to it.
7. List of experiments in the lab papers shall be upgraded regularly.
8. This scheme shall be effective from August 2008 onwards.

SYLLABUS

MATHEMATICAL PHYSICS

Course Code: BAEP-601 **L/T/P: 3 0 0**

Unit – I :Differential Equations: ODE, PDE, Boundary value problems in physics, eigen value, eigen functions, Sturm-Lioville problem.

Unit – II : Special functions: Hermite, Legendre, Laguerre, Bessel functiona 1st 2nd kind, Differential equation and generating function, recurrence relation, Gamma and Beta functions.

Unit –III :Transforms: Fourier, Laplace, Convolution therorem, Parseval's relations, Transfer function (Theta function), Dirac-Delta function.

Unit-IV : Programming in MATLAB: Simple Basics, Programme designing 2-D & 3-D plotting and simple applications.

Reference:

1. G.B. Arfken; HJ Weber, Mathematical Methods for Physicists, 4th ed. Academic Press,1995.
2. P.M. Morse and H. Feshbach; Methods of Theoretical Physics (Volume, I, II,1953)
3. Mary Boas, 'Mathematical Methods in Physical Sciences, Wiley
4. S. Hassani, 'Mathematical Physics: A Modern Introduction to its Foundations'(1998,99)
5. MATLAB Programming for Engineers, Stephen J. Chapman, Thomson Press (2007)

OPTIMIZATION METHODS

Course Code: BAEP 603 L/T/P: 3 **0 0**

Mathematical Modeling and the Operation Research Approach, Introduction to Formulation and Classification of Optimization Models, Search-Based Optimization, Algorithms, Formulation and Classification of Linear Programs.

Simplex Algorithms for Solving Linear Programs, Interior Point Algorithms for solving Linear Programs, Duality and Sensitivity in Linear Programming, Goal Programming, Shortest Path in CPM, Formulation and Structure Of Network Flow Models, Formulation and Classification of Discrete Optimization Models, Methods for Solving Discrete Optimization Models.

Nature and Diversity of Nonlinear Programs, Improving Search Paradigm for Nonlinear Optimization, Formulation of Unconstrained Nonlinear Programs One-Dimensional Search, Conditions for Local Optimality, Convex and Concave Functions, Gradient Search and Newton's Method, Quasi-Newton Methods for Unconstrained Optimization, Unconstrained Optimization without Derivatives, Formulation and Classification of Constrained Nonlinear Programs, Lagrange Multiplier Methods.

1. Dimitais Bertsimas and J.N.Tritsiklis,
   Introduction to linear optimization, Athena Scientific 1997.
2. D.Bertsimas , Nonlinear Programming ,Athena Scientific 1999.
3. J.P.Ignizio and T.M.Cavalier, Linear Programming, Prentice Hall 1994.
4. A.Sofer and S.Nash, Linear and Nonlinear Programming,
   McGraw-hill,1996

COMPUTATIONAL PHYSICS-I

Course Code: BAEP-605 L/T/P: **3 0 0**

Unit-1: Random numbers, quality of test for Randomness of the number, random number generators, simple applications.

Unit-2: Perturbation Theory: Time dependent and time independent; Variational method, WKB Approximations.

Unit-3: Computer simulations of Linear systems.

Unit-4: Computer Simulations of Non-Linear Systems: Introduction to Chaos and Fractals.

References:

1. Marzbacher, 'Quantum Mechanics'(Second Ed,1998)
2. RC Verma, PK Ahluwalia and KC Sharma, 'Computational Physics', New Age Publications.
3. An introduction to Computational Physics : Tao Pang (Cambridge University Press).(Second Ed,2006)

STATISTICAL PHYSICS

Course Code: BAEP 607 L/T/P: **3 0 0**

Unit – I

Random Variables: Fundamentals of probability theory and Statistics, Entropy, Computation with Random Variables.

Unit – II

Random Variables of Space States: Classical Statistical Mechanics, Introduction to Ensembles, Micro-canonical,macro-canonical and Grand canonical ensembles, Equipartition theorem, Approximate methods

Unit – III:

Time dependent Random Variables: Classical Stochastic process, Markov process, Master equation, Simulation of Stochastic processes and fields.

Unit – IV

Quantum Random Systems: Ideal Fermi and Bose gases, Simple applications.

References:

1. Statistical Physics:J.Honerkamp, Second reprint 2005, Springer
2. Statistical Physics: Patheria(Butterworth-Heinemann, Oxford,1972).
3. Statistical Physics: K.Huang(Wiley Eastern, New Delhi).(1975)
4. B.K.Aggarwal & Melvin Eisner: Statistical Physics(Wiley Eastern, New Delhi).

CONCEPTS OF OBJECT ORIENTED PROGRAMMING USING C++

Course Code: ITEP 609 L/T/P: **3 0 0**

Objects, relating to other paradigms (functional, data decomposition), basic terms and ideas (abstraction, encapsulation, inheritance, polymorphism).

Overview of C, Encapsulation, information hiding, abstract data types, object & classes: attributes, methods. C++ class declaration, state identity and behavior of an object, constructors and destructors, instantiation of objects, default parameter value, object types, C++ garbage collection, dynamic memory allocation, metaclass.

Inheritance, Class hierarchy, derivation – public, private & protected, aggregation, omposition vs classification hierarchies, polymorphism, operator overloading, parametric polymorphism, generic function – template function, function name overloading, overriding inheritance methods, run time polymorphism.

Reference:

1. S.B.Lippman & J.Lajoie,"C++ Primer",3th Edition,Addison Wesley.
2. A.R.Venugopalan, Rajkumar,T.Ravishankar,"Mastering C++",TMH.
3. E.Balaguruswamy,"Object Oriented Programming with C++",TMH.
4. D.Parasons. ,"Object Oriented Programming with C++",BPB Publications.
5. R.Lafore,"Object Oriented Programming with C++".
6. Stevan C.Lawlor,"Art of programming Computer Science with C++", Vikas Publication.

LAB - OOP

Course Code: ITEP 653 L/T/P: **0 0 2**

Concepts of Object Oriented Programming Using C++ programming language.

LAB - I

Course Code: BAEP – 651 **L/T/P: 0 0 8**

List of Experiments:

- Y ray spectroscopy
- ESR
- Electronics set up
- Nuclear lab
- Microprocessor
- Optical fibre
- LASER
- designing of electronic kit
- Op Amp
- Simulations like: Brownian Motion, Random Number generation

Note: List of experiments will be regularly upgraded.

THE PHYSICS OF INFORMATION TECHNOLOGY

Course Code: BAEP:602 **L/T/P::3 0 0**

Unit – I
Introduction: History of computers, Information systems, Noise in physical system, Random Variables, Probability distributions, Noise mechanism, Information in physical systems ,Channel capacity, Gaussian Channel, Fisher Information, Information in Thermodynamics .
Unit -II
The physics of Lasers and Optical Fibres, fourier series, fourier transform, Bandwidth, Modes, fibre optics communication.
Unit – III
Magnetic storage –Diamagnetism, Paramagnetism, Ferro, Antiferro & Ferrimagnetism, Magnetic recording and recording systems, Giant Magnetoresistance(special topic).
Unit – IV
Future Information technologies- (Term paper topics) (i) Quantum information & computation (ii) Optical computing (iii) DNA computing (iv) Nano technology & The future of computing.

References:

The physics of Information Technology-Neil Gershenfeld(Cambridge University Press)(2000)The quantum Dot – Richard Turton –Oxford University Press(1996).

Text on Laser & Fibre Optics

Text on Magnetism

Internet Resources.

ADVANCED STATISTICAL PHYSICS

Course Code: BAEP 604 L/T/P: **3 0 0**

Unit – I Semiconductor Statistics:
Statistical equilibrium of free electrons in semiconductors, impurity semiconductors, degenerate semiconductors, electrostatic properties of p-n junctions and metal-semiconductor junctions.

Unit -II Transport in Bulk:
Boltzmann transport equation, Particle diffusion, electrical and thermal conductivity, isothermal Hall effect, Non-equilibrium semiconductors, Quantum Hall Effect.

Unit – III Transport in Nanostructers:
Quantum and classical regimes of electron transport, important quantities in mesoscopic transport, Landauer formula, double barrier resonant tunneling structures: coherent and sequential tunneling, negative differential resistance, single electron transfer, coulomb blockade

Unit – IV Coperative Phenamena: Ising Model
Phase transitions of the second kind, ising model, Bragg-Williams Approximation, One- Dimensional Ising Model, Lattice gas, binary mixture alloy

References:

1.Statistical Physics: Patheria (Butterworth-Heinemann, Oxford,1972).
2. Statistical Physics: K.Huang (Wiley Eastern, New Delhi,1975).
3.B.K.Aggarwal & Melvin Eisner: Statistical Physics (Wiley Eastern, New Delhi).

ALTERNATE ENERGY TECHNOLOGIES

Course Code: BAEP:608 **L/T/P: 3 0 0**

UNIT I Energy scenario current, energy future, energy sources, environmental effects of energy sources, cheap energy versus environment, why renewable energy, solar day, equation of time, local and solar time, sun earth angles, shadow angles, sunrise and sunset

UNIT II Solar radiation, Thermal radiation fundamentals, Solar radiation and electromagnetic spectrum, solar radiation entering the earth system, Solar radiation using satellite, Instruments for measuring solar radiation: Pyranometer, Pyrheliometer, Sunshine recorder, Solar radiation on horizontal and inclined surface, Liu and Jordan Formula, Daily and monthly solar radiation, simulations to calculate sun earth angles and hourly solar radiation on tilted surface

UNIT III Photovoltaic (PV) cell technologies, solar pv power systems: semiconductors, p-n junction under equilibrium and biasing, equation, pv cell, modules and array, open circuit voltage and short circuit current, I-V and P-V curves, Array design, peak power point operation, pv system example, Design for remote photovoltaic Application, environmental effects of PV system, cost considerations

UNIT IV Nuclear Energy Engineering: Fundamentals of nuclear energy and radiation; introduction to the nuclear processes occurring in a reactor; basics concepts of nuclear reactors and power systems.
Reactor Technology: The analysis & design of nuclear assemblies with emphasis on design; nuclear reactor kinetics, stability and control; Breeder reactors; Safety & environmental Norms.

Reference:

1. Solar Energy: Fundamentals, design, Modeling and Applications: G.N.Tiwari, 2002, Narosa Publishing house
2. Understanding renewable energy systems, Volker Quaschning, 2006, Replika Press Pvt. Ltd., India
3. Alternative Energy, V0l 1-3, Neil Schlager and Jayne Weisblatt, 2006, Thompson Gale Generating electricity from the sun, Fred C Treble, 1991, Pergamon Press
4. Accelerator Based Research in Basic and Applied Sciences, 2002, Amit Roy and D K Avasthi, Phoenix Publishers
5. Solar Energy : S.P. Sukhatme (Tata McGraw-Hill, New Delhi)(1990).
6. Solar Cell Devices : Fonash (Academic Press, New York)(1981)

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ADVANCED COMPUTATIONAL PHYSICS

Course Code: BAEP:606 **L/T/P:3 0 0**

Unit-I

Errors in computation, Review of Taylor Series, Mean Value Theorem, Representation of numbers (integers and floating point), Loss of significance in computation. Linear Simplex Method, numerical solutions of linear systems, dual-simplex method, Linear Programming.

Unit-II

Random number generation, Test for quality, random sampling techniques; interior point method.

Unit-III

Monte Carlo methods and simulation: Numerical Integration, Boundary Value Problems, Simulation of radioactive decay, Neutron transport and Percolation, Random Walk, Ising Model.

Reference:

1. Introduction to Computational Physics , Tao Tang,Cambridge Press(2006)
2. Computational Physics,R.C.Verma .New Age Publication(2000)
3. Numerical Mathematics and Computing,Ward Cheney & David Kincaid, Thomson Press(2007)
4. Monte Carlo Methods in Statistical Physics,KPN Murthy,University Press(2004)

CONCEPTS OF DATA BASE MANAGEMENT SYSTEMS

Course Code: ITEP:622 **L/T/P: 3 0 0**

Basic concepts: database & database users, characteristics of the database, database systems, concepts and architecture, date models, schemas & instances, DBMS architecture & data independence, database languages & interfaces, data modelling using the entity-relationship approach. Overview of hierarchical, Network & Relational Data Base Management Systems.

Relational model, languages & systems: relational data model & relational algebra: relational model concepts, relational model constraints, relational algebra, SQL- a relational database language: date definition in SQL, view and queries in SQL, specifying constraints and indexes in sql, a relational database management systems, DB2.

DB2 Architecture, Logical Data Structures Physical Data Structure, Instances, Table Spaces, Types of Tablespaces, Internal Memory Structure, Background Processes, Data Types, Roles & Privileges, Stored Procedures, User Defined Functions, Cursors, Error Handling, Triggers.

Relational data base design: function dependencies & normalization for relational dataases: functional dependencies, normal forms based on primary keys, (1NF, 2NF, 3NF & BCNF), lossless join and dependency preserving decomposition.

Concurrency control & recovery techniques: concurrency control techniques, locking techniques, time stamp ordering, granularity of data items, recovery techniques: recovery concepts, database backup and recovery from catastrophic failures.

Concepts of object oriented database management systems, Distributed Data Base ManagementSystems.

Reference:

1. Database Management System: Henry Korth(1986).

LAB – II

Course Code: BAEP:652 **L/T/P:0 0 8**

Simple Experiments in MatLab and Mathematica environments with emphasis on parallel programming algorithms.

List of Experiments:

- Y ray spectroscopy
- Electronics kit designing
- Microprocessor
- Optical fibre
- Study of PV module
- Stand alone PV system

Note: List of experiments will be regularly upgraded.

DATA BASE MANAGEMENT SYSTEMS LAB.

Course Code: ITEP:654 **L/T/P:0 0 2**

Database Management System: SQL Plus Query Language.

PHOTOVOLTAIC SYSTEMS ENGINEERING

Course Code: BAEP-703 **L/T/P: 3 0 0**

Unit – I : Physics of solar cells: Review of semiconductor properties, dynamics of electrons and holes, densities of electrons and holes, location of Fermi level in doped semicnductors, carrier Transport, Interaction of light with semiconductor, Absorption of light in direct and Indirect Band gap Semiconductor, various recombination processes, electrosttics of p-n junctions, junction capacitance, carrier injection, minority carriers in Quasi Neutral Regions under dark and illuminated conditions, saturation current density, light generated current, solar cell output parameters: Isc, Voc, FF, Efficiency, Efficiency limit, Effect of Temperature.

Unit – II : Introduction to PV Systems:
PV cell, module, Array, Energy storage, study of associated system electronic components in brief like charge controller, battery, inverter, wiring, stand etc.

Unit – III : PV System examples: Designing, modeling and simulation Stand alone
Systems, hybrid systems, utility interactive system, designing of PV system: components, load evaluation system design, Example of PV remote cabin

Unit – IV : Present and future scope in SPV:
Status of SPV in industry and research labs in India and abroad,
Manufacturing processes in brief like CZ, floatzone, MBE, EFG etc., emerging technologies –Organic Solar cells, Bilayer and bulk heterojunction organic solar cell, dye sensitized solar cells, Quantum dot sensitized solar cells, CNT based solar cells etc.

Reference:

1. Solar Energy: Fundamentals, design, Modeling and Applications: G.N. Tiwari, 2002, Narosa Publishing house.
2. Understanding renewable energy systems, Volker Quaschning, 2006, Replika Press Pvt. Ltd., India.
3. Alternative Energy, Vol 1-3, Neil Schlager and Jayne weisblatt, 2006, Thompson Gale Generating electricity from the sun, Fred C Treble, 1991, Pergramon Press.
4. Solar Cells: Operating principles, technology and system Applications, Martin A. Green.
5. Physics of solar cells, Peter Wurfel, Wiley VCH Verlag GmbH & Co. KGaA.
6. Terrestrial solar photovoltaics, Tapan Bhattacharya, Narosa Publishing House.
7. Solar Cell Devices : Fonash (Academic Press, New York)(1981)
8. Internet resources and journals of the field

PHOTONICS

Course Code: BAEP-709 **L/T/P:: 3 0 0**

Review of wave nature and particle nature of light, Light sources-black body radiation, Interaction of light with matter-Emission and absorption of radiation, Laser Fundamentals: Stimulated and spontaneous Emission, Einstein relations, Optical feedback, threshold condition, lineshape function, Laser Modes, classification of laser, Requirement of Sources for Optical Fiber Communication, Injection Laser Diode (ILD) and Light emitting Diode (LED), Optical Power Launching and coupling from LED/ILD to optical fiber, Single mode operation, mode locking and Q switching of laser, LED and ILD drive circuitry. Elementry ideas of Display devices – Plasma, Liquid Crystal and Numeric Displays.

Optical fiber Communication and its advantages, Classification of optical fibers, Numerical aperture, light ray propagation through step index and graded index fiber, Timer dispersion, Light wave propagation through optical fibers, Eigen-value equation and its solution, Pulse Broadening, Material and Waveguide Dispersion. Signal Attenuation, Splice and connector loss.

Photodetection, PIN and Avalanche Photo diode (APD), Quantum Efficiency, Responsivity and Speed of Response Noise mechanism in photo detectors, Photomultipliers, Photon Counting techniques.

Components of Optical Fiber Communication Systems, Modulation Scheme, System design consideration, Optical power budget, Rise time budget. Over view of recent developments in optical fiber communication with special reference to Erbium Doped Fiber Amplifier (EDFA), coherent optical communication, Wavelength Division Multiplexing (WDM) and Dense WDM (DWDM) based optical fiber communication. Introduction to Non linear fiber optics and Solutions. Elementary ideas of Optical Fiber Sensors and applications of specialty optical fibers.

Books:

1. Optoelectronics: An Introduction by J. Wilson and JFB Hawkes, PHI (2000)
2. Optical fiber Communication by Gerd Keiser, McGraw Hill(2000).
3. Fiber Optics by Ghatak & Thyagarajan. Tata McGraw Hill (1998)
4. The hand book of Photonics: Gupta and Ballato-CRC Press(2006).

ION BEAM TECHNOLOGY

Course Code: BAEP -711 **L/T/P: 3 0 0**

Vacuum : Elements of a Vacuum system, molecular & viscous flow & conductance pumping speed, Displacement & containment pumps, design of ultra vacuum system , vacuum measurement gauges, Leak detection techniques.

Beam Optics & Beam Transport: Motion of charged particles in electric and magnetic fields , Phase space (both transverse and longitudinal) and Liouville's theorem , Focusing devices :Einzel lens, solenoid, quadruple, magnetic and electric sector fields; Matrix method Aberrations, Design of a beam line for beam transport & computer simulations.

Ion source: Production of charged particles Space charge limitation, Extraction & Focusing geometries, Positive and negative ion sources, Radio frequency ion sources, Duoplasmatron, Penning ionization source, sputter ion source, ECR source –room temperature & super conducting.

Accelerators: Electrostatic accelerators – Cockroft- Walton, Van – de – Graf , Pelletron, Pulsed accelerator – Cyclotron, Synchrotron, Radio frequency linear accelerators – LINAC, Storage rings – future trends.

Cryogenic: Introduction to cryogenics and its application to accelerator , Achieving low temperature, Various Thermodynamic Cycles, Heat transfer at low temperature : Conduction , Convection , Radiation process ,Insulation , LN2/He storage vessels , Cryostat Design , Properties of materials at low temperature , Heat load calculation , Superconducting magnet / cavity for accelerator, superconducting magnet vs conventional magnet, Cryogenic instrumentation- Temperature sensor, Liquid Helium, Nitrogen level, Flow sensors.

Applications of accelerator: Trace element analysis , Various methods , RBS-measurements of elemental ratios & concentrations , channeling RBS , ERDA – depth resolution & sensitivity , high resolution& sensitivity , high resolution sub monolayer thickness studies, Nuclear reaction analysis (NRA), Particle induced X – ray emission (PIXE) studies, Accelerator mass spectrometry (AMS), Medical applications of accelerators.

Books:

Accelerator Based Research in Basic and Applied Sciences, 2002, Amit Roy and D K Avasthi, Phoenix Publishers

NANO SCIENCE AND ENGINEERING

Course Code: BAEP – 705 **L/T/P: 3 0 0**

UNIT-I Introduction and scope of nano science and technology
Properties of Nano particles: Optical properties, Magnetic properties, Heat Capacity etc.

UNIT-II Synthesis and fabrication of nano particles: Ball milling, thermal evaporation, Chemical vapor deposition, biological method.

UNIT-III Characterization of Nano particles: X ray diffraction, SEM, TEM, EDX Analysis

UNIT-IV Nano Device and Modelling

- Introduction to Solid State Physics by Kittel, John Wiley,(1996)
- Introduction to Nanotechnology by Charles P. Poole Jr., Frank J. Owens(2003)
- Nanomaterials: Synthesis properties and Applications Edited by AS Edelstein and R C Cammarata(1998)

EMBEDDED SYSTEMS

Course Code: BAEP – 701 **L/T/P 3 0 0**

Introduction to an embedded systems design: Introduction to Embedded system, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Processes and Operating Systems: The Processes abstraction, Switching contexts between programs, Real-time operating systems, Intercrosses communication, Performance analysis and power consumption.

Microcontroller: Role of processor selection in Embedded System (Microprocessor V/s Micro-controller), 8051 Microcontroller: Architecture, basic assembly language programming concepts, Instruction set, Addressing Modes, Logical Operation, Arithmetic Operations, Subroutine, Interrupt handling, Timing subroutines, Serial data transmission, Serial data communication

Networks for Embedded Systems: The I^2C Bus, The CAN bus, SHARC link Ports, Ethernet, Myrinet, Internet, Introduction to Bluetooth: Specification, Core Protocol, Cable replacement protocol.

IEEE 1149.1 (JTAG) Testability: Boundary Scan Architecture

Text:

1. Embedded Systems by Raj Kamal, TMH
2. The 8051 Microcontroller by K.J. Ayala, Penram International
3. J B Peatman, Design with PIC Microcontrollers, Prentice Hall

References:

1. An Embedded Software Primer by David E. Simon, Pearson Education(1996)
2. Designing Embedded Hardware by John Catsoulis, O'reilly(2005)
3. Embedded System Design by Frank Vahid, Tony Givargis, John Wiley & Sons
4. Building Embedded Linux Systems by Karim Yaghmour, O'reilly
5. Programming Embedded Systems by Michael Barr, O'reilly(Oct.2006)
6. Real-time systems & software by Alan C. Shaw, John Wiley & sons, Inc.
7. Computers as Components by Wayne Wolf, Harcourt India Pvt. Ltd.
8. Embedded System Design by Peter Marwedel, Kluwer Acadeemic Pub.(2002)
9. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre, MGH
10. Fundamental of Embedded software by Daniel W. Lewis, PHI(1996)
11. Bluetooth Technology by CSR Prabhu & A.P. Reddi, PHI

COMPUTER ARCHITECTURE

Course Code: ITEP – 717 **L/T/P 3 0 0**

Digital Logic Circuits: Logic gates, Boolean algebra, K-maps, Combinational circuits, flip-flops, Sequential Circuits

Digital components: Integrated Circuits, multiplexers, encoders, demultiplexers, decoders, shift registers, binary counters, and memory units.

Data Representation: Data types, complements, fixed point representation, floating point representation , other binary code , error detection codes.

Register transfer and Microoperation: Register Transfer language, register transfer, bus and memory transfer, arithmetic microoperations, logic microoperations, shift microoperations

Basic Computer Organization and Design: Instruction codes, computer registers, computer instructions, timing and control, instruction cycle, memory reference instructions input output and interrupts, design of basic computer, design of accumulator logic

Central Processing Unit: Introduction, general registers organization, stack organization, instruction formats, and addressing modes.

Computer Arithmetic: Introduction, addition, subtraction, multiplication and division algorithms, floating point arithmetic operation, decimal arithmetic unit, decimal arithmetic operations

Text Book: Mano ,M "Computer System and Architecture", PHI, 2000.

PROJECT MANAGEMENT SYSTEMS

Course Code: SMSEP – 715 **L/T/P 2 0 0**

Introduction : Project management overview; Forms of project organisation; Project planning; Project control.

Project Identification and Presentation : Socio-economic consideration in project formulation; Social infrastructure projects for sustainable development; Investment opportunities; Project screening and presentation of projects for decision making; Expansion of capacity; Diversification.

Market and Technical Analysis : Market and demand analysis – Market survey, Demand forecasting, Uncertainties in demand forecasting; Technical Analysis – Product mix, Plant capacity, Materials and inputs, Machinery and equipment.

Project Costing and Finance : Cost of project; Cost of production; Break even analysis; Means of financing project; Tax aspects in project finance; Role of financial institution in project finance.

Project Appraisal : Time value of money; Project appraisal techniques – Payback period, Accounting rate of return, Net present value, Internal rate of return, Benefit cost ratio; Social cost benefit analysis; Effective rate of protection.

Risk Analysis: Measures of risk; Sensitivity analysis; Simulation analysis; Decision tree analysis.

Project Scheduling/Network Techniques in Project Management : CPM and PERT analysis; Float times; Crashing of activities; Contraction of network for cost optimization, updating; Cost analysis of resources allocation.

Multiple Projects : Project dependence; Capital rationing; Ranking methods of projects; Mathematical programming approach; Linear programming model; Post Project Evaluation.

INTRODUCTION TO QUANTUM INFORMATION AND COMPUTATION

Course Code: BAEP – 707 **L/T/P 3 0 0**

Introduction
Computers as physical systems, technological issues, Introduction to Turing machines- classical probabilistic and deterministic Turing machines, Quantum Turing machines; introduction to computability, complexity, classical complexity and quantum complexity classes

Quantum Physics and Computers
Review of Quantum Mechanics- state vectors, superpositions, unitary operators, hermitian operators, Schrödinger equation, Hamiltonian evolution, the concept of quantum measurement, the concept of qubits, quantum registers and quantum gates

Quantum Algorithms
Introduction to quantum algorithms, Deutsch's algorithm, Shor's algorithm and Grover's search Algorithm, Physical implementation of simple quantum gates.

Quantum Cryptography and Quantum Teleportation, real physical systems and technological feasibility
Heisenberg uncertainty principle, polarization states of photons, quantum cryptography using polarized photons, entanglements, introduction to the EPR paradox, BELL's theorem, Bell basis, teleportation of a single qubit, review of some current experiments and candidate physical systems, technological feasibility of a quantum computer and the limitations imposed by noise.

References:

1. Introduction to Quantum Computation and Information By Hoi-Kwong Lo, Tim Spiller, Sandu Popescu (World Scientific 1998).
2. The Quantum Computer by Jacob West (April 28, 2000)

COMPUTER NETWORKS LAB

Course Code: ITEP 767 **L/T/P 0 0 2**

1. Perform and Simulate the experiment of PAM using the PAM Kit.
2. Perform and Simulate the experiment of PPM using the PPM Kit
3. Perform and Simulate the experiment of CSMA Protocol with LAN Trainer Kit with Bus Toplogy
4. Perform and Simulate the experiment of CSMA/CD Protocol with LAN Trainer Kit with Bus Toplogy
5. Perform and Simulate the experiment of CSMA Protocol with LAN Trainer Kit with Star Toplogy
6. Perform and Simulate the experiment of CSMA/CD Protocol with LAN Trainer Kit with Star Toplogy
7. Write a Program to implement Connection Oriented Client Server communication (Socket Programming) using TCP Protocol
8. Write a Program to implement UDP oriented Client Server communication (Socket Programming)

Note: List of experiments will be regularly upgraded.

COMPUTER NETWORKS

Course Code: ITEP 727 **L T P 3 0 0**

UNIT – I

Introduction and The Physical Layer: Uses of Computer Networks, Network Hardware, Network Software, Reference Model (OSI, TCP/IP Overview), Topology , Types of Networks , Theoretical Basis for Data Communication, Guided Transmission Media, Unguided Transmission Media : Wireless Transmission, Communication Satellites.

[No. of Hrs.: 10]

UNIT – II

Digital Signal Encoding Formats – NRZ-L, NRZI, Bipolar-AMI, Manchester, Differential Manchester, Digital Modulation – ASK, FSK, PSK, QPSK, Digitization – Sampling Theorem, PCM, DM, Analog Modulation – Introducing AM, FM, PM.

[No. of Hrs.: 10]

UNIT – III

The Data Link Layer: Ethernet Frame Format , Flow Control Protocols, Stop-and-wait Flow Control, Sliding – Window Flow Control, Error Control, Stop-and-wait ARQ, Go-back-N, Selective-repeat.

The Network Layer: IPv4 Addressing Mechanism , Routers , Introduction to Routing Protocols.

[No. of Hrs.: 10]

UNIT – IV

The Transport Layer : Connection Oriented and Connection less Service Protocols : UDP, TCP.

Application Layer: DNS, E-Mail, SMTP , MIME.

Network Security: Firewalls (Application and packet filtering), Cryptography : Public and Private Key Cryptography.

[No. of Hrs.: 10]

TEXT:

1. A. S. Tanenbaum, "Computer Networks", 4th Ed., Pearson, 2003
2. Data Communications and Networking 2nd Ed.,TMH,2000
2. W. Stallings, "Data and Computer Communications", 7th Ed., Pearson, 2002.

REFERENCES:

1. Black U, "Computer Networks-Protocols, Standards and Interfaces", PHI 1996
2. Comer E. Doughlas, "Computer Networks and Internets", 2nd Ed., Pearson, 2000
3. Comer E. Doughlas, "Internetworking with TCP/IP, Vol. 1, PHI, 2000
4. Laura Chappell (Ed), "Introduction to Cisco Router Configuration", Techmedia, 99.