Department Of Physics
Osmania University

Scheme of Instruction, Examination and Syllabus

M.Sc (Physics) & M.Sc (Applied Electronics)

III and IV Semesters
under CBCS scheme

(Wef 2010-2011 at University and Constituent Colleges)
For the students admitted under CBCS *from 2009-2010 onwards*

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

REVISED SYLLABUS FOR MSc (PHYSICS & APPLIED ELECTRONICS) III AND IV SEMESTERS

(Under CBCS Scheme at University and Constituent Colleges)

General Information:

Osmania University offers the following course at campus and its Constituent colleges, under CBCS.

1. **M. Sc. Physics**
2. **M. Sc. Applied Electronics**

M. Sc. Physics: It is a two years course with Semester system having 4 semesters with the following specializations from III semester onwards

a)	Electronics Instrumentation	(Offered at UCS, OU)
b)	Materials Science	(Offered at UCS, OU)
c)	Solid State Physic	(Offered at UCS, OU)
d)	Bio-Physics	(Offered at Nizam College)
e)	Electronics Communications	(Offered at Nizam College)
f)	Condensed Matter Physics	(Offered at PGCS, Saifabad)
g)	Microwaves	(Offered at Women's College)

M. Sc. Applied Electronics (Offered at UCS, OU): It is also a two years course with semester system having 4 semesters. The syllabus is common as that of M. Sc. Physics in I and II semesters.

Abbreviations: P= Physics, PAE = Physics and Applied Electronics, PBP = Physics – Bio Physics - PCMP = Physics – Condensed Matter Physics, PEI = Physics – Electronics Instrumentation, PEC = Physics – Electronics Communications, PMS = Physics – Materials Science, PMW = Physics – Micro-waves, PSSP = Physics – Solid State Physics. **CB - CBCS**

The campus and constituent colleges are divided into three pools with respect to the Interdisciplinary Papers (ID):

a. Pool-I includes all the PG Departments in Campus (except Law and Business Management) and PG College, Secunderabad.

b. Pool-II includes all the PG Departments of Nizam College and PG College, Saifabad.

Pool-III includes all the PG Departments of University College for Women, Koti.

M. Sc. – Physics Course under CBCS
(w.e.f 2010-2011 for the batch admitted in I year from the academic year 2009 – 2010)
Scheme of Instruction and Examination

Semester – III (M. Sc. Physics)

Sl.No	Sub.Code	Subject	Instructions. Hrs/Week	Credits	Duration Of exam. (hours)	Max. Marks
		THEORY				
01	P 301T/CB	Modern Optics & Spectroscopy	4	4	3	20+80**
02		**Special paper –I**				
	PSSP 302T/CB	Crystal Physics and Physical Properties				
	PMS 302T/CB	Metals and Alloys				
	PEI 302T/CB	Digital Logic Circuits.				
	PEC 302T /CB	8051 Micro Controller & Its Applications	4	4	3	20+80**
	PBP 302T/CB	Molecular BioPhysics				
	PMW 302T/CB	Transmission lines, strip lines & Microwave passive Devices.				
	PCMP 302T/CB	Crystal Physics				
03		**Special paper – II**				
	PSSP 303T/CB	Physics of Phonons & Structural Phase Transitions.				
	PMS 303T/CB	Mechanical properties of Materials				
	PEI 303T/CB	Microprocessors & Interfacing.				
	PEC 303T/CB	Digital Transmission Techniques & Information Theory.	4	4	3	20+80**
	PBP 303T /CB	Cell and Membrane Biophysics.				
	PMW 303T/CB	Microwave active devices & Circuits				
	PCMP 303T/CB	Phonon Based Phenomena				
04		Special paper – III				
	PSSP 304T/CB	Band Theory and Electrical Properties	4	4	3	20+80**
	PMS 304T/CB	Thin films and their Properties				
	PEI 304T/CB	Electronic Instrumentation				
	PEC 304T/CB	Data and Computer Communications-I				
	PBP 304T /CB	Physiological Biophysics				
	PMW 304T/CB	Signal Conditioning & Processing Techniques				
	PCMP 304T/CB	Electrical Transport Phenomena in Solids				
05	ID/P 305T/CB	**Inter disciplinary Paper* (For the students of other Departments)**	4	4	3	20+80**
06	**Practicals:** P 351P/CB	**General Physics Lab.**	6	4	4	100
07	P 352P/CB	**Special subject Lab.**	6	4	4	100
08	PS1/CB	Seminar	4	1	--	25
		Total:	32+4	29		725

**** Out of 100 Marks for each theory paper 20 Marks are allotted for internals and 80 for University exam. Common Syllabus to University and Constituent Colleges. There shall be no internal assessment examinations for practicals.Practical Examinations will be conducted at the end of each semester.**

Pattern of Question Paper: The question paper consists of two parts, each covering all the **four units**. Part – A consists of EIGHT short notes questions, carrying 4 marks each. The student has to answer all the questions. Part – B consists of FOUR essay type questions with an internal choice. Each question carries 10 marks.

Details of Interdisciplinary papers in different pools are given separately

Semester – IV (M. Sc. Physics)

Sl.No.	Sub.Code	Subject	Instructions Hrs/Week	Credits	Duration of Exam (hours)	Max. Marks
01	**Theory** P 401T	Nuclear Physics	4	4	3	20+80**
02	PSSP 402T/CB PMS 402T/CB PEI 402T/CB PEC402T/CB PBP 402T/CB PMW 402T/CB PCMP 402T/CB	**Special paper – IV** Optical Phenomena in Solids Engineering Materials Embeded Microsystems Optical Fiber Communications Radiation Biophysics Principles of Communications. Optical Phenomena in Solids	4	4	3	20+80**
03	PSSP 403T/CB PMS 403T/CB PEI 403T/CB PEC 403T/CB PBP 403T/CB PMW 403T/CB PCMP 403T/CB	**Special paper – V** Resonance Phenomena in Solids Electronic Materials & Devices PC Architecture Data and Computer Communications-II Bio-Instrumentation & Medical Physics. Information theory, coding & computer Communication systems. Resonance Phenomena in Solids	4	4	3	20+80**
04	PSSP 404T/CB PMS 404T/CB PEI 404T/CB PEC 404T/CB PBP 404T/CB PMW 404T/CB PCMP 404T/CB	**Special paper – VI** Studies on Reduced Dimensionality in Solids &Fuel Cells. Advanced Materials Instrumentation for Measurement, Control , Data acquisition and Data Transmission Mobile Cellular Communications. Physio-chemical techniques in Bio-Physics Antennas & Radar Semiconductor Devices and Nano materials	4	4	3	20+80**
05	ID/P 405T/CB	**Inter disciplinary Paper** **(For the students of other Departments)**	4	4	3	20+80**
06.	**Practicals:** P 451P/CB	General Physics & Special lab	6	4	4	100
07	P 452P/CB	**Project work**	6	4	4	100
08	PS2/CB	Seminar	4	1	--	25
		Total:	32+4	29		725

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Pattern of Question Paper: The question paper consists of two parts, each covering all the **four units**. Part – A consists of EIGHT short notes questions, carrying 4 marks each. The student has to answer all the questions.

Part – B consists of FOUR essay type questions with an internal choice. Each question carries 12 marks.

Details of Interdisciplinary papers in different pools are given separately

M.Sc. – Applied Electronics Course under CBCS
(w.e.f 2010-2011 for the batch admitted in I year from the academic year 2009 – 2010)
Scheme of Instruction and Examination

Semester – III (M. Sc Applied Electronics)

Sl.No.	Sub.Code	Subject	Instructions Hrs/Week	Credits	Duration of Exam (Hrs)	Max. Marks
	Theory					
01	AE 301T/CB	Digital System Design	4	4	3	20+80**
02	AE 302T/CB	Computer Organisation	4	4	3	20+80**
03	AE 303T/CB	Data Communication and Networking	4	4	3	20+80**
04	AE 304T/CB	Optical Fibre Communication and Mobile Communication	4	4	3	20+80**
05	ID/AE 305T/CB	Interdisciplinary paper* **(for the students of other epartments)**	4	4	3	20+80**
06	**Practicals:** AE 351P/CB	Electronic Circuit Simulation and VHDL – Lab I	6	4	4	100
07	AE 352P/CB	Digital & Analog Lab	6	4	4	100
08	AE S1/CB	Seminar	4	1	--	25
		Total	32+4	29		725

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Pattern of Question Paper: The question paper consists of two parts, each covering all the four units.

Part – A consists of EIGHT short notes questions, carrying 4 marks each. The student has to answer all the questions.

Part – B consists of FOUR essay type questions with an internal choice. Each question carries 12marks.

Details of Interdisciplinary papers in different pools are given separately

M.Sc. – Applied Electronics Course under CBCS
(w.e.f 2010-2011 for the batch admitted in I year from the academic year 2009 – 2010)
Scheme of Instruction and Examination

Semester – IV (M. Sc Applied Electronics)

Sl.No.	Sub.Code	Subject	Instructions Hrs/Week	Credits	Duration of Exam. Hrs	Max. Marks
	THEORY					
01	AE 401T/CB	Digital Systems Design using VHDL	4	4	3	20+80**
02	AE 402T/CB	Micro Controller & It's Applications	4	4	3	20+80**
03	AE 403T/CB	Control Systems	4	4	3	20+80**
04	AE 404T/CB	Microwave Systems	4	4	3	20+80**
05	ID/AE 405T/CB	Interdisciplinary Paper* (**for the students of other Departments)**	4	4	3	20+80**
06.	**Practicals:** AE 451P/CB	Electronic Circuit Simulation and VHDL – Lab & Digital lab -Microwave and fiber optics	6	4	4	100
07	AE 452P/CB	Project work	6	4	4	100
08	AE S2/CB	Seminar	4	1	--	25
		Total	32+4	29		725

**** Out of 100 Marks for each theory paper 20 Marks are allotted for internals and 80 for university exam. Common Syllabus to University and Constituent Colleges. There shall be no internal assessment examinations for practicals. Practical Examinations will be conducted at the end of each semester.**

Pattern of Question Paper: The question paper consists of two parts, each covering all the four units.

Part – A consists of EIGHT short notes questions, carrying 4 marks each. The student has to answer all the questions.

Part – B consists of FOUR essay type questions with an internal choice. Each question carries 12marks.

Details of Interdisciplinary papers in different pools are given separately

M. Sc(Physics) and M.Sc.(Applied Electronics) Courses under CBCS
(for the batch admitted from the academic year 2009 – 2010 onwards)
Interdisciplinary papers (for other department students) wef 2010-2011

Scheme of Instruction and Examination for interdisciplinary courses

S.No	Subject Code	Subject	Instructions Hrs/week	Credits	Duration of examination	Marks
01	ID/P 305T /Pool 1/CB ID/P 305T/Pool3/CB	Basics of Nano Science	4	4	3	20+80**
02	ID/P 405T /Pool 1/CB ID/P 405T/Pool3/CB	Basic Electronics	4	4	3	20+80**
03	ID/AE 305T/Pool 1/CB	Fundamentals of Semiconductor devices and Applications	4	4	3	20+80**
04	ID/AE 405T/Pool 1/CB	Basics of Communication systems	4	4	3	20+80**
05	ID/NC 305T/Pool 2/CB	Fundamentals of Internet working	4	4	3	20+80**
06	ID/NC 405T/Pool 2/CB	Medical Physics & Bioinformatics	4	4	3	20+80**

Subject Codes with ID/P 305T /Pool 1, , ID/AE 305T/Pool 1 & ID/P 405T /Pool1, ID/AE 405T/Pool 1, are offered in III and IV- Semesters, by the Detartment of Physics, University college of Science, OU in pool 1.

Papers ID/NC 305T/Pool 2 and ID/NC 405T/Pool 2 are offered in III and IV Semesters, by the Department of Physics, Nizam College, OU in pool 2.

For Pool 3 students, Department of Physics, University College for Women, Koti offers the same ID papers, ID/P 305T , ID/P 405T, offered by Dept of Physics,UCS.

** Out of 100 Marks for each theory paper 20 Marks are allotted for internals and 80 for university exam

Note: The campus and constituent colleges are divided into three pools with respect to the Interdisciplinary Papers (ID):

a. Pool-I includes all the PG Departments in Campus (except Law and Business Management) and PG College, Secunderabad.
b. Pool-II includes all the PG Departments of Nizam College and PG College, Saifabad.
c. Pool-III includes all the PG Departments of University College for Women, Koti.

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

General Papers

(Common for all Specialisations)

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the students admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - IIIrd Semester Syllabus - General Paper

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

P 301T/CB

PAPER - I (Common for all Specializations)

(**Modern Optics & Spectroscopy**)

UNIT – I :: Principles of Lasers and Laser systems:

Emission and absorption of Radiation – Einstein Relations. Optical feedback - Pumping threshold condition – Laser Rate equations for two, three and four level lasers. Variation of laser power around threshold – optimum output coupling. Laser modes of rectangular cavity – the quality factor and line width of lasers – some laser systems: Neodymium, YAG based solid state laser, Ar ion laser, CO_2 molecular laser- Semiconductor lasers

UNIT – II :: Holography and Non-linear optics

Basic principle of Holography - Recording of amplitude and phase. The recording medium and Reconstruction of original wave front (qualitative and quantitative) -Gaber Hologram and its Limitations -Off axis Hologram- the Fourier transforming property of thin lens Fourier transform Hologram. Spatial frequency filtering – Applications of holography Non-Linear Optics – Harmonic generation - Second harmonic generation. Phase matching condition - Optical mixing - Self focusing of light.

UNIT – III :: Atomic Spectra

One electron system - Atomic orbitals, spectrum of hydrogen - spin – orbit coupling. Fine structure of spectral lines, Zeeman spectra, Paschen – Back and Stark effects. Two electron system, Pauli's Exclusion Principle, level scheme for two electron atoms- LS and JJ coupling – multiplet splitting - Landes ' g ' factor, Landes interval rule, equivalent and inequivalent electronics states of two electron system. Singlet and triplet series of two electron system,

UNIT – IV :: Rotation and Vibration spectra of molecules

Interaction of radiation with rotating molecules. Isotopic effect of rotational levels. Vibrational spectra – Vibrational rotational spectra of Diatomic molecules. Classical and quantum theory of Raman effect. Normal vibrations of Co_2 and H_2O molecules. Electronics spectra of Diatomic molecules – Deslandre's table. Progressions and sequences. Franck Condon principle – Dissociation energy - Fortrat parabola

Recommended Books:

1. Principles of Lasers – O.Svelto.
2. Lasers and Non-Linear optics – B.B. Laud Wiley Eastern
3. Introduction to Fourier optics – J.W. Goodman Mc Graw Hill
4. Optical Electronics – Ghatak nd Thyga Rajan.
5. Atomic Spectra – H.E. white.
6. Molecular Spectroscopy – G. Aruldhas, Prentice Hall of Inida Pvt. Ltd.
7. Fundamentals of Molecular spectroscopy – C.N. Banwell

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) - IV Semester Syllabus – General Paper

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

P 401T/CB

PAPER - I (Common for all Specializations)

(Nuclear Physics)

Unit- I NUCLEAR FORCE AND NUCLEAR MODELS

Systematics of nuclear force-strength, range, charge independence; Deuteron problem and its contribution to the definition of the Nuclear force. Exchange force theories-Majoranna, Bartlett, Heisenberg and Yukawa.

The liquid drop model-the semi empirical mass formula and its applications. The Shell model-states based on square well potential and harmonic oscillator potential. Predictions-spins and parities of nuclear ground states, magnetic moments ,electric quadrupole moments.

UNIT-II NUCLEAR DECAY PROCESSES

α-decay, Gamow's theory, fine structure of α spectrum. alpha decay, systematics, neutrino hypothesis, Fermi's theory of β-decay, Fermi-Kurie plot, angular momentum, selection rules for β-decay, -decay, Multipole radiation, selection rules.

UNIT – III NUCLEAR RADIATION DETECTION

Interaction of charged particles with matter, Bohr's theory, Bethe's formula. Range-energy relation. Stopping power. Measurements of range and stopping power. Interaction of gamma rays with matter-Photoelectric effect, Compton effect and pair production. gamma ray detection using gas, scintillation and solid state detectors.

UNIT – IV NUCLEAR REACTIONS

Classification of nuclear reactions, Kinematics and Q-value of reactions. Basic theory of Direct nuclear reactions-Born approximation, stripping and pick-up reactions, characteristics, cross-sections,examples and applications. Compound nucleus formation. Theory of Fission and fusion reactions. Nuclear structure information from nuclear reactions.

PARTICLE PHYSICS

Introduction; Classification of fundamental forces, Standard Model- Elementary particles (quarks, baryons, mesons, leptons); Spin and parity assignments, isospin, strangeness,

REFERENCES

1. Concepts of Nuclear Physics; B.L.Cohen (TMH)
2. Introductory Nuclear Physics: Kenneth S.Krane (Wiley)
3. Nuclear and Particle Physics:Blin-Stoyle (Chapman and Hall)
4. Nuclear Physics;I.Kaplan (Narosa 2002)
5. Introductory Nuclear Physics: W.Wong
6. Introductory Nuclear Physics: S.B.Patel
7. Nuclear Physics: Tayal

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

Special Subject: ***Biophysics***

w.e.f 2010-2011 under CBCS at
Nizam College

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) - IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Bio-Physics Specialisation at Nizam College

PBP302T/CB

Paper II
Molecular Biophysics

Unit I: Structure and functions of macromolecules and Biocatalysis

Structure and function of disaccharides and polysaccharide. Classification of proteins. Primary and secondary structures of proteins. Conformation of proteins. Structure of DNA double Helics. DNA duplication. Protein synthesis. Structure and functions of lipids. Classification of enzymes. Michaelis-Menten model for enzyme catalysed reactions. Lineweaver-Burke plots. Inhibitors- specific and non-specific. Modified Michaelis-Menten model for fully competitive and non-competitive inhibited enzyme catalysed reactions. Enzyme specificity. Enzyme structure and function relation.

Unit II: Statistical thermodynamics and CD & ORD

Intramolecular and intermolecular forces: Strong interactions – Covalenet bond and Ionic bond. Weak interactions – Dipole – dipole interaction, Permanent dipole and induced dipole interaction, Transient dipole, induced dipole interaction. Dispersion forces between large molecules. Hydrogen bond interaction. Molecules in solutions - Debye-Huckel theory. Statistical thermodynamics and biology. Entropy transfer of living organisms. Information theory – relation between information and entropy. Information content of some biological systems.

Nature and origin of optical activity. Optical rotation and circular dichorism. Drude's equation. Moffit's equation. Cotton effect. Optical activity in native proteins and conformation. Determination of helical content.

Unit III: Absorption spectroscopy and molecular structure

Basic principle and experimental technique of infrared spectroscopy. Application to biomolecules and tissues.

Basic principle and experimental technique of ultraviolet spectroscopy. Beer-Lambert law. Application to proteins and nucleic acids.

Basic principle and experimental technique of NMR spectroscopy. Resonance condition. Chemical shifts and spin-spin coupling . Application to proteins and nucleic acids.

Basic principle and experimental technique of ESR spectroscopy. Application to proteins, nucleic acids and cellular constituents such as chloroplast.

Unit IV: X-ray diffraction of biological molecules

Diffraction of X-rays: Crystal structure and the unit cell. Layer lines and crystal arrays. Vector representation of amplitudes and width of diffraction maxima. Density distribution within a cell. Structure determination – Amplitude and Phase information. Phase determination procedures: The Patterson method, Direct methods – Hauptman-Karle method, Hoppe-Zechmiester method.

The X-ray diffraction patterns of some protein fibers. Structure of polypeptide chains, Pleated sheaths and α - helix. Structure of globular proteins. X-ray diffraction of DNA.

Recommended Books:

1. Essentials of biological chemistry - by Fairley & Kilgour
2. Molecular Biophysics - by Setlow & Pollard
3. Essentials of Biophysics – P. Narayanan, New Age International Publishers
4. Biophysics – An Introduction – Rodney Cotterill, John Wiley & Sons (Asia) Pvt. Ltd.

Reference Books:

1. Life chemistry - An introduction to Biochemistry - by Steiner
2. Intermediate Physics for medicine and biology - by Russel K, Hobby
3. Biophysical Chemistry - by A G Marshall
4. An introduction to spectroscopy for biochemists – by Brown

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) - IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Bio-Physics Specialisation at Nizam College

PBP303T/CB

Paper III

Cell and Membrane Biophysics

Unit I : Cellular Oscillations and Biological cell dielectrophoresis

The biophysicist's view of the living cell. Modifications of the living cell. Cell division. Electrical oscillatory phenomenon associated with cellular reproductive cycle. Electrical oscillations related to the contact inhibition of reproduction in cells.

Origin of cellular spin resonance – A bipolar rotational conduction. Asymmetric cell to cell polarization. Cellular spin resonance (CSR). Evidences of oscillating electric fields from cells by Cellular spin resonance (CSR) and Dielectrophoresis.

A simple description of dielectrophoresis. Behaviour of charged and neutral matter in (a) uniform and (b) non-uniform D. C. and A. C. electric fields. Types of polarization. Bunching effect or pearl chain formation of cells. Field geometries – spherical, cylindrical and isomotive. Dielectrophoretic force in radial field. Dielectrophoretic collection rate (DCR) of cells in radial field. Experimental technique for DCR of biological cells. Calculation of excess permittivity of cells.
Single cell dielectrophoresis. Experimental technique for the determination of retention voltage. Calculation of excess permittivity of lone cells using retention voltage.

Unit II: Biological dielectrics

Theory of homogeneous dielectrics. Theory of heterogeneous dielectrics. Lossy dielectrics. Frequency dependence of dielectrics. Dielectric dispersions and Cole-Cole plots. Experimental techniques and theoretical models for the study of dielectric parameters of cells, and soft and hard calcified tissues.

Unit III : Semiconduction in molecules, cells and tissues

Semiconduction in biological macromolecules. Techniques of Hall effect and thermoelectric power for the study of nature, concentration and mobility of charge carriers in proteins, cells and tissues. Determination of activation energy. Role of adsorbed water in tissues.

Unit IV: Physics of charged membranes

Cell Membrane: Membrane models, Membrane channels. Membrane capacitance. Relation among capacitance, resistance and diffusion between two conductors.

Movement of substances across cell membrane: Donnan equilibrium. Potential change at the equilibrium. Ion movement in solution: the Nernst – planck equation. Zero total current in a constant field membrane – Goldmann equation.

Recommended Books:

1. Dielectrophoresis – H A Pohl
2. Experimental methods in biophysical chemistry – Nicolau
3. Intermediate Physics for Medicine and biology – Russel K, Hobby

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) - IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Bio-Physics Special at Nizam College

PBP304T/CB

Paper IV
Physiological Biophysics

Unit I : Physics of muscle

Ultrastructure of muscle. Ultrastructure of the Sarcomere – description, arrangement of A and I filaments; H zone and m line; Cross-bridges between A and I filaments; Z line structure. Molecular architecture of sarcomere – Myosine and Actine molecules. Molecular Biophysics and muscle contraction – Sliding filament model, Bioenergetics of muscle contraction, Regulation of muscle contraction Elastic behaviour of Muscle. Electrophysiology of muscle.

Unit II: Physics of Nerve

Nature of nerve and nerve cell. Chemical and electrical properties of mylinated and non-mylinated nerves. Charge distribution in resting nerve cell. Leakage current across the cell membrane. Electrotonus. Hodgkin-Huxley model for membrane current. Propagating nerve impulse. Properties of mylinated conduction.

Unit III : Physics of Eye

Eye as an optical instrument. Structure of eye – Physicist's view. Physiological optics. Anatomy of eye. Photochemistry of visual process. Quantum effects in dark adapted vision. Refraction of the eye. Visual Acuity. Intensity and wavelength limits of the visual system.Stabilised images, Acuity and Illusions. Integrative processes in the retina. Colorimetry and colour vision.

Unit IV : Physics of Ear

Human auditory system**.** Structure of ear. Auditory pathways Structure of choclea. Scanning electron micrographs of inner and outer hair cells of the organ of corti. Cochlear patterns. Theories of hearing. Perception of hearing. The growth of loudness. Audiometry. Deafness and Hearing Aids.

Recommended Books:

1. Electrogenesis and contractility in skeletal muscle cells – Jozef Zachar
2. Experimental sensory Physiology – B Scharf, Scott
3. Topics in Classical Biophysics – Harold J. Metcalf, Printeice Hall Inc

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Bio-Physics Special at Nizam College

PBP402T/CB

Paper II

Radiation Biophysics

Unit I : Action spectra and quantum yield

Introduction – Light sources and materials, monochromators, intensity measurements.

Definition and theory of action spectra. Inactivation of proteins and DNA. Light action on respiratory pigments. Photosynthesis. Cooperative events in light action: the Poisson's distribution.

Unit II : Ionizing radiation and cellular constituents

Nature of ionizing radiation, Measure of radiation – the roentgen, Ionisation by X-rays, γ rays or neutrons.

Dosimetry. Action of ionizing radiation on molecular systems. Target theory. Variable linear energy transfer. Radiation sensitivity of large molecules.

Ionising radiation interaction with tissues and chromosomes.

Unit III : Physics of diagnostic x-rays

Production of X-ray beams – X-ray machine. Properties of X-rays. Absorption of X-rays. X-ray image intensifier T.V. Radiation to patient from X-ray. Live X-ray imaging – fluoroscopy, digital imaging, computed tomography. Introduction to CT, MRI scan.

Unit IV : Nuclear medicine Physics

Radioactivity and radiation sources. Statistical counters. Basic instrumentation and its clinical applications. Nuclear medicine imaging devices. Physical principles of nuclear medicine imaging procedures and RIA. Therapy with radioactivity.

Biological effects of radiation - principles of radiation therapy, mega voltage therapy, Brachy therapy.

Recommended Books:

1. Molecular Biophysics – Setlow and Pollard
2. Medical physics – John R, Cameron & G Skefrenick
3. Physical for medical imaging – RF Farr and PJ Allisy-Roberts, Saunders – An Imprint of Elsevier.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Bio-Physics Specialisation at Nizam College

PBP403T/CB

Paper III
Bio – Instrumentation and Medical Physics

Unit I : Bio – instrumentation

Bioelectric signals and electrodes- Electrode and electrolytic interface; Surface and metal plate electrodes; Needle and wire electrodes; Microelectrodes. Physiological transducers – Variable resistance transducers; Variable inductance transducers; Variable capacitance transducers; thermo resistive transducers; Photoelectric transducers; Piezoelectric transducers. Biomedical amplifiers – Basic requirements; Differential amplifiers; Carrier amplifier; Chopper amplifier; Phase sensitive detector. Recording systems – Characteristics of recording systems; Moving coil recorder; moving iron recorder; Recording techniques – Heat stylus; optical light and ink jet.

Unit II : Physics of respiratory system

Major components of respiratory system. The airways. Interaction of blood and lungs. Pressure – airflow – volume relationship. Physics of the Alveoli. Breathing mechanism. Airway resistance. Work of breathing. Physics of some common diseases.

Unit III : Physics of the cardiovascular system

Major components of the cardiovascular system. Oxygen and carbon dioxide exchange in capillary system. Work done by the heart. Transmural pressure. Laminar and turbulent blood flow. Heart sounds. The physics of some cardiovascular diseases. Cardiovascular Instrumentation – Electrodes, Amplifiers, patient Monitoring, Defibrillators, Pace makers.

Unit IV Image processing in medicine

Principle, description, working, analysis and clinical applications of Ultrasonic imaging, ECG EMG, EEG & ERG.

Recommended Books:

1.Hand book of biomedical instrumentation – R S Khandpur
2.Medical Physics - John R, Cameron & G Skefrenick
3. Principles of medical electronics and Biomedical instrumentation

- C Raja Rao & S K Guha, Universities Press.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Bio-Physics Specialisation at Nizam College

PBP404T/CB

Pape IV

Physico Chemical Techniques n Biophysics

Unit-I Molecular weight determination

Specific and intrinsic viscosities and their determination by Ostwald's method. Determination of molecular weight from intrinsic viscosity.

Theory of sedimentation. Determination of sedimentation coefficient by sedimentation equilibrium method and sedimentation velocity method. Calculation of molecular weight from sedimentation equilibrium and velocity methods.

Rayleigh's equation for scattering for dilute gas. Theory for particles small compared with wavelength of light. Theory of large particles with dimensions approaching the wavelength of light. Expression for the particle scattering factor P (ϕ) and its relation to radius of gyration.

Unit-II Osmosis

Osmotic pressure in an ideal gas and in a liquid. Some clinical examples of osmotic pressure – Edema due to heart failure, Edema of inflammatory reaction, headaches in renal dialysis, osmotic dieresis, osmotic fragility of red blood cells. Volume transport through membrane. Solute transport through membrane. Artificial kidney. Gomerular filtration.

Unit- III Chromatography and Electrophoresis

Introduction to chromatography. Principle, Instrumentation, working and biological applications of Column chromatography, liquid chromatography, Thin layer chromatography (TLC), Paper chromatography, Ion exchange chromatography, Gel chromatography, Affinity chromatography, Gas chromatography.
Introduction to Electrophoresis. Supporting media. Disc electrophoresis: Isoelectric focusing, Isotachophoresis

Unit-IV Microscopy

Principle, description, working and biological applications of Fluorescence microscope; Ultraviolet microscope; Interference microscope; Polarizing microscope; Phase contrast microscope; Electron microscope; Scanning probe microscopy – Atomic Force microscope (AFM), Scanning tunneling microscope ((STM). Scanning near field optical microscope (SNOM).

Recommended Books:

1. Physical chemistry of macromolecules – Tanford
2. Intermediate physics for medicine and biology – Russel K, Hobby
3. Molecular Biophysics – Setlow and Pollard
4. Methods in Modern Biophysics– Bengt Nolting, Springer International Edition.

BIOPHYSICS Specialisation

Biophysics Practicals

Semester: III

1. Determine size of human RBC of different physiological conditions, using the techniques *Laser diffraction* and *Eriometer*.
   Discuss your results with respect to the physiology of RBC and technique used.

2. Draw V-I characteristics of the given hard tissues and protein samples and determine electrical resistivity of the samples at 100 volt.
   Determine dielectric parameters such as Dielectric constant, dissipation factor and Dielectric loss of the given samples using LCR meter.
   Determine *Activation energy* of the given samples.
   Discuss your results.

3. Study dielectrophoretic collection rate (DCR) of human erythrocytes suspended in glycine-glucose isotonic solution and subjected to non-uniform electric fields produced by pin-pin electrode configuration.
   Determine DCR as a function of (a) voltage, and (b) elapsed time of applied electric field.
   Determine Threshold voltage of human erythrocytes as a function of a) frequency of applied electric field.
   Calculate excess permittivity of human erythrocytes from the knowledge of DCR

4. Determine *Relative viscosity, specific viscosity* and *Intrinsic viscosity* of the given polymer solution using Ostwald viscometer.
   From the viscometric data, calculate the molecular weight of the given polymer.
   Discuss your results with respect to polymer and technique used.

5. Determine *viscosity* and *Surface tension* of human blood and its serum and plasma at room temperature using *Capillary technique*.
   What are the advantages of this technique?
   Discuss your results with respect to the sample and technique used.

6. Determine *Elastic Constants* such as Young's modulus, rigidity modulus, bulk modulus and Poisson's ratio of horny material using *Optical interference* technique.
   What are the advantages of the technique?
   Discuss your results with respect to material studied and technique used.

7. Study denaturation of glucose. Determine specific rotation of polarized light at the wave length of sodium light, when passed through the glucose solution, using polarimeter.
   Discuss your results.

8. Estimate *Chlorophyll **a*** and *Chlorophyll **b*** in the given leaves of different plants using spectrocolorimeter.
   Discuss your results with respect to species of the given leaves.

9. Study spectroscopically oxyhemoglobin, carboxyhemoglobin and methamoglobin.
   What inference you draw from the experimental results?

10. Study dielectric properties such as dielectric constant, dielectric loss of hard calcified tissues at microwave frequencies.

11. Determine *Auto catalytic ion efflux constant* by measuring the conductivity of the medium during the process of germination of seeds of different physiological conditions.

12. Determine velocity and absorption of ultrasound in biofluids using ultrasonic Interferometer.

13. Study osmotic fragility of human blood.

14. Determine specific gravity or density of blood of animals belonging to different Locomotion.

15. Find the HVT of a given biomaterial and hence determine mass absorption coefficient.

16. Study the dependence of back scattering of β particles on the thickness of the back scatterer and hence determine the saturation thickness of the given bio-material.

Semester: IV

1. Determine inspired volume using sustained maximal inspiration (SMI) technique.

2. Screen the lung function in suspected obstructive airway diseases and study the effectiveness of the bronchodilator therapy.

3. Measure blood pressure of a person in different postures using sphygmomano - meter and stethoscope by auscultatory method and discuss your results.

4. Estimate glucose, urea and total protein in the given biofluid.

5. Determine helical parameters of proteins and DNA using the x-ray diffracto-grams.

6. Study of Temperature Transducers

7. Study of Photo Transducers

8. Study of LVDT

9. Study of Strain gauge

10. Study of Ventilatory movements

11. Study of ECG

12. Study of EMG

13. Study of EEG

14. Study of Heart sounds

15. Determine velocity and absorption of ultrasound in animal and plant tissues and calculate acoustical characteristic parameters.

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

<u>Special Subject:</u> Electronics-Communications

w.e.f 2010-2011 under CBCS at
Nizam College

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

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Electronics Communication Specialization at Nizam College

PEC302T/CB

PAPER – II

(8051 Micro-controller & its Applications)

UNIT - I

Architecture of microcontroller: Micro controllers & Embedded Processors: Micro controller versus General-purpose Microprocessors, Microcontrollers for embedded systems, embedded applications, choosing a Microcontroller.

8051 Architecture: 8051 Microcontroller hardware, input/output pins, ports and circuits, external memory, counter and timer, serial data input and output, interrupts, other members of 8051.

UNIT – II

8051 Instructions and Programming: Addressing modes: immediate and register addressing modes, accessing memory using various addressing modes.

Arithmetic instructions and programs: unsigned addition and subtraction, unsigned multiplication and division, signed members concepts and arithmetic operations.

Logic Instruction and programs: Logic and compare instructions rotate and swap instructions. Jump, Loop and call instructions; Loop and jump instructions, call instructions, time delay, generation and calculation.

Single bit instructions and programming: single bit instruction programming, single bit operation with carry reading input pins versus port latch. I/O port programming: I/O programming, bit manipulation.

UNIT – III

8051 Timer / Counter, serial communication and interrupts programming:

Timer / Counter programming : programming 8051 timers, counter programming, pulse frequency and pulse width measurements.

Serial communication programming: Basics of serial communication, 8051 connection to RS232, 8051 serial communication programming.

Interrupts programming: Interrupts of 8051; programming timer interrupts, programming external hardware interrupts, and programming serial communication interrupts.

UNIT – IV

Application of 8051 micro controllers: Programmable peripheral interface (PPI)-8255, programming 8255, 8255 interfacing with 8051. Interfacing Key board. Interfacing LED / LCD, Interfacing A/D & D/A converters, Interfacing stepper motor.

RECOMMENDED TEXT BOOK:

1. The 8051 Microcontroller – Architecture. Programming and Applications by Kenneth J. Ayala: Penram International Pub (1996)
2. 8051 Micro controller and Embedded systems by Mazidi and Mazidi, Pearson Education Asia (2002)

REFERENCE BOOK:

The concepts and features of micro controllers (68HC11, 8051, 8096) by Rajkamal: Wheeler Pub (2000)

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PEC303T/CB

PAPER III

(Digital Transmission Techniques & Information Theory)

UNIT- I DIGITAL TRANSMISSION OF ANALOG SIGNALS

The Sampling Theorem, Pulse-Amplitude Modulation, Natural Sampling, Flat-top Sampling, Signal Recovery through Holding, Quantization of Signals, Quantization Error, Pulse-code Modulation(PCM), The PCM System, Companding, Multiplexing PCM Signals, Differential PCM, Delta Modulation.

DIGITAL MODULATION TECHNIQUES

Binary Modulation Techniques:: ASK, PSK, FSK, and their Generation & Detection QPSK, MSK.

UNIT II INFORMATION THEORY

Discrete messages, The concept of amount of Information, Average Information, Entropy, Information rate, Shannon's Theorem, Channel Capacity, Capacity of a Gaussian Channel, Bandwidth-S/N TradeOff, Use of Orthogonal Signals to attain Shannon's limit, Efficiency of Orthogonal Signal Transmission.

UNIT III CODING

Need for Coding, Parity Check Bit Coding for Error detection, Coding for Error detection and Correction, Block Codes, Coding and Decoding for block codes, Algebraic codes, Burst Error Correction, Convolution Coding and Decoding, Error in Convolution codes, Automatic repeat request.

An Application Information Theory – Optimum Modulation System, Trellis – decoded Modulation.

UNIT IV OPTIMUM RECEVERS – MATCHED FILTERS

Formulation of optimum receiver problems. Maximization of out put signal to noise ratio. Properties of matched filters; Approximations in matched filter design. Probabilistic approach; Probability of error in Binary PCM.

TEXT BOOK

Principles of Communication Systems- H.Taub and D.L.Schilling
Second Edition.
An Introduction to Analog and Digital Communications-Simon Haykin

REFERENCE

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

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Electronics Communication Specialization at Nizam College

PEC304T/CB

PAPER IV

(DATA AND COMPUTER COMMUNICATIONS – 1)

UNIT I:

DATA TRANSMISSION: Analog and Digital transmission, Transmission Impairments, Channel Capacity.

GUIDED AND WIRLESS TRANSMISSION: Guided transmission media, Wireless transmission, Wireless propagation, Line of sight transmission.

DIGITAL DATA COMMUNICATION TECHNIQUES: Asynchronous and synchronous transmission, Types of Errors, Error detection, Error correction, Line Configurations, Interfacing.

UNIT II

DATA LINK CONTROL: Flow Control, Error control, High level Data link control.

MULTIPLEXING: Frequency division Multiplexing, Synchronous Time division Multiplexing, Statistical Time division Multiplexing, Asymmetric Digital Subscriber line, xDSL.

CIRCUIT SWITCHING, PACKET SWITCHING: Switching Networks, Circuit Switching Networks, Circuit Switching Concepts, Control Signaling. Soft switch Architecture, Packet Switching principles, X.25.

FRAME RELAY: Frame Relay Protocol architecture, User Data Transfer.

UNIT III

ROUTING IN SWITCHINED NETWORKS: Routing in Circuit switching Networks, Routing in Packet switching Networks, Least cost Algorithms.

ASYNCHRONOUS TRANFER MODE (ATM): ATM Protocol architecture, ATM Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service categories, ATM Adaptation Layer.

CONGESTION CONTROL IN DATA NETWORKS: Effect of congestion, Congestion control, Traffic management, Congestion control in Packet switching networks, Frame relay congestion control, ATM Traffic Management.

UNIT IV

LOCAL AREA NETWORKS (LAN): Topologies & Transmission Media, LAN Protocol Architecture, Layer 2 & Layer 3 switches.

HIGH SPEED LANS: Ethernet, Token Ring, Fiber Channel.

WIRELESS LANs: Wireless LAN Technology, IEEE 802.11 Architecture and Services, IEEE 802.11 Medium Access Control, IEEE 802.11 Physical layer

TEXT BOOK

Data and Computer Communications – William Stallings [SEVENTH &EIGTH Edition]

REFERENCES

Computer Networks – A.S.Tanenbaum [Third Edition]

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

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Electronics Communication Specialization at Nizam College

PEC402T/CB

PAPER II

(OPTICAL FIBER COMMUNICATIONS)

UNIT I- OPTICAL FIBERS

Fiber modes and Configurations**:** Fiber types and their structures. Ray optics representation.

Mode theory for circular waveguides: Step index fibers, single mode fibers, and Graded index fibers - WKB Approximations for estimating number of modes.

Fiber Materials for glass fibers and plastic fibers. Fiber fabrication methods: Outside Vapor Pressure Oxidation; Vapor axial deposition; Modified chemical vapor deposition; Plasma activated chemical vapor deposition; Double crucible method. Fiber drawing processes.

Fiber optic cable design: Fiber to fiber joints, fiber splicing & Optical fiber connectors.

UNIT II - TRANSMISSION CHARACTERISTICS

Signal attenuation in optical fibers: Absorption, scattering and bending losses in fibers, core and cladding losses.

Signal distortion in optical wave guides: Material dispersion, wave guide dispersion, intermodes distortion. pulse broadening.

UNIT III - OPTICAL SOURCES AND DETECTORS

Optical Sources: Basic semiconductor properties, materials, p-n junction hetrostructures. (a) Light Emitting Diodes (LEDs): Structures, light source materials, internal quantum efficiency, modulation capability, transient response, power bandwidth product. (b) Laser diodes: Modes and resonant frequencies, reliability.

Optical Detectors: Physical principles of PIN photo detectors, Avalanche photo detectors. Detector noise: Noise in PIN photo diodes and Avalanche photo diodes

UNIT IV - DIGITAL TRANSMISSION SYSTEMS

Optical receivers: Fundamental receiver operation, receiver structures, receiver performance. Point to point links, link power budget.

Review of multiplexing techniques: Optical Time Division Multiplexing (OTDM), Wavelength Division Multiplexing (WDM).

Coherent Optical Detection: Basic System, Practical constraint, Modulation and Demodulation Formats.

TEXT BOOK:

Optical Fiber Communications – by Gerad Keiser

Optical Fiber Communications – by John M. Senior (PHI)

REFERENCE

Optical Fibres – T. Gowar

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

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Electronics Communication Specialization at Nizam College

PEC403T/CB

PAPER III

(DATA AND COMPUTER COMMUNICATIONS – 2)

UNIT I : PROTOCOL ARCHITECTURE:

Basic protocol functions. OSI Model: Model, standardization within the OSI framework. Service Primitives and Parameters. Functions of OSI layers. TCP/IP Model: TCP/IP layers and their functions, Operation of TCP/IP, TCP/IP application

INTERNETWORK PROTOCOLS: Principles of Internetworking: Requirements, architectural approaches. Connectionless Internet working: Operation of a connectionless internetworking scheme, Design issues. Internet protocol: IP services, IP datagram format, IP addresses – Network Classes, Subnets and Subnet masks, Internet Control Message Protocol (ICMP). IPV6: Motivation for new version, enhancements in IPV6 over IPV4, IPV6 structure, IPV6 header, IPV6 addresses, hop by hop option header, fragment header, routing header and destination option header.

UNIT II: INTERNETWORK OPERATION: Multicasting: Practical applications, multicasting in an internet environment, requirements for multicasting. Routing protocols: Autonomous systems, approaches to routing, Border Gateway Protocol (BGP) and Open Short Path First (OSPF) Protocol.

TRANSPORT PROTOCOLS: Connection Oriented Transport Protocol Mechanisms: Reliable sequencing network service, Unreliable network service. TCP: TCP services, TCP header format, TCP mechanisms. TCP congestion control: Retransmission Timer Management, window management. UDP.

UNIT III – NETWORK SECURITY:

Security Requirements and Attacks: Passive attacks and Active attacks. Confidentiality with Symmetric Encryption: Symmetric encryption, encryption algorithms, location of encryption devices, key distribution and traffic padding. Message Authentication and Hash Functions: Approaches to message authentication, secure hash functions, SHA-1 secure hash function. Public-Key Encryption and Digital Signatures: Public key encryption, digital signature, RSA public key encryption algorithm, Key management. IPV4 and IPV6 security: Applications of IPsec, scope of IPsec, security associations, authentication header and encapsulating security payload.

UNIT IV - DISTRIBUTED APPLICATIONS

Electronic Mail – SMTP and MIME: SMTP and MIME. Hypertext Transfer Protocol (HTTP): HTTP overview, messages, request messages, response messages and entities. Network Management – SNMP: Network management systems.

TEXT BOOK

Data and Computer Communications – William Stallings [SEVENTH & EIGHTH Edition]

REFERENCES

Computer Networks – A.S.Tanenbaum [Third Edition]

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

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Electronics Communication Specialization at Nizam College

PEC404T/CB

PAPER IV

(MOBILE CELLULAR COMMUNICATIONS)

UNIT I - CELLULAR CONCEPTS

Mobile communications-evolution , International Mobile Satellite, Personal Communication Systems [PCS], Standards, Mobile Personal Computers, Speech Codecs. Fundamental Radio Propagation and System concepts, Antenna Gain, Propagation characteristics, model for multipath-faded radio signals, Instumentation for lab testing.

UNIT II - SPREAD SPECTRUM SYSTEMS AND DIVERSITY TECHNIQUES

Concept of Spread Spectrum System, pseudo-noise sequences, performance of Direct Sequence Spread Spectrum Systems, Code Division Multiple Access, Direct Sequence and Frequency Hopping systems, Synchronization . Applications.

Concept of Diversity Branch and Signal Paths, Combining and Switching Methods, Carrier-to- Noise and Carrier- to- Interference Ratio, Performance Improvements.

UNIT III - MEDIUM ACCESS CONTROL

Motivation for a specialized MAC, Hidden and esposed terminals, Near and far terminals, SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packer reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhabit sense multiple access, CDMA, Spread Aloha multiple access, Comparison of S/T/F CDMA

TELECOMMUNICATION SYSTEMS

GSM, Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, New data services.

UNIT IV - SATELLITE SYSTEMS

History, Applications, Basics, GEO, LEO, MEO, Routing, Localization, Handover, Examples.

BROADCAST SYSTEMS

Overview, cyclic repetition of data, Digital audio broadcasting, Multimedia object transfer protocol, Digital video broadcasting,

TEXT BOOKS

Wireless Digital Communications -- Kamilo Feher

Mobile Communications – Jochen Schiller

REFERENCES

Mobile Cellular Telecommunications –W.C.Y. Lee [Second Edition]

ELECTRONICS COMMUNICATION PRACTICALS
THIRD & FOURTH SEMESTERS

ELECTRONIC COMMUNICATION PRACTICALS

1. Amplitude Modulation & Demodulation
2. Frequency Modulation & Demodulation
3. Pulse Code Modulation & Demodulation
4. Pulse Amplitude Modulation & Demodulation
5. Pulse Width Modulation & Demodulation
6. Delta Modulation & Demodulation
7. ASK Modulation & Demodulation
8. FSK Modulation & Demodulation
9. PSK Modulation & Demodulation
10. Analog Time division Multiplexing & Demultiplexing.

EXPERIMENTS IN OPTICAL FIBRES

1. Measurement of Numerical Aperture
2. Measurement of Propagation loss, Bending loss and Connector loss
3. Measurement of length of the Cable
4. Study effect of Lateral, Longitudinal and Angular Displacement
5. Study effect of EMI interference on Copper medium and Optical Fiber medium
6. Study of Characteristics of Optic LED and Photo detector
7. Setting up of Fiber Optic Analog link and Digital link
8. Study of Characteristics of LASER

EXPERIMENTS IN INTERNET WORKING

1. Designing of Internet with IP addresses
2. Configure Routers and Switch interfaces with IP addresses and subnet masks (VLSM & FLSM).
3. Static Routing
4. Basic RIP (Observe Rip routes and understand the commands).
5. RIP V2.
6. OSPF

EXPERIMENTS WITH MICROCONTROLLER

1. Basic Programs for understanding Instructions
2. Time delay
3. Generating Square wave using time delay
4. Generating Rectangular wave using Timers
5. Interfacing Analog to Digital Conversion
6. Interfacing Digital to Analog Conversion
7. Stepper Motor Controller
8. Computer graphics

9. Programs on Serial Interfacing

EXPERIMENTS IN DATA COMMUNICATIONS

1. Study of Serial Communication
2. Study of Protocols in Communication
3. Study of Fiber Optic Communication
4. Study of Wireless Communication
5. Study of Parallel Communication

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

Special Subject: Electronics-Instrumentation

w.e.f 2010-2011 under CBCS at
University College of Science

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010onwards)

Electronics – Instrumentation Specialization at University College of Science

PEI 302T/CB

Paper – II - (Digital Logic Circuits)

UNIT-I

COMBINATIONAL LOGIC CIRCUITS: Simplifying Logic Circuits, Sum of products form - Algebraic simplification, designing combinational logic circuits, Karnaugh Map Method, looping - pairs, quads, octets, complete simplification process, Don't care conditions, examples.

DIGITAL ARITHMATIC OPERATIONS AND CIRCUITS: Binary addition, representing signed numbers, binary subtraction, BCD addition, Hex arithmetic, ALU, parallel binary adder, design of full adder, carry propagation's,
IC parallel adder, 2's compliments system, IEEE/ANSI symbols.

UNIT-II

FLIP-FLOPS: NAND and NOR gate latches, clock signals and clocked flip-flops, clocked R-S, J-K, and D-FFs, D latches, Asynchronous inputs, IEEE/ANSI symbols, Timing consideration, one shot.

COUNTERS AND REGISTERS: Ripple counters, Counter with MOD numbers $< 2^n$.
IC asynchronous counters, asynchronous down counters, propagation delay in ripple counter, Up/Down counters. Presettable counters, 74193 counter, Decoding a counter, Decoding glitches, synchronous counter design, Left & Right shift registers, shift register counters, IEEE/ANSI symbols.

UNIT- III

IC LOGIC FAMILIES: Digital IC terminology, TTL logic family, TTL series characteristics, improved TTL series, TTL loading and fan-out other TTL characteristics, connecting TTL outputs together, tristate TTL, ECL Family, MOS digital IC's and characteristics, CMOS logic and characteristics, bilateral switch, TTL driving CMOS and vice versa. Low voltage technology

MSI LOGIC CIRCUITS: Decoders, BCD to 7 segment decoder/driver, liquid crystal display, Encoders, multiplexers and their applications, demultiplexers, magnitude comparators, code converters, data busing, data bus operations, IEEE./ANSI symbols,

UNIT- IV

MEMORY DEVICES: General Memory Operation, CPU-Memory connection, Read only memories, ROM architecture, ROM timing, and types of ROMs, Flash memory, and ROM applications.
Semiconductor RAMs, RAM architectures, static RAM, Dynamic RAM (DRAM), DRAMS structure and its operation, DRAM Read/Write cycles, DRAM refreshing, Expansion of word sizes and capacity

PROGRAMMABLE LOGIC DEVICES and INTRODUCTION TO VHDL:

Basic ideas, PLD architectures (PROM), PAL, PLAS, Application of programmable logic devices - GAL 16 V, 8A, programming a PLD, Introduction to VHDL- Description Languages verses Programming Languages, HDL Format and Syntax , Intermediate signals, representing data in VHDL, Truth tables using VHDL.

Text Books

1. Digital Systems - Principles and Applications - Ronald J.Tocci, 6/e, PHI, New Delhi. 1999.
2. Modern digital electronics – R.P.Jain, Tata McGraw Hill 3rd Ediction.
3. Digital Design – M.Morris Mano.

Reference Books

1. Digital Principes and Design -Donald D. Givone.
2. Digital Integrated Electronics - Herbert Taub and Donal Schilling, McGraw Hill, 1985.
3. Digital Electronics - An introduction to Theory and Practice -- William H.Gothmann.
4. Digital Principles and Applications -- Albert Paul Malvino and Donald P. Leach
5. Computer Architecture and Logic Design -- Thomas C.Bartee, McGraw-Hill. Inc.
6. Switching theory and Logic design – R.P. Jain.

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

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Electronics – Instrumentation Specialization at University College of Science

PEI 303T/CB

Paper – III
(Microprocessors, DSPs & Interfacing)

Unit – I

The 8086 Microprocessor - General Organization of a Microcomputer, Detailed Architecture of 8086, Addressing Modes, Instructions Set, Assembly Language Programming, Programming Examples. The 8086-Based **System Design -** Pins and Signals, System Components, Interfacing Memory, I/O Devices.

Unit – II

Peripheral Interfaces and Interfacing with 8086 : Parallel I/O Methods, Programmable Peripheral Interface (8255 A), Key board /Display interface (8279), Programmable Priority Interrupt Controller (8259 A), DMA Controller (8237/8257), Programmable Interval Timer (8254), Programmable Communication interface (8251), UART.

Unit – III

Digital Signal Processors (DSP) Architecture of TMS320C5X- Introduction-Bus structure-Central architecture logic unit (CALU)-Auxilary Register (AR)-Index register (INDX)-ARCR-Block move address register Block Repeat Register, Parallel Logic Unit (PLU), memory mapped registers-Program controller-Some flags in status registers. On chip memory – on chip peripherals.

Unit – IV

The IBM PC Motherboard, I/O Buses and Universal Serial Bus - Motherboard Components, System Resources, ROM BIOS Services. **I/O Buses -** ISA, MCA, EISA, PCI Buses; Local Buses, VL Bus, AGP. Parallel and Serial Ports. **USB -** USB System, USB Transfer, USB Controller.

Advanced Microprocessors - Protected Mode Operation, The 80286, 80386, 80486, Pentium, Pentium-Pro and Pentium I - IV Microprocessors.

Books:

1. Microprocessors, PC Hardware and Interfacing - By N. Mathivanan, PHI, 2003
2. The Intel Microprocessors 8086/8088, 80186/80188, 80286,80386,80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming, and Interfacing - By Barry B. Brey, 6th Ed., PHI / PEA, 17th Reprint, 2003
3. Digital Signal Processors- B.Venkata Ramani and M.Bhaskar (TMH).
4. The 8086 Microprocessor : Programming & Interfacing the PC - By Kenneth J. Ayala Penram International Publishing, 1995
5. Advanced Microprocessors and Peripherals - Architecture, Programming and Interfacing - By A K Ray and K M Bhurchandi, TMH, 2000

6. Advanced Microprocessors and Interfacing - By Badri Ram, TMH, 2nd Reprint 2002
7. Microprocessors and Interfacing, Programming and Hardware - By Douglas V. Hall, TMH, 2nd Ed., 18th Reprint, 2003
8. The 8088 and 8086 Microprocessors - Programming, Interfacing, Software, Hardware and Applications - By Walter A Triebel and Avtar Singh, PHI, 4th Ed., 2002
9. Microcomputer Systems : The 8086/8088 Family, Architecture , Programming, and Design
    a. By Yu-cheng Liu and Glenn A. Gibson, PHI, 2nd Ed., 1986.
10. Microprocessors – Data Hand Book, BPB.
11. IBM PB and Clones Hardware, Trouble shooting and Maintenance -By B.Govindarajalu - TMH, 2nd edition. 2002.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

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Electronics – Instrumentation Specialization at University College of Science

PEI 304T/CB

Paper – IV

(Electronic Instrumentation)

UNIT- I

Measurement and Error: Definitions- Accuracy and Precision – Significant figures – Types of error – Statistical analysis- Probability of errors – Limiting errors.

Performance characteristics of an instrumentation system: Zero, First and Second Order systems – Response of first and second order systems to STEP, RAMP and IMPULSE inputs- Frequency response of first and second order systems. Specification and testing of dynamic response.

UNIT- II

Amplifiers and Signal Conditioning: Instrumentation amplifiers- Isolation amplifiers- Chopper amplifiers- Voltage to frequency and frequency to voltage converters-Frequency multipliers - Logarithmic amplifiers,- S/H Circuits- Attenuators.

Second order active filters – Low pass , High pass, Band pass, and Band stop filters- Butterworth and Tchebychev filters- Frequency transformation- All pass filters.

Phase sensitive detectors (PSD) - Phase lock loop (PLL) – Lock-in-amplifier.

UNIT- III

Signal Generation: Frequency synthesized signal generator- Frequency divider generator- RF signal generator- Signal generator modulation- Sweep frequency generator- Function generator – Noise generator.

Signal Analysis: Wave Analyzer- Audio frequency Wave analyzer- Heterodyne wave analyzer- Harmonic distortion analyzer- Resonant harmonic distortion analyzer- Heterodyne harmonic distortion analyzer- Fundamental suppression harmonic distortion analyzer- Spectrum analyzer- Spectra of CW, AM, FM and PM waves.

UNIT- IV

Electronic Measuring Instruments: Q- meter- Vector impedance meter- Digital frequency meter – Digital voltmeter – Phase meter – RF power and voltage measurement – Power factor meter – Vector volt meter.

Display and Recording: X-t, X-Y Recorders – Magnetic tape Recorders- Laser printers – Ink jet printers. - Storage oscilloscope.

Characteristics of digital displays: LED- LCD – Dot matrix and seven segment display systems.

Recommended Books:

1. Modern Electronic Instrumentation and Measurement Techniques – A.O. Helfrick and W.D.Cooper, Prentice Hall India Publications.
2. Instrumentation Devices and Systems – C.S Rangan, G.R. Sharma and VSV Mani, Tata Mc Graw Hill Publications.
3. Introduction to Instrumentation and Control – A.K Ghosh – Prentice Hall India Publications.
4. Electrical and Electronics Measurement and Instrumentation – A.K.Sawhney.
5. Transducers and Instrumentation- D.V.S Murty PHI Publications.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IV Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Electronics – Instrumentation Specialization at University College of Science

PEI 402T/CB

Paper – II (Embedded Systems and Applications)

Unit – I: The 8051 Microcontroller

Introduction to Microcontrollers : History of Microcontrollers and Microprocessors, Embedded Versus External Memory Devices, CISC and RISC Processors, Harvard and Von Neumann Architectures, Block diagram of the 8051; Inside the 8051, Assembling and Running an 8051 Program, The Program Counter and ROM space, Date Types and Directives, Flag Bits and PSW Register, Register Banks and Stack; Pin Description, I/O Programming, Bit Manipulation; Addressing Modes- Immediate and Register Addressing Modes, Accessing Memory using Various Addressing Modes

Unit-II: Programming the 8051

Instruction Set- Arithmetic instruction Programs- Add, Subtract, Multiplication and Division of Signed and Unsigned and Unsigned Numbers; **Logical** Instruction and Programs- Logic, Compare, Rotate, Swap, BCD and ASCII Application Programs; **Single Bit** Instructions and Programming – Single Bit Instructions with CY; **Jump, Loop** and call Instructions, Time Delay Generation and Calculation; Timer/Counter Programming, Serial Communication an interrupts Programming.

Unit - III. PIC Microcontrollers

Overview and Features, **PIC 16C6X/7X** Architecture (PIC 16C61/C71), Registers, Pin diagram, Reset action Memory Organization, **Instructions**, Addressing Modes, I/O Ports, Interrupts, Timers, Analog-to- Digital Converter (ADC).

Pin Diagram of PIC **16F8XX Flash Microcontrollers**, Registers, Memory organization, Interrupts, I/O Ports and Timers.

Unit - IV Industrial Applications of Microcontrollers

Connecting of - Light Emitting Diodes (LEDs), Push Buttons, Relays and Latches.

Interfacing of - Keyboard, 7-Segment Displays, LCD Interfacing, ADC and DAC with 89C51 Microcontrollers.

Measurement Applications of – Robot Arm, LVDT, RPM Meter, Digital Thermo Meter and Strain Gauges.

Automation and Control Applications of – PID Controllers, D C Motors and Stepper Motors.

Recommended Books:

1. Microcontrollers – Theory and Applications – By Ajay V Deshmukh, TMH, 2005
2. The 8051 Microcontrollers and Embedded Systems – By Muhammad Ali Mazidi and Janice Gillispie Mazidi, Pearson Education Asia, 4th Reprint, 2002
3. The 8051 Microcontroller - architecture, programming & applications – By Kenneth J. Ayala, Penram International Publishing, 1995
4. Design with PIC Microcontrollers - By J B Peatman, MH, Pearson Education Asia, 2003

Reference Books:

1. Programming and Customizing the 8051 Microcontroller – By Myke Predko, TMH,2003
2. Embedded Microcontrollers Handbook, Intel Applications
3. Design with Microcontrollers By - J B Peatman, MH.
4. The 8051 Microcontroller - programming, interfacing and applications – By Howard Boyet and Ron Katz, (MII) Microprocessors Training Inc.
5. The concepts & features of Microcontrollers by Rajkamal, Wheeler Pub.
6. The Microcontroller Idea Book Circuits, Programs, & Applications featuring the 8052-BASIC Microcontroller By Jan Axelson, Penram International.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IV Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Electronics – Instrumentation Specialization at University College of Science

PEI 403T/CB

Paper – III (PC Architecture)

UNIT –1

Basic Computer organization: Instruction codes, computer instructions , timing and control, memory referred instructions , I/O and interrupts , complete computer description and design. **Programming the computer:** Assembly language, assembler, program loops, arithmetic and logical operations, subroutines and I/O programming. {Chap.5 &6]

UNIT –II

Microprogrammed control: Control memory, address sequencing and microprogram examples.**Central Processing Unit:** Introduction to CPU, general register organization, stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control and RISC,. [Chap 7&8]

UNIT – III

Pipeline and vector processing: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline and RISC pipeline, vector processing and Array processors . **Computer Arithmetic:** Addition and subtraction Multiplication algorithms, Division algorithms, Floating point Arithmetic Operations, Decimal arithmetic Unit, and Decimal Arithmetic Operations. [Chap.9 & 10]

UNIT- IV

Input –Output organization: Peripheral Devices, Input –Output Interface, Asynchronous Data transfer, Modes of transfer, Priority Interrupt, Direct Memory Access (DMA), Inapt-Output processor (IOP), Serial Communication. **Memory Organization:** Memory Hierarchy, Main memory, Auxiliary Memory, Associate memory, cache Memory, Virtual memory, Memory management Hardware. [Chap .11&12]

Recommended Text books :

Computer System architecture -- Moris mano , PHI (2000).

Reference books :

1.An introduction to digital computer design -- V.Rajaraman and T.Radhakrishna .

2.Computer Architecture and parallel processing -- k.Hang and F.A bigg , Mcgraw –Hill

3.Computer Architecture and logic design -- Thomas C.Bartee , Mcgraw –Hill

4.Computer Fundamentals ,Architecture and Organization -- B.Ram 3rd Edn. New Age International.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IV Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

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Electronics – Instrumentation Specialization at University College of Science

PEI404T/CB

Paper-IV

INTRUMENTATION FOR MEASUREMENT, CONTROL, DATA ACQUISITION, AND DATA TRANSMISSION

Unit – I

Transducers – Classification of transducers – Active and Passive transducers- Electrical transducers- Displacement transducers -Digital transducers -Basic requirement of a transducer .

Displacement Measurement :- Variable resistance devices– Variable inductance devices - Variable capacitance devices.

Strain Measurement :- Theory of operation of strain gauge – Types of strain gauges – Strain gauge circuits _ Quarter bridge- Half bridge and Full bridge – Temperature compensation – Calibration of strains gauges – Strain gauge load cell.

Unit – II

Pressure Measurement :- Bourdan Tube- Bellows - Diaphrams – Transduction methods- Potentiometer device- Straingauge transducer – LVDT type transducer –Variable capacitance device – Force- balance transducer – Piezoelectric transducer- Digital Pressure Transducer- Pressure calibration.

Temperature Measurement : - Classification of temperature measuring devices- Resistance type temperature sensors (platinum resistance thermometer, thermistrors) –Resistance thermometer circuts- Thermocouples – Types of thermocouples -Cold junction compensation – Solid State Sensors – Temperature measurement by radiation methods – Calibration of thermometers.

Flow Measurement :- Classification of flow meters – Head type flow meters-Orifice meter-Venturi Tube- Pitot tube – Rotameter- Anemometer – Electromagnetic flow meter - Ultrasonic flow meter.

Unit – III

Process Control :- Open loop control – Closed loop control – Examples- Block diagram algebra - Block diagram of Closed loop system - Closed loop transfer function –DC AND AC Servomotors- Stepper motor-Temperature Control-Liquid level control.

Analog and Digital Data Acquisition Systems:- Interfacing transducers to electronic control and measuring systems – Digital to analog multiplexer - Analog to Digital multiplexer - IEEE 488 Bus.

Unit – IV

Data Transmission and Telemetry :- Methods of data transmission–General telemetry system- Functional blocks of telemetry system – Types of telemetry systems– Land line telemetering system-Voltage telemetering systems–Current telemetering system-Position telemetering system–

Land line telemetry feedback system-Radio frequency telemetry - PAM, PCM Telemetering– Multiplexing in telemetering system- Transmission channels- Digital data transmission.

Recommended Books:-

1 Modern Electronic Instrumentation and Measurement Techniques – A.O.Helfrick and W.D.Cooper, Prentice Hall India Publications.

2 Instrumentation Devices and Systems- C.S.Rangan, G.R. Sharma and VSV Mani, Tata Mc.Graw Hill Publications.

3 Introduction to instrumentation and Control- A.K.Ghosh – Prentice Hall India Publications.

4 Electrical and Electronics Measurement and Instrumentation – A.K.Sawhney.

5 Transducers and Instrumentation – DVS Murthy, PHI Publications.

(Electronics Instrumentation- Practicals

III[rd] Semester (Analog, Digital & Simulation Lab)

(A1) Analog Experiments :

1. Power control by SCR using UJT.
2. PLL (IC 565) as FM Detector.
3. Active filters.
4. PLL (IC565) as frequency synthesizer.
5. Strain guage –Trainer kit.
6. LVDT -Trainer kit.
7. PLL (IC 565) as AM detector.

(A2) Analog Simulation Experiments

8. Active filters Using Op-Amps
9. Frequency Modulation and detection
10. Amplitude modulation and detection
11. Solution of differential equations using analog computation (Using TUTSIM)

(B) Digital experiments (Hardware and Simulation)

1. construct a synchronous up/down counter using IC74192 and display count using 7-segment display.
2. Implement Boolean functions using a multiplexer.
3. construct a shift register using IC 7495.
4. construct an 8-bit full adder using two 4-bit adders.
5. Implement Boolean functions using Dec/D
6. Simulating a four variable Boolean function using a 1 of 16 data Sel/Mu
7. Given a four variable Boolean function design and simulate the circuit using gates.
8. Simulate a 4-bit Bin/BCD decade counter
9. Simulate a full adder circuit using a Dec/Dem
10. Simulate a 4-bit shift register.
11. Design a counter with skipped counts & simulate
12. Simulate a Johnson Counter

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IV Semester : (Microprocessors & Microcontrollers Lab)

Programming and interfacing using Microprocessor (8086)

1. Addition of fifty 16-bit numbers stored in consecutive memory location
2. Divide a 28 bit unsigned number by 8 .
3. Convert a 2-digit unsigned BCD number to binary.
4. To add two words ,each word containing four packed BCD digits.
5. Write a subroutine ,to multiply a signed 16-bit number and a signed 8-bit number, that can be called by a main program in a different code segment and stores the result in consecutive memory locations.
6. Simple programs on PC using Macro Assembler MASM 86
7. To interface the analog-to-digital converter (ADC) kit with PC and to develop suitable programs to convert the analog signal into digital value.
8. To interface the digital-to analog converter (DAC) kit with PC and to develop suitable programs to generate various waveforms to display it on CRO.
9. To interface the given stepper motor and to develop suitable program to rotate it at various stepping angles

Experiments using Microcontroller (8051)

1. To test the 8051 system and its ports.
2. To interface an ADC to the 8051.
3. To program the 8051 timer. To generate a square wave using the 8051 timer.
4. To interface a DAC to the 8051. To generate a sine wave on the scope using the DAC.
5. To interface a DAC to the 8051. To generate a sine wave on the scope using the DAC.
6. To interface a stepper motor to the 8051.To write a program to control the angle and direction of stepper motor rotation by the user
7. To examine and use an 8051 Assembler. To examine and use an 8051 simulator
8. To code a program to add hex numbers. To code a program to add BCD numbers. To code a program to add two multi-byte BCD numbers.
9. To practice converting data from decimal to binary and hexadecimal systems.
10. To write a program to convert data from hex to ASCII. To write a program to find the average of a set of hex data. To examine the 8051 division and multiplication instructions.

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

<u>Special Subject:</u> Materials Science

w.e.f 2010-2011 under CBCS at
University College of Science

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 monwards)

Materials Science Specialization at University College of Science

PMS 302T/CB

Paper – II

(Metals and Alloys)

UNIT-I : METALS AND ALLOYS

Classification of engineering materials, structure of metals and alloys, types of alloys, solid solutions, Hume-Rothery's rules, substitutional solutions, interstitial solutions, property changes in solid solutions, intermediate phases, interstitial phases, Free energy of solid solutions, phase mixtures, stable state of an alloy, equations of phase equilibrium, Phase rule, The free energy of intermediate phases, Variation of solubility with temperature, long range and short range order in solid solutions.

UNIT-II: THE PHASE DIAGRAMS

Introduction, Construction of a simple equilibrium diagram, Interpretation of phase diagrams, Complete and partial miscibility in the solid state, Systems containing intermediate phases, Eutectic, Eutectoid, Peritectic, Peritectoid systems. Phase diagram of Fe-C system.

UNIT-III: DIFFUSION IN SOLIDS

Ideal solution, Fick's law of Diffusion, Volumetric diffusion, Effect of temperature on diffusion, Effect of concentration on diffusion, Kirkendall effect, Mechanism of Diffusion, Grain boundary and surface Diffusion,

Interstitial diffusion- measurement of interstitial diffusion, The Snoek effect, Relaxation times, Experimental determination of relaxation times.

UNIT-IV: HEAT TREATMENT OF ALLOYS

Introduction, Different heat treatment methods, Development of Commercial age-hardening alloys, Heat treatment of steels- Formation of pearlite, Formation of bainite, Formation of martensite, Tempering of quenched steel.

Heat treatment of alloys- Copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

Recommended Books:

1. Materials Science and Engineering – C. M. Srivastva
2. Materials Science and Engineering – W.D. Callister
3. Physical Metallurgy- R.E. Reed Hill
4. An Introduction to Metallurgy – Sir Allen Cottrell

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

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Materials Science Specialization at University College of Science

PMS 303T/CB

Paper – III

(Mechanical properties of Materials)

UNIT – I:DISLOCATIONS

Dislocations - Edge and screw dislocations, Mixed dislocation, Burgers vector and Burgers circuit, Stress field of dislocation, Force on a dislocation, Line tension, Forces between dislocations, Interaction of dislocations, Elastic energy of dislocations, Movement of dislocations, Glide motion, Slip vector and slip plane, Climb of an edge dislocation, creation of jogs, - Jogs and kinks, Grain Boundaries, Small angle boundaries - Tilt and twist boundaries, energies.

UNIT - II :ELASTIC BEHAVIOR OF MATERIALS

Mechanical behavior of crystalline materials: Elastic deformation - Thermo elastic effect, An-elasticity, Relaxation, Plastic deformation. Tensile Test, Mechanical parameters, Hardness tests, Critically resolved stress, Pierl's force, width of a dislocation, Stress - strain curves of crystals, Different stages, Dislocation mechanisms in easy glide stage, Multiplication of dislocations -- Frank-Read source, Creep, creep curve, Mechanism of creep, activation energy, Dislocation mechanisms, Creep resistant materials.

UNIT – III:STRENGTHENING MECHANISMS

Strengthening Mechanisms: Work hardening or Strain - hardening -- Degree of cold working, Dislocation mechanisms-creation of Partial dislocations in f.c.c cryals, sessile dislocations, dislocation locks, dislocation pile ups; Deformation of poly crystalline materials; Annealing –
Re-crystallisation, grain growth, recovery, effect of grain size on dislocation motion. Grain boundary sliding in polycrystalline materials during stage Iii or recovery of deformation; The effect of solute atoms on dislocation motion, Precipitation hardening - mechanisms.

UNIT IV:FAILURE AND CORROSION OF MATERIALS

Failure and Degradation of materials: Fracture - Brittle fracture and ductile fracture - Brittle fracture: Griffith's model. fracture toughness or resistance, Propagation of crack; Ductile fracture-Cup and Cone, mechanism involved in fracture, Ductile - Brittle transition ,Protection against fracture; Fatigue fracture, S-N curves, fatigue life; Corrosion -- principle of corrosion, the galvanic cell, stress corrosion ,intergranular corrosion , Prevention of corrosion - cathode and anodic protection, Passivation.

Recommended Books:

1. Materials Science and Engineering – W.D.Callister John Wiley & Sons
2. Physical Metallurgy principles – Reed Hill, Robert Mc-Graw Hill
3. Elements of Physical Metallurgy – A.G.Guy Addison-Wesley
4. Physical Metallurgy – R.W.Cahn.and Peter Haasen, North Holland

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Materials Science Specialization at University College of Science

PMS 304T/CB

Paper – IV

(Thin films and their properties)

UNIT - I :: VACUUM TECHNIQUES AND THIN FILM DEPOSITION METHODS

Production of vacuum, vacuum pumps, Oil seal rotary and roots pumps, diffusion pumps, cryogenic, cryosorption and getter pumps, measurement of vacuum- various types of gauges, Pirani gauge, Penning gauge.

Methods of thin film preparation, Physical vapour deposition methods-thermal evaporation, electron beam evaporation, pulsed laser deposition, cathodic sputtering, r.f. sputtering, ion beam sputtering, magnetron sputtering, Chemical vapour deposition methods, spray pyrolysis, Epitaxial methods, LPE, MBE.

UNIT – II :: THIN FILM FORMATION AND THICKNESS MEASUREMENT

Nucleation, film growth and structure- various stages in thin film formation, thermodynamics of nucleation, nucleation theories, Capillarity model and Atomistic model and their comparison. Thin film structure, substrate effect, film thickness effect, film thickness measurement- interferometry, ellipsometry, micro balance, quartz crystal oscillator techniques.

UNIT – III :: PROPERTIES OF THIN FILMS

Electrical conduction in metallic films- Continuous and discontinuous films, conduction in continuous metal films, conduction in discontinuous metal films,

Dielectric thin films - experimental techniques capacitor preparation and setup, measurement of dielectric constant, effect of voltage, frequency and temperature.

Optical properties of thin films- reflection, transmission and absorption by thin films- transition, reflection and transmission by a single film, reflections from multilayer film, applications of thin films.

UNIT – IV CHARACTERIZATION TECHNIQUES

XRD Techniques in Materials analysis, Electron diffraction, HEED, LEED, Electron Microscopy, SEM, TEM, AFM, Thermal analysis- DSC, DTA, Magnetic Properties measurements- VSM..

Books suggested:

1. Thin film fundamentals – A. Goswami, 1New Age International publishers, 2006.
2. Thin film phenomena – K.L.Chopra, Mc Graw -Hill Book Company, 1969.
3. Handbook of thin film technology- L.I.Maissel and R.Glang, Mc Graw -Hill Book Company, 1970
4. Materials science of thin films, M.Ohring, Elsevier, 2006

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Materials Science Specialization at University College of Science

PMS 402T/CB

Paper – II

(Engineering materials)

UNIT – I NON-LINEAR DIELECTRICS

Introduction to ferroics, Structural classification of ferroelectrics, hydrogen-bonded and non-hydrogen bonded ferroelectrics, Thermodynamics of ferroelectric phase transitions- proper, improper and pseudo-proper ferroelectric phase transitions, Ferroelectric diffuse transitions, Relaxor ferroelectrics, Domain structures in ferroelectric materials, Orientation of walls between domain pairs, Domain wall thickness, Domain switching, Hysteresis loop, Polycrystal ferroelectrics, size effects in ferroelectric powders, composites with at least one ferroic constituent, Some, combination and product properties of composites, Applications of ferroelectric materials.

UNIT – II COMPOSITES

Basic Concepts, Definition of Composite materials, reinforcements, Classification of composites- Particle reinforced, Fibre reinforced and structural composites, Particle reinforced composites- large particle composites, dispersion strengthened composites, Types of Fibers, Fiber-reinforced composites- influence of fibre length, orientation and concentration, Structural composites- Laminar Composites, sandwich panels, The matrix phase, Matrix materials, Polymer matrix composites, Metal matrix composites, Ceramic matrix materials, Carbon-Carbon Composites, Hybrid Composites, Applications of composites.

UNIT – III POLYMERS AND CERAMICS

Polymers: Classification of polymers**,** polymer molecules**,** chemistry of polymer molecules, molecular weight, molecular structure of polymers, thermoplastic and thermosetting polymers, polymer crystallinity, polymer crystals, mechanical behaviour of polymers- stress strain behaviour, viscoelastic deformation, strengthening of polymers, crystallization, melting and glass transition phenomenon in polymers, polymerization, manufacturing of polymers, applications of polymers.

Ceramics: Introduction to ceramics, classification of ceramics, Ceramic structures- oxide structures, silicate structures, structure of glass. Ceramic Phase diagrams- examples of two oxide systems, Different kinds of Ceramics- glass ceramics, refractories, Properties of Ceramics- Stress-Strain behaviour, mechanism of plastic deformation, glass properties, Microstructure of ceramics, Grain growth in ceramics, Sintering and vitrification of ceramics.

UNIT – IV LUMINESCENT MATERIALS AND APPLICATIONS

LUMINESCENCE: General considerations of luminescence, excitation and emission processes, configuration coordinate diagram, energy level diagram, radiative and non-radiative processes, decay mechanism, different kinds of luminescence-electroluminescence, photoluminescence and thermo luminescence, color centres, different kinds of color centres in the context of luminescence in alkali halides.

APPLICATION OF LUMINESCENCE: Lamp phosphors, preparation of lamp phosphors for lighting and high-pressure lamps, applications of thermoluminescence, radiation dosimetry, TL dating, TLD phosphors.

Books Recommended:

1. Solid State Physics – A.J.Dekker, Macmillan India Ltd., 2003.
2. Introduction to Ferrioc Materials – V.K. Wadhawan,
3. Materials Science and Engineering an Introduction- W.D. Callister Jr, John Wiley and sons.
4. Introduction to Ceramics -- W.D.Kingery, H.K. Bowen and D.R. Uhlmann, John Wiley and sons.
5. Luminescent materials – G.Blasse and C.Grabmaier, Springer-Verlog, 1994

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DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

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Materials Science Specialization at University College of Science

PMS 403T/CB

Paper – III

(Electronic Materials and Devices)

UNIT – I SEMICONDUCTOR MATERIALS

Classification of semiconductors - Elemental and compound semiconductors, Direct band and indirect band gap semiconductors, Charge carriers in extrinsic semiconductors, Diffusion currents, Mobility and its dependence on temperature and doping, Excess carriers in semiconductors, Recombination of electron -hole pairs - various recombination mechanisms.

UNIT II SEMICONDUCTOR JUNCTIONS

Types of junctions, abrupt and graded junctions, - potential distribution, space charge, built in voltage and junction capacitance, carrier concentration across the junctions, Recombination.

Preparation of junctions wafer selection, Oxidation, lithography photolithography, doping, metalisation, terminals, packaging Metal - semiconductor junctions: energy-band relation, surface states and depletion layer, Schottky-effect current transport process – thermo ionic emission, tunneling, device structures.

UNIT – III OPTOELECTRONIC DEVICES:

The ideal hetero junction, current-voltage characteristics, common anion rule. Light emitting diodes - Electroluminescent process. excitation and emission, LED materials, device configuration and efficiency, light out put, LED structures, Manufacturing processes: semiconductor lasers - Lasing condition in a semiconductor, Threshold condition for lasing Junction laser - operating principle, threshold current, power output, hetero junction lasers, losses, laser diode materials, Device fabrication, laser mounting and fiber coupling.

UNIT – IV PHOTONIC DEVICES

Photo detectors : photoconductors – absorption coefficient, D.C. and A.C. conductors. Junction photo detectors – Photo voltaic effect: Photodiodes, PIN diodes, quantum efficiency and frequency response, noise, hetero junction diodes, avalanche diode, Solar cells – basic principles, spectral response, efficiency, materials and cascaded solar cells, thin film solar cells, manufacturing and design characteristics.

Recommended Books:

1. Introduction to Semiconductor materials and devices – MS .Tyagi , Wiley.
2. Semiconductor optoelecronic devices –Pallab Bhattacharya, PHI

3. Physics of semiconductor devices – S.M Sze, John Wiley.
4. Physics and technology of semiconductor devices – S.M. Sze, John Wiley.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Materials Science Specialization at University College of Science

PMS 404T/CB

Paper – IV

(Advanced Materials)

UNIT-I: SYNTHESIS OF NANOMATERIALS

Introduction, particle size, particle shape, surface interaction of nanoparticles, DLVO theory, Classical nucleation theory for cluster formation.
Physical methods: inert gas condensation, Chemical vapour deposition, sputtering , Arc discharge, PLD, mechanical milling, MBE, Electrodiposition, laser pyrolysis.
Chemical methods: Introduction, Sol-gel process, Hydrothermal process, Solvothermal synthesis, Metal reduction method, Photochemical synthesis,

UNIT-II CHARACTERIZATION OF NANOMATERIALS

Introduction; XRD, Scanning probe microscopy (AFM, STM), SEM, TEM,
Uv-visible-IR, Raman spectroscopy, mass spectroscopy
Properties of nanomaterials: Mechanical, electrical, Magnetic, optical properties.
Applications of nanomaterials: Carbon nanotubes, nano-coatings, quantum dots, nano – wires and other applications.

UNIT-III: BIOMATERIALS

Implant materials: Introduction, Conditions for implant materials,
Classification of Implant materials: Polymers- synthetic and natural
Metals- S.S, Co and its alloys, Al and its alloys, Ti and alloys, Mg and its alloys
Ceramics- Alumina, Zirconia, Bioglass-ceramics, Hydroxyapatites
Application biomaterials

UNIT-IV: MAGNETIC MATERILAS

Hysteresis and its importance, Magnetic anisotropy in cubic and hexagonal crystals, magnetostriction in cubic and hexagonal crystals, magnetoresitance, GMR, CMR materials, Domain and magnetization process- Domain wall motion- Magnetostatic energy, Domain wall energy, observation of Domains,
Classification of magnetic materials, soft magnetic materials- crystalline alloys, soft ferrites , and amorphous alloys. Applications of soft magnetic materials,
Hard magnetic materials: alnico alloys, Nd-Fe-B magnets, Hard ferrites. Applications of hard magnetic materials.

Books Recommended:

1. Nanocrystalline materials- H. Gleiter
2. Biomaterials Science and Engg. – J.B. Park
3. Materials Science and Engg. – C. M. Srivastava

4. Nanoparticle Technology Hand book- Masuo Hosokawa, K. Nogi, M. Naito, T. Yokoyama, Pub: Elsevier
5. Hand book of nanotechnology- ed. Perag Diwan , Pentagon Press

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

Special Subject: Microwaves

w.e.f 2010-2011 under CBCS at
University College for Women, Koti

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Microwaves Specialization at University College for Women

PMW 302T/CB

PAPER – II

(Transmission lines, Strip lines & Microwave Passive Devices)

UNIT – I

Introduction – Frequency spectrum – RF behavior of passive components – HF resistors, capacitors and inductors – chip components – surface mounted inductors.

Transmission Lines: Examples of transmission lines – two wire lines-Coaxial lines – Microstrip lines . Equivalent circuit representation – General transmission line equation – Traveling voltage and current waves – Characteristic Impedance –lossless transmission – microstrip transmission lines – terminated lossless transmission line – voltage reflection coefficient – propagation constant and phase velocity – standing waves – Special termination conditions – Input impedance of a lossless line- short circuit transmission line – quarter wave transmission line – sourced and loaded transmission line- power considerations for a transmission line – input impedance matching – return loss and insertion loss.

UNIT - II

Strip Lines: Basic parameters – phase constant (β), Characteristic impedance (Z_o) , effective dielectric constant , Quality factor (Q). Some varieties of strip lines : Parallel strip lines –.Coplanar striplines – Shielded striplines.

Variation of the characteristic impedance with frequency. Losses in Microstrip lines –Dielectric losses, ohmic losses and radiation losses. Example calculations.

UNIT - III

Smith Chart and Applications : From reflection coefficient to load impedance – Impedance transformation, Admittance transformations, Parallel and series connections.

Single and Multiport Networks : Introduction – Basic definitions – Matrix representation of Pi-network – Low-frequency hybrid network description of a BJT – Internal resistance and current gain of BJT based on h-parameters – Interconnecting networks – parallel connection of networks – cascading networks – ABCD representation – ABCD network representation of an impedance element – ABCD

matrix computation of a T-network – ABCD-matrix coefficient computation of a transmission line section

Network properties and applications – Inter relations between Parameter Sets – Analysis of Microwave amplifier.

Scattering Parameters – definition – meaning of S-Parameters – Determination of a T-network elements – Chain Scattering matrix – conversion between Z- and S-parameters

Signal flow chart modeling – flow chart analysis of a dual port network – Generalization of S- parameters – Input impedance computation of a Transmission line using signal flow chart – Practical measurement of S-parameters.

UNIT - IV

Microwave Passive Devices :

Wave guides : Introduction – reflections of waves from a conducting plane – parallel plane wave guide – cutoff wave length – cutoff frequency – group and phase velocity in wave guides – rectangular wave guides – circular wave guides - different modes – field patterns.

Wave guide coupling – methods of exiting wave guides – slop coupling – direct coupling to coaxial lines – choke coupling , tuning . Directional couplers , circulators , cavity resonators, Hybrid junctions .

Microwave propagation in magnetic materials , Farady rotation in Ferrites – Gyrators, isolators and

phase shifters.

Recommended Books

1. R.F. Circuit Design - Theory and Applications - Reinhold Ludwig & Pavel Bretchko - Pearson Education Asia
2. Networks lines and fields – Ryder
3. Microwave engineering with wireless applications - Pennok & Shepherd
4. Microwave devices and circuits – Samuel Y. Liao
5. Electronic communication systems – Kennedy & Davis
6. Microwave integrated circuits – K.C. Gupta
7. Foundations for Microwave Engineering – R.E. Collin - McGraw Hill

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

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Microwaves Specialization at University College for Women

PMW 303T/CB

PAPER – III
(Microwave (active) devices and circuits)

UNIT – I

Klystron – Introduction – two cavity klystrons – velocity modulation – Bunching – output power – Beam heading - efficiency of klystron – power required to bunch the electron
Reflex klystron – velocity modulation – power output – efficiency
Magnetron – cylindrical magnetron Hull cutoff magnetic equations and cutoff voltage equations – cyclotron angular frequency – power output – efficiency
Travelling Wave Tube – Slow wave structure – amplification process

UNIT – II

Introduction - P – N Junction - PIN diode – Switching the PIN diode – Tunnel diode & back diode – Schottky barrier diode – IMPATT diode - Gunn diode – Photo devices Used in fibre optic communications.
Microwave transistors – BJTs – MESFETs – HEMETs – non linear effects– photo response.

UNIT – III

Detector diode – current sensitivity – Niose equivalent power and Tangential signal sensitivity
Mixers - Mixer components - Mixer parameters - Mixer circuits
Control circuits – Attenuators – Single diode circuits - Pi and T attenuators Limiters Switches - single diode Switch - Isolation and bandwidth extension –
Phase shifters – reflection based phase shifters – switched path – switched filter (Hi/Lo Phase shifter)

UNIT – IV

Amplifiers – reflection amplifier – Oscillation and gain condition – Parametric amplifiers – Manley-Rowe Power relations - two port transistor amplifier –

Network Stability – Amplifier gain – amplifier noise- effects of parasitics and Matching Active Isolator - transistor oscillator.

Masers – Principle or working of Masers – practical masers and their applications.

Recommended Books :

1. Microwave Engineering with wireless applications -- S.R. Pennock & P.R. Shepherd (MACMILLAN PRESS Ltd.)1998
2. Optical Fibre Communications – Keiser Gred McGraw-Hill
3. Optical Fibre Communication – Principle and Practice – SeniorJohn M. (PHI)
4. Optical Communication systems – Gowar John.
5. Microwave devices and circuits - Samuel Y Liao 3rd edition 6. Electronic communication systems - George Kennedy.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Microwaves Specialization at University College for Women

PMW 304T/CB

PAPER – IV
(Signal Conditioning and Processing Techniques)

UNIT – I

Introduction

Measurement of errors: accuracy, precision, resolution , sensitivity – absolute and relative errors. types of errors – gross error, systematic error and random error. standards of measurements – classification of standards, time and frequency standards, electrical standards, standards of temperature and luminous intensity. IEEE - standards

classification of electrical transducers – basic requirement of a transducer - active and passive transducers – resistive (strain gauge), inductive (LVDT) capacitive, types of transducers - PZT - thermocouple.

UNIT – II

Noise: introduction – thermal noise – shot noise – partition noise – low frequency noise – burst noise – avalanche noise – bipolar transistor & FBT noise – equivalent input noise generators – signal to noise ratio - cascaded amplifiers - s/n ratio of a tandem connection – noise factor – amplifier input noise in terms of noise factor (f) – noise factor of amplifier in cascade – noise factor and equivalent input noise generators – noise temperature – measurement of noise temperature and noise factor – narrow band pass noise .

UNIT – III

signal conditioning circuits :

Active filters: RC active filters – low pass and high pass filters (Butterworth, Bessal and Chebyshev types) , band pass and band reject filters – notch filter - switched capacitor filters.

Amplifiers : instrumentation amplifiers – isolation amplifiers -

phase locked loops & applications : introduction, basic principle of phase lock loop, phase detector comparator, voltage controlled oscillator – low pass filter – PLL applications

D/A & A/D conversion : methods of D/A (R-2R type) and A/D conversions (successive approximation, dual slope integration and flash types) conversion specifications.

UNIT – IV

Methods of data acquisition : interfacing and control for data acquisition - **on-line** and **off-line** data acquisition - case studies (block diagram approach) – software techniques in signal processing and analysis using virtual instruments **(labview)**

Recommended books:

1. Modern electronic instrumentation – W.D. Cooper
2. Principles of communication systems – Taub & Shilling (TMH) 1999
3. Linear integrated circuits - Roy Choudary and Jain(New age international private ltd.)
4. Instrumentation – Rangan, Sarma & Mani.
5. Transducers and instrumentation – DVS murthy.
6 Labview (manual) - National Instruments.

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PMW 402T/CB

PAPER – II

(Principles of Communications)

UNIT – I

Methods of Modulation - Amplitude Modulation - Single Side Band Modulation – Frequency Modulation – Phase Modulation

Methods of Pulse Modulation – PAM, PCM, PFM, PTM, PPM, PWM

UNIT - II

Digital Communications – Synchronization, Asynchronous Transmission – Probability of Bit error in Base band Transmission – The Matched Filter – Bit-timing recovery – Eye diagrams – Digital carrier systems – Carrier recovery Circuits – Differential Phase Shift Keying (DPSK) - Hard and Soft Decoders – Error control coding

UNIT - III

Radio-Wave Propagation :Propagation in free space – Tropospheric Propagation – Surface Wave – Low Frequency Propagation and Very Low Frequency Propagation – Extremely Low-Frequency Propagation

UNIT – IV

Satellite Communications: Introduction – Kepler's Laws – Orbits – Geostationary orbit – Power systems – Attitude Control – Satellite Station keeping – Antenna Look Angles – Limits of visibility – Frequency plans and polarization – Transponders – Uplink power budget calculations – Down link power budget calculations – Overall link budget – Digital carrier Transmission – Multiple-access Methods

Recommended Books:

1. Communications - Dennis Roddy & John Coolen (PHI) 2000
2. Principles of communication systems – Taub & Shilling (Tata McGraw Hill)1999
3. Electronic communication systems – George Kennedy (Tata McGraw Hill)

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PMW403T/CB

PAPER – III

(Information theory, coding and computer communication systems)

UNIT - 1

Information Theory: Discrete messages – the concept of am ount of information – average information , entropy – information rate – coding to increase average information per bit – Shannon's theorem, channel capacity – capacity of a Gaussian channel – Bandwidth – S/N tradeoff –

Use of Orthogonal signals to attain Shannon's limit – efficiency of orthogonal signal transmission .

Coding: Introduction – parity check bit coding for error detection – coding for error detection and correction – block codes – upper bounds of the probability of error with coding – Block codes – coding and decoding – examples of algebraic codes. Burst error correction – convolutional coding – decoding a convolutional code – probability of convolutional codes.

UNIT - II

Reference models - OSI reference model, TCP/IP reference model , comparison of OSI & TCP reference models.

Example networks - ARPANET, Internet.

Example Data Communication services: SMDS, X .25 networks, Frame Relay, Broad band ISDN, & ATM

UNIT - III

Data Link Control - Flow control, Error detectors (CRC) , Error control, HDLC

Multiplexing - FDM, Synchronous TDM. Statistical TDM

FDMA, TDMA - *ALOHA* - *SLOTTED ALOHA* - Carrier Sense Multiple Access (CSMA)

UNIT - IV

Circuit Switching: Switched networks, Circuit Switching networks, Switching concepts, Routing in circuit – Switched networks, Control Signaling
Packet Switching : Packet switching Principles , Routing, congestion control.

Recommended Books:

1. Principles of Communication Systems - Taub & Shilling (Tata McGraw Hill)
2. Data and Computer Communications – William Stalling (Prentice-Hall India Ltd.)
3. Data Communications and Networking - Behrouz A. Forouzan (Tata McGraw-Hill)
4. Computer Networks – Tanenbaum (Perintice-Hall India Ltd.)

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Microwaves Specialization at University College for Women

PMW 404T/CB

PAPER – IV

(Antennas & Radar)

UNIT – I

Antennas : Introduction – antenna equivalent circuits – coordinate system – radiation fields- polarization – isotropic radiator – power gain of an antenna – effective area of an antenna – effective length of an antenna
Hertzian dipole – Half wave dipole vertical antennas – Ground reflections – grounded vertical antennas –
folded elements loop and ferrite rod receiving antennas – non-resonant antennas – long wire antenna – rhombic antenna Driven arrays – Broad side array – end-fire array – turnstile antenna Parasitic arrays- Parasitic reflectors – Parasitic directors – Yagi-Uda array – Plane reflector arrays UHF antennas – Discone Omni- Helical antenna – Log periodic antenna Microwave antennas – Horns – Parabolic reflector antenna – variations on the parabolic reflector – Dielectric lens antennas – slot antennas
(Book : Electronic communications – D. Roddy & J. Coolen 4^{th} edition (PHI)(16^{th} chapter)

UNIT - II

Introduction- Radar principle, Range, Resolution ,RCS , Doppler Shift, Clutter, Noise, False alarm probabilities, Radar equation.
Tracking system properties and parameters. Conical scan angle tracking, Lobing angle tracking, Amplitude Comparison monopulse Angle tracking, tracking accuracy, receivers and displays.

UNIT – III

Introduction - Time signals and systems, Frequency domain representation,
Z-transform and its properties , Inverse Z-transform methods.
Fourier transform of a sequence, relationship between Z-transform, Fourier Transform and discrete transform.
Digital filter Structures, design techniques, IIR and FIR digital filters.
Signal Integration , correlation, convolution Spectrum Analysis.
Processing errors and windows (cosine family windows and clipped windows)
Recovery from samples – Interpolation, Doppler and moving target indicator (MTI) fundamentals, MTI principles and methods, Blind Doppler shifts, and PRF, Stagger, Destaggering and processing.

UNIT – IV

Introduction - Evaluation of waveforms for Range and Doppler Resolution, Analog pulse compression, Digital pulse compression, High cross range resolution.
Doppler beam sharpening (DBS) , Side looking synthetic Aperture Radar(SSAR)
Airborne Surveillance Radar for Air Traffic control – Doppler processing to combat clutter problems.

Recommended Books:

1. Electronic communications – D. Roddy & J. Coolen 4th edition (PHI) 16th chapter)
2. RADAR Principles, Technology, Applications – Byran Edde (Prentice-Hall)
3. Theory and Application of Digital Signal Processing – L.R. Rabiner and Bernard Gold (Prentice-Hall)

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M.Sc. (Physics) Microwaves Specialisation 3rd & 4th Semesters

Microwave Lab

Experiments on Data Acquisition with PC. (Using LabVIEW Software)

1. Familiarization of Principles of Graphical Programming- LabVIEW
2. Familiarization with virtual Instruments and signal processing tools in LabVIEW.
3. Transduction / Detection of signals (HARDWARE) pertaining to:
   a. Linear Displacement
   b. Rotation
   c. Vibration
   d. Pressure (static & dynamic)
   e. Temperature (very low temperatures & High Temperatures)
   f. Light signals

4. Signal Amplification and Conditioning of signals from experiments to suit A/D conversion
(Hardware)
5. Data Logging techniques (software -programming using Lab VIEW)
6.Signal Processing techniques and analysis of Data (Lab VIEW)

[Requirements: PC with Data Acquisition card, Lab VIEW software, Transducers, Signal Amplification /conditioning circuits – apparatus for experimental variables described above]

SOFTWARE SIMULATION :

1. Familiarization of MultiSIM software
2. Familiarization with RF& Microwave circuit simulation (RFsim99, Serenade)
3. Experiments in Circuit simulation using MultiSIM. (Steady State response)
4.. Experiments in Circuit simulation using MultiSIM. (Transient response)
5. Simulation of Linear Active Circuits

6. Simulation of Digital Circuits
7. Simulation of Matching Networks using discrete components
8. Simulation of Active Filters (low pass, High Pass, Band Pass, Notch filters)
9. Simulation of Strip-line & Microstrip circuits & Measurements (Serenade)
10. Circuit Simulation by importing Spice data from outside (MultiSIM)

{ Any Other simulation suggested by the Teacher }

HARDWARE CIRCUITS :

1. Voltage Controlled Oscillator
2. Phase sensitive detector
3. Active Low pass Filter
4. Instrumentation amplifier (Thermo couple input)
5. Experiments with Phase Lock Loop (PLL)
6. Analog to Digital Conversion (Successive approximation type)
7. A / D Conversion (Dual Slope Integration type) - 3 ½ Digit Panel Meter
8. BCD to 7 segment Display.
9. Frequency Division from a Crystal Oscillator
10. Data Multiplexing and De-multiplexing.
11. Multiplexed display
12. Measurement of frequency components in signals using **Spectrum Analyser**.

Experiments in RF & Microwaves:

1. Experiments in Microwaves (Characteristics of Passive Components)
2. Experiments in Microwaves (Active Devices & Circuits)
3. Measurement of Network Parameters using Network Analyser
4. Experiments in Microwaves (Radiation characteristics of Antennas)
5. Experiments with MicroStrip line Circuits (Power dividers, couplers, filters, Matching Networks Printed Antennas etc.)

{ Any Other experiments suggested by the Teacher }

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

<u>Special Subject:</u> Solid State Physics

w.e.f 2010-2011 under CBCS at University College of Science

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Solid State Physics Specialization at University College of Science

PSSP 302T/CB

Paper – II

(Crystal Physics and Physical Properties)

UNIT- I Elements of group theory

Introduction to crystallographic point groups, the five platonic solids, procedure for symmetry classification of molecules, class , matrix notation for geometrical transformations, matrix representation of point groups , reducible and irreducible representations, great orthogonality theorem and its consequences, Character tables for C_{2V} and C_{3V} point groups, Mullikan symbolism, Symmetry species.

Unit II: Elements of Ligand field theory and Electronic spectra

Concept of ligand field and crystal field. Free ion configurations- terms and states. Derivation of free ion terms for d^1 and d^2 configuration. Energy ordering of terms- Hund's rules. Strength of crystal fields, Crystal field potentials for O_h and T_d fields. Meaning of Dq. Construction of ligand field energy level diagrams- effect of weak crystal fields on terms. Splitting due to lower symmetries Electronic spectra of d^1 and d^9 systems.

UNIT – III Crystal symmetry and physical properties

Development of theoretical formalism, tensors, Physical property and its tensorial representation . Quotient theorem, Symmetry in crystals - point groups and space groups, Crystal classes. Neumann's Principal. **Fumi's** method determining symmetry of physical properties, Pyroelectricity and crystal Symmetry, Dielectric constant and Crystal symmetry –triclinic, monoclinic, orthorhombic and cubic systems; Piezoelectricity and crystal symmetry- triclinic, monoclinic and cubic systems, Piezoelectricity in quartz. Elasticity and crystal symmetry – triclinic, monoclinic, orthorhombic and cubic systems .

UNIT - IV Surface science

Introduction, Crystal shape and bond densities, Preparation clean surfaces, Low energy electron diffraction (LEED), Structure of surfaces, Examples of surface reconstruction, Interaction of gases with surfaces, Chemisorptions and co-adsorption, Photoelectron spectroscopy(PES), UPS, XPS, ESCA, Synchrotron radiation, Auger electron spectroscopy(AES), Electron Energy Loss spectroscopy (EELS), Extended X-ray absorption fine structure (EXAFS)

Recommended books

1. Chemical applications of group theory – F.A. Cotton
2. Spectroscopy of molecules - Veera Reddy
3. Ligand field theory - B.N. Figgs
4. Physical properties of crystals – J.F.Nye;
5. Physics of crystals – S.Bhagavantam and S.Radhakrishna,
6. Solid State Physics - G. Burns

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

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Solid State Physics Specialization at University College of Science

PSSP 303T/CB

Paper - III

(Physics of Phonons and Structural Phase transitions)

UNIT – I Phonon Physics

Theoretical background of lattice vibrations – Phonons and their properties – Crystal momentum – Conservation – Neutron diffraction from phonons – Experimental verification of dispersion relations – Thermal conductivity – Role of phonons – Thermal conductivity – Normal and Umklapp processes – Photon –Phonon interaction – TO and LO phonons – Liddane – Sach – Teller's (LST) relation – Applications – Infrared measurements, Raman effect – Theory of polaritons – Experimental measurement.

UNIT – II Diffusion in solids

Solid state diffusion, Diffusion mechanisms, Self-diffusion, Impurity diffusion coefficient, Fick's second law, Diffusion coefficient, Experimental determination of diffusion coefficient, Various methods, Random walk diffusion and correlated and uncorrelated motions, Diffusion in a simple cubic structure, Diffusion under external field, Nernst-Einstein relation, Correlation factor 'f', Kirkendall shift.;Ionic conductivity, Ionic conductivity of alkali halides and effect of divalent impurities on ionic conductivity.

UNIT – III Ferroelectricity and structural phase transitions

Introduction to ferroelectricity and phase transitions, The free energy expression to summarize characteristics of ferroelectrics, Soft modes in ferroelectrics, Structural phase transitions, Comparison with experiments, Symmetry of low temperature phases, Microscopic model of soft modes, Renormalization group, Optical properties of ferroelectrics, other related properties including pyroelectricity, Piezoelectricity, Ferroelasticity and Antiferroelectricity.

UNIT – IV Superconductivity

Instability of Fermi Sea and Cooper pairs, BCS ground state, manifestation of energy gap; consequence of BCS theory and comparison with experimental results, Quantization of magnetic flux, Giaver tunneling, Josephson effect – Phase coherence, D.C. and A.C. Josephson effects, Superconducting quantum interference devices (SQUIDS). Discovery of the phenomenon of High Temperature Superconductivity; Discovery of various types of HTSC materials, viz; - Y-, Bi-, Tl and Hg based materials. Preparation of HTSC materials by the solid state reaction method and their fundamental physical properties (Elementary treatment only).

Recommended Books

1. Solid state physics – G.Burns;
2. Intermediate theory of crystalline solids – Animalu
3. Solid state physics – H.Ibach and H.Luth,
4. Solid state physics – Christ,
5. Solid state physics – Kachchava
6. Solid State Physics --Dekker
7. Solid State Physics --Wahab.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Solid State Physics Specialization at University College of Science

PSSP 304T/CB

Paper - IV

(Band theory and Electrical properties)

UNIT I Band theory of solids

Brillouin zones.- Brillouin zones in one, two and three dimensions., Density of states,Extended, reduced and periodic zone schemes; Nearly free electron model, Tight binding approximation and its application to simple cubic lattice, Calculation of energy bands- Cellular method, APW method, Pseudo potential method, OPW method.

UNIT II Fermi surface

Introduction, Characteristics of Fermi Surface, Construction of Fermi surface, Fermi surface and Brillouin zones, Dynamics of an electron in electric field; Dynamics of an electron in magnetic field –Cyclotron frequency, Cyclotron mass, Onsager-Lifshitz quantization condition, Cyclotron resonance, Energy levels and density of states in magnetic field, de-Haas van Alphen effect.

UNIT III Transport phenomenon in metals

The Boltzmann transport equation, Electrical conductivity, Definition and experimental features – The Drude Lortentz theory, The Sommerfeld theory- Calculation of the relaxation time, The electrical conductivity at low temperatures, Matheissen's rule, Thermal conductivity, Widemann-Franz law, Hall-effect.

UNIT IV Electrical transport properties of insulators

Hopping conduction; Temperature variation of electrical conductivity; Seebeck coefficient; Polorons- small poloron band conduction; large poloron band conduction;

small poloron hopping conduction; Mott transitions; Ionic Conductivity; Superionic Conductivity- structure, defects and conductivity.

Recommended books:

1. Principles of theory Solids – Ziman

2. Solid state Physics - Singhal
3. Solid state Physics – H.C. Gupta
4. Elementary Solid State Physics – M.Ali Omar
5. Solid State Physics – M.A. Waheb
6. Solid State Physics – Kachchava,
7. Principles of the solid state – H.V. Keer

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Solid State Physics Specialization at University College of Science

PSSP 402T/CB

PAPER - II

(Optical Phenomena in Solids)

UNIT - I : OPTICAL PROPERTIES OF SOLIDS

Introduction, Relation between dielectric and optical properties (macroscopic theory), Kramers-Kronig relations, Absorption of electromagnetic radiation, Photon-Phonon transitions, Interband transitions, Direct and indirect absorption coefficients,

UNIT - II :OPTICAL BAND TRANSITIONS

Frenkel and Wannier excitons and their absorption, Imperfections - exciton absorption below the bandgap, Plasma absorption, Intraband transitions - Absorption and reflection in metals, Hagen-Rubens relation, reflectance in UV transparency region, Einstein coefficients, Raman and Brillouin scattering, Magneto-optic effects: the Faraday effect

UNIT- III: LUMINESCENCE

General considerations of luminescence, exciton, absorption and emission processes of luminescence, Configuration coordinate diagram, Energy level diagram, radiative and non radiative processes, Decay mechanisms, Effect of doping and efficiency, Energy transfer and charge transfer, Different kinds of luminescence, Electro luminescence, Photoluminescence and Thermoluminescence, Defects and color centers, Different kinds of color centers in the context of luminescence in alkali halides, Thallium activated alkali halides, Zinc sulphide phosphors.

UNIT- IV: PHOTOVOLTAICS and PHOTODETECTORS

Photovoltaic effect, Types of interfaces, homojunction, heterojunction and Schottky barrier- Choice of semiconductor materials for fabrication of homojunction solat cells, equivalent circuit of a solar cell, Solar cell out put parameters – Fill factor, conversion efficiency, quantum efficiency, effect of series and shunt resistance on the efficiency of solar cells, Variation of open-circuit voltage and short circuit current with intensity of incident light, effect of temperature on I-V characteristics.
Photo detectors - Photoconductors, d.c. and a.c. photoconductors, gain and bandwidth, PIN photodiodes.

References:

1. Solar cells – Charles E. Backus, IEEE Press.
2. Fundamentals of Solar cells, Farenbruch and Bube.
3. Principles of theory of solids – Ziman, Vikas Publishing House, New Delhi.
4. Solid State Physics – G. Burns
5. Luminescence and Luminescent Materials – Blasse
6. Solid State Physics – Dekker.
7. Optoelectronic devices _ P. Bhattacharjee
8. Physics of semiconductor devices – S. M. Sze.

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Solid State Physics Specialization at University College of Science

PSSP 403T/CB

Paper – III

(Resonance phenomenon in Solids)

UNIT – I : Magnetism in solids

Ferromagnetism - Ferromagnetic coupling, Theory of spin waves, magnons in ferromagnets; Anti-ferromagnetism – Molecular field theory, susceptibility and Neel temperature; Ferrimagnetism – susceptibility variation with temperature, Neel's theory, Bloch $T^{3/2}$ law; Ferrites - Structure, properties and applications; Novel magnetic materials – GMR/ CMR materials.

UNIT - II : Nuclear Magnetic Resonance:

Nuclear magnetic resonance (NMR), Basic principles of NMR, Resonance condition, Spin-lattice and Spin-spin relaxation mechanisms, Bloch's equations and complex susceptibility, Chemical shift, Bloch diagram of NMR spectrometer, Analysis of the spectra, Applications of NMR.

UNIT – III: Electron spin resonance:

Principle of Electron spin resonance , Nuclear hyperfine interaction, crystal field theory, splitting of energy levels for octahedral and tertrahedral fields in transition metals; rare earth and actinide ions, Experimental details of Electron spin resonance spectrometer; Analysis of ESR spectra.
Elements of Nuclear Qudrapole Resonance (NQR) and construction and working of NQR spectrometer.

UNIT- IV: Mossbauer effect

Resonance fluorescence/Natural and Doppler broadening of lines, Qualitative theory of recoil less gamma ray emission, Mossbauer effect, Temperature dependence of recoilless process, Debye-Waller factor, Experimental study, Mossbauer spectroscopy, Quantum mechanical theory of Mossbauer effect, Isomer shift, Magnetic hyperfine interactions, Electric quadrupole interactions, Applications of Mossbuer effect.

Recommended books:

1. Elementary theory of solid state Physics - J.P. Srivastava.
2. Mossbauer effect- Principles and applications – G.K.Wertheim,
3. Mossbuer spectroscopy – N.N.Greenwood and T.C.Gibb,
4. Solid State Physics – Singhal;
5. Horizons of Physics, Vol.I, --Wiley Eastern Publishers

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PSSP 404T/CB

PAPER - IV

(Studies on Reduced Dimensionality in Solids & Fuel cells)

UNIT – I: Preparation of Thin films

Vacuum evaporation: Types of evaporation sources – Resistive heating, electron beam evaporation, Two source evaporation – Flash evaporation – Laser ablation.
Epitaxial deposition: Vapor-phase epitaxy, Liquid-phase epitaxy, molecular bean epitaxy- Thickness distribution of evaporated films (Point and Ring sources).
Sputtering : Glow discharge, dc and RF sputtering, Reactive sputtering, magnetron sputtering, Ion beam deposition.
Chemical methods: Chemical Vapor deposition (CVD), Plasma chemical vapor deposition(PCVD), Metal organic chemical vapor deposition (MOCVD).

UNIT - II: Two dimensional solids - quantum-well device structures

A review of quantum mechanics w.r.t . infinite deep rectangular potential well, Basic concepts of artificial structures; Introduction to Semiconductor hetero-junction superlattices, Properties of semiconductor superlattices - Optical absorption, Resonance tunnelling, Negative differential conductivity, Modulation doped hetero-junction superlattices,n-i-p-i structures, Inversion layers in MOSFETS and MODFETS, Metallic superlattices and their preparation, characterization and properties.

UNIT – III: One and Zero dimensional solids

Definitions, Zero-dimensional systems, Fullerenes, Quantum dots and their optical and electronic properties; One-dimensional systems: one-dimensional metals, Peirls distortion, conjugated polymers, Nano-tubules, Quantum wires (elementary treatment only)

UNIT – IV: Fuel cells

Fuel cell- Classification of fuel cells- Phosphoric acid Fuel cell (PAFC), Alkaline Fuel cell(AFC), Solid polymer fuel cell (SPFC), Molten carbonate fuel cell (MCFC), Solid oxide fuel cell (SOFC), Fuel for fuel cells, efficiency of fuel cell, V-I characteristics of fuel cell, Chemical polarization, Resistance polarization, concentration polarization.

Recommended Books:

1. **Fundamentals of thin films - Goswamy**
2. Thin films - K.L.Chopra
3. Semiconductor Devices - Physics and Technology - S.M.Sze
4. Hand book of nanostructred materials and nanotechnology (Vol. 1-4) Ed. By Hari Singh Nalwa
5. Nano crystalline materials – H. Gleiter
6. Nanophase materials - R.W. Seigel
7. Solid State Physics – G.Burns
8. Physics and Chemistry of Solids - S.R.Elliott
9. Non-Conventional energy sources, B.H. Khan, Tata Mc Graw-Hill, 2006
10. Non-Conventional energy sources, G.D. Rai, Khanna Publishers, 4th Edn, 2000.

SOLID STATE PHYSICS - PRACTICALS

List of Experiments

1. Energy gap of a Semi Conductor by forward bias
2. Energy gap of a Semi Conductor by reverse bias
3. C-V Characteristics of a p-n junction diode
4. Determination of activation energy of a metallic film, by four probe method
5. characteristics of a solar cell and determination of power gradient and efficiency
6. Thermo electric power of a semi conducting material
7. Determination of Lande factor – ESR Spectrometer
8. Magnetic Susceptibility of a paramagnetic salt-Guoy's balance method
9. Determination of magnetic transition temperature and permeability of ferro magnet.
10. Variation of manetoresistance with magnetic field and temperature by four probe method
11. Determination of lattice parameter of a fcc crystal usind XRD pattern

12. Study of lattice vibrational Spectra.
13. Determination of ferro electric transition of a PZT material.
14. Determination of magnetic transition temperature B-H curve method.
15. Determination of activation energy of defects in semi conductors at low temperatures(77-300k)
16. Dipole method of a organic molecule(Acetone)
17. Dielectric constant of a non polar liquid.
18. Calibration of a Si diode and a copper thermocouple as temperature sensors.
19. Verification of curie-weiss law for the electrical susceptibility of a ferroelectric material.
20. Determination of Transition temperature of a Superconductor

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

Special Subject: Condensed Matter Physics

w.e.f 2010-2011 under CBCS at PG College of Science, Saifabad

(For the batch admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Condensed Matter Physics Specialization at PG College of Science, Saifabad

PCMP 302T/CB

PAPER – II
(CRYSTAL PHYSICS)

Unit:1 ELEMENTS OF GROUP THEORY

Introduction to crystallographic point groups , the five platonic solids , procedure for symmetry classification of molecules , matrix notation for geometric transformation , matrix representation of point groups , reducible & irreducible representation , great orthogonality theorem and its consequences , character tables , construction of character tables , for C2v and C3v points group , Mullikan symbolism, Symmetry Species.

Unit : II : ELEMENTS OF LIGAND FIELD THEORY AND ELECTRONIC SPECTRA

Concept of ligand field and crystal field. Free ion configurations – terms & states. Derivation of free ion terms for d1 and d2 configuration. Energy ordering of terms – Hund's rule. Strengths of crystal fields. Crystal field potentials for Oh & Td fields. Meaning of 10Dq. Construction of ligand field energy level diagram, effect of weak

crystal fields on terms. Splitting due to lowering of symmetry. Electronic spectra of d1 and d9 system.

Unit : III :CRYSTAL SYMMETRY AND PHYSICAL PROPERTIES

Development of theoretical formalism using tensor. Physical property and its tensorial representation. Quotient theorem. Symmetry in crystals, point group and space group. Crystal classes Neumann's Principle. Fumi's method of determining symmetry of physical properties. Pyroelectircity and crystal symmetry. Dielectric constant and crystal symmetry – triclinic, monoclinic, orthorhombic and cubic systems. Piezoelectricity in Quartz. Relationship between Elasticity and crystal symmetry for triclinic, monoclinic, orthorhombic and cubic systems.

Unit : IV : LIQUID CRYSTALS

Symmetry, structure and classification of liquid crystals , Polymorphism in thermotropics, Reitenerant phenomena in liquid crystals , blue phases , Polymer liquid crystals, Distribution function and order parameters , macroscopic and microscopic order parameters. Measurement of order parameters using spectroscopic techniques

Nature of phase transitions and critical phenomena in liquid crystals, hard particles, Maier – Saupe and van der Waals theories for nematic – smectic A transitions.

Recommended Books

1. Chemical application of group theory – F.A. Cotton
2. Symmetry and Spectroscopy of molecules – Veera Reddy
3. Ligand field theory – B.N. Figgs
4. Symmetry and spectroscopy of molecules
5. Physical properties of crystals – J.F. Nye
6. Solid State Physics – G. D.Burns
7. Physics of crystals – S.Bhagavantam and S. Radhakrishna
8. Horizons of Physics, Vol. 1, Wiley Eastern Publications

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Condensed Matter Physics Specialization at PG College of Science, Saifabad

PCMP 303T/CB

PAPER – III
(PHONON BASED PHENOMENA)

Unit : I : PHONON PHYSICS

Theoretical background of lattice vibrations – Phonons and their properties – Crystal momentum conservation – Neutron diffraction from phonons – Experimental verification of dispersion relation – Thermal conductivity – Role of phonons – Normal and Umklapp process – Photon–phonon interaction – TO and LO phonons – Liddane – Sachs – Teller (LST) relation – Application – infrared measurement, Raman effect – theory of polarization – Experimental measurement.

Unit : II : FERROELECTRICITY AND STRUCTURAL PHASE TRANSITION

Introduction to ferroeletricity and phase transition, The free energy expression to summarize characteristics of ferroelectrics, soft modes in ferroelectrics, Structural phase transition, Comparison with experiments, Symmetry of low temperature phases, Microscopic model of soft models, Renormalization group, Optical properties of ferroelectrics, other related properties including pyroelectricity , Piezoelectricity. Ferroelasticity and Antiferroelasticity.

Unit : III : SUPERCONDUCTIVITY

Instability of Fermi Sea and Cooper pairs, BCS ground state, manifestation of energy gap, Consequences of the BCS theory and comparison with experimental result, Quantization of magnetic flux, Giaver Tunneling, Josephson effect – Phase coherence, D.C and A.C. Josephson effect, Superconducting quantum interference devices (SQUIDS). Discovery of $YBa_2Cu_3O_6$ - the parent compound preparation; Characterization - role of oxygen in the CuO_2 layer on the high temperature superconductivity, role of impurity on the transition temperature.

Unit: IV : SUPERFLUIDITY

Introduction-discovery, superfluidity in Helium ; two fluid model. Bose-Einstein condensation, Landau's theory, First and second sound, third and fourth sound; Hydrodynamics of superfluid flow; quantisation of vortex lines. Ions in liquid Helium. Liquid Helium-3

Recommended Books

1. Solid state physics – G.D. Burns:
2. Solid state physics – Dekker:
3. Solid state physics – Wahab
4. Solid state physics – H. Ibach and H. Luth
5. Solid state physics – Christman
6. Solid state physics – Kachchava
7. Solid State Physics- Kakani and Hemrajani (Fourth Edition)
8. Superfluidity- Landau & Lifschitz

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IIIrd Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

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Condensed Matter Physics Specialization at PG College of Science, Saifabad

PCMP 304T/CB

PAPER – IV
(ELECTRICAL TRANSPORT PHENOMENA IN SOLIDS)

Unit : I : TRANSPORT PHENOMENA IN METALS :-

The Boltzmann transport equation, Electrical conductivity, Definition and experimental features – The Drude – Lortentz, The Sommerfield theory – Calculation of the relaxation time, the electrical conductivity at low temperature, Matheissens's rule.
Integral and Fractional Quantum Hall effect

Unit : II : BAND THEORY OF SOLIDS :-

Brillouin zones, Brillouin zones in one, two, and three dimension, Extended , reduced, periodic zone schemes, Nearly free electron model, Tight binding approximation, and its application to simple cubic lattice, Calculation of energy bands, Cellular method, APW method, Pseudopotential method, OPW method, Density of states.

Unit : III : FERMI SURFACE :-

Introduction, Characteristics of fermi surface, Construction of fermi surface, Fermi surface and Brillouin zones, Dynamics of an electron in electric field; Dynamics of an electron in magnetic field, Cyclotron frequency, Cyclotron mass, Onsager-Lifshitz quantization condition, Cyclotron resonance, Energy levels and density of states in magnetic field, de-Hass van Alphen effect.

Unit : IV : ELECTRICAL TRANSPORT PROPERTIES OF INSULATORS :-

Hopping conduction; Temperature variation of electrical conductivity; Seebeck coefficient; Polarons – small polaron band conduction; large polaron band conduction; small polaron hopping conduction; Mott transition; Ionic conductivity; Superionic conductivity – structure, defects and conductivity.

Recommended Books

1. Principles of theory of solids – Ziman
2. Solid state physics – Singhal
3. Solid state physics – H.C. Gupta
4. Elementry solid state physics – M.Ali Omar
5. Solid state physics – M.A.Wahab
6. Solid state physics – Kachchava
7. Principles of solid physics – H.V.Keer

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Condensed Matter Physics Specialization at PG College of Science, Saifabad

PCMP 402T/CB

PAPER – II

(OPTICAL PHENOMENA IN SOLIDS)

Unit : I : OPTICAL PROPERTIES OF SOLIDS :-

Microscopic classical theory of propagation of electromagnetic waves in solid and derivation of an expression for the wave propagated through solids; derivation of expression for Absorption and Reflection coefficient, Kramers – Kronig relation; Quantum Theory of dispersion and absorption of electro magnetic waves through solids and derivation of proto type dispersion relationship for dielectric constant and their corrections.

Unit : II : ELECTRONIC TRANSITIONS IN SOLIDS :-

Free carrier absorption – oscillator model – frequency dependent parameters; free carrier absorption as applied to metals and semiconductors – Experimental results, Direct band gap and indirect band gap semiconductors; Inter band transitions, Fundamental absorption near Eg: Optically induced vertical and non vertical transitions and their theory – Experimental results; Heavily doped materials; Excitons – weekly bound and strongly bound excitons.

Unit : III : LUMINESCENCE :-

General consideration of luminescence, excitations, absorption and emission processes; luminescence, configuration coordinate diagram, energly level diagram, radiative and

nonradiatave, decay mechanism, effect of doping and efficiency, energy transfer and charge transfer, different kinds of luminescence, electro luminescence, photo luminescence and thermo luminescence, defects and color centers, different kinds of color centers in he context of luminescence in alkali halides, thallium activated alkali halides, zinc sulphide phosphors.

Unit : IV : :-PHOTONIC DEVICES:-

A)Photo detectors; Photo conductors, d.c and a.c photo conductors, gain and bandwidth, photo diodes

B) Solar cells; introduction to solar cells, current voltage characteristics, conversion efficiency, spectral response, hetero junctions and cascaded solar cells, Schottky barrier solar cells hydrogenated amorphous silicon (a-Si:H) solar cells; organic solar cells.

Recommended Books

1. Principles of theory of solids – Ziman
2. Solid state Physics – G.Burns
3. Semiconductor optoelectronics – Jasprit Singh
4. Luminescence and Luminescent materials – Blasse
5. Solid State Physics – A.J. Dekker
6. Optoelectronic Devices – P.Bhattacharjee
7. Physics of semiconductors devices – S.M. Sze

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Condensed Matter Physics Specialization at PG College of Science, Saifabad

PCMP 403T/CB

PAPER – III

(RESONANCE PHENOMENA IN SOLIDS)

Unit : I : MAGNETISM IN SOLIDS :-

Ferro magnetic coupling for localized electrons; Anti ferro magnetism, molecular field theory of anti ferro magnetism, susceptibility and Neel temperature, Ferri Magnetism Neels theory, susceptibility variation with temperatures, theory of spin waves;

Magnons in ferro magnets and anti ferro magnets; Bloch $T^{3/2}$ law; Manetic properties of ferrites, structure of ferrites, application of ferrites; Novel magnetic materials – GMR/CMR materials.

Unit : II : ELECTRON SPIN RESONANCE :-

Phenomenon of electron spin resonance, spin-Hamiltonian and the terms therein, crystal field theory, splitting of energy levels for Octahedral and Tetrahedral fields in transition metals ions with d1 d3 d5 d7 d9 configurations. Electron Spin Resonance(ESR) spectrometer; analysis of ESR spectra. Elements of Nuclear Quadrupole Resonance(NQR) and NQR spectrometer.

Unit : III : NUCLEAR MAGNETIC RESONANCE :-

Nuclear Magnetic Resonance(NMR), Basic principles of NMR, resonance conditions, Spin-lattice and spin–spin relaxation mechanism, Bloch's equations and complex susceptibility, chemical shift, block diagram of NMR spectrometer, analysis of the spectra, application of NMR.

Unit : IV : MOSSBAUER EFFECT :-

Resonance fluorescence / natural and Doppler broadening of lines, qualitative theory of recoil less gamma ray emissions, Mossbauer effect, temperature dependence of recoilless process, Debye – Waller factor, experimental study, Mossbauer spectroscopy, Quantum mechanical theory of Mossbauer effect, isomer shift, magnetic hyperfine interactions, electric quadrupole interactions, application of Mossbauer effect.

Recommended Books

1. Elementary theory of solid state physics – J.P.Srivastava
2. Mossbauer Effect – Principles and applications – G.K. Wertheim
3. Mossbauer spectroscopy – N.N. Greenwood & T.C. Gibbs
4. Solid state physics – Singhal
5. Horizons of physics – Vol – I - Wiley Eastern publishers

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc., (Physics) – IVth Semester Syllabus

w.e.f 2010-2011 under CBCS at the University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Condensed Matter Physics Specialization at PG College of Science, Saifabad

PCMP 404T/CB

PAPER – IV

(SEMICONDUCTOR DEVICES AND NANO MATERIALS)

Unit : I : SEMICONDUCTOR MATERIALS :-

Direct band and indirect band gap semiconductors, Charge carriers in extrinsic semiconductors, Effect of heavy doping, Diffusion currents, Mobility and its dependence on temperature and doping , Excess carriers in semiconductors – low level and high level injection, Recombination of electro – hole pairs – various recombination mechanism. Types of junctions, abrupt and graded junctions, - potential distribution, space charge, built in voltage and junction capacitance, carrier concentration across the junction, Recombination.

Unit : II : OPTOELECTRONIC DEVICES :-

The ideal heterojunction, current – voltage characteristics, common anion rule. Light emitting diodes – Electroluminescent process. Excitation and emission, LED materials, Device configuration and efficiency, light out put, LED structures, Manufacturing process; semiconductors lasers – lasing condition in a semiconductor, threshold condition

for lasing junction laser – operating principle, threshold current, power output, hetrojunction lasers, losses, laser diodes material, Device fabrication, laser mounting and fibre coupling.

Unit:III: QUANTUN WELL DEVICES

Review of the quantum mechanics of infinitely deep coupled potential wells. Artificial structures resembling such coupled potential wells; semiconductor hetero junction super lattices; their preparation by various epitaxial techniques; Properties of semiconductor super lattices-optical absorption, resonance tunneling, negative differential conductivity, modulation doped semiconductors; n-i-p-i structures; Inversion layers in MOSFETS and MODFETS; metallic super lattices -their preparation,characterisation and properties.

Unit: IV : NANO MATERIALS

Characteristics of micro and nano materials; Processing techniques -top down;high energy ball milling and bottom-up- chemical,sol-gel methods,hydro or solve thermal synthesis; Characterisation- x-ray diffraction, TEM, atomic force microscopy. Geometries of nano materials-quantum dots, fibres/wires, nano-tubes; Nano-electronic devices, Nano material driven novel architecture; Properties of Nano materials-optical,chemical,mechanical,magnetic (super paramagnetism) ; Application of nano materials based on these porperties.

Recommended Books

1. Semiconductors material and devices – Thyagi , John Wiley
2. Semiconductors optoelectronic devices – Pallab Bhattachary
3. Physics of semiconductor devices – Sze , John Wiley
4. Physics and Technology of semiconductor devices – Sze , John Wiley
8. Solid state Physics – G.Burns
9. Hand Book of nanostructured materials and Nanotechnology (Vols 1-4) Ed: Hari Singh Nalwa
10. Nano crystalline materials -H.Gleiter
11. Nanophase materials – R.W.Seigel

CONDENSED MATTER PHYSICS SPECIALISATION - LIST OF EXPERIMENTS

X.- RAY CRYSTALLOGRAPHY
1.Analysis of rotation photography of BCC crystal
2.Analysis of oscillation photography of FCC crystal
LOW TEMPERATURE PHYSICS
1.Einstein temperature of copper
2. Einstein temperature of silver
ELASTIC CONSTANTS
1.BCC crystal
2.FCC crystal
FERROELECTRIC CURIE TEMPERATURE
1. Triglycine sulphate (TGS)
2. Potassium dihydrogen phosphate (KDP)
3.Barium titanate ($BaTiO_3$)

FERROELECTRICAL HYSTERSIS CURVE
1. Triglycine sulphate (TGS)
2. Potassium Nitrate (KNO_3)
MAGNETIC PROPERTIES
1 . Investigation of Diamagnetism in Aluminum (Quantitative)
2. Investigation of Para magnetism in $CuSO_4$, $5H_2O$. Study of various types of interaction, viz., exchange and dipolar using ESR spectra
3. Investigation of ferromagnetism in Fe3O4.
COMPUTER SIMULATIONS FOR SOLID STATE PHYSICS
1. Brilloun zones for high symmetry cases
2. Fermi Surface for high symmetry cases

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

Practicals for General lab

(Common for all Specialisations)

w.e.f 2010-2011 under CBCS at University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

LISTOF EXPERIMENTS IN GENERAL PHYSICS LAB

IIIrd and IV Semesters

NUCLEAR PHYSICS LABORATORY

1. To draw the characteristic curve of the given G.M. Detector and determine its plateau length and working potential.
2. To determine the dead time of a given G.M. tube using double source.
3. To determine the half life of a long lived radio active substance .
4. To determine the linear and mass absorption coefficients of β-particles in a given material, i.e. Al.
5. To determine the absorption coefficient of gamma rays in different absorbing materials, i.e., Al and Pb.
6. To determine the half life of irradiated Indium foil.
7. To determine the half life of short lived and long lived irradiated silver (Ag) foil.
8. To verify inverse square law using beta or gamma source.

(SPECTROSCOPY LAB)

1 Zeeman effect.

2 Raman effect.

3 Magnetic susceptibility of a paramagnetic liquid.

4 Verification of Beer's law.

5 Temperature variation of resistance/conductivity of a given material –two probe method.

6 Hall effect.

7 Curie temperature of PZT.

8 Powder X-ray diffraction method for Crystal Structure determination

9 Atomic Spectra

Syllabus

M.Sc.(Physics) under CBCS
III and IV Semesters

Interdisciplinary Papers

w.e.f 2010-2011 under CBCS at University and Constituent Colleges

(For the batch admitted from 2009-2010 onwards)

Department of Physics, Osmania University
Choice Based Credit System (CBCS) in PG at University and Constituent Colleges
Semester IV Syllabus w.e.f. 2010 – 2010
Interdisciplinary Paper
(Offered by Department of Physics, UCS under CBCS wef 2010-2011for the students of other departments admitted from 2009-2010 onwards)

ID/P 305T/Pool 1/CB

Paper V
Basics of Nanoscience

Unit – I

History of Nanoscience and Technology – Conceptual origins and experimental advances, Differences between micro and nano type materials, Benefits and Potential risks – Implications of nanomaterials – Health issues , Environmental issues, Societal implications. Need for regulations.

Unit – II

Classification of nano materials – Three, Two, One and Zero dimensional materials with examples, Synthesis of Nanomaterials – Methods of synthesis, Bottom up methods – Solgel, Hydrothermal, Spray pyrolysis, Coprecipitation, Top down methods, Mechanical milling, Chemical vapor deposition.

Unit – III

Characterization of Nanomaterials – X – ray diffraction, Atomic force microscope (AFM), Scanning Electron Microscope (SEM) , Transmission Electron Microscope (TEM), UV-Visible spectroscopy, Raman spectroscopy, Particle size analyzer.

Unit – IV

Applications of Nanomaterials – Medical, Chemical, Environmental, Energy, Information and Communication, Defence, Consumer goods, Nanosensors, Nanoelectronics, Applications based on Mechanical, Electrical, Optical , Magnetic properties of Nanomaterials and Biology at nanoscale.

REFERENCE BOOKS

1. Nanomaterials by A.K. Bandyopadhyay, New Age International Publications, 2009
2. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et al.

Department of Physics, Osmania University
Choice Based Credit System (CBCS) at the University and Constituent Colleges
Semester IV Syllabus w.e.f. 2010 – 2010
Interdisciplinary Paper
(Offered by Department of Physics UCS under CBCS wef 2010-2011for the students of other departments admitted from 2009-2010 onwards)
ID/P 405T/Pool 1/CB

Paper V
BASIC ELECTRONICS

UNIT – I
FUNDAMENTALS OF ALTERNATING CURRENTS [AC] AND DIRECT CURRENTS [DC]:
Idea of electrical potential – The simple Battery – Voltage – Current – Power – Generating Alternating Currents and Voltages – Simple Waveform – Complex Waveform – Cycle – Time Period – Frequency – Amplitude – Phase – RMS value – Average value.

UNIT - II
PASSIVE COMPONENTS :
Resistors – Unit of resistance – Value representation using color code – Types of resistances - Laws of resistance – Conductivity – Capacitors – Capacitance – Types of capacitances - Value representation using color code – Inductors – Mutual Inductance – Types of Inductances – Transformers – Types of Transformers.

UNIT - III

SIMPLE NETWORKS - RELATED THEOREMS AND DIGITAL CONCEPTS:

Two-port networks – Two-loop networks – Two sources networks – Ohm's Law – Kirchoff's Current Law – Kirchoff's Voltage Law – Maximum Power Transfer Theorem – Superposition Theorem – Voltage divider circuit.

Digital Concepts – Binary number system – Boolean Algebra – Gates [OR, AND, NOT, XOR, NAND, NOR] – Latch – RS Flip-Flop – Concepts of Registers and Memories – Block diagram of Digital Computer.

UNIT - IV

ACTIVE DEVICES AND SIMPLE CIRCUITS:

Insulators – Semiconductors – Conductors – P-type Semiconductor – n-type Semiconductor – Junction Diode and its working – Voltage-Current Characteristics of Junction Diode – Zener Diode and its working - Voltage-Current Characteristics of Zener Diode – Bipolar Junction Transistor [structure and its different configurations] – Field Effect Transistor [Structure only] – Rectifier – Half-wave rectifier – Full-wave rectifier – Concept of Amplifier.

REFERENCE BOOKS

1. Basic Electronics By B Grob
2. Electronic Devices and Circuits By S.K.Sahdev.
3. Digital electronics By P Malvino
4. Microprocessors By Hall.

Department of Physics, Osmania University

Choice Based Credit System (CBCS) at the University and Constituent Colleges

Semester III Syllabus w.e.f. 2010 – 2011

Interdisciplinary Paper

(Offered by Department of Physics,UCS under CBCS wef 2010-2011 for the students of other departments admitted from 2009-2010 onwards)

ID/AE 305T/Pool 1/CB

Paper V

Fundamentals of Semiconductor Devices and their Applications

UNIT - I : (13 Hrs.)

Band theory of Solids – p type semiconductor – n type semiconductor – p-n junction – Biasing of p-n junction – A junction diode – Voltage-Current Characteristics – Zener diode – Significance of biasing in a Zener diode – Voltage-Current Characteristics of Zener diode – Varactor diode – Applications of varactor diode – Photo diode – Applications of Photo diode – Diode as a switch.

UNIT - II : (13 Hrs.)

RMS value – Average value - Junction diode as a rectifier – Half wave Rectifier – Full wave rectifier – Bridge rectifier – Capacitor Filter – L Section Filter – Pi section Filter – Concept of regulation – Zener Regulator and its working – A simple Transistor Regulated Power Supply.

Wave Shaping Circuits: Concept of Clipping - Clipping using a Junction Diode – Double Ended Clipping using Junction Diodes.

UNIT - III : (13 Hrs.)
Bipolar Junction Transistor – pnp Transistor – npn Transistor - Current Components in a transistor – Biasing of a Bipolar Junction Transistor - Common Emitter Configuration - Common Base Configuration - Common Collector Configuration – Voltage-Current Characteristics of CE Configuration – Transistor as a Switch – Transistor as an Amplifier – Cascading of Amplifier Stages.

UNIT - IV : (13 Hrs.)
Junction Field Effect Transistor – Construction of a JFET – Voltage-Current Characteristics of a JFET in Common Source Configuration – JFET as a switch – JFET as an Amplifier – CMOS FET.

Uni Junction Transistor – Voltage-Current Characteristics of a UJT – Importance of Negative Resistance – Intrinsic Stand-off Ratio – UJT as an Oscillator.

Operational Amplifier – Inverting Amplifier – Non-inverting Amplifier.

REFERENCE BOOKS

1. **Electronic Devices and Circuits -- Millman and Halkias. TMH**
2. **Electronic Principles – Malvino. TMH**

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Department of Physics, Osmania University
Choice Based Credit System (CBCS) at the University and Constituent Colleges
Semester IV Syllabus w.e.f. 2010 – 2011
Interdisciplinary Paper
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ID/AE 405T/Pool 1/*CB*

Paper V

Basics of Communication Systems

UNIT - I : (13 Hrs.)
Introduction to Communication Systems – Information – Transmitter – Channel – Channel Noise – Receiver – Modulation – Need for Modulation – Bandwidth requirements – Block diagram of an Electronic Communication System – Block diagram of an Optical Communication system – Types of Communication possibilities based on Frequency Range.

UNIT - II : (13 Hrs.)
Amplitude Modulation – Theory of Amplitude Modulation process – Frequency Spectrum of Amplitude Modulated Wave – Representation of Amplitude Modulated Wave.
Frequency Modulation – Frequency Modulation Representation – Phase Angle Modulation – Phase Angle Modulation Representation – Names of Amplitude Modulation and Frequency Modulation Generators and Detectors.

UNIT - III : (13 Hrs.)

Pulse Communications – Information Theory – Information in a Communication System – Measurement of Information – The binary digit Coding – Pulse Modulation – Pulse Amplitude Modulation – Pulse Width Modulation – Pulse Position Modulation – Pulse Code Modulation – Advantages and Applications of Pulse Code Modulation.

UNIT - IV : (13 Hrs.)

Introduction to Wireless Communication – Wide Area Networks – Local Area Networks – Metropolitan Area Networks - Evolution of Mobile Communication – Paging Systems – Cordless Systems – Cellular Telephone Systems – Cellular Concept – Frequency reuse – Working of a simple Telephone System – Rotary dial Telephone – Touch Tone Dial Telephone.

REFERENCE BOOKS

1. Electronic Communication Systems -- John F Kennedy.
2. Wireless Communications -- T S Rapport.

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Department of Physics, Osmania University
Choice Based Credit System (CBCS) at the University and Constituent Colleges
Semester III Syllabus w.e.f. 2010 – 2011
Interdisciplinary Paper
(Offered by Department of Physics, Nizam College under CBCS wef 2010-2011 for the students of other departments admitted from 2009-2010 onwards)
ID/NC 305T/Pool 2/CB

Paper V
Fundamentals of Internet working

UNIT – I

Data Communications and Networking: A Communication Model, Data Communications, Data Communication Networking.

Data Transmission: Concepts and Terminology: Transmission terminology, Frequency, Spectrum and Bandwidth. Analog & Digital data transmission: Analog and Digital data, Analog and Digital signals, Analog and Digital Transmission. Transmission Imprints (qualitative): Attenuation, Delay distortion and Noise. Channel Capacity (qualitative): Nyquist bandwidth, Shannon Capacity formula and Expression of E_b/N_0.

Transmission Media: Guided Transmission media: Twisted pair, Coaxial Cable, Optical Fiber. Wireless Transmission: Antennas, Terrestrial Microwave, Satellite Microwave, Broadcast Radio, Infrared. Wireless Propagation: Ground wave Propagation, Sky wave Propagation, Line of sight Propagation. Line of Sight Transmission: Free space loss, Atmospheric Absorption, Multipath, Refraction.

UNIT – II

Signal Encoding Techniques (qualitative): Digital Data, Digital Signals: Nonreturn to Zero (NRZ), Multilevel Binary, Biphase, Modulation rate, Scrambling techniques. Digital Data, Analog Signals: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK). Analog Data, Digital Signals: Pulse Code Modulation (PCM), Delta Modulation (DM). Analog Data, Analog Signals: Amplitude Modulation, Angle modulation.
Digital Data Communication Techniques: Asynchronous transmission, Synchronous transmission. Types of errors. Error Detection: Parity Check, Cyclic Redundancy Check (CRC) (Modulo 2 Arithmetic method only), Line configurations: Topology, Full Duplex and Half Duplex. Flow control: Stop and wait flow control, Sliding window flow control, Credit based flow control. Error control: Stop and wait ARQ, Go back N ARQ and Selective Reject ARQ.
Multiplexing: Characteristics of Frequency division multiplexing, Synchronous Time division multiplexing and Statistical Time division multiplexing.

UNIT –III

Protocol Architecture: The need for protocol architecture. Open Systems Interconnection (OSI) model: The OSI model, layers in the model and their functions. TCP/IP model: The TCP/Ip suit , layers in the model and their functions, addressing.
Topologies of Local Area Network: Bus and Tree topologies, Ring topology, Star topology.
Connecting Devices: Repeaters, Hubs, Bridges, Switches and Routers

IP addressing: Classful addressing. Subnetting/Supernetting and Classless addressing. IP design for simple topologies.

UNIT – IV

Routing Protocols: Static and Dynamic routing. Routing table and Routing Modules. Switching and MAC table.
Application Protocols - an overview: File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP), Hypertext Transfer Protocol (HTTP).
Internet Security: Security requirements and attacks. Encryption methods (Excluding algorithms): Principles of Symmetric Key Encryption, Public Key Encryption, Digital Signature. Firewalls: Packet filter firewall, Proxy firewall.

REFERENCE BOOKS

1. Data and Computer Communications By William Stallings
2. TCP/IP Protocol Suite By Behrouz A. Forouzan

Department of Physics, Osmania University
Choice Based Credit System (CBCS) at the University and Constituent Colleges
Semester III Syllabus w.e.f. 2010 – 2011
Interdisciplinary Paper
(Offered by Department of Physics, NiZam College under CBCS wef 2010-2011 for the students of other departments admitted in 2009-2010)

ID/NC 405T/Pool 2/CB

Paper V
Medical Physics & Bioinformatics

Unit I:

Physics of Respiratory & Cardio vascular systems: Physics of respiratory system Major components of respiratory system.The airways. Pressure – airflow – volume relationship. Physics of the Alveoli. Breathing mechanism. Airway resistance. Work of breathing. Physics of some common diseases.
Physics of the cardiovascular system: Major components of the cardiovascular system. Work done by the heart. Transmural pressure. Laminar and turbulent blood flow. Heart sounds. The physics of some cardiovascular diseases.

Unit II:

Physics of sensory organs: Physics of muscle - Molecular basis of muscle contraction. Sarcomere and molecular mechanism of muscle contraction. Microscopic and X-ray diffraction. Studies on cross bridge structures. Electrophysiology of muscle.

Physics of Nerve: Chemical and electrical properties of mylinated and non-mylinated nerves. Charge distribution in resting nerve cell. Leakage current across the cell membrane. Electrotonus. Hodgkin-Huxley model for membrane current. Propagating nerve impulse. Properties of mylinated conduction.
Physics of Eye :Structure of eye Photochemistry of visual process. Quantum effects in dark adapted vision. Refraction of the eye.
Physics of Ear: Structure of human auditory system. Structure of choclea. Scanning electron micrographs of inner and outer hair cells of the organ of corti. Cochlear patterns. The growth of loudness. Audiometry

Unit III:

Ultrasonic Image processing & Electricity within the body: **Ultrasonic Image processing, Principle, working, analysis and clinical applications of ultrasonic imaging**
Electricity within the body - Principle, description, working, analysis and clinical applications of ECG EMG, EEG & ERG.

Unit IV:

Bioinformatics: Introduction to Bioinformatics, What is Bioinformatics? Various definitions of Bioinformatics; Bioinformatics in pharmaceutical industry ; Bioinformatics in business; Skills required by bioinformatics professionals; New perspectives.
Nucleotide & Protein sequence Analysis - Biological background for sequence analysis; Identification of protein sequence from DNA sequence; Introduction and calculation of sequence alignment; optimal alignment methods.

REFERENCE BOOKS

1. Medical Physics - John R, Cameron & G Skefrenick
2. Principles of medical electronics and Biomedical instrumentation - C Raja Rao & S K Guha, Universities Press
3. Medical Biophysics – R. N. Roy, Books 7 Allied Pvt.Ltd., Calcutta
4. Bioinformatics – Baldi & Brunak

Syllabus

M.Sc.(Applied Electronics)

III and IV Semesters

w.e.f 2010-2011 under CBCS at the University College of Science

(For the students admitted from 2009-2010 onwards)

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Applied Electronics) - IIIrd Semester Syllabus
w.e.f 2010-2011 under CBCS at the University College
(For the batch admitted from 2009-2010 onwards)

AE - 301 T/CB

Paper – I
(Digital System Design)

Unit – I

Basic Boolean Functions – Binary, Octal, Hexadecimal Numbers, Binary Codes and Logics**;** Boolean Algebra, Basic Theorems and Functions, Canonical, Digital and Integrated Circuits**;** Simplifications of Boolean Functions, Two to Six Variable Map Simplification, NAND and NOR Implementation, The Tabulation method, Determination and Selection of Prime Implicants.

Unit – II

Logic Design – Combinational Logic – Adders, Subtractors, Code Conversion, Multilevel NAND, NOR and Ex-OR functions**;** MSI and PLD Components – Decimal, Binary Adder and Subtractor, Comparators, Decoders, Encoders, Mux and De-Mux, ROM, PLA and PAL**;GAL,CPLD and FPGA.** Over view of Digital Integrated Circuits with all Logic Families – TTL, ECL, MOS, CMOS.

Unit – III

Sequential Logics – Synchronous Sequential Logics – FFs, Analysis, State Reduction and Assignment, FF Excitation Tables, Design Procedure and Design of Counters**;**

Asynchronous Sequential Logics – Analysis, Circuits with Latches, Design Procedure, Reduction, Race-Free of State Assignments and Hazards.

Unit – IV

Counters and Algorithms – Registers, Shift Registers, Ripple and Synchronous Counters, Timing Sequences, RAM, Memory Decoding and Error-Correcting Codes**;** Algorithmic State Machines – ASM Charts, Timing and Control Implementation, Design with Muxs, PLA Control.

Text Books:

1. Digital Design By – M. Morris Mano
2. Switching theory & Logic design –By R.P.Jain TMH 2003
3. Digital System Principles & Applications By – Ronald J. Tocci

Reference Books:

01. Computer Architecture and Logic Design By – Thomas C. Bartee
02. Digital Principles & ApplicationsBy – A.P. Malvino and D.P. Leach
03. Digital Computer Design By – V. Rajaraman & T. Radhakrishnan
04. Digital Electronics - An Introduction to Theory and Practice By – William H. Gothman
05. Digital Computer Electronics By – Malvino and Brown
06. Digital Integrated Circuits – A Design Perspective By – Jan M. Rabae
07. ICs & Microprocessors – Data Hand Book,BPB Publications, India
08. Digital Logic and Microprocessors By – FJ. Hill & GR. Peterson
09. Digital Circuits and Microprocessors By – Herbert Taub
10. Switching and Finite Automata Theory By – ZVI Kohavi
11. *Digital Design – By John F wakerly*

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Paper –II
(Computer Organisation)

UNIT-I

Basic structure of hardware and software: Functional units, Basic operational concepts , Bus structure , Software and performance.

Memory: locations and addresses, operation.

Instruction set architecture: ARM: Registers , Memory access and data transfer ,Arithmetic and logic instructions , Branch instructions, Pseudo instructions , I/O Operations .

Subroutine – example program with parameters passed through registers.

Program example: Vector dot product.

IA-32 – Architecture:Register structure , addressing modes , instructions ,Machine instruction format , Assembly language , program flow control , logical instructions , I/O operations ,subroutine – One example program.. Program example: Vector dot product

UNIT-2

I/O organization:Accessing I/O devices , interrupts : enabling and disabling interrupts , controlling device requests, exceptions , use of interrupts in OS .Direct memory access. Standard I/O interfaces : - PCI – Bus , SCSI Bus and USB functions (brief explanation). Semiconductor RAM memories , Speed , size and cost.Cache memories –Mapping functions – Example of mapping techniques.Cache in ARM and Pentium III processor . Performance consideration. Virtual memories, memory management requirements.

UNIT-3

Arithmetic :Addition and subtraction of signed numbers ,Design of fast adders,Multiplication of positive numbers, signed operand multiplication, fast multiplication ,integer division , floating point operations – implementing floating point operations .

Basic processing unit : Some fundamental concepts – Execution of a complete instruction, Multiple bus organization, Hardwired control , Mocroprogrammed control.

UNIT-4

Pipelining: Basic concepts - Role of cache memory, pipeline performance , data hazards , instruction hazards , influence on instruction sets ,data path and control considerations. Introduction to: Superscalar,superpipelined processors,vector processor.Example implementation for pentium.

Introduction to vector processor, advantages of vector processors.

Recommended Text Books:

1. Computer Organization By Carl Hamacher ,Zvonko Vranesic , Safwat Zaky, McGraw-Hill (2002) fifth edition
2. Fundamentals of Computer Organization & Design by Sivarama P.Dandamudi Springer pub., 2009

Reference Books:

1. Computer System Architecture by Moris Mano, Prentice Hall India (2000)
2. Computer Architecture and pipelined processing by K.Huang & F.A.Briggs ., Mc Graw-Hill
3. Computer Architecture and logic Design by V.Rajaraman & T.Radhakrishnan
4 Computer Architecture &Logic Design by Thomas A.Bartee., Mc-Graw-Hill (1991)
5. Computer Architecture-Pipelined and Parallel Processor Design, By M.J.Flynn., Narosa Pub., (1998)
6 Computer Fundamentals, Architecture and Organization,-B.Ram.,3rd Edn.,New Age International (1999)

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Paper III

(Data Communications and Net working)

Unit-1

Introduction: Data communications –components, data representations, and direction of data flow. Networks: distributed processing, Network criteria and Physical structure, category of networks. The Internet-brief history- internet today, protocols and standards. Network models: Layered tasks, Internet model and OSI model.

Signals: Analog signals and Digital signals. Analog versus Digital. Data rate limits – noisy and noiseless channels and Transmission impairments. Throughput, propagation speed and time, wavelength.

Transmission Media: Guided: twisted pair, coaxial cable and fiber optic cable. Unguided media: radio, microwave and infrared

Exercises at the end of each section.

Unit-2

Digital Transmission: Line Coding –characteristics and schemes. Block coding-steps in transformation and block codes. Sampling: PAM and PCM .Nyquist theorem.
Serial and parallel transmission.
Analog Transmission: Modulation of digital data-ASK, FSK, PSK and QAM.bit and baud comparison.
Telephone modems. Modulation of Analog signals- Amplitude modulation (AM) Frequency modulation (FM) and Phase modulation (PM).
Multiplexing: Frequency division multiplexing (FDM).-multiplexing demultiplexing, analog hierarchy and applications Time division multiplexing (TDM).-time slots and frames, interleaving, synchronizing, bit padding, digital signal service (DS), and TS lines. Inverse TDM.-applications.
. Exercises at the end of each section

Unit-3

Circuit switching –space division switch, time division switch, TDM bus, space and time division switch combinations.
Telephone network: major components, analog and digital services.
DSL technology-ADSL and other DSL technologies. Cable modem –traditional cable networks, HFC networks, CM and CMTS, data transmission schemes.
SONET: devices, frame transmission, virtual tributaries, higher rate services.
Data link layer: types of errors -- error detection –redundancy, parity, CRC and checksum. Correction methods--- Retransmission, forward error and burst error correction.
Flow and Error control: stop and wait ARQ, GO-back N ARQ, and Selective repeat ARQ.
HDLC: configuration and transfer modes. Frame format, type.PPP protocol format and stack.
Exercises at the end of each section

Unit-4

Multiple accesses:
Random access –multiple access, carrier sense multiple access (CSMA/CD, CSMA/CA), Controlled access.Channelization—FDMA, TDMA and CDMA.
Local area networks:--Traditional Ethernet, fast Ethernet and GIGA bit Ethernet: Mac sub layer and physical layer implementations.
Wireless LANs: IEEE 802.11 – architecture and addressing mechanisms.
Bluetooth: architecture and layers.
Connecting Devices: Repeaters, Hubs, Bridges and Routers. Backbone networks and virtual LANS.
Virtual circuit switching: global addressing, virtual circuit identifier, phases.
Frame relay –architecture—layers—congestion control.ATM: architecture-layers—congestion control and quality of service .ATM LANS.
Exercises at the end of each section

Text book:

1. Behrouz A.Forouzan, Data communications & networking 3/e TMH

Reference Books:

1. William Stallings, Data & computer communications 8/e Pearson education 2006.
2. Fred Hasal, Data communications computer network and open systems 4/e Pearson education 2005
3. William A .Shay, understanding Data communications & networks 2/e Thomson learning 2003.
4. R.P.Singh, S.D.Sapre communication systems, Analog and Digital
5. Prakash C.Gupta, Data communications PHI 1999

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Paper IV

OPTICAL FIBRE COMMUNICATION AND MOBILE COMMUNICATION

Unit – I :

Optical fiber wave guides , Ray theory transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew-rays. Electromagnetic Mode Theory for Optical Propagation- Electromagnetic Waves, Modes in a planar wave guide, Phase and Group velocity, Phase shift with total internal reflection and Evanescent fields.

Cylindrical optical Fiber-Modes, Mode coupling, Step index fiber, Graded index fiber and WKB method.

Transmission characteristics - Attenuation, absorption, intrinsic and extrinsic absorption. intra-modal and inter-modal dispersion.

Unit – II :

Sources : LED - structure, surface emitter LEDs, edge emitter LEDs, LED characteristics, Optical output power, Output Spectrum, Modulation bandwidth and reliability. Injection Lasers : Introduction to semiconductor lasers, Threshold condition, Current due to spontaneous emission, Power out put, Hetro-junction lasers, Distributed feedback system, Quantum well Lasers, Characteristics of Injunction Lasers.
Detectors : Junction photo diode, Avalanche-photodiode, Phototransistor. Schotky barrier diode, Metal-Semiconductor-Metal (MSM) photo diodes.

Unit _ III :
Introduction to cellular mobile systems : Significance of cellular mobile systems, Frequency spectrum allocation , Trunking efficiency , A basic cellular system , Performance criteria , Operation of cellular systems , Hexagonal shaped cells , Planning a cellular system , Elements of cellular system design , Frequency reuse , Cochannel interference reduction factor , Hand-off mechanism , Cell splitting , Components of Cellular systems.

Unit – IV :
Analog and Digital cellular systems : Definitions of terms and functions , Introduction to digital technology , ARQ techniques , Digital speech , Digital mobile telephony , Multiple access schemes , Global system for mobile (GSM) , TDMA , CDMA.

TEXT BOOKS :

1.Optical fiber communication- John M. Senior.
(Page nos, 12 to65to, 84,88,89,97,107to119, 160to171, 374to389, 399to410, 336to345, 532to572)
2.Optical fiber communication—G Keiser (page nos.130 to 142, 155 to 175)
3. Semiconductor opto electronics—Pallab Bhattacharya. (Page nos.395,396,435 to 475)
4. Mobile Cellular Telecommunications by William C. Y. Lee. [McGRAW HILL].
5. Wireless communications – theodore S Rapport [Pearson education]

REFERENCE BOOKS :

1. Optical communication system—J.Gower
2. Fundamentals of fiber optical communication and sensor system—Bishnu P Pal.
3. Integrated optics – Theory and technology—R.Ghunspurger.
4. Fiber optic communication—D.C.agarwal.
5. Introduction to fiber optics—A.R.Cherian.
6. Introduction to optoelectronics—J.Willlson and J.E.B.Haukes.
7. Fiber optic communication—J.C Palais.

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Paper – I

(Digital System Design using VHDL)

UNIT – I

Basic Language Elements : Identifiers, Data objects, Data types, Operators.

Behavioural Modeling : Entity declaration, Architecture body, Process statement, Variable assignment statement, Signal assignment statement , Wait statement, If statement, Case statement, Null statement, Loop statement, Exit statement, Next statement, Assertion statement, Report statement, other sequential statements, Multiple processes, Postponed processes.

UNIT – II

Data Flow Modelling: Concurrent signal assignment statement, Concurrent versus sequential signal assignment, Delta delay revisited, Multiple drivers, Conditional signal assignment statement, selected signal assignment statement.
The unaffected value block statement, concurrent assertion statement, Value of a signal.
Structural Modeling : An Example, Component declaration, Component instantiation and examples, Resolving signal values.
Generics, Configuration specification, Configuration declaration, Default rules, Conversion functions, Direct instantiation, Incremental binding.

UNIT – III

Subprograms and Overloading : Subprograms - Subprogram overloading, Operator overloading, Signatures, Default values for parameters.
Packages and Libraries : Package declaration, Package body, Design file, Order of analysis, Implicit visibility, Explicit visibility.
Advanced Features : Entity statements, Generate statement, Aliases, Qualified expressions, Type conversions, Guarded signals, Attributes, Aggregate targets, More details on block statements, Shared variables, Groups, More details on ports.

UNIT – IV

Model Simulation: Simulation - Writing a Test Bench - Converting real and integer to time - Dumping results into a text file - Reading vectors from a text file - A test bench example - Initializing a memory - Variable file names.
Hardware Modeling Examples : Modeling entity interfaces, Modeling simple elements, Different styles of modeling, Modeling regular structures, Modeling delays, Modeling conditional operations, Modeling synchronous logic. State machine modeling, Interacting state machines, Modeling a Moore FSM, Modeling a Measly FSM.
Recommended Books :

1. A VHDL Primer- By J.Bhasker., Pearson Education Asia, 11th Indian Reprint, 2004.
2. VHDL Programming by Example - By Douglas L. Perry, 4th Ed., TMH., 2002.
3. Introductory VHDL : From Simulation to Synthesis-By Sudhalar Yalamanchili., Pearson Education Asia 2001..
4. The Designer's Guide to VHDL-By Peter.J.Ashenden, 2nd Ed., 1st Indian Reprint, Harcourt India Pvt
   Ltd., 2001.

Reference Books :

1. Fundamentals of Digital Logic with VHDL Design-ByStephen Brown & Zvonko Vranesic., THM 2002.
2. Digital Systems Design usingVHDL by Charles H.Roth Jr.PWS Pub., 1998.
3. VHDL – Analysis & Modeling of Digital Systems-By Zainalabedin Navabi., 2nd Ed., MH., 1998.

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Paper II
(Microcontrollers and Applications)

Unit – I: The 8051 Microcontroller

Microcontrollers and Embedded process, overview and Block diagram of the 8051; Inside the 8051, Assembling and Running an 8051 Program, The Program Counter and ROM space, Date Types and Directives, Flag Bits and PSW Register, Register Banks and Stack; Pin Description, I/O Programming, Bit Manipulation; Addressing Modes- Immediate and Register Addressing Modes, Accessing Memory using Various Addressing Modes

Unit-II: Programming the 8051

Instruction Set- Arithmetic instruction Programs- Add, Subtract, Multiplication and Division of Signed and Unsigned and Unsigned Numbers; Logical Instruction and Programs- Logic, Compare, Rotate, Swap, BCD and ASCII Application Programs; Single Bit Instructions and Programming – Single Bit Instructions with CY; Jump, Loop and call Instructions, Time Delay Generation and Calculation; Timer/Counter Programming, Serial Communication an interrupts Programming

Unit - III. Interacting and Applications of 8051

Interfacing and LCD, ADC and Sensors with the 8051; Interfacing a Stepper Motor, Keyboard and DAC to generate waveforms on CRO with the 8051

Unit - IV. Programming ,RTOs and Development Tools:

Assembly and C programming - programming basics – Structure of the CPU registers and Internal RAMs – Programming in Assembly language – assemblers – saving CPU Status During Interrupts – Passing Parameters – Control Computing Branch Destination at Run time – Programming in C and use of GNU tools - Stacks – Queue – Table – Strings – State Machine – Key parsing.

Real Time Operating System for System Design- Real Time Operating System, Exemplary RTX51, RTOS of Keil, Uses of RTOS in Design, Microcontroller Application Development Tools- Development Phases of Microcontroller- Based System, Software Development Cycle and Applications, Software Development Tools, Exemplary IDE-Microvision and Tools from Keil, Emulator and In-circuit Emulator(ICE), Target Board, Device Programmer.

Recommended Books:

1. The 8051 Microcontrollers and Embedded Systems- By Muhammad Ali Mazidi and Janice Gillispie Mazidi, Persong Education , Asia, 4th Reprint, 2002
2. The 8051 Microcontroller- Architecture, Programming & Applications – By Kenneth J. Ayala, Penram International Publising , 1995
3. Microcontrollers Architecture, Programming Interfacing and System Design- By Raj Kamal, Pearson Education.

Reference Books:

1. Embedded Microcontroller Hand Book, Intel Applications

2. Programming and Customizing the 8051 Microcontroller- By Myke Predko, TMH, 2003
3. Advanced Microprocessors and Peripherals, Architecture, Programming and Interface- By A.K. Ray and K.M. Bhurchandi, TMH, 2000
4. Design with Microcontrollers By- J.B. Peatma, MH
5. The 8051 Microcontroller- Programming, interfacing and applications- By Howard Boyet and Ron Katz, (MII) Microprocessors Training Inc.
6. The Concepts & features of Microcontrollers by Rajkamal, Wheeler Pub.
7. The Microcontroller idea Book Circuits, Programs & Applications featuring the 8052- Basic Microcontroller by: Jan Axelson, Penram International

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Paper – III
(Control Systems)

UNIT – I

Transfer functions – Poles and Zeroes of network functions- Pole –Zero diagrams – Time domain behavior from Pole-Zero plot.

Basic components of a control system–Open loop and closed loop control systems – Examples.

Block diagram of control systems- Block diagram transformations- Closed loop transfer function- Signal flow graphs-

Mathematical modeling of physical systems- Electrical (RLC Network) and mechanical systems (Translational, Rotational, Gear train). - DC and AC servomotors – Tachometer-stepper motor.

UNIT – II

Time Domain analysis of control systems- Typical test signals for the time response of control systems- Steady state error- Unity feed back systems.

Steady state error for a unity feedback system with step input, ramp input and parabolic input- Unit step response and time domain specifications- Transient response of a prototype second order system.

UNIT – III

Frequency response plots- Polar plot of a transfer function-Bode plots- Bode plot of an RC filter- Minimum and non minimum phase transfer functions.

Frequency response of closed loop systems- Frequency- domain specifications- M_r, ω_r and band width of the prototype second order system.

Root locus technique – Basic properties of root loci- Important aspects of the construction of root loci.

Nyquist stability criterion- applications of Nyquist criterion to find the stability.

UNIT –IV

Design of control systems- Design specifications – Control configuration.

Design with PD controller- Time domain interpretation of PD controller-Design with PI controller- Time domain interpretation and design of PI controller-Design with PID controller- Design with phase lead controller- Time domain interpretation and design of phase lead controller- Design with phase lag controller- time domain interpretation and design of phase lag controller- Design with lead- lag controller.

Recommended Books:

1. Automatic Control Systems- Benjamin C. Kuo , PHI
2. Modern Control Systems – Richard C. Dorf and Robert H. Bishop, Addison – Wesley Publications.
3. Control Systems Engineering – IJ Nagarath and M. Gopal, New Age International Publications.
4. Theory and Problems in Feedback Control Systems- Schaum Series.
5. Control Engineering M.N.Bandyopadhyay PHI Publications

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Paper IV
MICROWAVE SYSTEMS

Unit – I :

Microwave waveguides and components , Rectangular Waveguides , Solutions of Wave equations in Rectangular coordinates , TE modes in Rectangular Waveguides , TM modes in Rectangular Waveguides , Circular Waveguides , Solutions of Wave equations in Cylindrical coordinates , TE modes in Cylindrical Waveguides , TM modes in Cylindrical Waveguides , TEM modes in Cylindrical Waveguides , Microwave cavities , Rectangular cavity resonator , Circular cavity resonator , Semicircular cavity resonator , Q Factor of a Cavity Resonator.

Unit – II :

Passive Microwave Devices , Scattering Matrix formulation , Properties of S-matrix, Symmetry of Scattering Matrix, Scattering Matrix for lossless junction, Scattering Matrix for a two-port junction, S-matrix of E-plane and H-plane Magic Tee, Hybrid Rings, Directional Couplers and Circulators. Termination , Phase Shifters , Rotary Phase Shifters , Electronically controlled Phase shifters , Hybrid Ring , Power Dividers - Farady rotation and its applications : Gyrator, Isolator and Three-port Circulator.

Unit – III :

Strip Lines : Microstrip Lines , Characteristic Impedance of Microstrip lines , Losses in Microstrip lines , Quality Factor Q of Microstrip lines , Parallel strip lines : Distributed parameters , Characteristic impedance , Attenuation losses , Coplanar strip lines , Shielded strip lines.

Monolithic Microwave Integrated Circuits [MMICs] , Materials (Substrate, Conductor, Dielectric and Resistive) , MMIC Fabrication Technique.

Unit – IV :

Avalanche Transit-Time Microwave Devices : Negative resistance devices , Tunnel diode, Avalanche effect , IMPATT , TRAPATT and BARITT Diodes, Parametric devices : Physical Description , Non-linear reactance and Manley-Rowe power relations Parametric Amplifiers , Parametric Up and Down - Converters

TEXT BOOKS :

1. Microwave Devices and circuits - By S.Y.Liao
2. Fundamentals of Mcrowave Engineering - R.E.Collin -Megraw-Hill International
3. Composite Satellite and Cable Television - R.R.Gulati - New Age International Publishers
4. Electronic Cominunication - IV Edition - Dennis Roddy and John Coolen
5. Electronic Communications Systems - G.Kennedy - Tata-MacGraw-Hill Series