SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
Post Graduate (PG) Programs under Faculty of Science
(Affiliated Colleges)
(w.e.f. Academic Year 2014-15)

SYLLABUS FOR M.Sc. PART-II EXAMINATION

M.Sc. PHYSICS
(SEMESTER PATTERN)

JUNE -2015

Draft Syllabus Prescribed for
M.Sc. Part-I and Part-II Examination in Physics
(Semester Pattern)

There shall be total four semesters (Two for M.Sc. Part-I and Two for M.Sc. Part-II). There shall be four theory papers (100 marks each) semester Pattern and Four practical papers (100 marks each) Annual pattern. It is expected that the students should visit Research Laboratories and industrial establishments of repute.

M. Sc. Part – II Third Semester

Paper No. Title of the Theory Papers Marks

Paper No.	Title of the Theory Papers	**credit**
PH-15	Electrodynamics	4
PH-16	Nuclear and Particle Physics	4
PH-17	Basics of Laser and Devices	4
*PH-18	Elective Papers: PH18 (A or B or C)	4
PH-19 Seminar	(25 marks)	Credets:1
Title of the Practical Papers		
PH-20	(Practical Course)	4
PH-21	(Practical Course)	4

M. Sc. Part –II Fourth Semester

Paper No. Title of the Theory Papers Marks

Paper No.	Title of the Theory Papers	**credit**
PH-22	Fiber Optics and Optical Fiber Communication	4
PH-23	Microwaves and Measurements	4
PH-24	Microprocessors and Microcontrollers	4
*PH-25	Elective Papers :PH25 (A or B or C)	4
PH-26 Seminar	(25 marks)	Credets:1
Title of the Practical Papers		
PH-27	(Practical course)	4
PH-28	Project work and Seminar on project	4

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
Post Graduate (PG) Programs under Faculty of Science
(Affiliated Colleges)
(w.e.f. Academic Year 2014-15)

Name of the Faculty	Total credits	Average credits per semester
Science	**100**	**25**

Note:

> Assessment shall consist of Continuous assessment **(CA)** and End of Semester Examination **(ESE).**

> **Weightage:** 75% for ESE & 25% for CA

> **Paper- (Elective):** Transfer of Credit as per Student cho

Tentative Distribution of Credits for PG under Science faculty:

Semester	Paper No	External (ESE)	Internal (CA)	Total
Sem. III	Paper-I (PH:15)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-II (PH:16)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-III(PH:17)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	*Paper-IV(PH:18 A, B, C or other choice of student) (Elective)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper – V (PH:19) (Seminar)	(25 marks)	Credit: 1(25 marks)	Credit: 1
	Sem: III Credit: 17		**Total for**	**Credit: 17**
Sem. IV	Paper-I (PH:22)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-II(PH:23)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-III (PH:24)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	*Paper-IV (PH:25A, B, C or other choice of student) (Elective)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper – V (PH:26) (Seminar)	(25 marks)	Credit: 1(25 marks)	Credit: 1
	Sem: IV Credit: 17		**Total for**	**Credit: 17**
Lab Course Work (Annual Practical)	Practical Course Work –I(PH:20	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Practical Course Work –II (PH:21)	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Practical Course Work-III (PH: 27)	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Project work PH:28	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Total for Lab Course work(Annual)			**Credit: 16**
	Total for M.Sc. II Year: Sem. III+ Sem. IV + Lab Course work (Annual) Credit: 50			**Credit: 50**

Paper Setting Pattern for M. Sc.II (Sem III and IV)

All questions are compulsory and carry equal Marks

Q.1 a) ---------- 8
b) ----------7
OR Unit I
x) ----------8
y) ----------7

Q.2 a) ---------- 8
b) ----------7
OR Unit II
x) ----------8
y) ----------7

Q.3 a) ---------- 8
b) ----------7 Unit III
OR
x) ----------8
y) ----------7

Q.4 a) ---------- 8
b) ----------7
OR Unit IV
x) ----------8
y) ----------7

Q.5 a) ---------- 8
b) ----------7
OR Unit V
x) ----------8
y) ----------7

SEMISTER: III
Electrodynamics

Paper: PH-15 **Lectures: 45** **Credits: 4**

Unit I. Maxwell's equations and Electromagnetic waves: (09 lectures)
Maxwell's equations and their physical significance. Equation of continuity and relaxation time, Vector and scalar potentials, Lorentz and Coulomb gauge, electromagnetic energy and Poynting's theorem, electromagnetic wave equations in free space, their plane wave solutions, waves in conducting medium: skin depth, waves in ionized medium (ionospheric opagation) polarization of EM waves. Concept of radiation pressure

Unit II. Electromagnetic waves in bounded media: (09 lectures)
Reflection and refraction of plane electromagnetic waves at a plane interface: normal incidence, oblique incidence, Fressnel's equations, and Brewster's angle. Total internal reflection. Reflection and refraction from metallic surfaces, Electromagnetic wave propagation between two parallel conducting plates, waves in hollow conductors, Rectangular wave guides – TE and TM modes.

Unit III Radiations from moving charges: (08 lectures)
Concept of retarded potential, The Lienard-Wiechert potentials, Fields produced by moving charges, radiations from an accelerated charged particle at low velocities, radiations from a charged particles with co-linear velocity and acceleration, Radiations from an accelerated charged particle at low velocities in circular orbits-Larmor formula, Radiations from an accelerated charged particle at relativistic velocities in circular orbitsrelativistic generalization of Larmor Formula.

Unit IV Radiating Systems: (09 lectures)
Multipole expansion of EM fields, Electric dipole radiations, field due to oscillating electric dipole, magnetic dipole radiations, electric quadrupole radiation, fields due to linear, centre-fed antenna, simple array of antennas.

Unit V Relativistic Electrodynamics: (10 lectures)
Galilean transformations, Lorentz transformations and basic kinematical results of special relativity (length contraction, time dilation, addition of velocities, charge invariance, field transformation, etc), relativistic momentum and energy of a particle, mathematical properties of space-time in special relativity

Text Books:

1. Classical Electrodynamics - J.D. Jackson (John Wiley and Sons)
2. Classical Electromagnetic Radiation - J.B. Marion (Academic Pres)

Books Recommended for reference:

3**.** The Classical theory of Fields - Landau and Lifshitz (*Pergman Press*)
4. Electrodynamics of continuous media - Landau and Lifshitz (*Butter Worth*)
5. Electricity and Magnetism - David J. Griffiths (*PHI*)
6. Electricity and Magnetism - Panofsky and Philips
7. Electromagnetic waves and fields - R.N. Singh (*Tata McGraw Hill*)
8. Electromagnetic Waves and Radiation system - Jordan and Balman (*PHI*)
9. Electromagnetic Fields and waves - Paul Lorrain and Dale Corson (*CBSPub*)

10. Electromagnetics - B.B Laud (*New Age Intl. Pub*.)

Nuclear and Particle Physics

Paper: PH-16 **Lectures: 45** **Credits: 4**

Unit I Basic Nuclear properties (09)

Nuclear size & its determination, nuclear radii by Rutherford scattering, electron scattering & mirror nuclei method, nuclear quantum numbers, angular Momentum, nuclear dipole moment, electric quadruple moment.

Unit II Interaction of nuclear radiation with matter (09)

Interaction of charged particles & em rays with matter, range, straggling, stopping power, ionization chamber, proportional counter, GM counter, scintillation detector, semiconductor detector.

Unit III Nuclear forces and Nuclear Models (09)

Elements of two body problem, charge independence & charge symmetry of nuclear forces, Meson theory of nuclear forces.

Nuclear Models:

B.E., Semi empirical mass formula & applications, nuclear shell model, liquid drop model collective model, collective model, Fermi gas model.

Unit IV Nuclear decay & Reactions (09)

Radioactive decay, laws of successive transformation, dosemetry nuclear reactions, fission & fusion. β – decay, three forms of β - decay, Fermi theory of β - decay, kurie plot, selection ule, non conservation of parity in β - decay.

Unit V Elementary particles (09)

Weak, strong & electromagnetic interaction, classification of elementary particles, conservation laws, quark theory.

Reference Books:

1) Nuclear Physics by -Irving Kaplan
2) Nuclear Physics by -Patel S.B. Wiley Eastern Publishing House

Basics of Laser and Devices

Paper: PH-17 **Lectures: 45** **Credits: 4**

Unit I **(09)**

Properties of Lasers,Intensity,Monochromaticity,Directionality and coherence, Einstein's coefficients, Momentum transfer, Life time and possibility of amplification.

Unit II **(09)**

Concepts of waves and interference, Temporal and spatial coherence, Coherence of the field and size of the source, Coherence and monochromaticity, Shape and width of spectral lines, Line broadening mechanism, Intrinsic broadening, collision broadening, Doppler broadening.

Unit III **(09)**

Basic principles of lasers, population inversion, Laser pumping, Two level and three level pumping, Vibrational modes and mode density of resonator, Open and confocal resonator.

Unit IV **(09)**

Ruby laser, Three level system and its pumping power, Nd:YAG and Nd:Glass laser ,its energy level diagram and salient features.

He-Ne lasers: Energy level diagram, construction and salient features of the He-Ne laser device,

He-Cd and He-Sc laser: Energy level description and salient features, Molecular gas laser- CO_2 gas laser, Energy level scheme and general features.

Unit V **(09)**

Nonlinear optics, Harmonic generation, Phase matching, Optical mixing parametric generation of light and self focusing.

Applications of Lasers: Applications of lasers in (i) Communication (ii) Industry (iii) Medicine (iv) Biology (v) Astronomy.

Recommended Books:

1.Lasers and Non linear Optics: B.B. Laud,New Age International Ltd,Delhi.
2.Introduction to Laser Physics: Koichi Shimoda (Springer Verlag)
3.Optics an Lasers : M.Young (Springer Verlag)
4. Laser Fundamentals : William T. Silfvast Cambridge University, Press

Thin Film and Nano Physics

Paper: PH-18A **Lectures: 45** **Credits: 4**

Unit 1: Thin film deposition methods (10)

Introduction to Thin Films, Physical Methods - Thermal evaporation methods: Resistive heating, Flash evaporation, Laser evaporation, Electron bombardment heating, Arc evaporation, Sputtering process: Glow discharge, DC sputtering, Radio frequency sputtering, Magnetron sputtering, Ion beam sputtering.

Unit 2: Chemical Methods (10)

Chemical vapor deposition: Common CVD reactions, Methods of film preparation, laser CVD, Photochemical CVD, Plasma enhanced CVD, Chemical bath deposition: ionic and solubility products, preparation of binary semiconductors, **Electrode position:** Deposition mechanism and preparation of compound thin film **Spray pyrolysis**: Deposition mechanism and preparation of compound thin Films

Unit 3: Nucleation, growth and structure of films (8)

Nucleation: Condensation process, Langmuir- Frenkel theory, other theories of condensation and experimental results, **Growth**: Liquid like coalescence, influence of deposition parameters, physical structure of films, Crystallographic structure of films: lattice constant, Size effect, Disordered and amorphous structures, Epitaxial growth of thin films: Influence of substrate and deposition conditions, theories of Epitaxy.

Unit 4: Properties of thin films (08)

Mechanical properties: Stresses in thin films, Mechanical constants of thin films, **Electrical properties:** Electrical conduction in thin metallic discontinuous films, Electrical conduction in thin metallic films, **Optical properties:** Optical constants of thin films, experimental methods as Reflection, Interferometric, and Critical angle method.

Unit 5: Nanoscience and nanotechnology (09)

Introduction, Nanoscience and nanotechnology, Quantum structures, Nanoclusters, organic nanocrystals. **Synthesis of Nanomaterials:** metal colloids, Nanoclusters, nanotubes, nanowires, nano rods, nanocrystalline materials, oxide nanoparticles. **Application of Nanotechnology**: Nanobiology, nanocatalysis, nanoelectrodes, nanoswitches, nanocomputers.

Reference books

1. Thin Film Phenomena by K L Chopra McGraw -Hill Book Company, NY 1969
2. Thin Film Technology by O S Heavens (1970)
3. Properties of Thin Films by Joy George, Marcel and Decker, (1992) (For Units 1-3)
4. Physics of Thin Films L Eckertova, Plenum Press NY (1980) (For Unit 4)
5. Thin Film Fundamentals (New Age International Publishers, New Delhi) by A. Goswami
6. Nanoscience and Nanotechnology V. S. Muralidharan, A. Subramania (Ane Books Pvt. Ltd.)(For unit V)
7. Encyclopedia of Nanoscience S. K. Prasad (Discovery Publishing house, New Delhi)

Materials Science

Paper: PH-18B **Lectures: 45** **Credits: 4**

Unit I: Types of Materials and Glass (10 Lect.)

Materials Science: Introduction, Importance of materials, Types of materials, Typical materials behaviour, significant properties, Applications.

Glass: Types of glasses, Glass Manufacturing process, Ceramics: Types of ceramics, Processing ceramics, Concrete: properties of concretes, Constituents of concretes (Cement, Aggregate, Water, Admixtures), Characteristic of good concrete, Classification of concrete, properties of cement concrete, water proof concrete, R.C.C (properties, advantages and disadvantages, uses), Adhesives, abrasives, Application of concretes.

Unit II: Magnetic materials (6 Lect.)

Terms related to Magnetic Materials, origin of magnetism, Classification of magnetic materials, Magnetic Domains, Magnetization, Magnetic anisotropy, Losses in magnetic materials, Factors effecting permeability and Hysteresis loss, soft and hard magnetic materials, Ferro fluids.

Unit III: Dielectric materials and Ferroelectric Materials: (12 Lect.)

Dielectric as an electric field medium, Leakage currents, Dielectric losses, Breakdown voltage and Dielectric strength, break down in solid dielectrics, liquid dielectrics, Gases as dielectrics, polarization, Electrical conductivity in solid liquid and gaseous dielectrics. Applications of dielectric materials

Common ferroelectric materials, Properties of ferroelectric materials in static field, spontaneous polarization, causes for existence of curie temperature, application of ferroelectric materials. Antiferroelectric materials, piezoelectric materials, pyroelectric materials

Unit IV: Bio Materials (6 Lect.)

General aspects of good timber, Advantages and disadvantages of Timber, Uses of timber, Defects in timber, seasoning of timber, Decay of timber, Testing timber. Play-wood, Lamin board, Black board, Fiber board, Hard Board.

Unit V: Materials Synthesis (11 Lect.)

Solid State Reactions:general principles, processes of the reactions between solids, precursor, solution and gel methods, sealed tubes and special atmospheres, solution and hydrothermal methods, phase diagram and synthesis. Low temperature reactions, intercalation in layer structures, insertion compounds of metal oxides, ion exchange methods

Synthesis by different wet chemical techniques viz., sol-gel, combustion, emulsion and polyol methods, Self-propagation combustion reaction, precursor dependent process, Microwave assisted process, Hydrothermal bomb calorimeter-hydrothermal and solvo-thermal process, Interfacial growth materials between the two immiscible phases,

Reference books:

1. Elements of Materials Science and Engineering, L Van Vlack, 6th ed., Addison Wesley, MA, 1999.
2. Materials Science and Engineering; An Introduction, W D Callister, Wiley, 2002
3. Modern Perspectives in Solid-State Chemistry,C N R Rao and J Gopalkrishanan, 1998
4. Electronic Ceramics, L M Levinson, Marcel Dekker, NY, 1988.

Modern Digital Communication

Paper: PH-18C **Lectures: 45** **Credits: 4**

Unit I: Digital communication (9 Lect.)

Introduction, synchronization, asynchronous transmission, probability of bit error in base band transmission. The matched filter optimal terminal filters, bit timing recovery, eye diagrams, digital carried Systems (ASK, FSK, PSK, DPSK, QPSK), carrier recovery circuits.

Unit II: Digital line waveforms (9 Lect.)

Symbols, binits, bits, bauds, functional notation pulses, line codes and waveforms, M-arry encoding, inter symbol interferences, pulse shaping.

Unit III: Pulse modulation (8 Lect.)

Introduction: PAM, PCM, PFM, PTM, PPM, PWM

Unit IV Base-band shaping for data transmission (9 Lect.)

Discrete PAM signals, power spectra of discrete PAM signals, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base band M-ary PAM systems, adaptive equalization for data transmission.

Unit V: Digital modulation technique (10 Lect.)

Digital modulation formats, Coherent binary modulation techniques, coherent quadrature modulation technique, Non-coherent binary modulation technique,

Comparison of binary and quarternary modulation techniques, M-ary, modulation techniques, synchronization and applications.

Reference Books:

1) Simon Haykin: Digital communications, John Wiley, 2003.

2) K. Sam Shanmugham: Digital and analog communication systems, John Wiley, 1996.

3) Simon Haykin: An introducation to analog and digital communication, John Wiley, 2003.

4) D Roddy and J Coolen: Electronics communication, PHI, 4/e, 1995.

5) B P Lathi: Modem digital and analog communication systems, Prism Books, 2/c 1993.

Nuclear Physics and Laser Lab (Practical Course)

Paper: PH-20 **Lectures: 50** **Credits: 4**

Nuclear Physics Lab.

1) Gamma Ray Spectrometer-1(Calibration)
2) Determination of operating voltage of G.M. tube
3) Random Nature of Radioactive decay
4) Absorption coefficient of Al.
5) Determination of half life of In.
6) Dead time of G.M.tube using single source
7) Dead time of G.M.tube using double source
8) Inverse square law
9) Gamma ray spectrometer-2

Laser Lab

1. To determine the grating pitch of transmission grating using laser.
2. To find the refractive index of transparent glass plate by measuring Brewster angle using laser.
3. To observe diffraction pattern and to calculate the slit width using laser.
4. To determine the absorption coefficient of liquid (water) using laser.
5. To study the shape of laser beam cross-section and to evaluate beam spot size.
6. To find the refractive index if transparent bar using diode laser.

Note:-Every student should perform at least 10 practicals

Laser, Thin Film and Nanophysics Lab (Practical Course)

Paper: PH-21 **Lectures: 50** **Credits: 4**

Laser Lab

1. To calculate the wavelength of laser using Michelson Interferometer.
2. To determine data track spacing on CDs using laser.
3. To determine the unknown concentration of the sugar solution using laser.
4. To determine the angle of wedge plate using laser.
5. To determine the refractive index of liquids using laser.
6. To determine and study the power distribution within the laser beam.

Thin Film and Nanophysics- Lab Work

List of Experiments:

1. Thin film deposition by Chemical bath deposition technique
2. Thin film deposition by Successive Ionic Layer Absorption and Reaction (SILAR)
3. Thin film deposition Deposition of electrodeposition
4. Crystal growth by gel technique
5. Measurement of Thermoelectric power
6. Determination of optical band gap
7. Study of Type of transition involved in optical absorption spectra of thin film
8. Photoconductivity Studies of thin film
9. Electrical Conductivity by Two Probe Method of thin film
10. Resistivity by Four probe method
11. Hall effect

Note:-Every student should perform at least 10 practicals

SEMISTER : IV

Fiber Optics and Optical fiber Communication

Paper: PH-22 **Lectures: 45** **Credits: 4**

Unit (I) Ray theory of transmission and preparation of optical fibers 8 Lectures

Propagation of light in different media : propagation of light in an optical fiber, Basic structure and optical path of an optical fiber, Acceptance angle and acceptance cone, Numerical aperture(NA) (General), Modes of propagation, Meridional and skew rays, Number of modes and cut-off parameters of fibers.

Fiber Fabrication Techniques : Chemical vapour deposition technique, Double crucible method.

Unit (II) Losses and Dispersion in Optical Fiber 8 Lectures

Fiber Losses : Attenuation in optic fibers, Materials or impurity losses, Rayleigh scattering losses, Absorption loss, Leaky modes, Bending losses, Radiation losses. **Dispersion in optical fiber :** Electrical Vs. optical bandwidth. Bandwidth-length product, Intermodal dispersion, Mixing modes, Material chromatic dispersion.

Unit(III) Light Sources and Detectors for Optical Fiber 8 Lectures

Light Sources : Introduction, LED (Light Emitting Diode), Processes involved, structure material and output characteristics of LED, Fiber LED coupling, Bandwidth, Spectral emission of LEDs, LASERS : Operation types, Spatial emission pattern, Current Vs. output characteristics.**Detectors :** Introduction, Characteristics of photodetectors (General), hotoemissive type, Photoconductive and photo voltaic devices, PN junction type, PIN photo diode, Avalanche photo diode (APD).

Unit (IV) Fiber optic sensors, Communication systems and Modulation 11 Lectures

Fiber optic sensors : Introduction, Fiber optic sensors, Intensity modulated sensors, Micro bend strain intensity modulated sensor, Liquid level type hybrid sensor, internal effect intensity modulated sensor, Diffraction grating sensors and Interferometric sensors. **Communication systems :**Transmitter for fiber optic communication, High performance transmitter circuit LED – Analog transmitter, LASER transmitter, Digital laser transmitter, Analog laser transmitter with A/D conversion and digital multiplexing, Fiber optic receiver, Fiber based modems : Transreceiver. **Modulation :** LED analog modulation, Digital modulation, Laser modulation, Pulse code modulation (PCM), Intensity modulation (IM).

Unit(V)Optical Fiber Communication and Measurements on Optical Fibers:10 Lectures

Optical fiber communication systems : Introduction, Important applications of integrated optic fiber communication technology, Long haul communication, Coherent optical fiber communication, Principle of coherent detection. **Measurements on Optical Fibers :** Introduction, Measurements of numerical aperture (NA), Measurements of Fiber- attenuation, Optical time Domain Reflectometry (OTDR), Measurements of dispersion losses, Measurements of refractive index, Cut-off wavelength measurement, Measurements of Mode Field Diameter (MFD), Near field scanning technique.

Reference Books:

1. Optical Fiber Communications : Principles and Practices- John M. Senior(Phi)

2. The Element of Fiber Optic- S.I.W. Meardon (Regend and Ph)
3. Optical Fiber Communication- G. Keiser (Mc Graw Hill)
4. Introduction to Fiber Optics- A. Ghatak and Tyagrajan (Cambridge University Press)
5. Optical Fiber Communication- Joseph C. Palais(Ph)
6. Fiber Optics- N.S. Kapany(Academic Press)
7. Optical Fiber and Optical Fiber Communication Systems S.K.Sarkar (S. Chand and Comp.)

Microwaves and Measurements

Paper: PH-23 **Lectures: 45** **Credits: 4**

Unit – (I) Microwave Fundamentals 8 lectures

Microwave frequency spectrum, Types and characteristics of transmission line, Transmission line equation solution, Reflection coefficient and transmission coefficient, Standing wave and standing wave ratio, Line impedance and admittance, Smith chart.

Unit – (II) Microwave Passive Devices 8 Lectures

Rectangular wave guide, Circular wave guide, Microwave cavities, Microwave hybrid circuit, Directional coupler, Circulators and ferrit devices, Attenuators, Scattering matrix, Isolators.

Unit – (III) Microwave Active Devices 8 Lectures

Klystron, Reflex Klystron, Velocity modulation, Basic principle of magnetron, Principles and operations of magnetrons and traveling wave tube, Transfer electron devices, Gunn diode, Pin diode.

Unit – (IV) Microwave Measurements 8 Lectures

Attenuation measurement, Frequency measurement, Power measurement, Reflection coefficient and VSWR measurement, Scattering measurement. Microwave detection, Point contact diode, Schottly barrier diode, Impedance measurement using smith chart.

Unit – (V) Microwave Applications 13 Lectures

Antenna fundamental, Microwave antennas, Antenna basic, Power received from an antenna, Radiation pattern, Radiation resistance, Efficiency, Directivity and gain, Antenna types, Rectangular horn antennas, H and E plane Horn antennas, Pyramidal Horn antenna, Parabolic reflector antenna. Radar system, Basic radar system, Radar range, Moving target indicator, Time domain reflectometry, Network analyzer, Microwave dielectric measurement techniques.

Reference Books:

1. Microwave Devices and Circuits- Samull Y. Lio, Prentice Hall of India Pravate Limited, New Delhi.
2. Microwave Communications Components and Circuits- Hunds, Mc Graw Hill, International Edition.
3. Microwave Techniques- D.C. Agarwal, S. Chand and Company.
4. Microwave Engineering- David M. Pozar, John Wiley and Sons, New York.
5. Microwave Principles- Herbert S. Reich, C.B.S. Publications.
6. Microwave Propagation and Techniques- D.C. Sarkar, S. Chand and Company.
7. Microwave Fundamental- Sanjeeva, Gupta and Others, Khanna Publications.

8. Microwave Circuits and Passive Devices- Sisodia and Raghuvanshi, Wiley Easter Ltd.
9. Antenna Theory and Design- Warren L. Stutzman Gray A. Thiele, John Wiley and Sons, Inc.
4

Microprocessors and Microcontrollers

Paper: PH-24 **Lectures: 45** **Credits: 4**

UNIT – I : Architecture of Microprocessor 8085 (12 lectures)
Intel 8085- Block diagram, ALU, Timing and control unit, Registers, Data and address bus, Pin configuration, Instruction word size, Instruction cycle, Fetch operation, Execute cycle, Machine cycle and state, Instructions and data flow, Timing diagram, Memory read, I/O read, Memory write, I/O write

Unit –II: Programming of Microprocessor 8085 and Data Transfer Techniques: (12 lectures)
Introduction, Instruction set for 8085, Programming of 8085, Assembly language programming (Data Transfer, Arithmetic, Branching, and Logical group). Programmed data transfer, Synchronous, Asynchronous and interrupt drivers modes, DMA, Serial data transfer.

Unit-III : Advanced Microprocessors (Intel Microprocessor 8086): 6 Lectures
Architecture of 8086, Pin diagram and pin function, Register organization, Minimum and Maximum mode of 8086, Microprocessor 80286, 80386 (Block Diagram only)

Unit – IV: Micro-controller 8051: 10 Lectures
Introduction to 8 - bit micro-controller, Architecture of 8051 signal description of 8051, Register set of 8051, Important operational features of 8051, Memory and I/O addressing by 8051, Interrupts of 8051, Instructions set of 8051, programming of 8051 (Simple Arithmetic and Logical programs).

Unit- V: 16 bit Micro-controller and Embedded Controller: 5 Lectures
Introduction, Architecture of 16 bit micro-controller (MCS-96 or 80196), General features of 80196, Register set of 80196, I/O processor, UPI 452 (Universal Peripheral Interface), Intel 80960 (block Diagram and its description only).

Reference Books:
1. Microprocessor Architecture, Progrmmining and Applications- R. Gaonkar, Wily-Eastern Ltd.
2. Microprocessor and Microcontroller- B. Ram, Dhanpati Rai and sons Delhi
3. Advanced Microprocessor and Principles- A.K. Ray, K.M. Bhurchandi Tata Mc Graw Hill Publication Co. Ltd. New Delhi.
4. The 8085 Basics, Progamming and Interfacing- U.V. Kulkarni and T.R. Sontakke, Sadhu Sudha Prakashan, Nanded.
5. Microprocessor and Digital Systems- Dauglas Hall, Tata Mc Graw Hill
6. Introduction to Microprocessor- A.P. Matur(TMH)
7. Advanced Microprocessor and Interfacing- B. Ram (TMH).
8. Microprocessor Architecture, Progrmmining and Applications With 8086 / 8080- R. Gaonkar, Wily-Eastern Ltd.

Energy Physics

Paper: PH-25A **Lectures: 45** **Credits: 4**

Unit – (I) Conventional and Non-conventional Energy Sources: 11 lectures
Man and energy, world production and reserves of commercial energy sources- fossil fuel, hydroelectric power, Nuclear energy ,Indian energy scenario- fossil fuel, hydroelectric power, Nuclear energy power plants, Non-conventional Energy Sources- scope and potential, Concept of Solar constant, Solar intensity on earth's surface, Direct and diffused radiation ,Measurements of Solar Radiations – Moll-Gorezynsky pyronometer, Sunshine Recorder

Unit – (II) Photovoltaic Conversion Technologies: 7 Lectures
Crystalline Solar Cell Technology- purification of Silicon conversion of metallurgical grade silicon to semiconductor grade- Czocharlski crystalline silicon formation process, Processes involved in the conversion of silicon wafer to solar cell ,Modular design of solar cell, Power generation through satellite solar power station, Advantages and Disadvantages of solar cell

Unit – (III) Photo thermal conversion technologies 13 Lectures
Basic principles of flat plate collector (FPC), elements of flat plate collector, selective coatings and ideal characteristics of absorber plate of flat plate collector, Solar cooker, Hot water system, Solar dryer, Solar pond, Design of central tower receiving system for power generation, Essential elements of Solar Concentrators, parameters and efficiency of solar concentrators, Cylindrical parabolid concentrators (PTC), Compound parabolid concentrators (CPC), Applications of solar concentrators

Unit – (IV) Biogas 7 Lectures
Principles of biogas production, The anaerobic digestion process, types of systems (standard and high rate system) proportion of gases in biogas, Design of the plant, process control consideration (temperature, pH), gas production, gas collection, gas utilization, Advantages and Disadvantages of biogas plant.

Unit – (V) Fuel Cells 7 Lectures
Hydrogen as source of energy, photo electrochemical cell, source of hydrogen, solar hydrogen through electrolysis and photo catalytic process, hydrogen storage, brief discussion of various processes, concept of fuel cell, thermodynamics of fuel cell, merits and demerits of fuel cell.

Reference Books:

1. Solar Energy -S. P. Sukhatme (TMH)
2. Solar Energy -Garg and Prakash (PHI)
3. Solar Cells -M. A. Green (PHI)
4. Biogas Technology -B. R. Veena (Ashish Pub. House)
5. Non conventional energy sources - G D Rai

Electronic Instrumentation

Paper: PH-25B **Lectures: 45** **Credits: 4**

Unit-I: Instrumentation **9 Lectures**

Introduction, definition, purpose of instrumentation. Measurement, types of measurements, importance of measurements, classification of instruments, generalized measurement system, instrument characteristics, error, types of errors.

Unit-II: Transducers **9 Lectures**

Definition, types of transducers, classification of transducers, resistive, inductive, capacitive, piezoelectric, photoelectric transducers. Temperature transducers, pressure and displacement transducers, strain gauges, optical transducers, detectors, biomedical electrode and transducers.

Unit-III: Electrical conductivity measurement **9 Lectures**

Conductivity cell, AC electrodynamometer, pH measurements, pH meter. Automation in digital instruments, auto-zeroing, auto-ranging, automatic polarity indication. Digital storage oscilloscope.

Unit- IV: PC Instrumentation

PC for measurement and control: Role of PC in instrumentation, application of PC for measurement of displacement, temperature measurement and control. AC motor speed measurement and control.

Unit- V: Telemetry and data acquisition system **9 Lectures**

Introduction, types of data acquisition system, basic elements of data acquisition system, sample and hold circuit. Digital instruments-DFM, DMM, Q meter, lock in amplifier, thickness measurement using LVDT, humidity Measurement. Recorders-X-Y recorder, strip chart recorder, magnetic tape recorder.

Reference books:

1) B. C. Nakra and K. K. Choudhri: Instumentation, measurement and analysis, TMH, 1995.

2) D. V. S. Murthy: Transducers and instrumentation, PHI, 1995.

3) Rajesh Hongal: DBM PC and clones.

Digital Signal Processing

Paper: PH-25C **Lectures: 45** **Credits: 4**

Unit–I: Introduction to digital signal processing **10 Lectures**

Introduction of common applications of DSP, signal, classification of signals, signal processing systems, advantages of DSP over ASP. Elements of DSP systems. Review of discrete-time signals and systems-introduction, discrete time signals, discrete time systems, convolution of two discrete time signals, correlation of two discrete time signals, sampling of continuous time signals, reconstructions of signals from its sample values.

Unit –II: The Z transform and discrete Fourier transform **6 Lectures**

Introduction, definition of Z transform, properties of Z transform, some common Z transform pairs, the inverse Z transform, system function.

Unit –III: Descrete Fourier Transform **9 Lectures**

DFT Introduction, definition of DFT, properties of DFT, tabulations of properties of DFT, relationship between DFT and Z transform, linear convolution using the DFT. FFT algorithm-introduction, Geortzel algorithm, classification of FFT algorithm, decimation in time FFT algorithm, decimation in frequency in FFT algorithm.

Unit –IV: Realization of discrete time system **10 Lectures**

Introduction, computational complexity, memory requirement, finite word length effects in the computations. Network structures for IIR systems-Direct form, transposed form, cascade form and parallel form network structures. Network structures for FIR systems-Direct form cascade form and frequency sampling network structure.

Unit –V: Digital filters **10 Lectures**

Introduction, selection of filter, specification of the frequency response characteristics of the filter, phase response specifications, filter design. Comparison between digital and analog filters. Comparison between IIR and FIR digital filters, notch filters, comb filters, all pass filters and digital oscillators and resonators.

Reference Books:

1) A. V. Oppenheim and R W Schafer: Digital signal processing, PHI, 1985.

2) J.G.Proakis and D.G.Manolkis: Introduction to digital signal processing, McMillan, 1989.

3) Rabiner and Gold, Digital signal processing, PHI. 1999

4) Farooq Husain, Digital signal processing and applications, Umesh Publication, New Delhi, 2001.

Lab Course on Microwave and Fiber Optics Lab

Paper: PH-27 **Lectures: 50** **Credits: 4**

Section-A Microwave Lab

1. Microwave bench and components setup study.
2. Characteristics of Reflex Klystron.
3. Characteristics of Gunn diode.
4. Study of Isolator, Circulator and Directional coupler,
5. To study Faraday rotator and determine Faraday rotation angle.
6. Measurement of VSWR / Reflection coefficient with different load.
7. Measurement of frequency of microwave source and establish relation between guided wavelength and free space wavelength.
8. Microwave detector characteristics.
9. To measure the performance of directional coupler.
10. To measure the performance of E-plane, H-plane and Magic tee.
11. Study of Horn antenna (Power distribution pattern).
12. To determine dielectric constant of solid using slotted section waveguide.
13. Dielectric constant of various liquids.

Section-B Fiber Optics Lab

1. Fiber end preparation launching of light into fiber.
2. Measurement of numerical aperture by zig method.
3. Measurement of numerical aperture by modal dispersion method.
4. Measurement of diameter of single mode fiber.
5. Determine the refractive index of glass slab and To study the total internal reflection.
6. Fiber to fiber (multimode) splice loss.
7. V-parameter of single mode fiber.

8. Loss measurement in single mode fiber.
9. Study of VDL (Visual diode laser).
a) Responsivity b) I / O Characteristics c) Inverse square law
10. Study of spectral response and spatial response of the detector.
11. To determine spatial, transverse and angular losses of a given multimode fiber.
12. To determine wavelength (λ) of laser source by diffraction grating.
13. To study the LED characteristics and determine the Plank's constant (h).
7

Microprocessor and Microcontroller Lab

Section-C

Microprocessor Lab

1. Write an ALP to transfer data bytes.
2. Write an ALP for various Arithmetic operations.
3. Write an ALP for different Logical operations.
4. Write an ALP to find out Smaller and Larger number.
5. ALP for port configuration of 8085 using 8255.
6. Study of 8255 (PPI).
7. Study of 8253 timer.
8. Study of 8257
9. Study of 8279
10. ALP for generation of Square wave

Section-D

Microcontroller Lab

1. Write an ALP for addition and verification by using 8051 microcontroller.
2. Write an ALP for subtraction and verification by using 8051 microcontroller.
3. Write an ALP for multiplication and verification by using 8051 microcontroller.
4. Write an ALP for division and verification by using 8051 microcontroller.
5. Write an ALP to find the 1's compliment 8 bit and 16 bit number using 8051 microcontroller.
6. Write an ALP to find the 2's compliment 8 bit and 16 bit number using 8051 microcontroller.
7. Write ALP for ascending /descending order of data.
8. Interfacing of seven segment display.

Note – Every student should perform at least 16 practical by choosing at least four (04) practical from each section.

The students can have their own choice to perform any two experiments outside from the list above, available in their laboratory.

Lab work marks distribution

1. Experiment------- 50
2. Oral ---------- 15
3. Record Book ----- 10

PROJECT WORK AND SEMINAR Paper: - PH – 24

Paper: PH-28 **Lectures: 45** **Credits: 4**

1. Project work: 75Marks

The student has to work on some current topic and write a Dissertation / Thesis on the Investigations carried out independently or in association with a research group
in the Campus of S.R.T.M.Univrsity Nanded or a reputed State or National Research Institute.

2. Seminars: 25 Marks

Every student will have to prepare for a seminar on a topic allotted to him. He will have to present it in the form of written report as well as orally at the time of Examination.

Distribution of Marks

1. Dissertation / Thesis --75 Marks

2. Seminar ---------- 25 Marks