DEPARTMENT OF PHYSICS

College of Science & Technology

ANDHRA UNIVERSITY

VISAKHAPATNAM – 530003

SYLLABUS

(Effective from 2017-2018 CBCS)

M.Sc. PHYSICS

M.Sc. SPACE PHYSICS

M.Sc. ELECTRONICS (INSTRUMENTATION)

NOVEMBER 2020

M.Sc. PHYSICS

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M.Sc. SPACE PHYSICS

DEPARTMENT OF PHYSICS

Course Structure for M.Sc. Physics and M.Sc. Space Physics

(Effective for the academic year 2020-21 only)

M.Sc. Physics – III Semester

Paper Code	Title of the Paper	T	P	Sem. end Exam Marks	Mid Sem. Marks	Total Marks	Credits
P-301	Solid State Physics	4		80	20	100	5
P-302	Lasers & Fiber Optics	4		80	20	100	5
P-303	Digital Electronics & Microprocessors **(Common for M.Sc. Space Physics)**	4		80	20	100	5
P-304	Communication Electronics **(Common for M.Sc. Space Physics)**	4		80	20	100	5
P-305	Communication Electronics & Microprocessor Lab 1 (Practical-80 & Record-20)		6	100		100	4
P-306	Solid state Physics Lab 1 (Practical-80 & Record-20)		6	100		100	4
	Total	16	12	520	80	600	28

M.Sc. Space Physics – III Semester

Paper Code	Title of the Paper	T	P	Sem. end Exam Marks	Mid Sem. Marks	Total Marks	Credits
SP-301	Aeronomy	4		80	20	100	5
SP-302	Principles of Plasma Physics & Space Plasmas	4		80	20	100	5
SP-303	Digital Electronics & Microprocessors **(Common for M.Sc. Physics)**	4		80	20	100	5
SP-304	Communication Electronics **(Common for M.Sc. Physics)**	4		80	20	100	5
SP-305	Microprocessor Lab (Practical-80 & Record-20)		6	100		100	4
SP-306	Space Physics Lab (Practical-80 & Record-20)		6	100		100	4
	Total	16	12	520	80	600	28

(T - Theory hours ; P - Practical hours)

M.Sc. Physics

III SEMESTER

P301: SOLID STATE PHYSICS.

UNIT-I: CRYSTAL STRUCTURE:

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two-Dimensional lattice types, three-Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

UNIT-II: CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE:

Bragg's law, Miller Indices indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical Structure Factor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

UNIT-III: PHONONS AND LATTICE VIBRATIONS:

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

FREE ELECTRON FERMI GAS:

Energy levels and density of orbitals in one-dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields- Hall effect, Ratio of thermal to electrical conductivity.

UNIT-IV: THE BAND THEORY OF SOLIDS:

Nearly free electron model, Origin of the energy gap, The Block Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron-Approximate solution near a zone boundary, Number of orbits in a band--metals and insulators. The distinction between metals, insulators and semiconductors

FERMI SURFACES OF METALS:

Reduced zone scheme, Periodic zone scheme, construction of Fermi surfaces, electron orbits, hole orbits and open orbits.

Text Books:

1. Introduction to Solid State Physics - C. Kittel, 5th edition,
2. Solid State Physics - A.J.DEKKER.

M.Sc. Physics

III SEMESTER

P302: LASERS AND FIBER OPTICS

UNIT-I

Laser systems: Characteristics of Laser, Laser construction, Pumping pathways. Rate equations for three level and four level systems. Laser systems: Nd-YAG laser, Titanium Sapphire laser, CO_2 Laser, Dye laser, Excimer laser, Semiconductor laser.

UNIT – II:

Laser cavity modes: Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

UNIT-III

Optical fiber waveguides: Basic optical laws and self-focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

UNIT-IV

Fiber characteristics: Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. Fiber splicing techniques, fiber connectors.

Text Books:

1. Lasers -Theory and Applications – K. Thyagarajan and A.K. Ghatak. (MacMillan)
2. Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)

Reference Books:

1. Laser fundamentals – William T. Silfvast (Cambridge)
2. Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)
3. Optical Electronics – Ajoy Ghatak and K.Thyagarajan (Cambridge)
4. Opto- electronics – J. Wilson and J.F.B. Hawkes (Printice Hall)

M.Sc. Physics

III SEMESTER

***ODD 3 Elective –I* P303 & SP303: DIGITAL ELECTRONICS & MICROPROCESSORS**

(*Common for M.Sc. Physics and M.Sc. Space Physics*)

UNIT- I: **Combinational Logic Circuits**: **(i)** Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, , encoder ,decoder, Multiplexer, Demultiplexers. Design of Adders and Subtractors, IC parallel adder. **(iii)** Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

UNIT – II: Sequential Logic Circuits:(i) Flip-Flops: NAND latch, NOR latch, , Clocked S-C flip-flop, J-K flip-flop, D flip-flop, , Asynchronous inputs.**(ii)** Counters: Asynchronous counters (Ripple), Counters with MOD number $< 2^N$, Asynchronous down counter, Synchronous counters, Up-down counter,(iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO. **(iv)** Applications of Counters: Frequency Counter.

v) A/D and D/A Converter Circuits: D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

UNIT – III: Intel 8085 Microprocessor (i) Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle. **Programming the 8085 Microprocessor:** Addressing Methods, Instruction set, Assembly language programming.**(ii)** Examples of Assembly Language Programming: - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

UNIT – IV: Data Transfer Technique: Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer. **8085 Interfacing:** I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

Text Books:

1. "Digital Systems – Principles and applications" –Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.

Reference Books:

1. Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh and P.R.Sridhar
2. Microprocessor Architecture, Programming and Applications with the 8085 /8080A" Ramesh. S. Gaonkar.

M.Sc. Physics

III SEMESTER

***ODD 3 *Elective II* (304)-COMMUNICATION ELECTRONICS**

(*Common for M.Sc. Space Physics and M.Sc. Physics*)

Unit I:

Wave spectra: Sinusoidal Wave forms, General petripodic wave forms, Trigonometric Fourier series for periodic wave, Fourier coefficients, Some general properties of periodic wave forms, Exponential Fourier series, Energy signals and Fourier Transforms, properties of Fourier Transforms, Fast Fourier transforms, Power signals

Unit II:

CW Modulation: Amplitude Modulation (AM): Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power for sinusoidal AM, Amplitude modulator and demodulator circuits, double side band suppressed carrier (DSBSC) Modulation, Super heterodyne receiver. Single Side Band Modulation (SSB): SSB principles, Balanced Modulator, SSB generation. **Angle Modulation**: Frequency modulation (FM), sinusoidal FM, Frequency spectrum for sinusoidal FM, frequency deviation, modulation index, Average power in sinusoidal FM, FM generation. Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

UNIT III:

Pulse Modulation: Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI, HDBn and Manchester codes, M-ary encoding, Differential Encoding, Sampling theorem, Principles of pulse Amplitude Modulation (PAM) and Pulse Time Modulation(PTM), Pulse code modulation (PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation(DM) .

Digital Carrier Systems: ASK, PSK, FSK and DPSK

UNIT IV:

Noise in Communication Systems: Thermal Noise, Shot Noise, Partition noise, Signal to noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Inter symbol interference (ISI), eye diagrams.

Text Books:

1. Electronic Communications - D. Roody and John Coolin
2. Communication Systems Analog and Digital - RP Singh & SD Sapre

Reference Books:

1. Electronic Communications Systems - G. Kennedy
2. Modern Analog & Digital Communications - B.P. Lathi.

M.Sc. Space Physics
III SEMESTER
SP 301: AERONOMY

UNIT – I : NEUTRAL ATMOSPHERE
Structure and Composition
(Chapters 1 in Rishbeth & Garriott and 4.1 in Hargreaves).
Nomenclature-Thermal structure of the atmosphere. Hydrostatic equation of the atmospheric structure. Scale height and geopotential height. Exosphere.
Atmospheric composition. Dissociation and diffusive separation and thermospheric composition. Heat balance and temperature profile of thermosphere.

UNIT – II: Chemical concepts in Atmosphere
(Chapters 2.1, 2.2, 2.3 and 3.4 in Brasseur & Solomon)
Thermodynamic considerations – Enthalpy. Elementary chemical kinetics- Reaction rate constants and chemical life time of species. Unimolecular, bimolecular and termolecular reactions.
Effect of dynamics on chemical species.

UNIT – III: Ionized Atmosphere
(*Chapters 3, 5 and 6 in Rishbeth & Garriott and 4.2, 4.3 and 10 in Hargreaves)*
Photochemical processes in the ionosphere
Introduction to ionosphere – discovery. Continuity equation and photochemical equilibrium.
Theory of photo-ionization and Chapman production function. Chemical recombination and electron density.
Solar radiation and production of ionospheric layers.
Loss reactions
Different types of recombination processes. Chemistry of E and F1 regions. D region balance equations. D region chemistry – formation of water cluster ions. Electron attachment and negative ions. Positive and negative ion schemes of D region.
Linear and square law loss formulae and splitting of F layer. Vertical transport, ambipolar diffusion and F2 peak. Diffusion between ionosphere and protonosphere.
Airglow.

UNIT – IV: Morphology
Geographical and temporal structure of the ionosphere – Diurnal, seasonal and solar cycle variations of D, E and F regions and F region anomalies.
Solar flare effects
Sudden Ionospheric Disturbances (SIDs)

Text Books:
1. "Introduction to Ionospheric Physics" - H. Rishbeth & O. K. Garriott

2. "Aeronomy of the Middle Atmosphere" - Guy Brasseur & S. Solomon.

3. "Upper Atmosphere and Solar Terrestrial Relations" - J. K. Hargreaves

M.Sc. Space Physics

III SEMESTER

SP302: PRINCIPLES OF PLASMA PHYSICS AND SPACE PLASMAS

UNIT – I: PRINCIPLES OF PLASMA PHYSICS

Plasma and its characteristics (*Chapter 1 in Boyd and Sanderson*)

Definition of a plasma. Plasma characteristics: Quasi neutrality, Plasma oscillations, Debye shielding, Debye length and Debye potential.

Particle orbit theory (*Chapters 2.1 to 2.8 in Boyd and Sanderson*)

Motion of charged particles in constant and uniform electric and magnetic fields. Particle motion in magnetic field with gradient and curvature: Particle motion in converging magnetic fields. Invariance of magnetic moment of a charged particle in slowly varying magnetic field. Magnetic mirror. Adiabatic mirror trap.

UNIT – II: Hydro magnetics (*Chapter 4 in Boyd and Sanderson*)

Frozen fields and Force free fields. Magneto-hydrostatics – magnetic stress tensor. Pinching in plasmas. Linear pinch – Bennett's relation, Theta pinch and Dynamic pinch. Hydro-magnetic stability. Kink and Sausage instabilities. R.T.instability. Alfven waves.

Cold plasmas (*Chapters 7.1 to 7.3 in Boyd and Sanderson*)

Definition of cold plasma. General wave concepts: wave polarization,group velocity. Waves in cold plasma: waves with **k** parallel to **B:** Shear Alfven waves and Ion Cyclotron waves; waves with **k** perpendicular to **B:** Compressional Alfven waves

UNIT – III: Space Plasmas

Geomagnetism (*Chapter 7 in Rishbeth and Garriott*)

Origins of geomagnetic field. Representation of Earth's magnetic field and magnetic field components. Geomagnetic field variations.

Solar Wind and Interplanetary Magnetic Field (IMF) (*Chapters 7.1, 7.2 and 7.3 in Hargreaves*)

Sun Spots and solar cycle. Solar flares. Theory of solar wind. Observed properties of the solar wind. IMF and sector structure

UNIT – IV: Magnetosphere and Plasma in magnetosphere (*Chapter 7.4 and 7.5, 7.6 in Hargreaves and Chapter 4 in Ratcliffe*)

The geomagnetic cavity – Formation of the cavity. Magnetopause and definition of Magnetosphere. The polar clefts. The shock and sheath. Magnetotail. Plasmasphere and low energy plasma and the plasma sheet. Radiation Belts - Observation of Van Allen particles and their production and loss mechanisms

Dynamical Magnetosphere and Space Weather (*Chapters 8.1.1, 8.1.2; 8.2, 8.3 and 11 and 12 in Hargreaves and Chapter 4 in Ratcliffe*)

The Oxford and Hines model. Reconnection with the IMF. Geomagnetic storms, sub storms and auroral phenomena and their influence on Earth's space environment and systems.

Text Books:

1. "Plasma Dynamics" - T. J. M. Boyd and J. J. Sanderson
2. "The Upper Atmosphere and Solar Terrestrial Relations" - J. K. Hargreaves

Reference Books:

1. "Introduction to Ionosphere and Magnetosphere" - J. A. Ratcliffe.

M.Sc. ELECTRONICS (INSTRUMENTATION)

M.Sc. Electronics (Instrumentation)
Course Curriculum under CBCS
[Effective from the admitted batch 2017-18]

Semester # 3 – SECOND YEAR

THEORY	EI 301	Electronic Measurements and Instrumentation
	EI 302	Industrial and Process Instrumentation
	EI 303	Analytical Instrumentation
	EI 304 **Elective - 1**	1.Telecommunication Switching Systems and Networks 2. PLC & SCADA 3. Industrial Management 4.VLSI Design
	EI 305 **Elective - 2**	
LABORATORIES	EI 306	Instrumentation Laboratory
	EI 307	PLC & SCADA Laboratory

CHIOCE BASED CREDIT SYSTEM – SCHEME OF INSTRUCTION AND EXAMINATION

M.Sc. Electronics (Instrumentation)
[Effective from the admitted batch 2017-18]

Semester # 3 – SECOND YEAR

Code	Title of the paper	Per / Week			Examination marks				Credits
		L	T	P	Sem Exam	Mid	Total	Pas Min	
EI 301	Electronic Measurements and Instrumentation	4	1		80	20	100	40	4
EI 302	Industrial and Process Instrumentation	4	1		80	20	100	40	4
EI 303	Analytical Instrumentation	4	1		80	20	100	40	4
EI 304	Elective-1	4	1		80	20	100	40	4
EI 305	Elective -2	4	1		80	20	100	40	4
EI 306	Instrumentation Laboratory			9			100	50	4
EI 307	PLC & SCADA Laboratory			9			100	50	4
	Comprehensive Viva-Voce						100	50	4
Total							800		32

M.Sc. Degree Examination
Electronics & Instrumentation

SYLLABUS

Third Semester

EI 301 – Electronic Measurements and Instrumentation
(Effective from the admitted batch of 2017-2018-CBCS)

Unit-1: Measurement Error and Standards
Accuracy and precision – Significant figures – Types of error – Statistical analysis – Probability of errors – Limiting errors – Classification of standards – Standards for mass, length, and volume – Time and frequency standards – Electrical standards – Standards of temperature and luminous intensity – IEEE standards.

Unit-2: Electromechanical Indicating Instruments and Instruments for Basic Parameters
Permanent-magnet moving-coil (PMMC) mechanism – DC ammeters – DC voltmeters – Ohmmeter – Electrodynamometer – Watt-hour meter – Power-factor meter – Instrument transformers.
Instruments for measuring basic parameters
FET input dc voltmeter – AC voltmeter – True RMS voltmeter – Digital multimeter –LCR meter – Vector impedance meter – Vector voltmeter – RF power measurement.

Unit-3: Oscilloscopes and Signal Generators
Principle of CRO – Cathode Ray Tube (CRT) – Vertical deflection system – Horizontal deflection system – CRO probes and transducers – Special purpose CROs.
Signal Generators
Sine wave generator – Frequency-synthesized signal generator – Sweep frequency generator – Pulse and square wave generator – Function generator.

Unit-4: Signal analyzers and Recording Instruments
Frequency selective wave analyzer – Heterodyne wave analyzer – Heterodyne harmonic analyzer – Fundamental-suppression harmonic distortion analyzer – Spectrum analyzer.
Recording instruments
Analog recorder – X-Y recorder – Galvanometer type recorder, Strip-chart recorder – Magnetic tape recorder – CD/DVD writer – Dot-matrix printer – Inkjet printer – Laser printer.

Text Books

1. Electronic Instrumentation and Measurement Techniques – Helfrick and Cooper
2. Electronic Measurement and Instrumentation – Sawhney

Reference Books

1. Electronic Instrumentation – Oliver and Cage
2. Electronic Instrumentation – Kalsi

M.Sc. Degree Examination
Electronics & Instrumentation

SYLLABUS

Third Semester

EI 302 – Industrial and Process Instrumentation
(Effective from the admitted batch of 2017-2018-CBCS)

Unit-1: Pressure and Temperature Measurement
Manometers – Elastic types – Bourdon tubes – Diaphragm Elements – Bellows elements – Electrical types.
Temperature Measurement
Solid expansion type – Fluid expansion type – Electrical type – RTDs – Thermocouples – Thermistor – Radiation and optical pyrometers.

Unit-2: Flow and Level Measurement
Head types – Pilot tube – Area flow meters – Electrical type – Magnetic types – Ultrasonic or acoustic velocity flow meter – Hot wire anemometer.
Level measurement
Float type – Displacer type – Hydrostatic – Electrical methods.

Unit-3: Process Control
Process variable – Batch process and continuous process – Self regulation – Basic control actions – Characteristics of on off – Proportional – Single speed floating – Integral and derivative control modes – Composite control modes – P+I, P+D, P+I+D, response of controllers for different types of inputs – Tuning of controllers- ratio control – Cascade control.

Unit-4: Final Control Elements
I/P & P/I converter – Valve positioners/actuators – Control valve – Characteristics – Globe – Butterfly – Diaphragm – Ball valves- valve sizing – Instrumentation diagrams.

Text Books

1. Principles of Industrial Instrumentation – Patranabis
2. Principles of Process Control – Patranabis

Reference Books

1. Principles of Industrial Instrumentation – Eckman
2. Automatic Process Control – Eckman

M.Sc. Degree Examination
Electronics & Instrumentation

SYLLABUS

Third Semester

EI 303 – Analytical Instrumentation

(Effective from the admitted batch of 2017-2018-CBCS)

Unit-1:
Classification of the methods of analysis – Classical / instrumental methods.
UV-VIS spectrophotometer – IR spectrometer – NMRspectrophotometer – X-ray methods

Unit-2:
Flame photometry – AAS,ICP-AES, ICP-MS spectrometers.
pH – Photentiometry – Conductivity – Polarography.

Unit-3:
Thermogravimetry – Differential thermal analysis – Differential scanning calorimetry.
Gas chromatography – GC-MS – High performance liquid chromatography (HPLC) – LC-MS.

Unit-4:
Air pollution monitoring systems for carbon monoxide, sulphur dioxide, Hydrocarbons – Water pollution monitoring instruments.

Text Books

1. Instrumental Methods of Analysis – Willard
2. Handbook of Analytical Instruments – Khandpur

Reference Books

1. Instrumental Methods of Chemical Analysis – Sharma

M.Sc. Degree Examination
Electronics & Instrumentation

SYLLABUS

Third Semester

ELECTIVE PAPER

1. Telecommunication Switching Systems and Networks

(Effective from the admitted batch of 2017-2018-CBCS)

UNIT – I:

Evolution of telecommunication systems, Network structures, Types of Networks, guided transmission media, wireless transmission media, structure of public switched telephone network, trunks and multiplexing, switching, generations of mobile systems

UNIT – II:

Protocol hierarchies, Design issues of layers, connection oriented and connectionless services, relationship of services and protocols, OSI and TCP/IP reference models, comparison of TCP/IP and OSI, Error detection and Error correction, HDLC, Frame relay and ATM Networks

UNIT – III:

Wireless spectrum, wireless channel capacity, frequency hopping spread spectrum, direct sequence spread spectrum, multiple access techniques, diversity

UNIT – IV:

IEEE 802.11: Architecture, Frame structure and Services, IEEE 802.11 Standards, Bluetooth: Architecture, Applications and Frame structure, Mobile IP, GPRS, GSM Network Architecture and Signalling protocol Architecture, UMTS Network Architecture, Features of cdma 2000 and cdmaone.

Text Books

1. Wireless communications & Networks – William Stallings
2. Computer Networks – Andrew S. Tanenbaum

Reference Books

1. Wireless Communications – Andrea Goldsmith
2. Telecommunications switching, Traffic and Networks – J.E.Flood
3. WCDMA and cdma 2000 for 3G Mobile Networks – M.R. Karim, Mohsen Sarraf

M.Sc. Degree Examination
Electronics & Instrumentation

SYLLABUS

Third Semester

ELECTIVE PAPER

2. PLC & SCADA
(Effective from the admitted batch of 2017-2018-CBCS)

Unit 1: Overview of PLCs. PLC Hardware Components, Number Systems and Codes.

Brief history of PLCs, what makes PLCs work, PLCs configurations, System Block diagrams, basic components and symbols, PLCs system, PLCs controllers, Internal Architecture, Hardware, PLCs number and codes.

Unit 2: Logic Fundamentals, Basic PLC Programming.
Physical components Vs Programme components, Lighting control, Internal relays,Disagreement circuits, oscillators, holding, always ON & always OFF contacts, Input Devices, output devices, I/P and O/P units, Signal conditioning, remote connections, Networks, commercial system example, processing inputs, I/O addresses, Discrete Output models, TTL o/p modules, analog o/p modules.

Unit 3: PLC Wiring Diagrams & Ladder Logic Programs, Timers & Counters.
Fundamentals of ladder diagram, conventional ladders Vs PLCs ladder logic, overview of logic and logic functions, lader functions, latching, multiple outputs, Entering outputs, function blocks, Series logics (AND, 3 I/P AND), Parallel logics (OR, NOT,) Analysis of Rung #1, Analysis of Rung #2, Ex-OR, Ex-OR logic, combinational logic, Types of Timers, ON delay, OFF delay, Pulse and Retentive Timers, Form of counters, up and down counting, Timers with Counters, sequences.

Unit 4: Data Manipulation, Encoders, Transducers, Sensors, Introduction to SCADA software.
Data Manipulations Instructions, Data transfer instructions, special function instructions, Temperature, liquid level, pressure, flow, inclination, acceleration, angle position, Linear Displacement, SCADA fundamentals, Overview of SCADA software.

Text Books:

1. Programmable logic controllers- W.Bolton.
2. Introduction to Programmable logic Controllers,(Delmar Publisher)- Gary Dunning

Reference Books

1. Programmable logic controllers Hardware, software and Applications- George.L..
2. Programmable logic Controllers, (Prentice Hall of India)- Webb & Reis.
3. Programmable Logic Controller – Principles and Applications- J. W. Webb.
4. Programmable Logic Controller – Programming methods and Applications- Hackworth John R. and Hackworth Frederick D. Jr.
5. Programmable Controllers, Theory and Implementations—L.A Bryan, E.A Bryan.