



**M.Sc. (Tech.)
ENGINEERING PHYSICS**

**RULES AND REGULATIONS
SCHEME OF INSTRUCTION AND SYLLABI
of
P.G. Programs**

NATIONAL INSTITUTE OF TECHNOLOGY

WARANGAL 506 004

M.Sc. (Tech.) ENGINEERING PHYSICS**COURSE STRUCTURE****I Year (Common to Electronics, Photonics, Instrumentation) I Semester**

S. No.	Course No.	Course Name	L	T	P	C
1	MA5012	Complex Variables and Integral Transforms	4	0	0	4
2	PH5101	Electromagnetic Theory	4	0	0	4
3	PH5102	Quantum and Statistical Mechanics	4	0	0	4
4	PH5103	Modern Optics	4	0	0	4
5	PH5104	Electronics Devices and Circuits	4	0	0	4
6	PH5105	Optics I Laboratory	0	0	3	2
7	PH5106	Electronics Laboratory	0	0	3	2
8	ME5039	Engineering Graphics	0	0	3	2
Total						26

I Year (Common to Electronics, Photonics, Instrumentation) II Semester

S. No.	Course No.	Course Name	L	T	P	C
1	MA5061	Numerical Methods and Optimization Techniques	4	0	0	4
2	PH5151	Laser Physics and Systems	4	0	0	4
3	PH5152	Digital Electronics	4	0	0	4
4	PH5153	Solid State Physics	4	0	0	4
5	PH5154	Computer Programming and Data Structures	4	0	0	4
6	PH5155	Solid State Physics Laboratory	0	0	3	2
7	PH5156	Computer Programming and Data Structures Laboratory	0	0	3	2
8	ME5087	Workshop Practice	0	0	3	2
9	PH5191	Seminar	0	0	3	1
Total						27

II Year (Electronics Specialisation) I Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH6101	Linear IC Applications and Data Converters	4	0	0	4
2	PH6201	Opto Electronics	4	0	0	4
3	PH6102	Digital System Design	4	0	0	4
4	PH6103	Microprocessors and Interfacing	4	0	0	4
5		Elective I	3	0	0	3
6	PH6104	Linear IC Applications Laboratory	0	0	3	2
7	PH6105	Digital System Design Laboratory	0	0	3	2
8	PH6106	Microprocessor and Interfacing Laboratory	0	0	3	2
Total						25

II Year (Photonics Specialisation) I Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH6101	Linear IC Applications and Data Converters	4	0	0	4
2	PH6201	Opto-Electronics	4	0	0	4
3	PH6202	Optical System Design	4	0	0	4
4	PH6203	Optical Materials, Production and Testing	4	0	0	4
5		Elective I	3	0	0	3
6	PH6104	Linear IC Applications Laboratory	0	0	3	2
7	PH6204	Optical System Design Laboratory	0	0	3	2
8	PH6205	Optics II Laboratory	0	0	3	2
Total						25

II Year (Instrumentation Specialisation) I Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH6101	Linear IC Applications and Data Converters	4	0	0	4
2	PH6301	Control Systems	4	0	0	4
3	PH6302	Nuclear Instrumentation	4	0	0	4
4	PH6303	Transducers and Measurement Techniques	4	0	0	4
5		Elective I	3	0	0	3
6	PH6104	Linear IC Applications Laboratory	0	0	3	2
7	PH6304	Transducers & Measurements Laboratory	0	0	3	2
8	PH6305	Nuclear Instrumentation Laboratory	0	0	3	2
Total						25

II Year (Electronics Specialisation) II Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH6151	Micro Controllers and Embedded Systems	4	0	0	4
2	PH6152	Communication Theory	4	0	0	4
3	PH6251	Fiber Optic Communication	4	0	0	4
4		Elective II	3	0	0	3
5		Elective III	3	0	0	3
6	PH6153	Communication Laboratory	0	0	3	2
7	PH6253	Fiber Optic Communication Laboratory	0	0	3	2
8	PH6154	Micro Controllers Laboratory	0	0	3	2
9	PH6191	Seminar	0	0	3	1
Total						25

II Year (Photonics Specialisation) II Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH6152	Communication Theory	4	0	0	4
2	PH6251	Fiber Optic Communication	4	0	0	4
3	PH6252	Optical Instrumentation	4	0	0	4
4		Elective II	3	0	0	3
5		Elective III	3	0	0	3
6	PH6153	Communication Laboratory	0	0	3	2
7	PH6253	Fiber Optic Communication Laboratory	0	0	3	2
8	PH6254	Optical Instrumentation Laboratory	0	0	3	2
9	PH6191	Seminar	0	0	3	1
Total						25

II Year (Instrumentation Specialisation) II Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH6151	Micro Controllers and Embedded Systems	4	0	0	4
2	PH6252	Optical Instrumentation	4	0	0	4
3	PH6351	Process Instrumentation	4	0	0	4
4		Elective II	3	0	0	3
5		Elective III	3	0	0	3
6	PH6154	Micro Controller Laboratory	0	0	3	2
7	PH6254	Optical Instrumentation Laboratory	0	0	3	2
8	PH6352	Process Instrumentation Laboratory	0	0	3	2
9	PH6191	Seminar	0	0	3	1
Total						25

III Year (Electronics Specialisation) I Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH7101	Digital Signal Processing	4	0	0	4
2	PH7102	Microwaves and Wave Propagation	4	0	0	4
3		Elective IV	3	0	0	3
4		Elective V	3	0	0	3
5		Elective VI	3	0	0	3
6	PH7103	Digital Signal Processing Laboratory	0	0	3	2
7	PH7142	Comprehensive Viva				2
Total						21

III Year (Photonics Specialisation) I Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH7201	Opto Electronic Sensing and MOEMS	4	0	0	4
2	PH7202	Integrated Optics	4	0	0	4
3		Elective IV	3	0	0	3
4		Elective V	3	0	0	3
5		Elective VI	3	0	0	3
6	PH7203	Opto Electronic Sensing Laboratory	0	0	3	2
7	PH7142	Comprehensive Viva				2
Total						21

III Year (Instrumentation Specialisation) I Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH7301	Analytical Instrumentation	4	0	0	4
2	PH7302	Nondestructive Testing	4	0	0	4
3		Elective IV	3	0	0	3
4		Elective V	3	0	0	3
5		Elective VI	3	0	0	3
6	PH7303	Analytical Instrumentation and NDT Laboratory	0	0	3	2
7	PH7142	Comprehensive Viva				2
Total						21

III Year (Electronics, Photonics, Instrumentation) II Semester

S. No.	Course No	Course Name	L	T	P	C
1	PH7199	Project Work (22 weeks)	0	0	0	20
Total						20

LIST OF ELECTIVES**Electronics Specialisation****Elective I**

PH6111	VLSI Basics
PH6211	Laser Technology
PH6311	Sensors and Transducers

Elective II, III

PH6161	Computer Organization and Operating Systems
PH6162	Industrial Electronics
PH6261	Nonlinear Optics
PH6262	Nanophotonics
PH6361	Fundamentals of Control Systems
PH6362	Device Materials and Fabrication Techniques

Elective IV, V, VI

PH7111	Data Communication
PH7112	Medical Physics and Physiological Measurements
PH7113	Electronic Instrumentation
PH7211	IR Optics and Thermal Imaging
PH7212	Biophotonics
PH7213	Laser Applications
PH7214	Fourier Optics and Holography
PH7311	Digital and Distributed Control Systems
PH7312	PC Based Instrumentation

LIST OF ELECTIVES

Photonics Specialisation

Elective I

PH6112	Digital Systems and Microprocessors
PH6211	Laser Technology
PH6311	Sensors and Transducers

Elective II, III

PH6161	Computer Organization and Operating Systems
PH6162	Industrial Electronics
PH6261	Nonlinear Optics
PH6262	Nanophotonics
PH6361	Fundamentals of Control Systems
PH6362	Device Materials and Fabrication Techniques

Elective IV, V, VI

PH7111	Data Communication
PH7112	Medical Physics and Physiological Measurements
PH7113	Electronic Instrumentation
PH7211	Infrared Optics and Thermal Imaging
PH7212	Biophotonics
PH7213	Laser Applications
PH7214	Fourier Optics and Holography
PH7311	Digital and Distributed Control Systems
PH7312	PC Based Instrumentation

LIST OF ELECTIVES

Instrumentation Specialisation

Elective I

PH6112	Digital systems and Microprocessors
PH6211	Laser Technology
PH6311	Sensors and Transducers

Elective II, III

PH6161	Computer Organization and Operating Systems
PH6162	Industrial Electronics
PH6262	Nanophotonics
PH6263	Fiber Optics
PH6361	Fundamentals of Control Systems
PH6362	Device Materials and Fabrication Techniques

Elective IV, V, VI

PH7111	Data Communication
PH7112	Medical Physics and Physiological Measurements
PH7113	Electronic Instrumentation
PH7211	Infrared Optics and Thermal Imaging
PH7212	Biophotonics
PH7213	Laser Applications
PH7214	Fourier Optics and Holography
PH7311	Digital and Distributed Control Systems
PH7312	PC Based Instrumentation

Syllabus**M.Sc. (Tech.) ENGINEERING PHYSICS****MA5012 COMPLEX VARIABLES AND TRANSFORM TECHNIQUES (4-0-0)4**

Analytic function - complex integration - Taylor's and Laurent's series expansions - evaluation of real integrals using residue theorem - Laplace Transform - inverse Laplace transform - Solution of linear differential equations - Fourier transform, inverse Fourier transform - Fourier sine and cosine transforms - fast Fourier transform.

Reading:

1. R.V. Churchill, *Complex Variables and Applications*, McGraw Hill, 1960.
2. R.V. Churchill, *Operational Mathematics*, McGraw Hill, 1954.
3. M.R. Spiegel, *Laplace Transforms (Schaum Series)*, McGraw Hill, 1999.
4. M.R. Spiegel, *Complex Variables (Schaum Series)*, McGraw Hill, 1999.

PH 5101 ELECTROMAGNETIC THEORY (4-0-0)4

Electrostatics and Magnetostatics-Maxwell's Equations-Boundary conditions- Propagation of plane electromagnetic waves - Reflection and refraction of plane waves - Poynting Vector - Waveguides - parallel plate, rectangular - TE, TM waves - Propagation of EM waves in waveguides with dielectric medium - Transmission Lines.

Reading:

1. Jordan E.C. Balmain K.G., *Electromagnetic Waves and Radiating Systems*, 2nd Edition, Prentice Hall, 2008.
2. G. Keiser, *Optical Fiber Communications*, McGraw Hill, 2007.
3. D.J. Griffiths, *Introduction to Electrodynamics*, 3rd Edition, Prentice Hall, 2002.

PH 5102 QUANTUM AND STATISTICAL MECHANICS (4-0-0)4

Operators - Schrodinger wave equation (time-independent and time-dependent) – problems in one and three dimensions – perturbation theory – approximation methods – Matrix representation of wave equation – Angular momentum – Ensembles – MB, FD and BE statistics.

Reading:

1. Schiff, L., *Quantum Mechanics*, TMH, 2005.
2. Beiser, *Concepts of Modern Physics*, TMH, 2004.
3. G. Aruldas, *Quantum Mechanics*, PHI, 2006.

PH 5103 MODERN OPTICS (4-0-0)4

Wave Optics - EM Waves - Interferometers - Coherence - Theory of Diffraction - Ray optics - Ray matrices - Polarization - Jones vectors - crystal optics - Gaussian beams - Electromagnetic Optics - Elements of Fourier optics.

Reading:

1. Saleh, B.E.A. and Carl Teich, M., *Fundamentals of Photonics*, John Wiley & Sons, New York, 2002.
2. Hecht, E., *Optics*, 2nd Edition, Addison-Wesley, London, 2003.

PH 5104 ELECTRONICS DEVICES AND CIRCUITS (4-0-0)4

Network theory, mesh and node analysis, Network Theorems, Diode-BJT, FET-Working-h-parameter analysis- Small signal and power amplifiers-analysis and design-SCR, UJT, Tunnel Diode, Photo Diode LED-Working and applications.

Reading:

1. Millman, J. and Halkias, C., *Electronic Devices and Circuits*, TMH, 2000.
2. John D. Ryder, *Electronic Fundamentals and Applications*, PHI, 2002.

PH6104	LINEAR IC APPLICATIONS AND DATA CONVERTERS LABORATORY	(0-0-3)3
	Inverting and non-inverting and summing amplifiers, Precision rectifiers, Second order low pass and high pass filters, Multivibrators, Function generator using 8038, Dual slope A/D converter, 4-bit D/A converter using R-2R ladder, Applications using DAC 0800, Power supply with three terminal voltage regulators.	
PH6105	DIGITAL SYSTEM DESIGN LABORATORY	(0-0-3)3
	Biquinary and BCD counting, Shift Register, prime number detector, data selectors and decoders, Four-bit prime number detector, 3 to 8 binary decoder, Eight input priority encoder (like 74 x 148), Four bit binary counter (like 74163), Ones counting machine using VHDL.	
PH6106	MICROPROCESSORS AND INTERFACING LABORATORY	(0-0-3)3
	Assembly language programming and interface experiments with INTEL 8086 using digital I/O card on PC for the following-Stepper Motor, LVDT - Calibration and Measurement, Temperature measurement using PT 100-IC sensors and thermocouples, Strain gauge.5. Proximity detection and relay operation.	
PH6201	OPTO ELECTRONICS	(4-0-0)4
	Optical circular waveguides and their modes of propagation. Optical fiber structures, materials, fabrication, and cables. Signal degradation and design optimization of SM fibers. Semiconductor light sources and detectors for Optical communications. Light modulators and display devices.	
	<i>Reading:</i>	
	1. G. Keiser, <i>Optical Fiber Communications</i> , MGH, 2000.	
	2. J. Wilson and J.F.B. Hawkes, <i>Optoelectronics - An Introduction</i> , PHI, 2009.	
	3. S. M. Sze, <i>Semiconductor Devices</i> , Wiley, 2002.	
PH6202	OPTICAL SYSTEM DESIGN	(4-0-0)4
	Introduction to Optical systems, Ray tracing procedures, Aberrations, Multi lens systems, Photometry of optical systems, Mirrors and prisms, Image evaluation, Optical systems, Optimization techniques.	
	<i>Reading:</i>	
	1. Kingslake, R., <i>Optical System Design</i> , 2nd Edition, Academic Press, 2010.	
	2. Smith, W.J., <i>Modern Optical Engineering</i> , 3rd Edition, McGraw Hill, 2000	
PH6203	OPTICAL MATERIALS PRODUCTION AND TESTING	(4-0-0)4
	Types of Optical glass - IR materials - gallium arsenide - Optical glass making, IR materials manufacturing - abrasives, polishing compounds - Tools and fixtures - spherical and plano tools - Optical fabrication - Optical shop testing.	
	<i>Reading:</i>	
	1. Hank H. Karow, <i>Fabrication Methods for Precision Optics</i> , John Wiley and Sons, New York, 1993.	
	2. David Malacara, <i>Optical Shop Testing</i> , John Wiley and Sons, New York, 1992.	
PH6204	OPTICAL SYSTEM DESIGN LABORATORY	(0-0-3)2
	Ray tracing - lay output of an optical system - Computation of Aberrationst - Design of aplanatic objective - Seidal aberrations - zonal spherical aberration - apochromatic objective - Tracing oblique meridional rays and skew rays - primary lateral colour - Triplet design.	
PH6205	OPTICS II LABORATORY	(0-0-3)2
	Fabrication of optical flat, lens, prism - Measurement of thickness, curvature, focal length - Testing by Interferometers - Rotation of the plane of polarization - electro-optic and Acoustic-optic modulator - LED and ILD- Light Detectors - Index profile of graded index fibers - Measurement of NA, attenuation - Waveguide and Chromatic dispersion in fibers using PC.	

PH6301	CONTROL SYSTEMS	(4-0-0)4
<p>Open and closed systems, mathematical modeling, block diagrams, Transient response analysis, steady state error analysis, stability, Root locus, frequency domain analysis, Bode plot, polar plot, Nyquist stability criteria, lead, lag compensators, PI, PD, PID controllers, sampled data control systems.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. K. Ogata, <i>Modern Control Engineering</i>, PHI, 2002. 2. Benjamin C Kuo, <i>Automatic Control Systems</i>, PHI, 2003. 		
PH6302	NUCLEAR INSTRUMENTATION	(4-0-0) 4
<p>Radioactivity and matter: Nuclear properties; Radiation detection and measurement, Nuclear techniques and analytical instruments, X.R.F techniques, Industrial instruments, density estimation of the fluids, Medical instrumentation, thyroid estimation, CT, MRI.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Michael Sayer and Abhai Mansingh, <i>Measurement, Instruments and Experimental Design in Physics and Engineering</i>, PHI, 2000. 2. Glen F. Knoll, <i>Radiation Detection and Measurement</i>, 4th Edition, Wiley Science, 2010. 		
PH6303	TRANSDUCERS AND MEASUREMENT TECHNIQUES	(4-0-0)4
<p>Characteristics of instrument systems: Static and Dynamic characteristics; Errors in measurement and calibration: Transducers for the measurement of physical parameters like temperature, pressure, displacement etc., telemetry systems and recorders.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Liptak.B.G, Philadelphia Chilton, <i>Instrument Engineers Handbook</i>, Vol-I and II, 1970. 2. Murty, D.V.S., <i>Transducers and Instrumentation</i>, Prentice Hall of India, 1995. 		
PH6304	TRANSDUCERS AND MEASUREMENT TECHNIQUES LABORATORY	(0-0-3)2
<p>Temperature measurement with RTD, Thermistor, Thermocouple and calibration, Displacement measurement using capacitive and inductive Transducers, Speed and torque measurement- Calibration of LVDT load cell, Strain and Gaugefactor measurement - measurement of pH.</p>		
PH6305	NUCLEAR INSTRUMENTATION LABORATORY	(0-0-3)2
<p>GM detection-inverse square law for gamma rays - End point energy of Beta rays-activation and decay characteristics using a neutron source - Resolution and linearity of Na (TI) detector - linear absorption coefficient-gamma emitter - mass absorption coefficient- Energy analysis of an unknown source-counting statistics of a radioactive source.</p>		
PH6151	MICRO CONTROLLERS AND EMBEDDED SYSTEMS	(4-0-0)4
<p>The Intel MCS-51 Microcontrollers Architecture - Assembly Language Programming of 8051-instructions- PIC Microcontrollers - PIC18F452 - Special features of CPU-Programming with PIC microcontrollers- Development tools - Interfacing of different devices - Serial and Wireless communication protocols.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Kenneth.J.Ayala, <i>The 8051 Microcontroller Architecture Programming and Applications</i>, 3rd Edition, Thomson Publications, 2004. 2. Muhamad Ali Mazdi, <i>The 8051 Microcontroller and Embedded Systems Using Assembly and C</i>, 2nd Edition, Pearson Education India, 2007. 		
PH6152	COMMUNICATION THEORY	(4-0-0)4
<p>Introduction: overview of modulation and demodulation. Analog communication: introduction, amplitude modulation, DSB suppressed carrier modulation and detection. Digital communication: introduction to pulse modulation, sampling process. Introduction to error control coding.</p>		

Reading:

1. Kennedy, Davis, *Electronic Communication Systems*, 4th Edition, TMH, 2008
2. Simon Haykin, *Communication Systems*, 3rd Edition, John Wiley and Sons, New York, 1996.
3. Wayne Tomasi, *Advanced Electronics Communication Systems*, 6th Edition, Pearson, 2004.

PH6153 **COMMUNICATION SYSTEMS LABORATORY** (0-0-3)2

Amplitude modulation - BJT, IC 1496 - Balanced modulator - IC 1496-Frequency modulation - VCO-Detection of AM-Detection of FM - PLL-PWM, PPM using 555 timer and Op-amp S/H - FSK generation using 555 timer FSK detection using PLL.

PH6154 **MICROCONTROLLERS LABORATORY** (0-0-3)2

Simulation of traffic control signal sequence - Study of Latch, Buffer, Decoder and RAM -Interfacing DC motor and simulation, Elevator using DYNA - 51 kit- A/D Conversion using PIC - Development of LCD driver for PIC DEM2 PLUS board- Interfacing Temperature sensor to PIC 18F452 - D/A conversion using PIC micro controller.

PH6251 **FIBER OPTIC COMMUNICATION** (4-0-0)4

Elements of optical fiber link, advantages and applications. power launching, joints, splices, connectors, and test methods. Optical receiver and transmission systems - power and rise time budget, noise effects. WDM concepts and components, Optical amplifiers, Optical networks- SONET/SDH, Nonlinear effects, Solitons, Ultrahigh Capacity Networks.

Reading:

1. G. Keiser, *Optical Fiber Communications*, McGraw Hill, 2008,
2. G. P. Agrawal, *Fiber Optic Communication Systems*, John Wiley, 2008,
3. J. M. Senior, *Optical Fiber Communications*, PHI, 2009.

PH6252 **OPTICAL INSTRUMENTATION** (4-0-0)4

Radiometry: basic concepts; Visual Systems: magnifiers and eyepieces; Projection Systems: profile projectors; IR and Medical Systems: thermal imaging instruments; Metrology Instruments: interferometric instruments, online optical sensing of temperature and flow.

Reading:

1. Malcara, D., *Geometrical and Instrumental Optics*, Academic Press, London, 2000.
2. Kingslake, R. *Applied Optics and Optical Engineering*, Vol. 4 and 5, Academic Press, London, 2001.

PH6253 **FIBER OPTIC COMMUNICATION LABORATORY** (0-0-3)2

Source coupling and Misalignment losses in fibers, Practice of preparing fiber ends and fiber splicing, Characterization of Components for fiber Communication, Design aspects of fiber optic communication system , studies on fiber optic analog and digital links, Time division multiplexing of signals in fibers.

PH6254 **OPTICAL INSTRUMENTATION LABORATORY** (0-0-3) 2

Guild spherometer- Abbe refractometer- Auto collimator-thread angle, pitch measurement-Mach - Zehnder interferometer, thickness of transparent media, testing of optical components-Angle of wedge -Laser interferometer, precision distance measurement- diffraction strain gauge-Shear plate interferometer.

PH6351 **PROCESS INSTRUMENTATION** (4-0-0)4

Introduction to process control; Analog and digital signal condition-ing;Thermal, mechanical and optical transducers - Final control - mechanical, electrical control elements; Controller principles - process characteristics; Analog and Digital control principles; supervisory and direct digital control, control system quality, stability, frequency response methods.

- PH7103 **DIGITAL SIGNAL PROCESSING LABORATORY** (0-0-3)3
- Linear convolution, Circular convolution, Auto correlation and Cross convolution - Sampling and Reconstruction - Fourier Transforms - DFT - FFT - Analog filter design - IIR Filter design - FIR filter design - Using MATLAB.
- PH 7201 **OPTOELECTRONIC SENSING AND MOEMS** (4-0-0)4
- Optoelectronic sensors - classification; Materials interactions for sensing; Components and optical fibers for sensing; Optoelectronic systems for sensing Displacement, Temperature, Pressure, Flow, Level, etc., and distributive sensing. FBGs and LPGs for Smart structures. MOEMS for sensing applications.
- Reading:*
1. B. Culshaw, *Optical Fiber Sensors*, Artech House, 2006.
 2. D.A. Krohn, *Fiber Optic Sensors- Fundamentals and Applications*, Instrument Society of America, 2010.
 3. J.W. Gardner, *Microsensors, MEMs, and Smart Structures*, John Wiley, 2002.
- PH 7202 **INTEGRATED OPTICS** (4-0-0)4
- Optical waveguides: modes, losses - Planar waveguides, Channel waveguides, Bent and curved waveguides, Branching waveguides-Waveguide excitation- Simulation and Measurements techniques - Waveguide couplers and Gratings - Materials - Electro-optics - Acousto-optics - Fabrication technology - Applications.
- Reading:*
1. Robert G. Hunsperger, *Integrated Optics: Theory and Technology*, Springer, 2009.
 2. Ajoy Kumar Ghatak, K. Thyagarajan, *Optical Electronics*, Cambridge University Press, 1989.
- PH7203 **OPTOELECTRONIC SENSING LABORATORY** (0-0-3)2
- Fiber Optic Sensors: Proximity, Liquid level, Microbend, Temperature, Refractive index, Pressure/strain, Shutter and grating. Fiber Optic Polarimetric Sensor, FBG Sensor, Rotation sensor, Chemical sensor, Distributive sensor.
- PH7301 **ANALYTICAL INSTRUMENTATION** (4-0-0)4
- UV-Vis, Fluorescence and Phosphorescence Spectrophotometry; Atomic Emission, Infrared, Raman spectroscopy, Magnetic resonance spectroscopy: NMR , ESR, Bainbridge types of Spectrometers, Thermal Analysis: DSC (or DTA) and TG - TMA - DMAs; Imaging Techniques: SEM, TEM, STM and AFM.
- Reading:*
1. Willards, Merrit et. al, *Instrumental Methods and Analysis*, CBS, 2011.
 2. Pavia Lampman Kriz, *Introduction to Spectroscopy*, Thomson, 2002.
 3. G R Chatwal, S K Anand, *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House, 2009.
- PH7302 **NONDESTRUCTIVE TESTING** (4-0-0)4
- Ultrasonic instrumentation technology in non destructive evaluation, Standardization and calibration, Electrical instrumentation and surface testing techniques, Principles of eddy currents; Residual stress analysis, Mechanical and Thermal and Radiographic NDT methods, Thermo-graphic inspection, Crack depth gauges, Surface texture analysis.
- Reading:*
1. J.Prasad , C.G.Krishnadas Nair, *Non-Destructive Test and Evaluation of Material*, TMH, 2008.
 2. Paul E. Mix, AJohn, *Introduction to Non-Destructive Testing, A Training Guide*, 2nd Edition, Wiley & Sons, 2005.
- PH7303 **ANALYTICAL INSTRUMENTATION AND NDT LABORATORY** (0-0-3)2
- Liquid penetration, Magnetic particle inspection - Measurements of velocities and young's moduli - Evaluation of defects in solids using ultrasonic flaw detector - Calibration -spectral studies - by NMR spectrometer and ESR spectrophoto meter, absorption and transmission coefficients of the samples- UV-IR spectrometers.

PH 7111	DATA COMMUNICATION	(3-0-0) 3
<p>Basic concepts of data communication: Data communication networks. Protocol basics and data link protocols: Error control, and different protocols. Data communication networks: wired and wireless LANs.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Fred Halsall, <i>Data Communications, Computer Networks and Open Systems</i>, 4th Edition, Pearson, 2001. 2. Wayne Tomasi, <i>Advanced Electronic Communication Systems</i>, 5th Edition, PHI, 2001. 		
PH 7112	MEDICAL PHYSICS AND PHYSIOLOGICAL MEASUREMENTS	(3-0-0)3
<p>Overview of Human body - Origin of biopotentials -ENG, EMG,ECG and EEG- Heart and ECG Waveform - standard lead system and functional blocks - Biofluid mechanics - Blood pressure measurement - Different blood flow meters - Electric impedance plethysmography - photo plethysmography - pulse oximetry.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Brown, B.H., <i>Medical Physics and Biomedical Engineering</i>, Institute of Physics Publishing, 1999. 2. John. G. Webster, <i>Medical Instrumentation : Application and Design</i>, 2nd Edition, John Wiley and Sons, 1995. 		
PH7113	ELECTRONIC INSTRUMENTATION	(3-0-0)3
<p>Digital storage Oscilloscopes and logic analyzers, probing, clocking, triggering, advanced measurement techniques- Signal sources, arbitrary waveform and pattern generators - Spectrum and network analyzers, instrument drivers and driver software, GPIB - VXI, PCI and PXI bus standards, application software lab view, calibration of practical instruments - DMM, oscilloscopes, DSO's.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Kularatna, A.D.V.N., <i>Digital and Analogue Instrumentation: Testing and Measurement</i>, PHI, 2001. 2. David A Bell, <i>Electronic Instrumentation and Measurements</i>, Oxford University Press, 2007. 		
PH7211	INFRARED OPTICS AND THERMAL IMAGING	(3-0-0)3
<p>Unique features of the infrared region - materials, effect of temp on optical properties and athermalization methods, Optical design and material selection, tolerances, Reflective and transmissive infrared zoom systems, Thermal imaging instruments, Night vision equipment. Applications in industry and defence.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Mann Allen, <i>Infrared Optics and Zoom Lenses</i>, SPIE, 2002. 2. R. Kingslake, <i>Applied Optics and Optical Engineering</i>, Vol. 4 and 5, Academic, 2002. 3. Michael Vollmer, <i>Infrared Thermal Imaging: Fundamentals, Research and Applications</i>, Wiley, 2010. 		
PH 7212	BIOPHOTONICS	(3-0-0)3
<p>Light Sources, Delivery systems and Spectroscopy: Basics of Biology: Tissue structure - Features of living tissues from the point of optics.- Fundamentals of light-matter interactions. Bioimaging, Biosensors, Tissue engineering, Flow cytometry.</p> <p><i>Reading:</i></p> <ol style="list-style-type: none"> 1. Paras N. Prasad, <i>Introduction to Biophotonics</i>, John Wiley and Sons, 2003. 2. Katzir. A, <i>Lasers and Optical Fibers in Medicine</i>, AP, 1993. 		
PH7213	LASER APPLICATIONS	(3-0-0)3
<p>Material processing and testing, optical radar, Raman backscattering, absorption, pollution control, alignment surveying and tooling, range finding-rotation rate and velocity measurement, surface inspection, displays, information storage, optical computing, speckle interferometry, ophthalmology, surgery and diagnosis, dentistry.</p>		

Reading:

1. Ready, J.F., *Industrial Applications of Lasers*, 2nd Edition, AP, 2000.
2. Charschan, S.S., *Lasers in Industry*, Van Nostrand, 2001.

PH7214

FOURIER OPTICS AND HOLOGRAPHY

(3-0-0)3

Frequency response technique for image formation in coherent and incoherent light, Theory of partial coherence - statistical optics, Optical imaging systems and their analysis, Spatial filtering and optical information processing, holography, statistical properties of laser speckle patterns, speckle reduction.

Reading:

1. Goodman, J.W., *Introduction to Fourier Optics*, McGraw Hill, 2001.
2. Collier, R.J. et. al, *Optical Holography*, AP, 2000.

PH 7311

DIGITAL AND DISTRIBUTED CONTROL SYSTEMS

(3-0-0)3

Sampling and reconstruction, Transformation analysis of sampled data systems, Transform design of digital control, examples. State variable analysis and design, Liapunov's stability analysis, Optimal control systems, parameter optimization. Self tuning control, Advances in control systems: Adaptive control.

Reading:

1. Nagarath, I.J. and Gopal, M., *Control System Engineering*, New Age International Publication, 2005.
2. Gopal, M., *Control Engineering*, New age International Publication, 2000.
3. Norman, S.N., *Control Systems Engineering*, John Willey and Sons, 2003.

PH7312

PC BASED INSTRUMENTATION

(3-0-0)3

The IBMPC and compatibility - PC expansion system - Assembly language programming - IEEE488 Bus Interfacing - Software packages - Applications - Reliability and Fault finding - System configuration.

Reading:

1. Michael H. Tooley, *PC Based Instrumentation and Control*, 3rd Edition, Elsevier Science, 2003.
2. Mathivanan N, *PC based Instrumentation, Concepts and Practice*, PHI, 2007.