DEPARTMENT OF APPLIED PHYSICS

INDIAN SCHOOL OF MINES, DHANBAD

COURSE STRUCTURE & SYLLABUS

FOR

2-YEARS M.Sc.

IN

APPLIED PHYSICS

Effective from 2008-2009

Course structure

2-Years M.Sc. (Applied Physics)

SEMESTER –I

	Course Name	Course No.	L- T- P	Credit Hrs
1)	Classical Mechanics	APC 31101	3- 0- 0	6
2)	Methods of Mathematical Physics	APC 31102	3- 0- 0	6
3)	Solid State Electronics	APC 31103	3- 0- 0	6
4)	Digital Electronics (Capsule course)	EIR 13101	3- 0- 0	6
5)	Computer programming	AMC 31102	3- 1- 0	7
6)	Computer programming lab	AMC 31202	0- 0-2/2	1
7)	Experimental Physics-I	APC 31201	0- 0- 8	8
		Total	**15 -1-9**	**40**

SEMESTER - II

	Course Name	Course No.	L- T- P	Credit Hrs
1)	Quantum Mechanics	APC 32101	3- 0- 0	6
2)	Atomic and Molecular Physics	APC 32102	3- 0- 0	6
3)	Electrodynamics	APC 32103	3- 0- 0	6
4)	Seismology (Capsule course)	GPC 96102	3- 0- 0	6
5)	Object Oriented Programming	AMC 32101	3 - 0- 0	6
6)	Object Oriented Programming Lab	AMC 32201	0 - 0- 2	2
7)	Experimental Physics-II	APC 32201	0 - 0- 8	8
8)	Co-Curricular Activity	SWC 32701	0 - 0- 0	3
9)	Summer Training (Two weeks) Marks to be added in the next semester	APC32901		
		Total	**15 –0 –10**	**43**

SEMESTER - III

Course Name	Course No.	L- T- P	Credit Hrs
1) Condensed Matter Physics	APC 33101	3- 1- 0	7
2) Laser & Holography	APC 33102	3- 1- 0	7
3) Nuclear Physics & Special Theory of Relativity	APC 33103	3- 1- 0	7
4) Statistical Mechanics	APC 33104	3- 1- 0	7
5) Elective-I (Any one from)-		3- 0- 0	6
i) Non-linear Optics	APE 33101		
ii) Space Physics and Astrophysics	APE 33102		
6) Experimental Physics-III	APC 33201	0 -0-8	8
7) Seminar	APC 33401	0 -0-0	6
8) Summer training	APC33901		4
	Total	**15- 4 –8**	**52**

SEMESTER – IV

Course Name	Course No.	L- T- P	Credit Hrs
1) Non-conventional Sources of Energy	APC 34101	3- 0- 0	6
2) Superconductivity	APC 34102	3- 0- 0	6
3) Elective –II (Any one from)-		3- 0- 0	6
i) Physics of Nano Materials	APE 34101		
ii) Optical Communication	APE 34104		
4) Elective – III (Any one from)-		3- 0- 0	6
i) Biomedical Physics	APE 34102		
ii) Environmental Physics	APE 34103		
5) Project & Dissertation	APC 34801	0-15-0	15
6) Viva-voce on dissertation	APC 34802	0- 0- 0	4
7) Comprehensive Viva	APC 34501	0- 0- 0	4
8) Co-Curricular Activity	SWC 34701	0 - 0- 0	3
	Total	**12-15-0**	**50**

SEMESTER – I

APC 31101 CLASSICAL MECHANICS (3-0-0)

Lagrange's equations; gyroscopic forces; Jacobi integral; gauge invariance; generalized coordinates and momenta; integrals of motion; sysmmetries of space and time with conservation laws; invariance under Galilean transformations.
Rotating frames; inertial forces; terrestrial and astronomical applications of Coriolis force.
Central force; definition and characteristics; Two-body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's laws and equation; artificial satellites; Action integrals, Principle of least action; derivation of equations of motion; variation and end points; Hamilton's principle and characteristic functions; Hamilton-Jacobi equation. Canonical transformation; generating functions; Properties; group property; examples; infinitesimal generators; Poisson bracket; Poisson theorems; angular momentum; small oscillations, normal modes and coordinates.

APC 31102 METHODS OF MATHEMATICAL PHYSICS (3-0-0)

Vector Spaces and Matrices, linear independence; Bases; Dimensionality; Inner product; Linear transformations; Solutions of equations using matrices, Orthogonal and unitary matrices; Eigenvalues and eigenvectors; Diagonalization; Complete orthonormal sets of functions; Differential Equations and Special Functions; Second order linear ODEs with variable coefficients; Solution by series expansion; Legendre, Bessel, Hermite and Lagauerre equations and their solutions; Physical applications; Generating functions; recursion relations.
Integral Transforms, Laplace transform (LT); First and second shifting theorems; Inverse LT by partial fractions; LT of derivative and integral of a function; Solution of differential equation using LT, Fourier series; Fourier series of arbitrary period; Half-wave expansions; Partial sums; Fourier integral and transforms; Laplaces Transform and Fourier Transform of delta function and their uses.

APC 31103 SOLID STATE ELECTRONICS (3-0-0)

Lattice Dynamics: Vibration of monoatomic lattices, vibrations of lattice with two atoms per unit cell, quantisation of lattice vibrations, interaction of electromagnetic waves and particle waves with phonons.
Dielectric properties: Static, electronic, ionic and orientational Polarization, Lorentz internal field, dielectric loss and relaxation time, absorption of solids including coal and rocks, Piezo, Pyro, Ferro electric properties and applications.
Semi-conductor Physics: Charge carrier density in intrinsic semiconductors, doping of semi-conductors, carrier densities in doped semiconductors, conductivity of semiconductors, Hall effect, (Classical and Quantum) , semi-conductor Hetro-structures and Super lattices. P. N. Junction, metal- semiconductor junction, Transistors, Luminescence, photo conductivity and optical absorption Diffusion.
Material Preparation and Characterization: Crystal growing, After growth Quality improvement, thin film deposition and Electro-ceramics, Analytical techniques like X-ray

diffraction, Infra-red and Atomic absorption Spectroscopy, Synthesis & characterization of Nano-materials and properties, CVD, MBE.

EIR 13101 DIGITAL ELECTRONICS (3-0-0)

Boolean algebra, logic gates and switching functions, truth tables and switching expressions, Minimization of completely and incompletely specified switching functions-Karnaugh map and Quine-McCluskey method. Decoders, multiplexers. Clocks, Flip-flops, Latches, counters and shift registers, synthesis of synchronous sequential circuits, minimization and state assignment, Timing circuits.

AMC 31102 COMPUTER PROGRAMMING (3-1-0)

FORTRAN: Preliminaries, control structures-selective and repetitive, arrays, format statements; subprograms-functions, subroutines, DATA, SAVE, COMMON and EQUIVALENCE statements; file processing; additional date types-logical, double precision and complex types.
C: Preliminaries- introduction, constants, variables and data types, operators and expressions, I/0 operations, decision making and branching; looping; arrays, structures and unions, user defined functions, pointers, file management, dynamic memory allocations and linked lists, the preprocessors.

AMC 31202 COMPUTER PROGRAMMING LAB (0-0-2/2)

Execution of FORTRAN programs using Control Structures- Logical IF, Arithmetic IF, Nested Block IF, Computed GO TO. Repetitive Structures- IF loop, Do-loop, Nested Do-loop. Arrays-Traversing, Sorting, Searching, Inserting, Deleting Operations, Use of two or more dimensional arrays. Functions- Statement functions, Function Subprograms. Subroutine Subprograms Use of DATA, SAVE, COMMON and Equivalence Statements. File Processing.
C Language: Execution of Programs using the following: Decision Making and Branching- if statement, Nested if , Else if ladder, Block if, Switch statement. Decision Making and looping-while, do-while, for. Arrays-Traversing, Sorting, Searching, Inserting, Deleting operations; Processing Arrays with more than one dimensions. Functions, Recursive functions, Nesting of Functions. Structures- Use of structure, Array of Structures, Unions. Handling Files in C-Sequential, random access files.
Use of Pointers, Linked Lists: Linear one-way linked list- Traversing, Insertion, Deletion and Searching operations. Use of Preprocessors: Simple Preprocessors - Macro substitutions, File inclusion directives.

APC 31201 EXPERIMENTAL PHYSICS –I (0-0-8)

Study of Amplitude modulation & demodulation, Study of Input and output characteristics of a Transistor, Study of transients current using 555 timer, Study of frequency response curve of R-C coupled amplifier, Variation of refractive index of prism with wavelength of incident light, Plotting a curve between wavelength and deviation produced by a prism, Experiment on the measurement of diameter of a thin wire.

SEMESTER – II

APC 32101 QUANTUM MECHANICS (3-0-0)

Schrodinger equation in three dimensions, wells and barriers; tunneling; Harmonic oscillator, Spherically symmetric potentials; Hydrogen atom, Introduction to wave mechanics; Commutation relations; State and dynamical variables; Dirac delta function; bra and ket notation; operators and their properties; Unitary transformation, Parity and parity operators.
Time-independent perturbation theory; Non-degenerate and degenerate cases; Applications; Zeeman and Stark effects.
WKB approximation; Time-dependent perturbation theory; Harmonic perturbation; scattering theory; Laboratory and CM reference frames; Scattering, Square well potentials.
Identical particles; Symmetric and antisymmetric wave functions; Collision of identical particles; Spin angular momentum; electron spin, Pauli's spin matrices,
Field quantization, creation and annihilation operators.

APC 32102 ATOMIC AND MOLECULAR PHYSICS (3-0-0)

Quantum states of one electron atoms-Atomic orbitals-Hydrogen spectrum-Pauli's principle-Spectra of alkali elements – Spin orbit interaction and fine structure in alkali Spectra – Equivalent and non-equivalent electrons – Normal and anomalous Zeeman effect – Paschen Back effect, Stark effect-Two electron systems, Vector atom model, interaction energy in LS and jj Coupling – Hyperfine structure, – Line broadening mechanisms, Doppler and Lorentz Broadening.
Molecular spectra, Rotational spectra of diatomic molecules as a rigid rotor and non rigid rotor, intensity of rotational lines, Frank-Condon principle.
Vibrational-rotational spectra, vibrational energy of diatomic molecule-Diatomic molecule as a simple harmonic oscillator, effect of anharmonicity, Energy levels and spectrum-Morse potential, energy curve-Molecules as vibrating rotor- Vibration spectrum of diatomic molecule.
IR, Raman and FTIR spectrophotometer, Raman spectroscopy, Rotational Raman spectra of diatomic molecules, Effect of Nuclear spin on intensities of Rotational Raman spectra.

APC 32103 ELECTRODYNAMICS (3-0-0)

Electrostatics, Space distribution of charges and dipoles, Uniqueness of solution with Dirichlet conditions, Solution of Electrostatic Boundary value problem with Green Function, Variation approach to the solution of the Laplace and Poisson Equation.
Boundary value problems, Method of Images, Point charge in the Presence of a Charged, Insulated, conducting Sphere, Conducting sphere in a Uniform Electric field by Method of Images, Green function for the Sphere, Green's function, Green solution for the Potential, Separation of Variables, Laplace equation in Rectangular Spherical and Cylindrical Co-ordinates.
Dielectrics, Multipole Expansion of the Energy of a Charged Distribution in an External field, Boundary value problems with dielectrics.

Steady currents, Magnetostatics, Vector potential Magnetic Induction for a circular Current Loop, Methods of Solving Boundary Value Problems in Magnetostatics, Uniformly magnetized sphere in an external field, Numerical Methods for two-Dimensional Magnetic Fields.
Time varying fields, Maxwell's equation, Gauge Transformation, Lorentz Gauge, Coulomb Gauge, Retarded solution for fields, Dirac quantization condition.
Lorentz force equation and motion of charges, Plane electromagnetic waves, Refraction and Reflection of Electromagnetic wave at a Plane interface Between Two Dielectrics, Simplified Model of Propagation in the Ionosphere and Magnetosphere, Illustration of the Spreading of a Pulse as it propagates in a Dispersive Media.
Wave-guide and resonant cavities, Field at the Surface of and within a Conductor, Cylindrical Cavities and Wave guides, Modes in rectangular wave guide, Power Loses in a cavity, Q of a Cavity, Earth and Ionosphere as a Resonant Cavity.
Propagation of electromagnetic wave in ionosphere.

GPC 96102 SEISMOLOGY (3-0-0)

Introduction to Seismology and phenomena of earthquake and its effects. Elastic rebound theory, causes of intra and inter plate earthquakes, classification of earthquakes based on depth and magnitude.
Localizing of magnitude scale, various magnitude scales and their limitations, seismic moment, stress drip and dimension of rupture during earthquakes.
Intensity scales: MM and MSK, impacts and assessment of earthquakes and related hazard and their mitigation.
Theory of elasticity, generalized Hooke's law, different types of elastic waves and their propagation, characteristics, equation of motion of seismic body waves, Attenuation and dispersion of seismic waves.
Instruments: Amplitude and phase characteristics of seismometers, short-period, long period and broad-band seismometers, analysis of seismograms and identification of various phases on the seismograms, basic principle of strong motion instrument.
Ray characteristics and related parameters for horizontally and spherically stratified earth, basic principles of seismic tomography and receiver function analysis.
Fault plane solutions and related interpretation, moment tensors for different fault patterns, earthquake characteristics along constructive, conservative and destructive boundaries, Study of micro-earthquakes and induced seismicity, free oscillations of earth.
Seismic networks and arrays, stand-alone and telemetry systems.
Earthquake prediction: dilatancy theory, Short-term, middle-term and long-term prediction.

AMC 32101 OBJECT ORIENTED PROGRAMMING (OOP) (3-0-0)

OOPs: Basic concepts of OOPs ; C++ preliminaries, data types, arrays, functions, classes and objects, constructors and destructors, function overloading, operator overloading and Type conversions; inheritance, pointers, polymorphism, console oriented I/O operations, file management, templates, exception handling.
JAVA: Introduction to JAVA.
Information Technology: Introduction to Data Base Management System, Foxpro, RDBMS, HRDBMS, Relational Data Base, Introduction to Internet and intranet Multimedia.

AMC 32201 OBJECT ORIENTED PROGRAMMING LAB (0-0-2)

C++ programming: Classes and objects, Arrays of objects, Passing objects to member functions, Function overloading, Friend functions, Passing objects to friend functions, Member functions /Friend functions returning objects, Pointer: Accessing data members and member functions using pointers, Constructors and Destructors: constructors, parameterized constructors, overloaded constructors, Copy constructors, Dynamic constructors; destructors, Operator Overloading: Overloading of unary operators such as minus, increment operator, decrement operator etc.; Overloading of binary operators such as +, * etc.; overloading of operators such as >>, << etc., Type Conversions: Basic type to class type, Class type to basic type, one class type to another class type, Inheritance: Single Inheritance, Multiple Inheritance, Hierarchical Inheritance, Multilevel Inheritance and Hybrid inheritance, Constructors in Derived classes, Polymorphism: Run time polymorphism- Virtual functions, Console oriented I/O operations: using IOs class functions and flags, Manipulators, User-defined output functions, File Processing: Sequential files, Random Files, Accessing files using class objects, Updating a file, Templates: Function Templates, Class Templates, Error Handling.

JAVA programming: Simple programs in JAVA
DBMS: development of data base using suitable DBMS packages

APC 32201 EXPERIMENTAL PHYSICS –II (0-0-8)

Study of Frequency modulation & demodulation, Measurement of Compressibility of liquids using Ultrasonic diffraction grating**,** Experiments on the measurement of wavelength of sodium light using Newton's rings & Fresnel's bi-prism methods**,** Measurement of Ultrasonic velocity in liquids using Ultrasonic Interferometer, Measurement of Dielectric constant of different materials, Experiment on the calculation of Diffusion potential and band gap of P-N junction, Photo-electric effect experiment.

SEMESTER – III

APC 33101 CONDENSED MATTER PHYSICS (3-1-0)

Interaction of X-rays with matter, absorption of X-rays. Elastic scattering from a perfect lattice. The reciprocal lattice and its applications to diffraction techniques. The Laue, powder and rotating crystal methods, crystal structure factor and intensity of diffraction maxima Excitons due to lattice centering.
Defects in Crystals (Point defects, line defects and planer (stacking) faults). Plastic deformation, X-ray and electron microscopic techniques.
Electronic Properties of Solids:
Electrons in a periodic lattice: Bloch theorem, band theory. Tight-bonding, cellular and pseudopotential methods. Fermi surface, de Hass von Alfen effect, cyclotron resonance, magnetoresistance, Giant magneto resistance, colossal magneto resistance, Magnetic Resonance, quantum Hall effect.

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Spin waves and magnons, Curie-Weiss law for susceptibility, Ferri- and antiferro-magnetic order, Ferro and anti-ferro electric effect. Domains and Bloch-well energy.

APC 33102 LASERS AND HOLOGRAPHY (3-1-0)

Gaussian beam and its properties, Laser Rate equations, Stability conditions, focal concentric and unstable resonators, Stable Two – Mirror Optical Resonators, Longitudinal and Transverse Modes of Laser Cavity , Mode Selection , Gain in a Regenerative Laser Cavity, Threshold for 3 and 4 level Laser Systems. Mode Locking, Pulse Shortening – Pico second & femtosecond operation, Spectral Narrowing and Stabilization.

Gas Lasers, Solid state lasers, Liquid lasers, Semiconductor lasers, Tunable lasers, Excimer Laser and Free electron laser.

Basics of Holography, Reflection, Rainbow, Colour and Fourier transform hologrphy, theory of in - line and off – axis holography, Speckles and its applications, Holographic interferometry, Non-destructive testing of engineering objects.

APC 33103 NUCLEAR PHY. & SP. THEORY OF RELATIVITY (3-1-0)

NUCLEAR PHYSICS

Nuclear forces, Exchange forces and tensor forces – Meson theory of nuclear forces – Nucleon – nucleon scattering – Effective range theory – Spin dependence of nuclear forces – Charge independence and charge symmetry of nuclear forces – Isospin formalism – Yukawa interaction.

Liquid drop model, Experimental evidence for shell effects – Shell model – Spin – Orbit coupling – Magic numbers - Angular momenta and parities of nuclear ground states - Qualitative discussion and estimates of transition rates.

Beta decay - Fermi theory of beta decay - Shape of the beta spectrum - Total decay rate – Angular momentum and parity selection rules – Comparative half – lives – Allowed and forbidden transitions - Selection rules – Parity violation, Detection and properties of neutrino – Gamma decay, Angular momentum and parity selection rules – Internal conversion – Nuclear isomerism.

SPECIAL THEORY OF RELATIVITY

Orthogonal transformations, Tensors, Tensor Analysis, Tensor densities, tensor density of Levi-Civita, Generalization, n dimensional continuum, Metric tensor, Reimannian spaces, Raising and lowering indices, Geodesic lines, Minkowski world and Lorentz transformations, world lines.

Relativistic Mechanics of Mass Points, Lorentz covariance of the new conservation laws, Compton effect, Relativistic analytical mechanics, Relativistic force.

Relativistic Electrodynamics, Maxwell's equations, The representation of four dimensional tensors in three plus one dimensions, Gauge transformations, The ponderomotive equations.The mechanics of continuous matter, the stress energy tensor of electrodynamics.

Applications of special theory of relativity, Experimental verifications of the special theory of relativity, Charged particles in electromagnetic fields, the field of rapidly moving particles, De Broglie waves.

APC 33104 STATISTICAL MECHANICS (3-1-0)

Microcanonical ensemble, phase space, trajectories and density of states, Liouville's theorem, canonical and grand canonical ensembles; partition function, calculation of statistical quantities, Energy and density fluctuations. Density matrix, statistics of ensembles, statistics of indistinguishable particles, Maxwell-Boltzman, Fermi-Dirac and Bose Einstein statistics, properties of ideal Bose and Fermi gases, Bose—Einstein condensation. Cluster expansion for a classical gas, Virial equation of state, ising model, mean-field theories of the ising model in one, two and three dimensions, Exact solutions in one dimension.
Landau theory of phase transition, critical indices, scale transformation and dimensional examination.
Correlation of space-time dependent fluctuations, fluctuations and transport phenomena, Brownian motion, Langevin theory, fluctuation dissipation theorem. The Fokker-Planck equation.

APE 33101 NONLINEAR OPTICS (3-0-0)

Non-linear effect in optics, three and four wave mixing processes, Non-linear susceptibility, Optics harmonic generation, phase matching, parametric amplification, Conversion efficiency-small and large signal, Manluy-Rowe relations, Methods of enhancement of non-linear conversion efficiency-(1) phase matching and (2) Focussing, Electro-optic modulators, phase conjugation and frequency conversion techniques & devices,
Non-Linear effects in optical fibres including self phase modulation, non-linear wave propagation, non-linear laser spectroscopy including femtosecond optics, Higher order non-linear optical processes, Photon statistics, squeezed state of light, density matrix techniques.

APE 33102 SPACE PHYSICS AND ASTROPHYSICS (3-0-0)

Historical astronomy, Astronomical instrumentation, Stars: spectra and classification, Stellar structure equations and survey of stellar evolution, Stellar oscillation, Degenerate and collapsed stars, radio pulsars. Interacting binary systems: accretion disks, Gravitational lenses, dark matter, Interstellar medium, supernova remnants, molecular clouds, dust, radiative transfer, Jeans' mass, star formation. Red giant, white dwarfs and black hole, super-nova explosions, Pulsar and quasi-stellar objects (QSO).
High energy astrophysics: Compton scattering, bremsstrahlung, cosmic rays, Galactic stellar distributions and populations, globular clusters.

APC 33201 EXPERIMENTAL PHYSICS-III (0-0-8)

Experiment on the measurement of Fringe width using Michelson's interferometer, Calculation of Lande g-factor using ESR spectrometer, Hysteresis loss in various ferromagnetic materials, Numerical Aperature of Single and Multi mode fibres, Photoconductivity measurements.

APC 33401 SEMINAR (0-0-0)

SEMESTER – IV

APC 34101 NON-CONVENTIONAL SOURCES OF ENERGY (3-0-0)

Solar Energy and Spectral Distributions, Heat Transfer for solar energy, Convective Heat Transfer effect within Honeycomb structures for Flat Plate Solar collectors, Solar air heaters and their applications, Concentrating collectors, Photo-Voltaic conversion, Solar cells, Storage of Solar energy, solar ponds.
Fission & Fusion, Lawson's criteria for fusion, Impacts of the byproducts on environment, geothermal and hydel energy, Fissile and fissionable materials, Heavy water, Theory of reactors. Bio-energy, wind energy, Tidal energy, Fuel cells.

APC 34102 SUPERCONDUCTIVITY (3-0-0)

Superconductivity, Destruction of Super Conductivity by magnetic fields, Meissner effect, Heat capacity, Energy gap, Micro- wave and Infra-red Properties, Isotope effect.
Thermodynamics of the superconductive transition, London equation, Coherence length, BCS theory of superconductivity, Flux quantisation in a superconducting ring, duration of persistent currents, Type II superconductors – Vortex state, estimation of Hc_1, and Hc_2 , Ginzburg – Landau theory, Josephson effect, super conductor tunneling - DC Josephson effect, A C Josephson effect and Macroscopic quantum effects.
Applications of superconductivity, High temperature superconductors - structure, synthesis, properties and their applications, SQUIDS (Super Conducting Quantum Inference Devices), super conducting magnets.

APE 34101 PHYSICS OF NANOMATERIALS (3-0-0)

Band structure, Density of state in bands, Variation of density of states with energy, Variation of density of state and band gap with size of crystal.
Quantum Size Effect:Electron confinement in infinitely deep square well, confinement in two and one dimensional well, Quantum dots, Idea of quantum well structure , Quantum wires. Application of nano-structures.Different methods of preparation of nanomaterials, Cluster beam evaporation, Ion beam deposition, Chemical bath deposition, Ball Milling.
Amorphous and nano-materials, Determination of particle size, XRD, photoluminescence, Raman etc.

APE 34104 OPTICAL COMMUNICATION (3-0-0)

Introduction of Optical Communications: Significance of guided communications, Advantages, Different communication windows and different generations. Transmission characteristics of Optical fibres: Ray Theory Transmission – Acceptance Angle, NA, Skew rays, Wave Transmission – Modes in a planar wave guide, Phase and group velocity, Evanescent field, Goos Hanchen Shift, Cylindrical wave guides – Modes, Step index fiber, Graded index fiber, Single and multimode fiber characteristics, Fibre fabrication, Dispersion Characteristics: Intra and intermodal dispersion, Dispersion modified fibers. Attenuation in Fibers: material absorption, wave guide dispersion, micro bending, bending, scattering etc. Couplers and connectors, Basics

of Optical sources and detectors, Optical Modulation and demodulation techniques, Optical link amplifier, Optical design: power budgets and rise time budget, Coherent Optical Communication, WDM Techniques, Free space communication.

APE 34102 BIOMEDICAL PHYSICS (3-0-0)

Interaction of laser radiation with tissue, Scattering of light by biological objects, optics of eye, Laser safety, Confocal Microscopy, scanning laser opthalmoscopy, different type of scanners, photo detectors, low coherence and high coherence interferometry, optical coherence tomography and its applications, Different types of noises, Imaging of skin, Eyes and study of dentistry and neoplasia.
Magnetic resonance imaging, Computer aided tomography, Laser surgery, Nd YAG Laser and CO_2 laser.

APE 34103 ENVIRONMENTAL PHYSICS (3-0-0)

Essentials of Environmental Physics:
Structure and thermodynamics of the atmosphere, Composition of air, Trace of atmospheres, Greenhouse effect (ozone hole, CFC), Transport of matter, energy and momentum in nature. Stratification and stability of atmosphere, Laws of motion, hydrostatic equilibrium, General circulation of the tropics, Elements of weather and climate of India.
Environmental Pollution and Degradation:
Elementary fluid dynamics, Diffusion, Turbulence and turbulent diffusion. Factors governing air, water and noise pollution. Air and water quality standards. Waste disposal. Heat island effect. Land and see breeze. Puffs and plumes. Gaseous and plarticulate matters. Wet and dry deposition.
Environmental Changes and Remote Sensing:
Energy sources and combustion processes. Renewable sources of energy. Solar energy, wind energy, bioenergy, hydropower, fuel cells, nuclear energy, Forestry and bioenergy. Global and
Global and Regional Climate:
Elements of weather and climate, Stability and vertical motion of air, Horizontal motion of air and water, Pressure gradient forces. Viscous forces. Inertia forces, Reynolds number, Enhanced Greenhouse Effect, Energy balance, a zero-dimensional Greenhouse model, Global climate models.

APC 34801 PROJECT & DISSERTATION (0-15-0)

APC 34802 VIVA-VOCE ON DISSERTATION (0-0-0)

APC 34501 COMPREHENSIVE VIVA (0-0-0)