SEMESTER V			
Common Core Core VII – Solid state and Material Science			
Code : 18UPCC51	Hrs/Week : 6	Hrs/Sem :90	Credits : 4

Unit I: Crystal Structure and Crystal imperfections

Crystal lattice – Primitive and unit cell – Basic symmetry elements and operations – Plane of Symmetry, centre of symmetry & axis of symmetry – Types of Crystals – Bravais lattices – Simple cubic, body centered, FCC structures with an example – Miller indices, Inter planar spacing – Crystal imperfections – Point defects – Schotty and Frenkel defects – Line Defects –Edge & screw dislocations – Surface defects – Volume defects(imperfection).

Unit II: New Materials

New materials – Metallic glasses – Fibre reinforced plastics – Fibre reinforced metals – Bio materials – Ceramics – Cements – High temperature materials – Intermetallic compounds – Alloys – Smart materials.

Unit III: Wave Nature of Matter and X-ray Diffraction

Wave nature – Introduction – De Broglie Hypothesis – Experimental study of matter waves – Davision –Germer's experiment – Heisenberg's Uncertainity Principle.
Bragg's law – Derivation of Bragg's equation – Experimental methods of X –ray study – Laue rotating crystal and powder methods.

Unit IV: Magnetic and Dielectric materials

Classification of magnetic materials – Langvein theory of diamagnetism – Theory of Paramagnetism – Domain theory of Ferromagnetism – Antiferro magnetic materials – Application of Different magnetic materials.
Dielectric materials – Types of dielectric materials – Different types of electric polarization – Internal field – Clausius –Mossotti equation – Frequency and temperature dependence of dielectric constant.

Unit V: Nanomaterials

Nanomaterials – Synthesis – Plasma Arcing – Chemical vapour Deposition – Sol gels – Electro deposition – Ball milling – Properties of nano particles and applications. Carbon nanotubes fabrication – Arc method – Pulsed laser deposition – Chemical vapour deposition – Structure –properties – applications.

SEMESTER V			
Core VIII	**Digital Electronics**		
Code : 18UPHC52	**Hrs/Week : 5**	**Hrs/Sem : 75**	**Credits : 4**

Unit I: Arithmetic Circuits

Binary to decimal system – Decimal system to binary system – Octal system – Hexadecimal System – Excess 3 Code – Gray Code – Binary addition – Subtraction – Unsigned Binary numbers 2's complement – Half adder – Full adder –Half subtractor – Full subtractor.

Unit II: Logic circuits

Boolean algebra – OR, AND and NOT operation – Boolean equation – Logic circuits – Boolean theorems and Basic laws – De Morgan's theorem – Duality theorem – Sum of products – Product of sums – Karnaugh map – Pairs, Quads and Octets – Karnaugh map simplification.

Unit III: Data processing circuits

Flip –Flops: R –S flip flop – Clocked RS flip flop – JK flip flop – JK master slave flip flop – Schmitt trigger.
Multiplexer – Demultiplexer – 1-16 decoder – BCD to decimal decoders – Seven segment decoder – Encoder – Parity checker and generator.

Unit IV: Shift registers and counters

Serial in register – Serial out register – Serial in–parallel out register – Parallel in-serial out register – Parallel in–parallel out register.
Ring counter – Binary counter – Decade counter UP/DOWN counter – Mod 3 counter – Mod 5 counter.

Unit V: Semiconductor memories:

ROM– RAMS – SRAMS – Dynamic RAMS.
A/D and D/A conversion:Variable resistor network – Binary ladder – A/D conversion – D/A conversion – Simultaneous conversion – Continuous AD conversion.

SEMESTER V			
Core IX	Computational Physics		
Code : 18UPHC53	Hrs/Week : 5	Hrs/Sem : 75	Credits : 4

Unit I: Tokens and Expressions

Tokens– Keywords – Identifiers and Constants – Basic data types – User defined data types – Derived data types – Symbolic constants – Declaration of variables – Dynamic initialization of variables – Reference variables – Operators in C++ – Scope resolution operator – Member dereferencing operators – Memory management operators – Manipulators – Expressions and their types – Control structures.

Unit II: Functions, Classes and Objects

Functions in C++ – The main function – Function prototyping – Call by reference – Return by reference – Inline functions – Default arguments. Specifying class – A simple class example – Creating objects – Accessing class members – Defining member functions – Nesting of member functions – Private member functions – Arrays within a class – Arrays of objects – Objects as function arguments – Returning object.

Unit III: Constructors and Operator Overloading

Constructors – Parameterized constructors – Multiple constructors in a class Dynamic constructor – Copy constructors – Destructors.
Defining operator over loading – Overloading unary operators – Overloading binary operators – Manipulation of strings using operators – Rules for overloading operators.

Unit IV: Inheritance and Managing Console I/O Operations

Defining derived class – Single inheritance – Multilevel inheritance – Multiple inheritance – Hierarchical inheritance – Hybrid inheritance.
C++ streams – C++ stream classes – Unformatted I/O operations – Formatted console I/O operations – Managing output with manipulators – Designing our own manipulators.

Unit V: Numerical Methods (No derivations)

Iterative methods: Bisection method, Newton – Raphson method – Solution of linear simultaneous equations: Gauss elimination method – Method of least squares: Straight line – Interpolation: Newton's forward and Lagrange's interpolation – Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule – Solution of differential equation: Taylor's series method.

SEMESTER V			
Core Integral I	**Renewable Energy Sources**		
Code :18UPHI51	**Hrs/Week : 4**	**Hrs/Sem : 60**	**Credits : 4**

Unit I: Solar Energy

Introduction – Solar Constant – Solar Radiation at the Earth's Surface : Beam and Diffuse Solar Radiation, Attenuation of Beam Radiation – Solar Radiation Measurements: Pyrheliometers, Pyranometers, Sunshine Recorder – Solar Radiation Data – Solar Energy Collectors: Introduction – Conversion of Solar Radiation into Heat
– Green House Effect – Flat –Plate Collectors: Introduction – Typical Liquid Collector – Advantages of Flat Plate Collectors.

Unit II: Solar Energy Storage and applications

Introduction – Solar Energy Storage Systems: Thermal Storage – Chemical Storage – Solar Pond: Introduction – Principle of Operation and Description of Non-convective Solar Pond –Extraction of Thermal Energy – Applications of Solar Ponds – Applications of Solar energy: Agriculture and Industrial Process heat – Solar Distillation – Solar Cooking: Box type Solar Cooker – Green House effect – Solar Green Houses (Introduction, Types, advantages, parameters for plant growth and Green house environment and control) – Global Warming.

Unit III: Wind Energy

Introduction – Basic Principles of Wind Energy Conversion: The nature of the wind – The power in the wind (only theory) – Wind energy conversion – Wind data and energy estimation – Site selection considerations – Basic components of a WECS (Wind Energy Conversion System) – Classification of WEC systems – Advantages and disadvantages of WECS – Applications of wind energy – Safety systems – Environmental aspects.

Unit IV: Energy Conservation

An Economic Concept of Energy – Principles of Energy Conservation and Energy Audit – Types of Energy Audit – Energy Conservation Approach: Energy saving devices eligible for higher depreciation – Renewable energy devices eligible for higher depreciation – Co-Generation – Waste Heat Utilization – Heat Recuperators (Definition and Uses) – Heat Regenerators– Instrumentation and control.

Unit V: Other Conventional Energy Sources

Biomass energy – Classification – Biomass conversion Technologies: Wet and Dry Processes – Photosynthesis – Biogas generation – Advantages of Anaerobic Digestion – Factors Affecting Biodigestion – Types of biogas plant (KVIC Digester) – Geothermal energy (Introduction, Applications and advantages) – Ocean Thermal Electric Conversion (OTEC – Basics principle) – Method and Working Principle of Closed OTEC.

SEMESTER VI			
Core Integral II	Advanced Physics		
Code :18UPHI61	Hrs/Week : 4	Hrs/Sem : 60	Credits : 4

Unit I: Applications of Laser

Application of laser in material processing – Laser drilling – laser cutting – Laser welding – Experimental welding – Air pollution monitoring – Water pollution monitoring – Propagation of laser radiation through atmosphere – Laser remote sensing – LIDAR – Raman LIDAR – Sensing wind velocity using laser – Holography
– Applications.

Unit II: Microprocessor architecture

Microprocessor – Microprocessor instruction set and computer language – Microprocessor architect and its operations – Input and output devices – Microcomputer system – Logic devices for interfacing – 8085 MPU.

Unit III: Programming the 8085

8085 programming model – Instruction classification – Instruction and data format – How to write, assemble and execute simple programs – Instruction set – Data transfer operations – Addressing modes – Arithmetic operations – Logical operations – Branching operations.

Unit IV: Superconductors

Superconductivity – Effect of magnetic field – The Meissner effect – Effect of current – Type I and Type II superconductors – Thermal properties – Isotope effect – London equations – BCS theory – flux quantisation – Josephson's effect – Application of superconductors – High Tc superconductor – Application of superconductor.

Unit V: Materials For Nuclear and Space Applications

Nuclear fuels – Fuel cladding – Moderators, control materials – Coolants – Shielding materials – Space programme – Structural material and their properties – System requirements – Extreme high temperature materials for thermal protection – Pressure vessels – Lubrication.