**Subject : Mathematics II**

**Units: 6**

**Weekly Hours : Theoretical : 3**

**Experimental: −**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-5 | Coordinate systems, Cartesian, and polar   Polar coordinate system,   Polar functions and polar equations, graph.   Polar equation of conic section and other curves.   The angle between radius vector and tangent line.   Arc length and plane area in polar coordinate system. |
| 6-10 | Vector and vector analysis   Vector definition and the unit vectors (i,j and k)   Space coordinate (Cartesian cylindrical, and spherical coordinate systems)   Vector algebra (vector operation)   Equation of line and plane.   Cylinders and quadric surfaces.   Vector functions, definitions, limit, and continuity.   Derivative of a vector function.   Tangent vector, curvature, normal vector, and radius of curvature. |
| 11-15 | Partial differential equations.   Function of two or more variables.   Definition of partial derivative |

|  |  |
| --- | --- |
|  |  The directional derivative   Tangent plane and normal line,   Approximate value of W, W=f(x,y)   The gradient, chain rule, total differential, exact differential.   Maximum and minimum of functions.   Lagrange multiplier.   High order derivative. |
| 16-20 | Multiple integral   Double integrals   Area and double integrals   Physical applications   Polar coordinate system   Triple integrals   Volume, physical applications of triple integral.   Cylindrical and Spherical coordinate   Surface area. |
| 21-25 | Ordinary differential equations (O.D.E’s)   Definition, order, degree, solution   First order – first degree D.E. (Separable, Homogeneous, Linear, and Exact)   Special types of second order D.E.   Linear D.E. with constant coefficients   Linear 2nd order non-homogeneous D.E. with constant coefficients, method of variation of parameters, method of undetermined coefficient.   High order linear D.E. with constant coefficients. |
| 26-30 | Infinite series   Sequences   Certain limits   Infinite series, definition, convergence, divergence, and the sum of the series.   Test of convergence (comparison, integral ratio, root, and other test)   Alternating series   Absolute and conditional convergence   Power series of functions   Maclaurin & Tylor series, Tylor theory. |

**Subject : Instrument and Measurements**

**Units: 4**

**Weekly Hours : Theoretical : 2**

**Experimental: −**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-4 | Basic concepts of measurements   Introduction   Measurements and units.   Units obtained from SI unit system   Multiple and sub-multiples for SI units   Definitions   Systems configuration   Basic elements of measuring devices.   Classification of errors.   Random errors.   Other sources of errors.   Unit conversion. |
| 5-7 | Electrical measuring instruments   Absolute instrument   Secondary instrument   Electrical principle of operation.   Indicating instrument   Torque   Controlling torque.   * Deflecting torque    Damping torque |

|  |  |
| --- | --- |
| 8-9 | Moving iron instrument   Source of error in moving   Iron instrument |
| 10-13 | Moving coil instrument   Extension of range   Ammeter   Voltmeter   Dynamometer type  - Dynamometer as ammeter  - Dynamometer as voltmeter |
| 14-16 | Resistance and measurements   Bridge method   Wheatstone bridge method   Cary – Foster (slide – wire) method   Kelvin bridge method |
| 17-19 | Ohmmeter method of resistance measurements   shunt type   series type |
| 20-22 | Mega Ohmmeter ( Megger ) |
| 23-25 | Measurements of inductance and capacitance by using A.C bridges |
| 26-28 | Measurement of system dynamics   Force function   Zero – order system   First – order system   Second – order system   * Measurement of power (wattmeter) |
| 29-30 | * wattmeter method    wattmeter method |

**Subject : Electronics I**

**Units: 6**

**Weekly Hours : Theoretical : 2**

**Experimental: 2**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-4 |  p-n junction   Introduction to p-n junction   Diode applications   Rectifiers   Clipping and clamping   Zener diode |
| 5-10 | Transistor circuits   Biasing of transistor   Configuration of transistor   Equivalent circuit of transistor   Graphical analysis   Operating point of transistor   DC & AC load line of Transistor   Bias stability   Quiescent point operation   Effect of temperature on Q-point.   Stability factor analysis   Temperature compensation using diode biasing   Thermal consideration in Tr.Amp. |

|  |  |
| --- | --- |
| 11-15 | Transistor amplifier   Common – Base transistor amplifier   Common emitter transistor amplifier   Common collector transistor amplifier. |
| 16-20 | h-parameter of transistor   Common – base transistor   Common – emitter transistor   Common – collector transistor |
| 21-25 | Classes of Amplifiers   Class A amplifier   Class B amplifier   Class C amplifier   Class D amplifier |
| 26-30 | The Field effect transistor:   Theory of JFET & MOSFET   P-channel FET   FET amplifier   FET switch |

**Subject : Geometrical Optics**

**Units: 6**

**Weekly Hours : Theoretical : 2**

**Experimental: 2**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-10 | GEOMETRICAL OPTICS   Introduction   Paraxial Approximation   Ray Matrix Approach to Gaussian Optics   The Lens Matrix   Ray Transformation between Principal Planes   Image Formation   Ray Tracing   Ray Matrix for Reflection   Apertures and Stops   Two-Lens Optical Systems   Optics of a Laser Cavity   Optics of the Human Eye   Defects of the Human Eye   Cylindrical Lens |
| 11-15 | LENS ABERRATIONS   Stigmatic Image   Aplanatic Points   Image Formation with Non-paraxial Rays   Wave front Aberration Function |

|  |  |
| --- | --- |
|  |  Ray Deviations   Focusing Errors |
| 16-20 | INTERFERENCE OF LIGHT WAVES   Interference   Two-Wave Interference   Interference by Division of Wavefront   Interference by Division of Amplitude   Testing Flatness of Surfaces   Interference with Extended Sources |
| 21-30 | FRINGES & INTERFEROMETER   Haidinger Fringes   Fizeau Fringes   Newton’s Rings   Straight Fringes   Two-Wave Interferometers   Michelson Interferometer   Mach–Zehnder Interferometer   Multi-wave Interference   Fabry–Perot Interferometer   Widths of Transmission Peaks   Fabry–Perot Interferometer as a Spectrometer   Free Spectral Range   Spectral Resolution   Thin Optical Coatings   Interference filter |

**Subject : Thermodynamics**

**Units: 4**

**Weekly Hours : Theoretical : 2**

**Experimental: −**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-2 | Definitions: force, pressure, systems, atmospheric pressure, absolute  pressure, pressure units. |
| 3-5 | Temperature: units, conversion, methods of temperature measuring, zero  law, energy definition, types of energy: potential energy, kinetic energy, work, power, and pressure diagram. |
| 6-7 | Internal energy, Enthalpy, first law of thermodynamics. Systems energy  equation: open systems, close systems, applications. |
| 8-10 | Ideal gas, Boil’s law, Charles’s law, equation of state. Specific heat at  constant pressure, specific heat at constant temperature. Processes of closed systems, volume constant and pressure constant. |
| 11-15 | (T-V) diagram, Polytropic process (P-V & P-T) diagrams. Open system  procedures. Vapor, matter and phase changing and phase changing on (P-V)  diagram. |
| 16-20 | Volume fraction – liquid line – vapor line – wet vapor. Saturated vapor,  second law of thermodynamics, thermal machine and thermal pump. |
| 21-24 | Carnot’s cycle and inverse Carnot’s cycle, Reverse and inverse procedures.  Definition of 2nd law in thermodynamics, Entropy and gas entropy calculations, T-S diagram. |
| 25-28 | Entropy computation of vapors. Entropy of system and its surrounding  environment. Adiabatic efficiency. |
| 29-30 | Standard air cycles, Auto-Cycle, Diesel cycle, Diol Cycle. |
|  | |

**Subject : Wave Propagations**

**Units: 4**

**Weekly Hours : Theoretical : 2**

**Experimental: −**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-2 | Definitions: force, pressure, systems, atmospheric pressure, absolute  pressure, pressure units. |
| 3-4 | Standing wave, Energy of standing waves and Wave propagation in free  space |
| 5-8 | Wave propagation in dielectrics, the pointing vector and power  considerations. |
| 9-11 | Propagation in good conductors: skin effect. |
| 12-15 | Polarization, wave polarization |
| 16-20 | Radio wave propagation, Light wave propagation. |
| 21-23 | Radio wave propagation in vacuum and in matter, attenuations and damping  factors. |
| 24-27 | Electromagnetic wave propagation in vacuum and matters, reflections,  refractions, and scattering. Riely Scattering, Raman scattering. |
| 28-30 | Light wave propagation in free space, Laser light propagation in free space  and in matter, gain, losses, reflection, refraction, and scattering. |

**Subject : Laser Principles**

**Units: 6**

**Weekly Hours : Theoretical : 2**

**Experimental: 2**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-3 | Light and Blackbody Emission   Emission of Thermal Light   Electromagnetic Spectrum   Blackbody Radiation and the Stefan –Boltzmann Law   Wein’s Law   Cavity Radiation and Cavity Modes   Quantum Nature of Light   Absorption and Emission Processes   Boltzmann Distribution and Thermal Equilibrium |
| 4-7 | Atomic Emission   Line Spectra   Spectroscope   Einstein and Planck: 𝐸 = ℎ𝜗   Photoelectric Effect   Atomic Models and Light Emission   Franck –Hertz Experiment   Spontaneous Emission and Level Lifetime   Fluorescence |

|  |  |
| --- | --- |
|  |  Semiconductor Devices   Light-Emitting Diodes |
| 8-15 | Lasing Processes   Characteristics of Coherent and incoherent Light   Boltzmann Distribution and Thermal Equilibrium   Creating an Inversion   Stimulated Emission   Rate Equations and Criteria for Lasing   Laser Gain   Linewidth   Thresholds for Lasing   Calculating Threshold Gain   Selective Pumping   Three- and Four-Level Lasers   CW Lasing Action   Thermal Population Effects |
| 16- 18 | Population inversion and depopulation of low energy level in three and four level  systems. Rate Equation Analysis for Atomic Transitions, Rate Equation Analysis for Three- and Four-Level Lasers, Gain, Saturation. Required Pump Power and Efficiency. Output power. |
| 19-25 | Cavity Optics   Requirements for a Resonator   Gain and Loss in a Cavity   Resonator as an Interferometer   Longitudinal Modes   Wavelength Selection in Multiline Lasers   Single-Frequency Operation   Characterization of a Resonator   Gaussian Beam   Resonator Stability   Common Cavity Configurations   Spatial Energy Distributions: Transverse Modes |

|  |  |
| --- | --- |
|  |  Limiting Modes   Resonator Alignment: A Practical Approach |
| 26-30 | Fast-Pulse Production   Concept of Q-Switching   Intracavity Switches   Energy Storage in Laser Media   Pulse Power and Energy   Electro-optic Modulators   Acousto-optic Modulators   Cavity Dumping   Mode locking   Mode locking in the Frequency Domain |

**Subject : Electromagnetic Fields**

**Units: 4**

**Weekly Hours : Theoretical : 2**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1-4 | Vector analysis   Scalar and vector   Vector algebra   The Cartesian coordinate system   Vector components and unit vector   Vector field   The Dot product   The cross product   Polar coordinate system |
| 5-15 | Electric Field   Coulomb’s law   The experimental law of coulomb   Electric field intensity   Field of line charge   Field of a sheet charge   Stream lines and sketches of field   Electric flux density   Gauss’s law |

**Experimental: −**

|  |  |
| --- | --- |
|  |  Integral form of Gauss’s law   Differential form of Gauss’s law   Divergence theorem   Stock’s theorem   Maxwell’s first equation   The vector operator V and the divergence theorem |
| 16-30 |  The Line integral   Potential and potential difference   Potential field of a point charge   Potential field of a system of charges: conservative property   Potential gradient   The dipole   Energy density in the electrostatic field   Poisson’s and Laplace’s equations   The magnetic field.   Steady magnetic field   Biot – Savart law   Ampere’s Circuital law   Curl   Stocke’s theorem   Magnetic flux and magnetic flux density   Scalar and vector magnetic potential.   Other Maxwell’s equations |

**Subject : Visual Basic**

**Units: 4**

**Weekly Hours : Theoretical : 1**

**Experimental: 2**

|  |  |
| --- | --- |
| **week** | **Syllabus** |
| 1 |  Introduction to visual basic: Integrated development Environment. |
| 2-3 |  Basic definition: Application, Code, Controls, Declaration, Procedure,  Object, Property   Event procedure, method, form, Class, modules. |
| 4-8 |  Common properties: name, position, size. Font, container font, color, other  properties.   common method: move, et foucs, z order, refresh   examples with command button, text and label   common events mouse events, keyboard events and Examples and application   code |
| 9-19 |  Variables   a) Use variables for input box   b) Use variables for msg box   c) Data type Constants   Basic and advance mathematical parameters   Mathematical functions   Convert the mathematical equations to code   Examples |

|  |  |
| --- | --- |
|  |  Arrays and their declaration with application   if then procedure with application on checkbox and option Buttons |
| 20-30 |  procedure of for~ next, do~ loop, do~ while, do~ until, While ~ wend   timer tools and examples   subroutine, functions, sub and their calling   V-scrollbar and H-scrollbar with application   Examples of scrollbar and sub, subroutine, function   drawing in visual basic, pset, line, circle, print, Cls, Scale   line chart, bar chart and Examples |