**Subject : Mathematics II**

 **Units: 6**

**Weekly Hours : Theoretical : 3**

 **Experimental: −**

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| **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 |

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|  |  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: −**

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| **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 |

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| 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**

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| **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. |

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| 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**

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| **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 |

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|  |  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: −**

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| **week** | **Syllabus** |
| 1-2 | Definitions: force, pressure, systems, atmospheric pressure, absolutepressure, pressure units. |
| 3-5 | Temperature: units, conversion, methods of temperature measuring, zerolaw, energy definition, types of energy: potential energy, kinetic energy, work, power, and pressure diagram. |
| 6-7 | Internal energy, Enthalpy, first law of thermodynamics. Systems energyequation: open systems, close systems, applications. |
| 8-10 | Ideal gas, Boil’s law, Charles’s law, equation of state. Specific heat atconstant 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 systemprocedures. 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 surroundingenvironment. Adiabatic efficiency. |
|  29-30 | Standard air cycles, Auto-Cycle, Diesel cycle, Diol Cycle. |
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**Subject : Wave Propagations**

 **Units: 4**

**Weekly Hours : Theoretical : 2**

 **Experimental: −**

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| **week** | **Syllabus** |
| 1-2 | Definitions: force, pressure, systems, atmospheric pressure, absolutepressure, pressure units. |
| 3-4 | Standing wave, Energy of standing waves and Wave propagation in freespace |
| 5-8 | Wave propagation in dielectrics, the pointing vector and powerconsiderations. |
| 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 dampingfactors. |
| 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 spaceand in matter, gain, losses, reflection, refraction, and scattering. |

**Subject : Laser Principles**

 **Units: 6**

**Weekly Hours : Theoretical : 2**

 **Experimental: 2**

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| **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 |

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|  |  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 levelsystems. 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 |

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|  |  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**

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| **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: −**

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|  |  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**

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| **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, otherproperties. 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 |

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|  |  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 |