

**Subject : Mathematics II**

**Units: 6**

**Weekly Hours : Theoretical : 3**

**Experimental: –**

week	Syllabus
1-5	<p>Coordinate systems, Cartesian, and polar</p> <ul style="list-style-type: none"><li>• Polar coordinate system,</li><li>• Polar functions and polar equations, graph.</li><li>• Polar equation of conic section and other curves.</li><li>• The angle between radius vector and tangent line.</li><li>• Arc length and plane area in polar coordinate system.</li></ul>
6-10	<p>Vector and vector analysis</p> <ul style="list-style-type: none"><li>• Vector definition and the unit vectors (i,j and k)</li><li>• Space coordinate (Cartesian cylindrical, and spherical coordinate systems)</li><li>• Vector algebra (vector operation)</li><li>• Equation of line and plane.</li><li>• Cylinders and quadric surfaces.</li><li>• Vector functions, definitions, limit, and continuity.</li><li>• Derivative of a vector function.</li><li>• Tangent vector, curvature, normal vector, and radius of curvature.</li></ul>
11-15	<p>Partial differential equations.</p> <ul style="list-style-type: none"><li>• Function of two or more variables.</li><li>• Definition of partial derivative</li></ul>

	<ul style="list-style-type: none"> <li>• The directional derivative</li> <li>• Tangent plane and normal line,</li> <li>• Approximate value of <math>W</math>, <math>W=f(x,y)</math></li> <li>• The gradient, chain rule, total differential, exact differential.</li> <li>• Maximum and minimum of functions.</li> <li>• Lagrange multiplier.</li> <li>• High order derivative.</li> </ul>
16-20	<p>Multiple integral</p> <ul style="list-style-type: none"> <li>• Double integrals</li> <li>• Area and double integrals</li> <li>• Physical applications</li> <li>• Polar coordinate system</li> <li>• Triple integrals</li> <li>• Volume, physical applications of triple integral.</li> <li>• Cylindrical and Spherical coordinate</li> <li>• Surface area.</li> </ul>
21-25	<p>Ordinary differential equations (O.D.E's)</p> <ul style="list-style-type: none"> <li>• Definition, order, degree, solution</li> <li>• First order – first degree D.E. (Separable, Homogeneous, Linear, and Exact)</li> <li>• Special types of second order D.E.</li> <li>• Linear D.E. with constant coefficients</li> <li>• Linear 2<sup>nd</sup> order non-homogeneous D.E. with constant coefficients, method of variation of parameters, method of undetermined coefficient.</li> <li>• High order linear D.E. with constant coefficients.</li> </ul>
26-30	<p>Infinite series</p> <ul style="list-style-type: none"> <li>• Sequences</li> <li>• Certain limits</li> <li>• Infinite series, definition, convergence, divergence, and the sum of the series.</li> <li>• Test of convergence (comparison, integral ratio, root, and other test)</li> <li>• Alternating series</li> <li>• Absolute and conditional convergence</li> <li>• Power series of functions</li> <li>• Maclaurin &amp; Tylor series, Tylor theory.</li> </ul>

**Subject : Instrument and Measurements**

**Units: 4**

**Weekly Hours : Theoretical : 2**

**Experimental: –**

week	Syllabus
1-4	<p>Basic concepts of measurements</p> <ul style="list-style-type: none"><li>• Introduction</li><li>• Measurements and units.</li><li>• Units obtained from SI unit system</li><li>• Multiple and sub-multiples for SI units</li><li>• Definitions</li><li>• Systems configuration</li><li>• Basic elements of measuring devices.</li><li>• Classification of errors.</li><li>• Random errors.</li><li>• Other sources of errors.</li><li>• Unit conversion.</li></ul>
5-7	<p>Electrical measuring instruments</p> <ul style="list-style-type: none"><li>• Absolute instrument</li><li>• Secondary instrument</li><li>• Electrical principle of operation.</li><li>• Indicating instrument</li><li>• Torque</li><li>• Controlling torque.</li><li>• Deflecting torque</li><li>• Damping torque</li></ul>

8-9	<p>Moving iron instrument</p> <ul style="list-style-type: none"> <li>• Source of error in moving</li> <li>• Iron instrument</li> </ul>
10-13	<p>Moving coil instrument</p> <ul style="list-style-type: none"> <li>• Extension of range</li> <li>• Ammeter</li> <li>• Voltmeter</li> <li>• Dynamometer type <ul style="list-style-type: none"> <li>- Dynamometer as ammeter</li> <li>- Dynamometer as voltmeter</li> </ul> </li> </ul>
14-16	<p>Resistance and measurements</p> <ul style="list-style-type: none"> <li>• Bridge method</li> <li>• Wheatstone bridge method</li> <li>• Cary – Foster (slide – wire) method</li> <li>• Kelvin bridge method</li> </ul>
17-19	<p>Ohmmeter method of resistance measurements</p> <ul style="list-style-type: none"> <li>• shunt type</li> <li>• series type</li> </ul>
20-22	<p>Mega Ohmmeter ( Megger )</p>
23-25	<p>Measurements of inductance and capacitance by using A.C bridges</p>
26-28	<p>Measurement of system dynamics</p> <ul style="list-style-type: none"> <li>• Force function</li> <li>• Zero – order system</li> <li>• First – order system</li> <li>• Second – order system</li> <li>• Measurement of power (wattmeter)</li> </ul>
29-30	<ul style="list-style-type: none"> <li>• wattmeter method</li> <li>• wattmeter method</li> </ul>

**Subject : Electronics I**

**Units: 6**

**Weekly Hours : Theoretical : 2**

**Experimental: 2**

week	Syllabus
1-4	<ul style="list-style-type: none"><li>• p-n junction</li><li>• Introduction to p-n junction</li><li>• Diode applications</li><li>• Rectifiers</li><li>• Clipping and clamping</li><li>• Zener diode</li></ul>
5-10	<p>Transistor circuits</p> <ul style="list-style-type: none"><li>• Biasing of transistor</li><li>• Configuration of transistor</li><li>• Equivalent circuit of transistor</li><li>• Graphical analysis</li><li>• Operating point of transistor</li><li>• DC &amp; AC load line of Transistor</li><li>• Bias stability</li><li>• Quiescent point operation</li><li>• Effect of temperature on Q-point.</li><li>• Stability factor analysis</li><li>• Temperature compensation using diode biasing</li><li>• Thermal consideration in Tr.Amp.</li></ul>



11-15	Transistor amplifier <ul style="list-style-type: none"><li>• Common – Base transistor amplifier</li><li>• Common emitter transistor amplifier</li><li>• Common collector transistor amplifier.</li></ul>
16-20	h-parameter of transistor <ul style="list-style-type: none"><li>• Common – base transistor</li><li>• Common – emitter transistor</li><li>• Common – collector transistor</li></ul>
21-25	Classes of Amplifiers <ul style="list-style-type: none"><li>• Class A amplifier</li><li>• Class B amplifier</li><li>• Class C amplifier</li><li>• Class D amplifier</li></ul>
26-30	The Field effect transistor: <ul style="list-style-type: none"><li>• Theory of JFET &amp; MOSFET</li><li>• P-channel FET</li><li>• FET amplifier</li><li>• FET switch</li></ul>

**Subject : Geometrical Optics**

**Units: 6**

**Weekly Hours : Theoretical : 2**

**Experimental: 2**

week	Syllabus
1-10	<p>GEOMETRICAL OPTICS</p> <ul style="list-style-type: none"><li>• Introduction</li><li>• Paraxial Approximation</li><li>• Ray Matrix Approach to Gaussian Optics</li><li>• The Lens Matrix</li><li>• Ray Transformation between Principal Planes</li><li>• Image Formation</li><li>• Ray Tracing</li><li>• Ray Matrix for Reflection</li><li>• Apertures and Stops</li><li>• Two-Lens Optical Systems</li><li>• Optics of a Laser Cavity</li><li>• Optics of the Human Eye</li><li>• Defects of the Human Eye</li><li>• Cylindrical Lens</li></ul>
11-15	<p>LENS ABERRATIONS</p> <ul style="list-style-type: none"><li>• Stigmatic Image</li><li>• Aplanatic Points</li><li>• Image Formation with Non-paraxial Rays</li><li>• Wave front Aberration Function</li></ul>

	<ul style="list-style-type: none"><li>• Ray Deviations</li><li>• Focusing Errors</li></ul>
16-20	<p><b>INTERFERENCE OF LIGHT WAVES</b></p> <ul style="list-style-type: none"><li>• Interference</li><li>• Two-Wave Interference</li><li>• Interference by Division of Wavefront</li><li>• Interference by Division of Amplitude</li><li>• Testing Flatness of Surfaces</li><li>• Interference with Extended Sources</li></ul>
21-30	<p><b>FRINGES &amp; INTERFEROMETER</b></p> <ul style="list-style-type: none"><li>• Haidinger Fringes</li><li>• Fizeau Fringes</li><li>• Newton's Rings</li><li>• Straight Fringes</li><li>• Two-Wave Interferometers</li><li>• Michelson Interferometer</li><li>• Mach-Zehnder Interferometer</li><li>• Multi-wave Interference</li><li>• Fabry-Perot Interferometer</li><li>• Widths of Transmission Peaks</li><li>• Fabry-Perot Interferometer as a Spectrometer</li><li>• Free Spectral Range</li><li>• Spectral Resolution</li><li>• Thin Optical Coatings</li><li>• Interference filter</li></ul>



**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 2 <sup>nd</sup> 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: –**

<b>week</b>	<b>Syllabus</b>
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	<p>Light and Blackbody Emission</p> <ul style="list-style-type: none"><li>• Emission of Thermal Light</li><li>• Electromagnetic Spectrum</li><li>• Blackbody Radiation and the Stefan –Boltzmann Law</li><li>• Wein’s Law</li><li>• Cavity Radiation and Cavity Modes</li><li>• Quantum Nature of Light</li><li>• Absorption and Emission Processes</li><li>• Boltzmann Distribution and Thermal Equilibrium</li></ul>
4-7	<p>Atomic Emission</p> <ul style="list-style-type: none"><li>• Line Spectra</li><li>• Spectroscope</li><li>• Einstein and Planck: <math>E = h\nu</math></li><li>• Photoelectric Effect</li><li>• Atomic Models and Light Emission</li><li>• Franck –Hertz Experiment</li><li>• Spontaneous Emission and Level Lifetime</li><li>• Fluorescence</li></ul>

	<ul style="list-style-type: none"> <li>• Semiconductor Devices</li> <li>• Light-Emitting Diodes</li> </ul>
8-15	<p>Lasing Processes</p> <ul style="list-style-type: none"> <li>• Characteristics of Coherent and incoherent Light</li> <li>• Boltzmann Distribution and Thermal Equilibrium</li> <li>• Creating an Inversion</li> <li>• Stimulated Emission</li> <li>• Rate Equations and Criteria for Lasing</li> <li>• Laser Gain</li> <li>• Linewidth</li> <li>• Thresholds for Lasing</li> <li>• Calculating Threshold Gain</li> <li>• Selective Pumping</li> <li>• Three- and Four-Level Lasers</li> <li>• CW Lasing Action</li> <li>• Thermal Population Effects</li> </ul>
16- 18	<p>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.</p>
19-25	<p>Cavity Optics</p> <ul style="list-style-type: none"> <li>• Requirements for a Resonator</li> <li>• Gain and Loss in a Cavity</li> <li>• Resonator as an Interferometer</li> <li>• Longitudinal Modes</li> <li>• Wavelength Selection in Multiline Lasers</li> <li>• Single-Frequency Operation</li> <li>• Characterization of a Resonator</li> <li>• Gaussian Beam</li> <li>• Resonator Stability</li> <li>• Common Cavity Configurations</li> <li>• Spatial Energy Distributions: Transverse Modes</li> </ul>



	<ul style="list-style-type: none"><li>• Limiting Modes</li><li>• Resonator Alignment: A Practical Approach</li></ul>
26-30	<p>Fast-Pulse Production</p> <ul style="list-style-type: none"><li>• Concept of Q-Switching</li><li>• Intracavity Switches</li><li>• Energy Storage in Laser Media</li><li>• Pulse Power and Energy</li><li>• Electro-optic Modulators</li><li>• Acousto-optic Modulators</li><li>• Cavity Dumping</li><li>• Mode locking</li><li>• Mode locking in the Frequency Domain</li></ul>



**Subject : Electromagnetic Fields**

**Units: 4**

**Weekly Hours : Theoretical : 2**

**Experimental: –**

<b>week</b>	<b>Syllabus</b>
1-4	Vector analysis <ul style="list-style-type: none"><li>• Scalar and vector</li><li>• Vector algebra</li><li>• The Cartesian coordinate system</li><li>• Vector components and unit vector</li><li>• Vector field</li><li>• The Dot product</li><li>• The cross product</li><li>• Polar coordinate system</li></ul>
5-15	Electric Field <ul style="list-style-type: none"><li>• Coulomb's law</li><li>• The experimental law of coulomb</li><li>• Electric field intensity</li><li>• Field of line charge</li><li>• Field of a sheet charge</li><li>• Stream lines and sketches of field</li><li>• Electric flux density</li><li>• Gauss's law</li></ul>



	<ul style="list-style-type: none"><li>• Integral form of Gauss's law</li><li>• Differential form of Gauss's law</li><li>• Divergence theorem</li><li>• Stock's theorem</li><li>• Maxwell's first equation</li><li>• The vector operator <math>\nabla</math> and the divergence theorem</li></ul>
16-30	<ul style="list-style-type: none"><li>• The Line integral</li><li>• Potential and potential difference</li><li>• Potential field of a point charge</li><li>• Potential field of a system of charges: conservative property</li><li>• Potential gradient</li><li>• The dipole</li><li>• Energy density in the electrostatic field</li><li>• Poisson's and Laplace's equations</li><li>• The magnetic field.</li><li>• Steady magnetic field</li><li>• Biot – Savart law</li><li>• Ampere's Circuital law</li><li>• Curl</li><li>• Stocke's theorem</li><li>• Magnetic flux and magnetic flux density</li><li>• Scalar and vector magnetic potential.</li><li>• Other Maxwell's equations</li></ul>

**Subject : Visual Basic**

**Units: 4**

**Weekly Hours : Theoretical : 1**

**Experimental: 2**

<b>week</b>	<b>Syllabus</b>
1	<ul style="list-style-type: none"><li>• Introduction to visual basic: Integrated development Environment.</li></ul>
2-3	<ul style="list-style-type: none"><li>• Basic definition: Application, Code, Controls, Declaration, Procedure, Object, Property</li><li>• Event procedure, method, form, Class, modules.</li></ul>
4-8	<ul style="list-style-type: none"><li>• Common properties: name, position, size. Font, container font, color, other properties.</li><li>• common method: move, et focus, z order, refresh</li><li>• examples with command button, text and label</li><li>• common events mouse events, keyboard events and Examples and application</li><li>• code</li></ul>
9-19	<ul style="list-style-type: none"><li>• Variables</li><li>• a) Use variables for input box</li><li>• b) Use variables for msg box</li><li>• c) Data type Constants</li><li>• Basic and advance mathematical parameters</li><li>• Mathematical functions</li><li>• Convert the mathematical equations to code</li><li>• Examples</li></ul>





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	<ul style="list-style-type: none"><li>• Arrays and their declaration with application</li><li>• if then procedure with application on checkbox and option Buttons</li></ul>
20-30	<ul style="list-style-type: none"><li>• procedure of for~ next, do~ loop, do~ while, do~ until, While ~ wend</li><li>• timer tools and examples</li><li>• subroutine, functions, sub and their calling</li><li>• V-scrollbar and H-scrollbar with application</li><li>• Examples of scrollbar and sub, subroutine, function</li><li>• drawing in visual basic, pset, line, circle, print, Cls, Scale</li><li>• line chart, bar chart and Examples</li></ul>