**Graphical user interface, application

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| **Course Code** | **12PH209** | **Duration** | **3hrs** |
| **Course Name** | **THIN FILMS TECHNOLOGY FOR ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Insulators cannot be deposited by \_\_\_\_\_\_\_\_\_\_\_ sputtering. | | CO1 | U | | 1 |
| 2. | Mention a gauge which works on the principle of Boyle’s law. | | CO1 | R | | 1 |
| 3. | In MBE the source material is sublimated from \_\_\_\_\_\_\_\_\_\_\_ cells. | | CO1 | R | | 1 |
| 4. | Mention a gauge which works on the principle of Boyle’s law. | | CO1 | R | | 1 |
| 5. | Mention the Debye Scherrer formula to determine the crystallite size. | | CO1 | R | | 1 |
| 6. | \_\_\_\_\_\_\_\_\_\_\_ forces causes physisorption. | | CO1 | R | | 1 |
| 7. | In epitaxial growth \_\_\_\_\_\_\_\_\_\_\_ is a measure of structural compatibility between different materials. | | CO1 | U | | 1 |
| 8. | Majority carrier type, concentration and mobility can be determined by \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 9. | The type of adsorption due to the formation of chemical bond is called \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 10. | NEMS is the acronym for \_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Define thin film. | | CO1 | | U | 3 |
| 12. | Write short notes on diffusion pump. | | CO1 | | U | 3 |
| 13. | Define epitaxy. Differentiate homo and hetero epitaxy. | | CO1 | | U | 3 |
| 14. | What are the main reasons for loss of film adhesion? | | CO1 | | U | 3 |
| 15. | Differentiate hard and soft magnetic materials. | | CO1 | | U | 3 |
| 16. | Differentiate MEMS and NEMS. | | CO1 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | With a neat sketch explain in detail the construction and working of piraniguage. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 18. |  | Explain magnetron sputtering method with necessary diagram. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 19. |  | With suitable diagram explain the construction and working of molecular beam epitaxy. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 20. |  | Explain the various steps involved in the growth of thin film. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 21. |  | Define lattice mismatch. With adequate diagram explain the different types of lattice mismatch in detail. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 22. |  | Describe how the structure of a material and the particle size are determined by X- ray diffraction studies. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 23. |  | Explain in detail the construction and working of UV-Visible spectrophotometer. | CO1 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Explain the steps in fabrication of thin film transistors. Mention the various types of transistors. | CO1 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | To demonstrate and execute the process of thin film for various applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 119 |  |  |  |  | 124 |
| CO2 |  |  |  |  |  |  |  |
| CO3 |  |  |  |  |  |  |  |
| CO4 |  |  |  |  |  |  |  |
| CO5 |  |  |  |  |  |  |  |
| CO6 |  |  |  |  |  |  |  |
|  | | | | | | | **124** |

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| **Course Code** | **14PH2006/17PH2001** | **Duration** | **3hrs** |
| **Course Name** | **MECHANICS AND PROPERTIES OF MATTER** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Derive an expression for Newton’s laws from Kepler’s laws. | CO1 | R | 10 |
|  | b. | Demonstrate the potential and field intensity due to a solid ring at a point inside the sphere and outside the sphere. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Give the statement for universal law of gravitation and derive the theory of relativity. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | How the range of projectile on an inclined plane is calculated? | CO1 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Draw diagrams for collisions in one dimensional and two dimensional approach and derive its expressions. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain Hooke’s law with stress-strain diagram. | CO3 | C | 15 |
|  | b. | A cord has original length of 100 cm is pulled by a force. The change in length of the cord is 2 mm. Determine the strain. | CO4 | E | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | With a schematic diagram of torsional pendulum, derive an expression for couple per unit twist in a cylindrical wire. | CO5 | U | 8 |
|  | b. | Obtain an expression for work done in twisting a wire. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 7. |  | Explain the bending of beams experiment to determine the Young’s modulus of a rectangular bar using non-uniform bending. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the theory and experiment to determine the Young’s modulus of a cylindrical scale by cantilever depression method. | CO5 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Draw the diagram of surface tension experiment and explain its theory of expression. | CO6 | E | 10 |
|  | b. | State Bernoulli’s theorem and explain one of its important applications. | CO6 | C | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Gain knowledge and understand concepts related to mechanics and properties of matter. |
| CO2 | Understand earth’s gravitation, elasticity of materials, and mechanics of fluids. |
| CO3 | Solve problems related to mechanics and properties of matter. |
| CO4 | Differentiate between types of modulus and find its applications. |
| CO5 | Apply the knowledge of properties of matter in solving problems associated with mechanics. |
| CO6 | Appreciate the role of inertia in determining the properties of matter. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 |  | 10 |  | 20 |  | 40 |
| CO2 |  | 20 | 20 |  |  |  | 40 |
| CO3 |  |  |  |  |  | 15 | 15 |
| CO4 |  |  |  | 20 | 17 |  | 37 |
| CO5 |  | 8 | 20 |  |  |  | 28 |
| CO6 |  |  |  |  | 10 | 10 | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **14PH2007/17PH2003** | **Duration** | **3hrs** |
| **Course Name** | **HEAT AND THERMODYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define Van der Waals equation of state. | CO1 | R | 5 |
|  | b. | Demonstrate the porous-plug experiment and debate the results. | CO1 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss critical temperature of a gas. | CO1 | R | 5 |
|  | b. | State the principle of regenerative cooling and illustrate the Linde’s process for the liquefaction of air with necessary diagram. | CO1 | U | 15 |
|  |  |  |  |  |  |
| 3. | a. | Outline first law of thermodynamics. How this law leads to the concept of internal energy? | CO2 | An | 5 |
|  | b. | From the first law of thermodynamics prove that Cp- Cv= R. | CO2 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Clarify Carnot’s theorem. | CO2 | U | 5 |
|  | b. | Deduce an expression for the efficiency of a Carnot’s engine. | CO2 | A | 15 |
|  |  |  |  |  |  |
| 5. | a. | Illustrate the two versions of second law of thermodynamics. | CO5 | U | 5 |
|  | b. | State Carnot’s theorem and show that it is a necessary consequence of second law of thermodynamics. | CO5 | A | 15 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe the reversibility of Carnot’s cycle. | CO3 | R | 5 |
|  | b. | Demonstrate the principle of working and coefficient of performance of refrigerator. | CO3 | A | 15 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the concept of entropy. | CO4 | U | 5 |
|  | b. | Entropy remains constant in reversible process but increases in irreversible process – Justify. | CO4 | A | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Brief about the entropy of ideal gas. | CO5 | U | 5 |
|  | b. | Report the importance of T-S diagram. Derive an expression for efficiency of a reversible Carnot’s engine with the help of T-S diagram. | CO5 | A | 15 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Develop any three Maxwell’s thermodynamical relations from the general expression of Maxwell. | CO6 | U | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Appreciate the knowledge on thermodynamics in day-to-day life. |
| CO2 | Gain the capability to evaluate thermo physical properties of substances. |
| CO3 | Evaluate different thermodynamic systems. |
| CO4 | Apply conservation of energy for the control mass and control volume processes. |
| CO5 | Understand the second law of thermodynamics. |
| CO6 | Understand Irreversibility's. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 30 |  |  |  |  | 40 |
| CO2 |  | 20 | 15 | 5 |  |  | 40 |
| CO3 | 5 |  | 15 |  |  |  | 20 |
| CO4 |  | 15 | 5 |  |  |  | 20 |
| CO5 |  | 10 | 30 |  |  |  | 40 |
| CO6 |  | 20 |  |  |  |  | 20 |
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| **Course Code** | **14PH2019/17PH2013** | **Duration** | **3hrs** |
| **Course Name** | **CONDENSED MATTER PHYSICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe lattice vibrations. | CO1 | Understand | 5 |
|  | b. | Write a short note on ‘electrical conductivity’. Obtain an expression for the electrical conductivity of a conductor. | CO1 | Understand | 15 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe low resistivity conducting materials with examples. | CO2 | Understand | 5 |
|  | b. | Derive an equation for the carrier concentration in an n-type intrinsic semiconductor and discuss its Fermi level. | CO2 | Understand | 15 |
|  |  |  |  |  |  |
| 3. | a. | Compare and contrast direct and indirect band gap semiconductors. | CO2 | Understand | 5 |
|  | b. | With a neat sketch explain the experimental technique used to find Hall coefficient. | CO2 | Understand | 15 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Distinguish type I and type II super conductors. | CO3 | Understand | 10 |
|  | b. | Explain BCS theory of super conductivity. | CO3 | Understand | 10 |
|  |  |  |  |  |  |
| 5. | a. | Describe ferroelectric curie temperature in brief. | CO5 | Understand | 5 |
|  | b. | Explain electronic or induced polarization in detail based on the application of an electric field and discus its applications. | CO4 | Understand | 15 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss in detail color centres using KCL as example. | CO4 | Understand | 10 |
|  | b. | Summarize the properties and applications of superconductors. | CO3 | Understand | 10 |
|  |  |  |  |  |  |
| 7. |  | Derive an expression to show the relation between the molecular polarizability and dielectric constant by deducing the Clausius-Mossotti relation. | CO4 | Understand | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain domain theory of ferromagnetism in detail with its experimental verification and adequate diagrams. | CO6 | Understand | 20 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain ferromagnetic and antiferro magnetic materials in detail and differentiate its properties in magnetic materials. | CO6 | Understand | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the band theory of solids. |
| CO2 | Interpret the different types of semiconductors. |
| CO3 | Define and explain the properties of superconductors. |
| CO4 | Gain knowledge on dielectrics. |
| CO5 | Appreciate the properties of ferroelectrics. |
| CO6 | Explain the different types of magnetic materials. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 20 | - | - | - | - | 20 |
| CO2 | - | 40 | - | - | - | - | 40 |
| CO3 | - | 30 | - | - | - | - | 30 |
| CO4 | - | 45 | - | - | - | - | 45 |
| CO5 | - | 5 | - | - | - | - | 5 |
| CO6 | - | 40 | - | - | - | - | 40 |
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| **Course Code** | **17PH3005** | **Duration** | **3hrs** |
| **Course Name** | **QUANTUM MECHANICS-I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Give the five postulates of quantum mechanics and discuss them in detail. | CO1 | R | 10 |
|  | b. | Obtain the proof for the following theorems,   1. Hermitian operators have real eigen values. 2. Two eigen functions of Hermitian operators, belonging to different eigen values, are orthogonal. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss in detail how the operators and state vectors are represented by Schrodinger. | CO1 | U | 10 |
|  | b. | Give an account on the following,   1. Eigen function and eigen values. 2. Normalization of wave function. 3. Probability current density. | CO2 | R | 10 |
| 3. | a. | Obtain and solve the time independent Schrodinger wave equation for a particle in a box. | CO3 | A | 15 |
|  | b. | An electron is trapped in a potential well of 2 nm length. Calculate the energy required to excite it from ground state to third excited state. | CO3 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Using Schrodinger concept derive the eigen value of the one dimensional linear harmonic oscillator by obtaining and solving its wave equation. | CO3 | A | 15 |
|  | b. | Elucidate the significance of zero point energy with a neat diagram. | CO3 | A | 5 |
| 5. |  | Prove the following,   1. [J2, Jx] = 0 2. [Jz, J+] = (h/2π) J+ 3. [J+, J-] = (h/π) Jz | CO4 | A | 15 |
|  | b. | Give an account on the angular momentum operator in terms of position representation. | CO4 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Obtain the eigen values of,   1. J2and Jz 2. Jxand Jy | CO4 | Apply | 20 |
| 7. |  | The first order perturbation energy correction for a non-degenerate system is just the expectation value of first order perturbation Hamiltonian over the unperturbed state of the system. Discuss | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Use variation method to obtain an upper limit for the energy of the ground state of the helium atom. | CO5 | An | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain in detail the Thomas-Fermi model of atom. | CO6 | An | 10 |
|  | b. | Briefly discuss the Hartree-Fock equation. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Gain an in depth understanding on the central concepts and principles of quantum mechanics: the Schrödinger equation, the wave function and its physical interpretation, stationary and non-stationary states and expectation values. |
| CO2 | Improved mathematical skills necessary to solve differential equations and eigenvalue problems using the operator formalism. |
| CO3 | Quantum mechanical solution of simple systems such as the harmonic oscillator and a particle in a potential well. |
| CO4 | Grasp the concepts of spin and angular momentum, as well as their quantization- and addition rules. |
| CO5 | Student forms a mental picture on the meaning of linear combination of states within quantum mechanics. |
| CO6 | Solutions to perturbation problems and many electron systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  | 20 |
| CO2 | 10 | 10 |  |  |  |  | 20 |
| CO3 |  |  | 40 |  |  |  | 40 |
| CO4 |  | 5 | 35 |  |  |  | 40 |
| CO5 |  |  |  | 40 |  |  | 40 |
| CO6 |  | 10 |  | 10 |  |  | 20 |
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| **Course Code** | **17PH3017** | **Duration** | **3hrs** |
| **Course Name** | **RENEWABLE ENERGY SOURCES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | i) Summarize the different available energy sources.  ii) List the advantages and limitations of renewable energy sources. | CO1 | Understand  Remember | 5  5 |
|  | b. | Illustrate the various conventional energy sources. | CO1 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the construction and working of flat plate collectors with a suitable sketch. | CO2 | Understand | 10 |
|  | b. | Demonstrate the working principle of concentrating collectors. | CO2 | Understand | 10 |
|  |  |  |  |  |  |
| 3. | a. | i) Explain the basic principle of wind energy conversion.  ii) Derive the expression for power developed due to wind. | CO2 | Understand | 5  5 |
|  | b. | Enumerate the different main applications of solar storage. | CO2 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain with a neat sketch the basic components of WECS. | CO3 | Understand | 10 |
|  | b. | i) Discuss in brief the classification of WEC Systems.  ii) Discuss the advantages and disadvantages of the wind energy conversion system. | CO3 | Remember | 5  5 |
|  |  |  |  |  |  |
| 5. | a. | Explain the process of ‘photosynthesis’. What are the conditions, which are necessary for it? | CO4 | Understand | 10 |
|  | b. | Discuss in detail biofuels and types of biofuels. | CO4 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain direct combustion, thermochemical and biochemical conversion of biomass. | CO5 | Understand | 10 |
|  | b. | Discuss in brief wet processes in biomass conversion process. | CO5 | Remember | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write notes on: (i) Solar pumping (ii) Solar water heating. | CO2 | Remember | 10 |
|  | b. | Write notes on: (i) Solar Furnace (ii) Solar cooking. | CO2 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss the methods of solar energy storage. | CO2 | Remember | 10 |
|  | b. | Discuss in brief dry processes in biomass conversion process. | CO2 | Remember | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | What is the basic principle of ocean thermal energy conversion (OTEC). Describe the ‘hybrid cycle’ variation of the standard OTEC open cycle system. | CO6 | Understand | 10 |
|  | b. | Describe the ‘open cycle’ and ‘closed cycle’ OTEC system. | CO6 | Understand | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | List and generally explain the main sources of energy and their primary applications in the world. |
| CO2 | Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment. |
| CO3 | Discuss remedies/potential solutions to the supply and environmental issues associated with |
| CO4 | Understand fossil fuels and other energy resources. |
| CO5 | List and describe the primary renewable energy resources and technologies. |
| CO6 | Describe/illustrate basic electrical concepts and system components. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 15 | - | - | - | - | 20 |
| CO2 | 50 | 30 | - | - | - | - | 80 |
| CO3 | 10 | 10 | - | - | - | - | 20 |
| CO4 | 10 | 10 | - | - | - | - | 20 |
| CO5 | 10 | 10 | - | - | - | - | 20 |
| CO6 | - | 20 | - | - | - | - | 20 |
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| **Course Code** | **17PH3021** | **Duration** | **3hrs** |
| **Course Name** | **MATERIAL CHARACTERIZATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Describe bright and dark field microscopy in detail with its principle and working. Also mention its applications in brief. | CO1 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Illustrate the powder X-ray diffraction method in details and explain its principle behind in analyzing the structure of the given material. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 3. |  | Explain the principle and working of a Raman spectrophotometer in determining the vibrational, rotational states in a molecular system | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Illustrate the basic concepts of nuclear magnetic resonance spectroscopy in detail with necessary diagram in analyzing the properties of a given material. | CO5 | A | 20 |
|  |  |  |  |  |  |
| 5. |  | Describe SEM. Explain the principle and working of an SEM with adequate block diagram in analyzing the surface morphology of the samples under investigation. | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Differentiate various photoluminescence processes with examples. Also discuss the light matter interaction in brief. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 7. |  | Explain in detail how thermogravimetric analysis (TGA) is being used in analyzing the mass loss of a compound under study. | CO6 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Compare and contrast the principle and working of a liquid and gas chromatography in separating and detecting the chemical components of a given compound. | CO4 | An | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Differentiate two probe and four probe method in detail about the principle and working of the instruments in observing the resistivity measurements of sample under study. | CO2 | E | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify suitable techniques for specific materials characterization. |
| CO2 | Use various instrumentations to scan and test materials for electrical, mechanical and thermal propertyanalysis. |
| CO3 | Analyse the structurual and compositional properties of materials using XRD, SEM, XPS, EDAX and AFM. |
| CO4 | Apply the microscopic and macroscopic property analysis for various materials. |
| CO5 | Analyse the magnetic properties of materials and functions. |
| CO6 | Practice the testing of materials for various thermal property analysis. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 20 |  |  |  |  | 20 |
| CO2 |  |  |  |  | 20 |  | 20 |
| CO3 |  |  | 20 | 20 | 20 |  | 60 |
| CO4 |  |  | 20 | 20 |  |  | 40 |
| CO5 |  |  | 20 |  |  |  | 20 |
| CO6 |  |  |  | 20 |  |  | 20 |
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| **Course Code** | **17PH3022** | **Duration** | **3hrs** |
| **Course Name** | **CRYSTAL GROWTH TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the importance of crystal growth in the field of semiconductor fabrication technology. | CO1 | A | 10 |
|  | b. | What do you mean by crystallization? Classify and explain briefly the methods available for crystal growth. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Give the classical theory of nucleation and discuss the effects of soluble impurities of nucleation. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | Elaborate saturation and super saturation in solution growth technique. | CO2 | A | 5 |
|  | b. | What are the basic requirements for the growth of crystals from solutions? Highlight the conditions for growing crystals by low temperature solution method. | CO2 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain the following.   1. Slow cooling method. 2. Solvent evaporation method. 3. Temperature gradient method. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 5. |  | Elaborate on the different methods of crystal growth and how do you choose the method based on phase diagram in melt growth? | CO3 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Describe the important of versatile flux growth method of obtaining single crystals of oxides. | CO6 | C | 20 |
|  |  |  |  |  |  |
| 7. | a. | Mention the advantages of Zone melting technique and explain the experimental procedure. | CO4 | An | 10 |
|  | b. | Describe the process of pulling technique using Czochralski method with a neat sketch of instrumentation. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain Bridgman technique for growth of good quality single crystals. | CO6 | R | 12 |
|  | b. | Explain Vernueil technique for crystal growth. | CO6 | An | 8 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Outline the classification of various kinds of vapour growth processes. Discuss the PVD and CVD methods with diagram. | CO6 | A | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Students can understand the different techniques used for growing crystals. |
| CO2 | To review physics and chemistry in the context of material science and engineering. |
| CO3 | Understand the broad areas of crystal growth methods. |
| CO4 | Review the melt growth, solution and vapour phase growth of crystals. |
| CO5 | To describe and demonstrate melt growth techniques, Heat and transfer techniques. |
| CO6 | To describe the flux growth methods and Hydrothermal methods of growing crystals. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 10 | 10 |  |  |  | 20 |
| CO2 |  | 15 | 5 | 20 |  |  | 40 |
| CO3 | 20 |  |  |  | 20 |  | 40 |
| CO4 |  |  |  | 10 |  |  | 10 |
| CO5 |  |  | 10 |  |  |  | 10 |
| CO6 | 12 |  | 20 | 8 |  | 20 | 60 |
|  | | | | | | | **180** |

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| **Course Code** | **17PH3024** | **Duration** | **3hrs** |
| **Course Name** | **NANOFLUIDS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain cooling challenges and conventional methods to enhance heat transfer. | CO1 | U | 10 |
|  | b. | Discuss the synergistic effect of static and dynamic mechanisms in nanofluids. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain how thermal stability and chemical compatibility play a role in the synthesis of nanofluids. | CO2 | U | 10 |
|  | b. | Discuss the common methods used for the synthesis of gold nanoparticles. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the importance of magnetic nanoparticles in ferrofluidic with examples. | CO2 | U | 10 |
|  | b. | Discuss the transient hot wire method to measure thermal conductivity of liquids. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain solvothermal synthesis route of nanofluids. | CO2 | U | 10 |
|  | b. | Discuss the synthetic routes used for oxide nanoparticles. | CO3 | R | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the thermal conductivity of oxides in nanofluids. | CO4 | U | 10 |
|  | b. | Discuss the Hamilton Crosser Theory (Al2O3 – Water and Al2O3 – Ethylene Glycol). | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain natural convection. | CO5 | U | 10 |
|  | b. | Discuss the Eulerian-Eulerian approach – Eulerian-Lagrangian approach. | CO5 | R | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the fundamentals of Boiling: Nukiyama curve & nucleate boiling. | CO5 | U | 10 |
|  | b. | Explain the experimental study of pool boiling of water-Al2O3 Nanofluid. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss the milestones in Thermal conductivity measurements. | CO1 | R | 10 |
|  | b. | Discuss milestones in Convection Heat Transfer. | CO1 | R | 10 |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the applications of nanofluids in vehicle cooling, transformer cooling. | CO6 | R | 10 |
|  | b. | Explain how nanofluids can be used in biomedical applications. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundaments of cooling and thermal support. |
| CO2 | Synthesis nanofluids. |
| CO3 | Understand the conduction of heat transfer. |
| CO4 | Analyses the fundamentals of convective heat transfer. |
| CO5 | Know about boiling and various cooling mechanism. |
| CO6 | Find the various industrial application of nanofluids. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 30 | 10 | - | - | - | - | 40 |
| CO2 | 10 | 30 | - | - | - | - | 40 |
| CO3 | 20 | - | - | - | - | - | 20 |
| CO4 | 10 | 10 | - | - | - | - | 20 |
| CO5 | 10 | 30 | - | - | - | - | 40 |
| CO6 | 10 | 10 | - | - | - | - | 20 |
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| **Course Code** | **17PH3034** | **Duration** | **3hrs** |
| **Course Name** | **MOLECULAR QUANTUM MECHANICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Elaborate on the effect of inclusion of successive terms in the atomic Hamiltonian for the helium configuration with necessary diagram. | CO1 | Apply | 10 |
| b. | Give a detailed account on the Condon-Slater rules. | CO2 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | The one electron H2+ ion furnishes many ideas useful for discussing many-electron diatomic molecule. Using the necessary approximate treatments obtain the atomic probability densities for H2+ ground electronic state. | CO2 | Apply | 20 |
|  |  |  |  |  |  |
| 3. | a. | Compare and explain the molecular-orbital (MO) and valence bond (VB) treatments of the H2 ground state molecule. | CO3 | Understand | 10 |
| b. | Obtain the MO and VB wave functions for homonuclear diatomic molecules. | CO3 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | The virial theorem is a relation between the total kinetic energy and the total potential energy of a system in equilibrium. Discuss in detail. | CO4 | Analyze | 10 |
| b. | Illustrate clearly on the various concepts based on chemical bonding. | CO4 | Remember | 10 |
|  |  |  |  |  |  |
| 5. | a. | Give an account on the self-consistent field molecular orbital treatment of polyatomic molecule. | CO4 | Apply | 10 |
| b. | Brief about a basis function. Illustrate the different types of basis functions used in a molecular system. | CO4 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Having obtained the molecular geometry of any system, discuss the following in detail.  Equilibrium geometry (ii) Potential energy surface | CO5 | Understand | 10 |
| b. | Calculation of the zero point energy requires knowing the molecular vibrational frequencies. Henceforth describe the latter in detail. | CO5 | Analyze | 10 |
|  |  |  |  |  |  |
| 7. | a. | How does Thomas –Fermi model support in the development of density functional theory (DFT). Explain. | CO5 | Analyze | 10 |
|  | b. | Mention the three theorems in Thomas Fermi theory and discuss in detail. | CO5 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | How does the local density approximation (LDA) of Hohenberg and Kohn vary from the generalized gradient approximation (GGA). Describe in detail. | CO5 | Analyze | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Give an account on the following,  a. Hardness and Softness.  b. Atoms in Molecules (AIM). | CO6 | Understand | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Gain an understanding on how molecular phenomena can be related to model problems. |
| CO2 | Know the connection between common approximation methods(Born-Oppenheimer approximation, molecular orbitals) and standard chemical frameworks (diatomic molecules). |
| CO3 | Understand the electronic structure of many electron molecules and chemical bonding using various theorems and treatments. |
| CO4 | Understand the ab initio method applied for polyatomic molecules to calculate the geometry and thermodynamic properties. |
| CO5 | Apply the density functional theory in order to understand the behavior and properties of the chemical systems. |
| CO6 | Able to perform simple quantum-chemical calculations applying density functional theory to study various reactivity parameters. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 10 |  |  |  | 10 |
| CO2 | 10 |  | 20 |  |  |  | 30 |
| CO3 |  | 20 |  |  |  |  | 20 |
| CO4 | 10 | 10 | 10 | 10 |  |  | 40 |
| CO5 |  | 20 |  | 40 |  |  | 60 |
| CO6 |  | 20 |  |  |  |  | 20 |
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| **Course Code** | **19PH1003** | **Duration** | **3hrs** |
| **Course Name** | **ENGINEERING PHYSICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | LED is usually made up of materials like \_\_\_\_\_\_\_\_\_\_. | | | CO1 | U | 1 |
| 2. | Intrinsic semiconducting materials have \_\_\_\_\_\_\_\_\_\_.  a. High conductivity b. Low conductivity  c. Small amount of impurity d. Large number of holes | | | CO1 | An | 1 |
| 3. | The transistors are most commonly used for \_\_\_\_\_\_\_\_\_\_.  a. Voltage regulation b. Rectifier c. Switching and amplification  d. Controlling the current | | | CO2 | A | 1 |
| 4. | In the P-channel JFET, the gate terminal is made up of \_\_\_\_\_\_\_\_\_\_.  a. N-type material b. P-type material c. Metal grid  d. Insulating material | | | CO2 | U | 1 |
| 5. | What is the condition to achieve total internal reflection in an optical fibre?   1. Angle of reflection should be equal to the critical angle 2. Angle of incidence should be greater than the critical 3. Angle of incidence should be equal to angle of reflection 4. Angle of reflection should be greater than the critical angle | | | CO3 | U | 1 |
| 6. | The diameter of single mode fibre is \_\_\_\_\_\_\_\_\_  a. Very big b. Two times larger than the multimode  c. Very small d. Equal to the diameter of cladding | | | CO3 | R | 1 |
| 7. | The less frequency sound wave that is not perceptible by humans is \_\_\_\_\_\_\_\_\_\_. | | | CO4 | R | 1 |
| 8. | Ultrasonic waves are different from normal soundwaves in terms of \_\_\_\_\_\_\_\_.  a. Frequency b. Shape of the waveform c. Quality d. Mass | | | CO5 | U | 1 |
| 9. | The amount of current generation in solar cell is depends on the \_\_\_\_\_\_\_\_\_\_\_.  a. Heat energy b. Diode current c. Shunt current  d. Photons that strikes the cell | | | CO6 | An | 1 |
| 10. | The conversion of mechanical power of wind turbine into the electrical power can be accomplished by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.  a. Transformer b. Gearbox c. Generator d. Pitch system | | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Distinguish amorphous and crystalline solids. | | | CO1 | An | 3 |
| 12. | Sketch the structure of MOSFET with its parts. | | | CO2 | U | 3 |
| 13. | Define the principle of optical fibre with necessary diagrams. | | | CO3 | U | 3 |
| 14. | Classify sounds based on frequency and explain them in brief. | | | CO4 | A | 3 |
| 15. | State piezoelectric effect. | | | CO5 | U | 3 |
| 16. | Explain any two renewable energy sources. | | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. | |  | Classify semiconductors and explain each in detail. | CO1 | U | 12 |
|  | |  |  |  |  |  |
| 18. | |  | List out the significance of Zener diode. Discuss the working of zener diode with I-V characteristics. | CO1 | A | 12 |
|  | |  |  |  |  |  |
| 19. | |  | Demonstrate the construction and working of depletion MOSFET. | CO2 | U | 12 |
|  | |  |  |  |  |  |
| 20. | |  | Sketch the basic construction of JFET and explain the working of JFET. | CO2 | U | 12 |
|  | |  |  |  |  |  |
| 21. | |  | Derive the formula for numerical aperture. | CO3 | A | 12 |
|  | |  |  |  |  |  |
| 22. | |  | Categories the optical fibres based on refractive index profile and explain them in detail. | CO3 | U | 12 |
|  | |  |  |  |  |  |
| 23. | |  | Illustrate the magnetostriction method to produce ultrasonic waves. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | |  | Demonstrate the construction and working of solar cells. | CO6 | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Remember the fundamentals of semiconducting materials. |
| CO2 | Understand the principle and operation of semiconductor devices. |
| CO3 | Demonstrate the application of fibre optics in communications. |
| CO4 | Analyze the application of acoustics in construction and acoustic design. |
| CO5 | Ability to explore the application of ultrasonic in various fields. |
| CO6 | Understand about the renewable energy sources and devices. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 13 | 12 | 4 |  |  | 29 |
| CO2 |  | 28 | 1 |  |  |  | 29 |
| CO3 | 1 | 16 | 12 |  |  |  | 29 |
| CO4 | 1 |  | 15 |  |  |  | 16 |
| CO5 |  | 4 |  |  |  |  | 4 |
| CO6 |  | 1 | 15 | 1 |  |  | 17 |
|  | | | | | | | **124** |

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| **Course Code** | **20FS2005** | **Duration** | **3hrs** |
| **Course Name** | **INDIAN CONSTITUTION, FUNDAMENTAL LAWS AND PROCEDURE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | | **Bloom’s Level** | | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | | |
| 1. | a. | Define crime and explain the essential elements of crime with examples. | | CO1 | | U | 10 |
|  | b. | Explain the Constitution of Criminal Courts under the Code of Criminal Procedure. | | CO1 | | U | 10 |
|  |  | **(OR)** | |  | |  |  |
| 2. | a. | Discuss the meaning of cognizable offenses, and compare cognizable and non-cognizable offenses with an example. | | CO1 | | R | 10 |
|  | b. | Define Culpable homicide and explain the situations where culpable homicide will not amount to murder with examples. | | CO2 | | U | 10 |
|  |  |  | |  | |  |  |
| 3. | a. | Explain the types of grievous hurt as described under the Indian Penal Code with examples. | | CO2 | | U | 10 |
|  | b. | Illustrate with an example the offense of kidnapping under the Indian Penal Code. | | CO2 | | U | 10 |
|  |  | **(OR)** | |  | |  |  |
| 4. | a. | Define the following offenses against property with an illustration, and distinguish under the Indian Penal Code:   1. Theft 2. Extortion | | CO2 | | R | 10 |
|  | b. | 'Rape is a violation of women's right with violence'. When does a person commit the offense of rape as per the Indian Penal Code? | | CO2 | | U | 10 |
|  |  |  | |  | |  |  |
| 5. | a. | Outline the different types of evidence under the Indian Evidence Act with examples. | | CO3 | | U | 10 |
|  | b. | Explain the legal provisions concerning Reports of Certain Government Scientific Experts as evidence under the Indian Evidence Act. | | CO3 | | U | 10 |
|  |  | **(OR)** | |  | |  |  |
| 6. | a. | The Indian Evidence Act explains the order of examination of a witness in a court of law. | | CO3 | | U | 10 |
|  | b. | Not all reports of certain Government Scientific Experts are accepted as evidence during a trial, inquiry, etc under the Indian Evidence Act. Brief the legal provisions concerning reports of experts as evidence under this act. | | CO3 | | U | 10 |
|  |  |  | |  | |  |  |
| 7. | a. | Summarize the punishable offenses committed against untouchability and the punishment imposed under the Untouchability Offences Act. | | CO5 | | U | 10 |
|  | b. | A national-level survey carried out by the Food Safety and Standards Authority of India (FSSAI) has found that adulteration, and higher than the permissible level of antibiotic residues in milk remain a problem in the country. Brief the measures are taken by the government to control such food adulteration under the Food Adulteration Act with examples. | | CO5 | | U | 10 |
|  |  | **(OR)** | |  | |  |  |
| 8. | a. | Giving and taking bribes is a social crime, and the latest amendment of the Prevention of Corruption Act has laid down more stringent regulations to curb corruption among public servants. Brief them. | | CO6 | | U | 10 |
|  | b. | Food adulteration in India starts from the field itself where fertilizers and pesticides are overused. Explain the measures taken by the government to control food adulteration under the Food Adulteration Act with examples. | | CO6 | | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | |
| 9. | a. | The Fundamental Duties are dealt with under Part-IV A of the Indian Constitution. Summarize the Fundamental Duties of every Indian citizen listed. | CO4 | | R | | 10 |
|  | b. | The Constitution makers gave the preamble "the place of pride" Explaining the ideals and aspirations in the Constitution for which the country had struggled during the British period. | CO4 | | R | | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand various types of crime laws. |
| CO2 | Understand section laws. |
| CO3 | Understand witness related laws. |
| CO4 | Know the principles and basics of the Indian constitution. |
| CO5 | Recognize social crimes. |
| CO6 | Recognize environmental crimes. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 20 |  |  |  |  | 30 |
| CO2 | 10 | 40 |  |  |  |  | 50 |
| CO3 |  | 40 |  |  |  |  | 40 |
| CO4 | 20 |  |  |  |  |  | 20 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 |  | 20 |  |  |  |  | 20 |
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| **Course Code** | **20FS2006** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC DERMATOGLYPHICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain Foot prints and its collection methods. | CO6 | R &U | 10 |
|  | b. | Explain briefly on Ridge counting and Ridge tracing. | CO3 | U &A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the development of fingerprints from deceased. | CO3 | R &U | 10 |
|  | b. | Explain Ear prints and its forensic significance. | CO6 | R&U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the development of fingerprints from human skin. | CO3 | U | 10 |
|  | b. | Explain the principles and significances of fingerprints. | CO2 | R& U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | What are the physical and chemical methods of developing fingerprints. | CO5 | R&U | 10 |
|  | b. | Explain Lip prints, its forensic significance and the classification of Martin Santos and Suzuki and Tsuchihashi. | CO6 | R&U | 10 |
|  |  |  |  |  |  |
| 5. | a. | What are Poroscopy and Edgeoscopy? Explain its significance in Fingerprint science. | CO2 | U&A | 10 |
|  | b. | Explain the development of blood stained fingerprints. | CO3 | R &U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain briefly about AFIS and FACTS. | CO3 | R &U | 10 |
|  | b. | Explain the technique of developing fingerprints from Latex gloves. | CO3 | U&R | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the class and individual characteristics of fingerprints. | CO1 | U &An | 10 |
|  | b. | Explain the biological basis of fingerprints and formation of ridges. | CO1 | R&U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain Palm prints and its forensic significance. | CO6 | U | 10 |
|  | b. | Explain the history of fingerprints. | CO1 | R | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain briefly on Henry’s Ten digit classification. | CO4 | A&E | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamental principles on which the science of fingerprinting is based. |
| CO2 | Learn the importance of fingerprints. |
| CO3 | Learn the methods of recording fingerprints. |
| CO4 | Summarize the methods of classifying criminal records by fingerprints. |
| CO5 | Understand the ways of physical and chemical techniques of developing fingerprints on crime scene evidence. |
| CO6 | The significance of foot, palm, ear and lip prints. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 15 | 5 |  |  |  |  | 20 |
| CO2 | 5 | 10 | 5 |  |  |  | 20 |
| CO3 | 20 |  |  |  |  |  | 20 |
| CO4 |  |  | 10 |  | 10 |  | 20 |
| CO5 | 5 | 5 |  |  |  |  | 10 |
| CO6 | 15 | 25 |  |  |  |  | 40 |
| 60 45 15 10 | | | | | | | **130** |

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| **Course Code** | **20FS2008** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC SCIENCE AND CRIMINAL JUSTICE SYSTEM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define crime. Explain the types of crime with example. | CO1 | R | 10 |
|  | b. | Define biological and psychological theory of crime. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | What is punishment? Explain the types of criminal punishment in detail. | CO3 | A | 10 |
|  | b. | Explain Classical theory and routine activities theory of crime. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | What is a scene of crime? What are the basic precautions to be followed at the crime scene? | CO2 | E | 10 |
|  | b. | Define saliva and importance of collecting saliva from a crime scene. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the crime scene procedure in detail. | CO2 | U | 10 |
|  | b. | Give a detailed description about chain of custody. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Describe the structure of hierarchy of courts in India with a flowchart in detail. | CO4 | R | 10 |
|  | b. | List down the differences between Civil and Criminal justice system with example. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the functions, importance and history of Lok Ayukta in detail. | CO4 | E | 10 |
|  | b. | Write a brief note on definition of Human Rights. Explain the substantive Rights. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | What is criminal justice system? Explain the components of criminal justice system in detail. | CO5 | U | 10 |
|  | b. | Explain the types of policing styles and principles of policing. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | What are the ten principles of community policing? | CO5 | R | 10 |
|  | b. | How to write a report of crime scene? Prepare a report. | CO6 | C | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write a note on CrPC section 91,92 and 93. | CO4 | R | 10 |
|  | b. | Explain the crime scene management in bride burning case with a case study. | CO2 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the development of forensic science. |
| CO2 | Understand the types, protection of scene of crime and preservation of scene of crime. |
| CO3 | Understand the theories of causation of crime and forms of punishment. |
| CO4 | Understand the importance of criminal procedure code and Indian evidence act. |
| CO5 | Know the operation of criminal justice systems and related procedures. |
| CO6 | Understand about report formats of crime scene and laboratory findings. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  |  |
| CO2 | 10 | 10 | 20 |  |  |  |  |
| CO3 |  |  | 10 | 10 | 10 |  |  |
| CO4 | 20 |  | 10 | 10 | 10 |  |  |
| CO5 | 20 | 10 |  |  |  |  |  |
| CO6 |  |  |  |  |  | 10 |  |
|  | | | | | | | **180** |

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| **Course Code** | **20FS2011** | **Duration** | **3hrs** |
| **Course Name** | **QUESTIONED DOCUMENTS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Write a note on preliminary examination of questioned document. | CO1 | A | 10 |
|  | b. | Write a note on basic tools used for questioned document examination. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain how UV-Visible spectroscopy will be useful in questioned document examination. | CO2 | U | 10 |
|  | b. | Explain the working and principle of Electrostatic Detection Apparatus along with its forensic application. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Elaborate class and individual characteristics of handwriting. | CO3 | E | 10 |
|  | b. | Explain the process of obtaining the formal and informal exemplars and mention the merits and demerits of the same. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss alterations in documents. | CO4 | An | 10 |
|  | b. | Elaborate the restoration and decipherment of handwriting from the charred document. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Discuss types of forgeries in detail. | CO5 | R | 10 |
|  | b. | Write a note on:   1. Disguised writing. 2. Anonymous letters. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain Video Spectral Comparator with its forensic applications. | CO2 | U | 10 |
|  | b. | Discuss how to determine the age of the document. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Elaborate types of printers and their forensic aspects. | CO4 | R | 10 |
|  | b. | Describe and compare the types of printing processes with their examples. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the examination of security documents. | CO6 | An | 10 |
|  | b. | Describe how to examine printed document. | CO6 | A | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the security features of currency note Rs. 500. | CO6 | R | 10 |
|  | b. | Explain the security features of currency note Rs. 2000. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Choose the correct method to examine the questioned documents. |
| CO2 | Apply various method to analyze questioned documents. |
| CO3 | Compare the questioned documents with standards. |
| CO4 | Analyze the questioned documents of various types. |
| CO5 | Identify the different types of forgery in the documents. |
| CO6 | Examine the documents that has forgery. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 20 |  |  |  | 20 |
| CO2 | 10 | 20 | 10 |  |  |  | 40 |
| CO3 |  |  |  |  | 20 |  | 20 |
| CO4 | 10 |  | 10 | 10 | 10 |  | 40 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 | 20 |  | 10 | 10 |  |  | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **20FS2014** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC BIOLOGY AND SEROLOGY-I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the composition and functions of blood. | CO1 | R | 10 |
|  | b. | Explain the procedure for the collection and identification of blood evidence at scene of crime. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write a short note on the morphology of spermatozoa. | CO2 | U | 10 |
|  | b. | Explain Sequence polymorphism with diagrams. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Examine the importance and forensic identifications tests of saliva. | CO3 | An | 10 |
|  | b. | Examine the importance and forensic identifications tests of urine. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the forensic significance of sweat and milk. | CO4 | An | 10 |
|  | b. | Write a short note on the bloodstain found as evidence at the crime scene. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Define ABO blood groups and determination of blood groups procedure. | CO5 | R | 10 |
|  | b. | Explain dry blood grouping technique. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss the sexual assault investigations procedure. | CO1 | U | 10 |
|  | b. | Elaborate types of blood stain pattern formation. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | State and explain the distinction between human and non-human blood. | CO3 | R | 10 |
|  | b. | Elaborate the examination procedure to differentiate for human and non-human blood. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the age estimation of bloodstains evidences. | CO6 | An | 10 |
|  | b. | Discuss the procedure of blood typing of dried blood stains. | CO6 | A | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss in detail how bloodstain pattern analysis helps in the crime scene reconstruction. | CO6 | R | 10 |
|  | b. | Explain the effect of angle of impact on bloodstains formation. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand importance of blood fluids in forensic science. |
| CO2 | Understand the significance of forensic semen. |
| CO3 | Understand the importance of other body fluids in forensic science. |
| CO4 | Analyze genetic markers and fluid stain patterns. |
| CO5 | Document crime scene. |
| CO6 | Document crime scene. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 20 | 10 |  |  |  | 40 |
| CO2 | 10 | 10 |  |  |  |  | 20 |
| CO3 | 10 |  | 20 | 10 |  |  | 40 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 | 20 |  | 10 | 10 |  |  | 40 |
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| **Course Code** | **20FS2016** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC BALLISTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Sketch the firearm and explain the function of each parts of a firearm in detail. | CO1 | A | 15 |
|  | b. | Distinguish shot gun and rifle. | CO1 | An | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe ballistics and its types. Summarize the factors affecting the internal ballistics of a firearm in depth. | CO1 | U | 15 |
|  | b. | Illustrate the ballistic trajectory in an external ballistics. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | Identify the different part of the ammunition and elaborate about each component with neat sketch. | CO2 | U | 15 |
|  | b. | Discuss the primer and priming compounds. | CO2 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Categorize the bullets based on manufacturing and shape. Illustrate them in detail. | CO3 | An | 15 |
|  | b. | Brief about the firing marks on bullet during firing process. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the characteristics of improvised firearms. Give a detailed report on evidence collection, investigation, evaluation and identification of country made firearm. | CO4 | An | 15 |
|  | b. | Clarify about zip guns and pen guns. | CO4 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Appraise the automated method for comparing bullets. | CO4 | An | 15 |
|  | b. | Classify the home made firearms and survey the materials used for its construction. | CO4 | R | 5 |
|  |  |  |  |  |  |
| 7. | a. | Report the formation mechanism, compositions and collection of gunshot residues. | CO5 | A | 15 |
|  | b. | Interpret the positive and negative results from gunshot residues analysis. | CO5 | E | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Illustrate the working mechanism of SEM and discuss the analysis of GSR through SEM images with the necessary diagrams. | CO5 | A | 15 |
|  | b. | EDAX is used in the analysis of GSR- Justify the statement. | CO5 | An | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Define wound ballistics. Explain in detail about rifled and smooth bore firearm injuries. | CO6 | U | 15 |
|  | b. | Distinguish entry and exit wound. | CO6 | An | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the detailed classification of firearms. |
| CO2 | Learn types of ammunition and headstamp markings on ammunitions. |
| CO3 | Classify various kinds of firing marks. |
| CO4 | Know the types of firearm evidences |
| CO5 | Understand the mechanism of formation of gunshot residues. |
| CO6 | Identify the nature of fireman injuries. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 15 | 20 | 5 |  |  | 40 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 |  |  | 5 | 15 |  |  | 20 |
| CO4 | 10 |  |  | 30 |  |  | 40 |
| CO5 |  |  | 30 | 5 | 5 |  | 40 |
| CO6 |  | 15 |  | 5 |  |  | 20 |
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| **Course Code** | **20FS2019** | **Duration** | **3hrs** |
| **Course Name** | **CYBER CRIMES AND CYBER FORENSICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Differentiate the various methods of storing data with suitable examples. | CO1 | U | 10 |
|  | b. | Visualize the types of networks with suitable diagrams. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain the functioning of memory and processors with suitable block diagrams. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Define data breach. Interpret the various phases and their possible impacts of it. | CO3 | R | 10 |
|  | b. | List down five reasons for the commission of computer crimes. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Tabulate the features, operations, and types of viruses and worms. | CO3 | R | 10 |
|  | b. | Analyze the threats that can be caused by the Trojan Horse. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. |  | Examine the effects of hacking and phishing with a suitable explanation. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Determine the necessity of cyber security in the national space. | CO3 | A | 10 |
|  | b. | Write five features of cyber terrorism with an example. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Identify the password-cracking tools that are existing in the Windows and Linux operating systems with an explanation of any five password-cracking techniques. | CO6 | R | 10 |
|  | b. | Illustrate the data forensics process with a suitable explanation. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the various phases involved in seizing and handling of digital evidence. | CO4 | U | 20 |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Discuss the encryption and decryption methods in a detailed manner. | CO6 | U | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the principle of operation of computer hardware and accessories. |
| CO2 | Understand the types of computer crimes. |
| CO3 | Know crimes related to intellectual property rights, computer terrorism and hacking. |
| CO4 | Understand the concept of collecting of magnetic data. |
| CO5 | Know about extraction of information from the hard disk. |
| CO6 | Understand the principle of restoration of deleted files, encryption and decryption methods. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 20 | - | - | - | 40 |
| CO2 | 10 | - | - | 10 | - | - | 20 |
| CO3 | 20 | - | 40 | - | - | - | 60 |
| CO4 | - | 20 | - | - | - | - | 20 |
| CO5 | - | - | 10 | - | - | - | 10 |
| CO6 | 10 | 20 | - | - | - | - | 30 |
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| **Course Code** | **20FS2021** | **Duration** | **3hrs** |
| **Course Name** | **CRIME SCENE INVESTIGATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define the following terms:   1. Crime. 2. Crime scene. 3. Crime scene management. 4. Mens rea. 5. Actus reus. | CO1 | Remember | 10 |
|  | b. | Describe the role of different agencies involved in crime scene management. | CO1 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Recall the various methods of documentation. | CO2 | Remember | 10 |
|  | b. | Describe the Locard’s exchange principle with examples. | CO2 | Remember | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the different search methods used in crime scene investigation. | CO3 | Apply | 10 |
|  | b. | Explain the different sketching methods for outdoor crime scene. | CO3 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain different collection and packaging methods used for the biological evidences. | CO4 | Analyze | 10 |
|  | b. | Classify different methods of collection for the physical evidence. | CO4 | Analyze | 10 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between crime scene investigation and crime scene reconstruction. | CO5 | Analyze | 10 |
|  | b. | Explain how you will reconstruct the arson crime scene. | CO5 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the collection, packaging and preservation methods for the following evidences:   1. Tyreprints 2. Lip prints 3. Bitemarks 4. Foot prints | CO4 | Apply | 10 |
|  | b. | Explain the classification of evidences. | CO4 | Remember | 10 |
|  |  |  |  |  |  |
| 7. | a. | Discuss the role of medico legal experts. | CO1 | Understand | 10 |
|  | b. | Describe different types of crime scenes. | CO1 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss collection and preservation method for blood, urine, semen and saliva samples | CO4 | Understand | 10 |
|  | b. | Explain the collection preservation methods for firearm evidences. | CO4 | Analyze | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Explain the steps of crime scene reconstruction in detail. | CO6 | Analyze | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the reasons for committing crime and types of crime scenes. |
| CO2 | Understand the objectives of documentation and evidence classification. |
| CO3 | Know the methods relevant to crime scene documentation. |
| CO4 | Understand the methodology of collecting, packaging and preservation of evidences. |
| CO5 | Understand the concepts of crime scene reconstruction. |
| CO6 | Unow about stages of crime scene reconstruction. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 20 | 20 |  |  |  |  | 40 |
| CO2 | 20 |  |  |  |  |  | 20 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 | 10 | 10 | 10 | 30 |  |  | 60 |
| CO5 |  |  | 10 | 10 |  |  | 20 |
| CO6 |  |  |  | 20 |  |  | 20 |
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| **Course Code** | **20FS2022** | **Duration** | **3hrs** |
| **Course Name** | **DNA TYPING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Write a note on salting out DNA extraction method. | CO1 | R | 10 |
|  | b. | Write a note on proteinase method of DNA extraction. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write a note on technique of Polymerase Chain Reaction with diagram. | CO2 | U | 10 |
|  | b. | Explain Sequence polymorphism with diagrams. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Compare STRs and VNTRs. | CO3 | An | 10 |
|  | b. | Explain the Restriction Fragment Length Polymorphism technique in detail with diagram. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write a note on Paternity Testing. | CO4 | An | 10 |
|  | b. | Write a case study relating to missing bodies and their identification. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write a note on quantitative PCR. | CO5 | R | 10 |
|  | b. | Explain chain termination method of mitochondrial DNA sequencing. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain FTA-based DNA extraction technique. | CO1 | U | 10 |
|  | b. | Give the principle of DNA extraction process with diagram. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a note on role of fluorescent dyes in STR Typing. | CO3 | R | 10 |
|  | b. | Explain Touch DNA with case study. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the role of DNA in identifying unrecognizable bodies. | CO6 | An | 10 |
|  | b. | Write case studies on role of DNA in identifying unrecognizable bodies. | CO6 | A | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain Hardy-Weinberg Law. | CO6 | R | 10 |
|  | b. | What are the factors determining allele frequency? | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the basic principle of DNA analysis |
| CO2 | Apply the forensic significance of DNA typing |
| CO3 | Understand the importance of short tandem repeats and restriction fragment length polymorphism in DNA technique |
| CO4 | Comprehend the principles of parentage testing |
| CO5 | Write a detailed report on DNA typing |
| CO6 | Analyze the probability determination in a population database |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 20 | 10 |  |  |  | 40 |
| CO2 | 10 | 10 |  |  |  |  | 20 |
| CO3 | 10 |  | 20 | 10 |  |  | 40 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 | 20 |  | 10 | 10 |  |  | 40 |
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| **Course Code** | **20FS2024** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC ANTHROPOLOGY AND ODONTOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | |
| 1. | | a. | Explain Forensic Anthropology and its significance. | CO1 | U | 10 |
|  | | b. | Explain the human skeletal system and types of skeletal bones. | CO1 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 2. | | a. | Explain Intramembranous ossification. | CO2 | U | 10 |
|  | | b. | Explain the anatomy of the Pelvic girdle. | CO2 | U | 10 |
|  | |  |  |  |  |  |
| 3. | | a. | Explain the chemistry of bone. | CO3 | U | 10 |
|  | | b. | Explain race determination from skull bone. | CO3 | An | 10 |
|  | |  | **(OR)** |  |  |  |
| 4. | | a. | Explain the process of facial reconstruction. | CO4 | U | 10 |
|  | | b. | Explain superimposition and its types. | CO4 | U | 10 |
|  | |  |  |  |  |  |
| 5. | | a. | Explain forensic odontology and the role of forensic odontologists. | CO5 | U | 10 |
|  | | b. | Explain Gustafson's method for determining age from teeth. | CO5 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 6. | | a. | Explain the height determination method from skeletal remains. | CO3 | U | 10 |
|  | | b. | Explain the division of skeletal bones. | CO1 | U | 10 |
|  | |  |  |  |  |  |
| 7. | | a. | Explain the anatomy of the skull. | CO2 | U | 10 |
|  | | b. | Explain facial reconstruction and its types. | CO4 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 8. | | a. | Explain the determination of sex from the skeletal bone. | CO6 | U | 10 |
|  | | b. | How will you determine the age from human remains? | CO6 | R | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | |
| 9. | | a. | Distinguish male and female skull bone and pelvic girdle. | CO6 | An | 10 |
|  | | b. | Explain the forensic significance of bones. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the importance of skeletal system. |
| CO2 | Understand the anatomy of different bones. |
| CO3 | Understand the chemistry of bones and biological profiling. |
| CO4 | Know the facial anatomy of humans and facial superimposition. |
| CO5 | Know about forensic odontology and recovery of forensic evidences from graves. |
| CO6 | Understand about skeletal variation. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 30 |  |  |  |  | 30 |
| CO2 |  | 30 |  |  |  |  | 30 |
| CO3 |  | 20 |  | 10 |  |  | 30 |
| CO4 |  | 30 |  |  |  |  | 30 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 | 10 | 20 |  | 10 |  |  | 40 |
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| **Course Code** | **20FS2025** | **Duration** | **3hrs** |
| **Course Name** | **ACCIDENT INVESTIGATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe motor vehicular accidents?  What are the sources of forensic information in accident investigation cases? | CO1 | U | 10 |
|  | b. | In motor vehicular accidents we usually come across skid marks. Elaborate the skid marks with the forensic significance. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | In motor vehicular accidents we usually come across Scuff marks. Provide detailed information on scuff marks and significance. | CO2 | U | 10 |
|  | b. | Describe airbag and the purpose of it. Elaborate the stages/mechanism of airbag deployment. Why do airbags cause serious injuries? | CO2 | U | 10 |
| 3. | a. | 1. A police report stated that a car had left 150-foot skid marks on a tar road, but the report did not state the weather.  * Estimate how fast the car was probably traveling if the road had been wet. * Estimate the speed if the road had been dry.   *(For a dry tar road, f is usually about 1.0; For a wet tar road, f is about 0.5)*   1. The coefficient of friction for a dry concrete road is about 0.8 and for a wet concrete road about 0.4. If a car had been traveling at 50 mph before it skidded, estimate the lengths of skid marks it would have left on each type of road (tar). | CO2 | A | 10 |
|  | b. | Explain the Post-crash and Pre-crash movement. Also, considering it as an inelastic collision, derive the formula of post-crash velocity. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | With diagram elaborate the following terms:   1. Aspect ratio. 2. Load Index. 3. Speed ratings. 4. Middle ordinate. 5. Inelastic collision. | CO2 | R | 10 |
|  | b. | 1. An accident reconstructionist took measurements from yaw marks left at a scene. Using a 43-foot length chord, she determined that the middle ordinate measured approximately 4 feet. The drag factor for the road surface was determined to be 0.8. Determine the radius of the curved yaw mark to the nearest tenth of the foot. Determine the minimum speed that the car was going when the skid occurred to the nearest tenth. 2. Determine the minimum speed of a car at the point the brakes are immediately applied to avoid collision based upon a yaw mark chord measuring 5 feet. The drag factor of the road surface is 1.2. | CO2 | A | 10 |
| 5. | a. | Put forward a detailed discussion on railway injuries along with the medicolegal aspects. | CO4 | U | 10 |
|  | b. | Elaborate a case study on accident investigation in detail  mentioning all the facts and investigation. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Elaborate aircraft injuries along with the medicolegal aspects. | CO4 | An | 10 |
|  | b. | Elaborate a case study on hit and run case investigation in detail mentioning all the facts and investigation. | CO5 | An | 10 |
| 7. | a. | Mention and elaborate the types of injuries caused by road accident. | CO4 | U | 10 |
|  | b. | Discuss on Gauging driver’s reaction and occupant’s kinematics. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Put forward a case study on aircraft crash injury analysis. | CO6 | An | 10 |
|  | b. | Considering railway accidents investigation discuss a case study on railway accident. | CO2 | An | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Expand the term tachograph. Mention the significance of tachograph and the principles of chart analysis. What are all the recent advances that is replacing or got the potential to replace the current tachograph mechanism? | CO6 | U | 20 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Realize the background of vehicle accidents. | | | | | | | |
| CO2 | Analyze motor accidents. | | | | | | | |
| CO3 | Assess the post-crash movement. | | | | | | | |
| CO4 | Do systematic analysis of injuries in accidents. | | | | | | | |
| CO5 | Perform the tachographic data analysis. | | | | | | | |
| CO6 | Analyse the falsification and diagnostic signals. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | |  | 10 |  | 10 |  |  | 20 |
| CO2 | | 10 | 30 | 20 | 10 |  |  | 70 |
| CO3 | |  | 20 |  |  |  |  | 20 |
| CO4 | |  | 20 |  | 10 |  |  | 30 |
| CO5 | |  |  |  | 10 |  |  | 10 |
| CO6 | |  | 20 |  | 10 |  |  | 30 |
|  | | | | | | | | **180** |

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| **Course Code** | **20FS2028** | **Duration** | **3hrs** |
| **Course Name** | **FOUNDATION COURSE ON COMPUTER FUNDAMENTALS AND OFFICE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the features of Microsoft Excel. | CO1 | U | 10 |
|  | b. | Illustrate the uses of Microsoft Power-point. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Define internet and list the benefits of using internet. | CO2 | R | 10 |
|  | b. | Illustrate the different types of OSI models. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain switch case conditional statement with an example. | CO3 | U | 10 |
|  | b. | Differentiate break and continue statement. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain two-dimensional array with an example. | CO4 | U | 10 |
|  | b. | Explain any five string functions. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain structures in C programming. | CO5 | U | 10 |
|  | b. | Explain the concept of union in C programming. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain about pointers. | CO6 | U | 10 |
|  | b. | Summarize about dynamic memory allocation. | CO6 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the concept of recursion. | CO3 | U | 10 |
|  | b. | Explain the different data types in C programming. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write a C program using for loop. | CO2 | A | 10 |
|  | b. | List and explain the different types of operators in C. | CO2 | R | 10 |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | List and explain the types of networks. | CO2 | R | 10 |
|  | b. | Construct a C program using gets( ) and puts( ) function. | CO3 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze the fundamentals of MS office. |
| CO2 | Utilize the internet. |
| CO3 | Understand the fundamentals of C programming. |
| CO4 | Know the basic concepts of arrays and functions in C. |
| CO5 | Apply the concept of structures in C programming. |
| CO6 | Understand the concept of pointers. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 20 | - | - | - | - | 20 |
| CO2 | 30 | 20 | 10 | - | - | - | 60 |
| CO3 | - | 20 | 20 | - | - | - | 40 |
| CO4 | - | 20 | - | - | - | - | 20 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | 20 | - | - | - | - | 20 |
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| **Course Code** | **20FS3001** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC SCIENCE AND CRIMINAL JUSTICE SYSTEM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define Forensic science. List all seven Central Forensic Science Laboratories and tell their functions/working. | CO1 | Remember | 10 |
|  | b. | Explain Chain of Custody and Locard’s Principle. | CO1 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe about BPRD, NCRB and CDTS. | CO2 | Understand | 10 |
|  | b. | Define Physical evidences and explain classification of physical evidences. | CO2 | Remember | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the Hierarchy of courts and Power of each court in detail. | CO3 | Understand | 10 |
|  | b. | Explain IPC Sections 302, 304B and 376. | CO3 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe about Probation, Parole and Open Prison in detail. | CO4 | Understand | 10 |
|  | b. | Define Cognizable and Non-cognizable offence with suitable  example. | CO4 | Understand | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain theories of punishment in detail. | CO5 | Remember | 10 |
|  | b. | Explain powers of police to search, seize and arrest. | CO5 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Define crime, criminology, classical theory and Neo-classical theory. | CO6 | Remember | 10 |
|  | b. | Explain Biometric in Personal identification. | CO6 | Understand | 10 |
|  |  |  |  |  |  |
| 7. | a. | Define Sociology and describe sociological causes of crime in  detail. | CO5 | Remember | 10 |
|  | b. | Explain Indian Evidence Act section 45,46, 47 and 57. | CO5 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain Geo forensic and Environmental forensics. | CO6 | Understand | 10 |
|  | b. | Explain Indian Penal Code sections 171 B, 171 E, 463 and 465. | CO5 | Understand | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain admissibility of expert testimony and Modus Operandi. | CO3 | Understand | 10 |
|  | b. | Define crime scene reconstruction and elaborate each steps in crime scene reconstruction. | CO3 | Remember | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the importance of forensic sciences. |
| CO2 | Summarize the organizations in India related to forensic science. |
| CO3 | Understand the importance of collecting physical evidence. |
| CO4 | Know the problems in society and collecting the evidences. |
| CO5 | Understand the importance of criminal justice system. |
| CO6 | Describe the recent advancements in Forensic science. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  |  |
| CO2 | 10 | 10 |  |  |  |  |  |
| CO3 | 10 | 30 |  |  |  |  |  |
| CO4 | 00 | 20 |  |  |  |  |  |
| CO5 | 30 | 20 |  |  |  |  |  |
| CO6 | 10 | 20 |  |  |  |  |  |
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| **Course Code** | **20FS3003** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC BIOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Write a note on *AbrusPrecatorius*. | CO1 | R | 10 |
|  | b. | Explain forensic significance of diatoms. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write presumptive and confirmatory tests of blood stains. | CO2 | A | 10 |
|  | b. | Explain Phenol-chloroform method of DNA extraction. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Write a note on superimposition technique. | CO3 | R | 10 |
|  | b. | Explain the methods of determination of age from teeth. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain fiber analysis in detail. | CO4 | U | 10 |
|  | b. | Discuss the determination of PMI from entomological evidences. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Discuss in details methods adopted to analyze hair evidence. | CO5 | R | 10 |
|  | b. | Discuss the determination of age from fusion of sutures. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the role of DNA in identifying unrecognizable bodies. | CO5 | U | 10 |
|  | b. | Write presumptive and confirmatory tests of semen stains. | CO5 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a note on the common arthropods and entomological succession found on the dead body. | CO3 | A | 10 |
|  | b. | Write a note on diatoms and their significance in drowning cases. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write presumptive and confirmatory tests of saliva stains. | CO6 | An | 10 |
|  | b. | Write presumptive and confirmatory tests of urine stains. | CO6 | R | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write a detailed case study on Wildlife Forensics. | CO6 | A | 10 |
|  | b. | Write a note on Anthrax Poisoning and pathogenesis with diagram. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the various forms of biological evidences. |
| CO2 | Know the chemistry of blood and semen. |
| CO3 | Become a forensic anthropologist. |
| CO4 | To perform hair analysis. |
| CO5 | Know the importance of wildlife. |
| CO6 | Identify bacteria and viruses. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  | 20 |
| CO2 | 10 |  | 10 |  |  |  | 20 |
| CO3 | 10 |  | 20 | 10 |  |  | 40 |
| CO4 |  | 20 |  |  |  |  | 20 |
| CO5 | 20 | 10 | 10 |  |  |  | 40 |
| CO6 | 10 |  | 10 | 20 |  |  | 40 |
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| **Course Code** | **20FS3004** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED QUESTIONED DOCUMENTS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the rules of handwriting examination. | CO1 | A | 10 |
|  | b. | Write a note on preliminary examination and basic tools used for forensic document examination. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the decipherment of secret writing. | CO2 | U | 10 |
|  | b. | Compare the characteristics of simulated forgery and traced forgery. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Elaborate recess and relief printing processes along with their examples in detail. | CO3 | E | 10 |
|  | b. | Explain the process of obtaining the formal and informal exemplars and mention the merits and demerits of the same. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss types of forgery in documents in detail. | CO4 | An | 10 |
|  | b. | Elaborate the restoration and decipherment of handwriting from the charred document. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write a note on:   1. Torn document. 2. Disguised writing. | CO5 | R | 10 |
|  | b. | Discuss how to determine the age of the document. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain VSC with its forensic applications. | CO2 | U | 10 |
|  | b. | Explain the features of security document passport. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | State and explain important sections of IPC relating to document. | CO4 | R | 10 |
|  | b. | Describe and compare the dot-matrix and laser printer with their examples. | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Elaborate examination of typewritten document in detail. | CO6 | An | 10 |
|  | b. | Describe the examination of photocopied document. | CO6 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the security features of currency note Rs. 2000. | CO6 | R | 10 |
|  | b. | Explain the forensic report writing of questioned document case with an example. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the various types of documents. |
| CO2 | Compare the questioned documents with standards. |
| CO3 | Identify the different types of forgery in the documents. |
| CO4 | Apply various method to analyze questioned documents. |
| CO5 | Analyze the questioned documents of various types. |
| CO6 | Prepare the report. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 20 |  |  |  | 20 |
| CO2 | 10 | 20 | 10 |  |  |  | 40 |
| CO3 |  |  |  |  | 20 |  | 20 |
| CO4 | 10 |  | 10 | 10 | 10 |  | 40 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 | 20 |  | 10 | 10 |  |  | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **20FS3005** | **Duration** | **3hrs** |
| **Course Name** | **FINGER PRINTS AND OTHER IMPRESSIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Elaborate structure of skin and different constituents of fingerprint. (Include Diagram). | CO1 | U | 10 |
|  | b. | Discuss various types of fingerprints. (Include diagram). | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss in details about the different types of finger prints found in crime scenes and the collection methods. | CO2 | U | 10 |
|  | b. | Elaborate AFIS and it’s applications. | CO2 | U | 10 |
| 3. | a. | According to different surface types, mention various methods to develop finger prints. | CO2 | R | 10 |
|  | b. | Elaborate primary fingerprint classification system. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss in detail the poroscopy and the different levels of analysis with expert opinion. | CO2 | U | 10 |
|  | b. | How palm prints are collected for examination, elaborate the process of analysis. Mention the forensic significance of palm prints. | CO2 | U | 10 |
| 5. | a. | Briefly discuss the significance of footwear impression, information that can be retrieve from impression found in crime scene, | CO3 | U | 10 |
|  | b. | Discuss about foot print significance and elaborate the collection method for the footwear impression. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Provide one case study based on Foot print analysis. | CO3 | An | 10 |
|  | b. | Provide one case study based on Fingerprint analysis. | CO3 | An | 10 |
| 7. | a. | Discuss a case study on tire mark analysis. | CO4 | An | 10 |
|  | b. | With diagram elaborate tire side wall information. What is exemplar and known tires? Provide few information on tread wear indications. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the collection, analysis, significance and possible opinion for lip prints. | CO6 | U | 10 |
|  | b. | Describe the collection, analysis, significance and possible opinion for bite mark. | CO6 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Rate (consider a scale of 10, 1 for least reliable and 10 for extremely reliable) the reliability of bite marks and lip prints found in crime scene. Justify your answer with proper information. Use one case study to explain how lip print/bite marks can be important evidence. | CO6 | E | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the various elements of fingerprints. |
| CO2 | Understand the type of fingerprints. |
| CO3 | Analyze footwear reprints. |
| CO4 | Apply various methods to analyze tire reprints. |
| CO5 | Analyze the Lip reprints. |
| CO6 | Analyze the bite marks. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 20 |  |  |  |  | 20 |
| CO2 | 20 | 40 |  |  |  |  | 60 |
| CO3 |  | 20 |  |  |  |  | 20 |
| CO4 |  | 20 |  |  |  |  | 20 |
| CO5 |  |  |  |  |  |  |  |
| CO6 |  |  |  |  | 40 |  | 20 |
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| **Course Code** | **20FS3009** | **Duration** | **3hrs** |
| **Course Name** | **CYBER CRIME** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain the operating system concepts. | CO1 | U | 10 |
|  | b. | Describe the word processing techniques. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss in details about different types of binary code used in a computer system. | CO2 | U | 10 |
|  | b. | State the purpose of flash memory and list out the devices used in flash memory. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the Classification of computer crime. | CO5 | U | 10 |
|  | b. | Explain the different phases of cyber forensics. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the purpose of CIE Chromaticity diagram. | CO4 | U | 10 |
|  | b. | Explain timeline analysis. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Analyze the tools used in forensics investigation. | CO6 | A | 10 |
|  | b. | List out the rules followed for collecting electronic evidence. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss in detail about search and seizure in cyber crime. | CO3 | U | 10 |
|  | b. | Explain the purpose of formatted partition. | CO5 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain about Hardware based security. | CO5 | U | 10 |
|  | b. | Summarize the following   1. Types of viruses 2. Software piracy 3. Mail bombs | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | List out the different scenarios for Computer based document than paper based document. | CO4 | R | 10 |
|  | b. | Explain the E-mail investigation and related tools. | CO4 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Illustrate the concept of digital signature. | CO3 | U | 10 |
|  | b. | Explain the concept of cryptography with example. | CO3 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the principle of operation of computer hardware and accessories. |
| CO2 | Understand the types of various storage devices. |
| CO3 | Know crimes related to computer security. |
| CO4 | Analyze computer files. |
| CO5 | Understand types of cyber crimes. |
| CO6 | Understand the various investigation methods. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  | 20 |
| CO2 | - | 20 |  |  |  |  | 20 |
| CO3 | - | 40 |  |  |  |  | 40 |
| CO4 | 20 | 30 |  |  |  |  | 50 |
| CO5 | - | 40 |  |  |  |  | 40 |
| CO6 | - | - | 10 |  |  |  | 10 |
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| **Course Code** | **20FS3010** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC PSYCHOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define: Psychology. Discuss the classification of behaviour. | CO1 | R | 10 |
|  | b. | Describe the scope and goals of psychology. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain criminal profiling, its need and goals. | CO2 | U | 10 |
|  | b. | Discuss any two psychological theories of criminal behavior. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Examine the role and functions of forensic psychologist. | CO3 | A | 10 |
|  | b. | Critically analyze the ethical issues in forensic psychology. | CO2 | AN | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Debate whether a person can become a victim or a criminal due to social and economic conditions. | CO4 | E | 10 |
|  | b. | Differentiate the characteristics of organized and disorganized killer. | CO3 | AN | 10 |
|  |  |  |  |  |  |
| 5. |  | Define and discuss the concept of mental illness and mental disorders from forensic perspective. | CO5 | AN | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Inspect how BEOS test is conducted in assessing the guilt. | CO6 | A | 10 |
|  | b. | Elucidate different types of lies with an example. | CO3 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Defend the need of Interviewing in forensic assessment and describe in detail the process of interview technique. | CO3 | A | 10 |
|  | b. | Critically analyze the physiological and psychological Symptoms of an offender during an assessment. | CO3 | AN | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Imagine, you have been asked conduct the polygraph test to find out the truth. Discuss how you would conduct the test. | CO4 | A | 10 |
|  | b. | Explain the uniqueness of Polygraph test in lie detection. | CO4 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Defend the need of Narco analysis test in deception detection and explain the way this test is done in forensic assessment. | CO5 | A | 10 |
|  | b. | Debate some of the ethical issues in forensic psychology field. | CO2 | E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand The Basics Of Psychology. |
| CO2 | Explain Forensic Psychology. |
| CO3 | Describe The Significance Of Psychological Assessment. |
| CO4 | Outline The Principles Of Polygraph. |
| CO5 | Describe The Procedure For Nacroanalysis. |
| CO6 | Demonstrate Brain Electrical Oscillation Signatures. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  | 20 |
| CO2 |  | 20 |  | 10 | 10 |  | 40 |
| CO3 |  | 10 | 20 | 20 |  |  | 50 |
| CO4 |  | 10 |  | 10 | 10 |  | 30 |
| CO5 |  |  | 10 | 20 |  |  | 30 |
| CO6 |  |  | 10 |  |  |  | 10 |
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| **Course Code** | **20FS3011** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC SEROLOGY AND MOLECULAR GENETICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain bloodstain pattern analysis and its significance in crime scene investigation. | CO1 | U | 10 |
|  | b. | Give a detailed note on menstrual blood and its analysis. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the identification of amniotic fluid. | CO2 | U | 10 |
|  | b. | Elaborate ABO blood grouping. | CO2 | U | 10 |
| 3. | a. | Explain the structure of DNA. | CO3 | U | 10 |
|  | b. | Describe serum proteins with examples. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Differentiate nuclear and mitochondrial DNA. | CO4 | An | 10 |
|  | b. | Describe restriction fragment length polymorphism (RFLP) with figure. | CO4 | U | 10 |
| 5. | a. | Analyze and interpret the paternity result provided above. Is the result conclusive or inconclusive? | CO5 | An | 10 |
|  | b. | Give a detailed note on capillary electrophoresis. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain Hardy – Weinberg law in genetics. | CO4 | U | 10 |
|  | b. | Discuss STR analysis. | CO4 | U | 10 |
| 7. | a. | Elaborate the methods of extraction of DNA. | CO3 | U | 10 |
|  | b. | Illustrate polymerase chain reaction with a diagram. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Summarize the peak detection and thresholds with the help of a diagram. | CO6 | C | 10 |
|  | b. | Draw the organizational chart of NABL. | CO6 | R | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain DNA databases. | CO6 | U | 10 |
|  | b. | Discuss the importance of NABL. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the basic principle of Forensic Serology. |
| CO2 | Classify the biological stains. |
| CO3 | Understand about serological markers. |
| CO4 | Summarize about DNA typing and its forensic significance. |
| CO5 | Interpret the DNA typing results. |
| CO6 | Understand the basics of bioinformatics. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  | 20 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 |  | 30 | 10 |  |  |  | 40 |
| CO4 |  | 30 |  | 10 |  |  | 40 |
| CO5 | 10 |  |  | 10 |  |  | 20 |
| CO6 | 10 | 20 |  |  |  | 10 | 40 |
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| **Course Code** | **20FS3012** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC PHONETICS, VOICE ANALYSIS AND SPEAKER RECOGNITION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe Speech Production in humans. | CO1 | U | 10 |
|  | b. | Define Phonetics, articulatory phonetics, and Forensic Linguistics. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the collection of evidence in the case of forensic phonetics. | CO2 | R | 10 |
|  | b. | Explain the significance of forensic linguistics in Forensic investigation. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the factors affecting voice identification. | CO3 | U | 10 |
|  | b. | Name a few computerized software used for voice analysis and describe author identification in the suicide note. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the ASR method in detail. | CO4 | U | 10 |
|  | b. | Illustrate steps of Speaker Recognition identification. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the type of evidence encountered in Forensic phonetics cases. Explain each evidence and its Forensic analysis. | CO5 | U | 10 |
|  | b. | Name a few storage media used for the collection of evidence in case of voice evidence also describe the collection of voice evidence in detail. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Differentiate written and voice/oral evidence in detail. Also, list a few examples. | CO6 | An | 10 |
|  | b. | Explain the speech production mechanism. | CO6 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Distinguish Speaker identification and authentication of tape recording. | CO5 | An | 10 |
|  | b. | Define speech enhancement and speech decoding. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain types of evidence and types of Psycholinguistics forensic texts. | CO2 | U | 10 |
|  | b. | Explain Forensic voice comparison and features that are commonly analyzed in forensic phonetics. | CO4 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the significance of forensic phonetics and voice analysis and define authorship. | CO6 | U | 10 |
|  | b. | Explain Voice Identification by the Aural/Spectrographic Method. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the importance of phonetics. |
| CO2 | Understand the basics of psycholinguistics. |
| CO3 | Understand the methods involved in voice analysis. |
| CO4 | Summarize the various types of speaker recognition. |
| CO5 | Understand the methods involved in automatic speaker recognition. |
| CO6 | Realize the application of voice analysis in forensic science. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 20 | 10 |  |  |  |  |  |
| CO2 | 10 | 20 |  |  |  |  |  |
| CO3 | 10 | 10 |  |  |  |  |  |
| CO4 | 00 | 30 |  |  |  |  |  |
| CO5 | 10 | 10 |  | 10 |  |  |  |
| CO6 | 00 | 30 |  | 10 |  |  |  |
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| **Course Code** | **20FS3017** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL JURISPRUDENCE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | | |
| 1. | | a. | Define Inquest and its types. | CO1 | R | 10 |
|  | | b. | Distinguish dying declaration and dying deposition. | CO1 | An | 10 |
|  | |  | **(OR)** |  |  |  |
| 2. | | a. | Explain the medico legal importance of occupational marks and tattoo marks. | CO2 | U | 10 |
|  | | b. | Explain the medico legal importance of teeth. | CO2 | U | 10 |
| 3. | | a. | Explain the procedure of post-mortem examination. | CO3 | U | 10 |
|  | | b. | Explain autopsy and its types. | CO3 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 4. | | a. | Define Injury and explain its types. | CO4 | R | 10 |
|  | | b. | Distinguish Ante mortem and Post Mortem burns. | CO4 | An | 10 |
| 5. | | a. | Define death and explain its types. | CO5 | R | 10 |
|  | | b. | Explain modes of death. | CO5 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 6. | | a. | Distinguish Medical Certificates and Medico legal reports. | CO1 | An | 10 |
|  | | b. | Explain Examination-in-Chief, Cross Examination and Re-examination. | CO1 | U | 10 |
| 7. | | a. | Give a detailed note on criminal courts and their powers. | CO1 | R | 10 |
|  | | b. | Explain exhumation and its procedure. | CO3 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 8. | | a. | Explain Later changes after death. | CO6 | U | 10 |
|  | | b. | Explain Rigor Mortis in detail. | CO6 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | |
| 9. | | a. | Explain the significance of entomological evidence in estimating post-mortem interval. | CO6 | U | 10 |
|  | | b. | Explain immediate and early changes after death. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know about various legal procedures. |
| CO2 | Know about the parameters contributing to personal identity. |
| CO3 | Understand the importance of post-mortem examination. |
| CO4 | Know about wounds. |
| CO5 | Understand the modes of death. |
| CO6 | Acquire knowledge to estimate time since death. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 20 | 10 |  | 20 |  |  | 50 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 |  | 30 |  |  |  |  | 30 |
| CO4 | 10 |  |  | 10 |  |  | 20 |
| CO5 | 10 | 10 |  |  |  |  | 20 |
| CO6 |  | 40 |  |  |  |  | 40 |
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| **Course Code** | **20PH1001** | **Duration :** | **3hrs** |
| **Course Name** | **ELEMENTS OF PHYSICS IN AVIATION** | **Max. Marks :** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome / Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Define critical angle of incidence. | CO1/U | 1 |
| 2. | Ray passing through center of the lens would \_\_\_\_\_\_\_\_\_\_\_\_. | CO1/U | 1 |
| 3. | For a wave travelling at certain velocity increase in frequency result in \_\_\_\_\_\_\_. | CO2/U | 1 |
| 4. | In a standing wave there are two nodes and one antinode. Find wave length. | CO2/U | 1 |
| 5. | Define stopping potential. | CO3/U | 1 |
| 6. | Define work function. | CO3/U | 1 |
| 7. | Define sun synchronous orbit. | CO4/U | 1 |
| 8. | From Kepler’s laws orbits are in \_\_\_\_\_ shape. | CO4/U | 1 |
| 9. | Define compression and rarefaction. | CO5/U | 1 |
| 10. | \_\_\_\_\_ defines the compressibility of a medium. | CO5/U | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | Explain with a sketch Fresnel and Fraunhofer’s diffraction. | CO1/U | 3 |
| 12. | If is an equation representing wave motion, derive wave equation. | CO2/U | 3 |
| 13. | Write a short note on absorption spectroscopy. | CO3/U | 3 |
| 14. | Prove that . | CO5/U | 3 |
| 15. | State all the Kepler’s laws. | CO4/U | 3 |
| 16. | Define nano material? Name some products where they are found. | CO6/U | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | Compare the behavior of principal rays for converging and diverging lens. | CO1/U | 6 |
| b. | Sketch image formation by a thin converging lens for varying object distances (answer must include formation of virtual object). | CO1/U | 6 |
|  |  |  |  |  |
| 18. | a. | Show that the amplitude of a standing is twice the amplitude. | CO2/U | 5 |
| b. | Sketch the standing wave for antinodes varying from one to five. For each sketch write the relation between wave length and length of the string. | CO2/U | 7 |
|  |  |  |  |  |
| 19. | a. | Prove that a body undergoing simple harmonic motion will have maximum velocity . Hint: displacement is given by *x* = *A* cos (ωt+φ). | CO2/U | 8 |
|  | b | Write a short note on damped oscillations and explain forces acting on the string experiencing damped oscillations. | CO2/U | 6 |
|  |  |  |  |  |
| 20. | a. | With a neat sketch explain the working of Scanning Electron Microscope. | CO3/U | 6 |
| b. | In Photo Electric Effect experiment discuss on what happens when potential difference; frequency and intensity are increased. | CO3/U | 6 |
|  |  |  |  |  |
| 21. | a. | What is a space probe? Write about a space probe that you know. | CO4/U | 7 |
| b. | What are space debris? Write a note on handling space debris. | CO4/U | 5 |
|  |  |  |  |  |
| 22. | a. | Show that the speed of sound wave in a medium . | CO5/U | 6 |
| b. | Assume that a point source emits constant sound power, with intensity obeying the inverse-square law. If you move twice the distance from the source, by how many decibels does the sound intensity level drop? (Hint: Decibel scale ; and sound travels in all directions with equal intensity from the source). | CO5/U | 6 |
|  |  |  |  |  |
| 23. | a. | Derive lens makers equation. | CO1/U | 6 |
| b. | Derive the relation between curvature image and object distance for a refraction through spherical surfaces. | CO1/U | 6 |
|  |  | **COMPULSORY QUESTION** | | |
| 24. | a. | Explain a mechanical process to obtain nano material. | CO6/U | 6 |
| b. | Explain chemical vapor deposition of synthesizing nano materials. | CO6/U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Compare the laws of optics with regards to reflection, refraction, interference, diffraction and polarization. |
| CO2 | Explain various laws governing oscillations and waves. |
| CO3 | Compare the ability of analytical instruments. |
| CO4 | Describe the interplanetary travel in solar system. |
| CO5 | Describe the characteristics of acoustic waves. |
| CO6 | Explain the process of obtaining nanomaterial and its applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / PO | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 29 |  |  | - | - | 29 |
| CO2 |  | 29 |  |  |  |  | 29 |
| CO3 |  | 17 |  |  | - | - | 17 |
| CO4 |  | 17 |  |  |  |  | 17 |
| CO5 |  | 17 |  |  | - | - | 17 |
| CO6 |  | 15 |  |  | - | - | 15 |
|  | | | | | | | 124 |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **20PH1011** | **Duration** | **3hrs** |
| **Course Name** | **PHYSICAL ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define the phenomenon of a phonon. | | CO1 | R | | 1 |
| 2. | Sketch the energy band diagram of an insulator. | | CO1 | A | | 1 |
| 3. | Identify a trivalent dopant which is added to a pure semiconductor to get p-type semiconductor. | | CO2 | U | | 1 |
| 4. | Compare valence electrons and free electrons. | | CO2 | U | | 1 |
| 5. | Recall the terminals of MOSFET. | | CO3 | R | | 1 |
| 6. | List any two applications of MOSFET. | | CO3 | R | | 1 |
| 7. | The existence and prolongation of a sound wave even after the source is cut off is known as \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 8. | State Weber-Fechner Law. | | CO4 | R | | 1 |
| 9. | Tell the frequency range of ultrasound. | | CO5 | R | | 1 |
| 10. | Give examples for conventional energy sources. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Classify the types of material based on valance electrons. | | CO1 | | U | 3 |
| 12. | Define threshold voltage. | | CO2 | | R | 3 |
| 13. | Compare BJT and FET. | | CO3 | | U | 3 |
| 14. | A conference room has a total volume of 7000 m3. The magnitude of total absorption within the conference room is 888sabine. Calculate the reverberation time. | | CO4 | | A | 3 |
| 15. | An ultrasonic interferometer-based system is used to measure the velocity of ultrasonic waves in sea water. The distance between two consecutive antinodes is found to be 0.4 mm. Frequency of the waves generated by the crystal is 1.5 MHz. Calculate the velocity of the waves in sea water. | | CO5 | | A | 3 |
| 16. | Classify the types of wind energy. | | CO6 | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | Explain how charge density varies with respect to time and distance in a semiconductor and derive continuity equation for a n-type semiconductor. | CO1 | | A | 12 |
| 18. |  | Discuss the forward bias and reverse bias characteristics of a PN junction diode with necessary diagrams. | CO2 | | U | 12 |
| 19. |  | Explain the construction and operation of n-channel DMOSFET. | CO3 | | U | 12 |
| 20. |  | Analyzethe various factors affecting acoustics of an auditorium and suggest the remedial measures for overcoming the same. | CO4 | | An | 12 |
| 21. |  | Discuss the method of producing ultrasonic waves by using inverse piezoelectric effect in detail with necessary circuit diagrams. | CO5 | | U | 12 |
| 22. |  | Ultrasonic waves can be produced by applying magnetostriction method. Explain the methodology with principle, construction and working and necessary circuit diagram. | CO5 | | A | 12 |
| 23. |  | The acousto-optic effect can be utilized to create a diffraction grating like element in liquid columns thereby producing diffraction of monochromatic source of light. Explain in detail how the speed of ultrasonic waves can be calculated by such an experimental setup. | CO4 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | By applying the principle of photovoltaic effect, explain in detail the construction, principle and working of a photovoltaic cell. | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Remember the fundamentals of semiconducting physics. |
| CO2 | Understand the principle and operation of semiconductor junctions. |
| CO3 | Demonstrate the MOS structures. |
| CO4 | Analyse the application of acoustics in construction and acoustic design. |
| CO5 | Ability to explore the application of ultrasonics in various fields. |
| CO6 | Understand about the renewable energy sources and devices. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 3 | 13 | - | - | - | 17 |
| CO2 | 3 | 14 | - | - | - | - | 17 |
| CO3 | 2 | 15 | - | - | - | - | 17 |
| CO4 | 2 | - | 15 | 12 | - | - | 29 |
| CO5 | 1 | 12 | 15 | - | - | - | 28 |
| CO6 | - | 4 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **20PH1018** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED PHYSICS FOR FOOD PROCESS OPERATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Give an example for a laser which works on the principle of ‘direct electron excitation’.  a. CO2 laser b. Argon laser c. Nd:YAG laser d. HF laser. | | | CO1 | R | | 1 |
| 2. | Pick out the right statement about stimulated emission process in a laser system.   1. The electromagnetic radiation need not have a resonance effect with the system. 2. A stimulated emission is induced by the interaction of a system with an electromagnetic radiation. 3. The emitted photon is not identical to the absorbed photon of the electromagnetic radiation. 4. All atoms in the emission spectra have different phase as they emerge together. | | | CO1 | U | | 1 |
| 3. | Identify the fiber optics application which is suitable for preserving ancient arts and artifacts.   1. Real time monitoring of civil structures. 2. Cold Lighting using optical fiber cables. 3. Telecommunication. 4. Personal use. | | | CO2 | R | | 1 |
| 4. | A fiber with loss \_\_\_\_ can realize the dream of optical fiber communication.  a. Less than 20 dB/mm b. Less than 20 dB/km  c. Less than 20 dB/m d. Less than 20 dB/μm | | | CO2 | U | | 1 |
| 5. | At \_\_\_\_ frequencies and \_\_\_\_ power, ultrasonics based non-destructive methods can be used as an analytical and evaluation tool.  a. High, High b. High, Low c. Low, High d. Low, Low | | | CO3 | R | | 1 |
| 6. | Ultrasound waves travel faster in solid materials. This is because \_\_\_\_\_\_\_.   1. Ultrasound waves are transverse waves. 2. Ultrasound waves are longitudinal waves. 3. Ultrasound waves are electromagnetic waves. 4. Ultrasound waves are thermal waves. | | | CO3 | U | | 1 |
| 7. | Infrasound, referred to as **\_\_\_\_**, describes sound waves with a frequency below 20 Hz.  a. High Frequency Sound b. Low Frequency Sound.  c. Very High Frequency Sound. d. Ultra-High Frequency Sound. | | | CO4 | R | | 1 |
| 8. | The following quantity is directly related to frequency.  a. Pressure b. Pitch c. Temperature d. Resistance. | | | CO4 | U | | 1 |
| 9. | An electronic magnetic moment is given by the following quantity.  a. Nuclear Magneton b. Bohr Magneton c. Quark Magneton.  d. Quantum Magneton. | | | CO5 | R | | 1 |
| 10. | The atomic magnetic moment is always calculated with electrons only. The proton magnetic moment is neglected. This is because \_\_\_\_.   1. Protons magnetic moment is at least 183.6 times smaller than that of an electron (e/m ratio). 2. Protons magnetic moment is at least 1836 times smaller than that of an electron (e/m ratio). 3. Protons magnetic moment is at least 18.36 times smaller than that of an electron (e/m ratio). 4. Protons magnetic moment is at least 1.836 times smaller than that of an electron (e/m ratio). | | | CO5 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Explain population inversion. | | | CO1 | | U | 3 |
| 12. | Define the term acceptance angle. | | | CO2 | | A | 3 |
| 13. | Discuss the inverse piezoelectric effect in brief. | | | CO3 | | U | 3 |
| 14. | List four factors that affect the acoustics of a good auditorium. | | | CO4 | | A | 3 |
| 15. | Name a few examples for ferromagnetic materials. | | | CO5 | | U | 3 |
| 16. | Explain the phenomenon of Meissner effect. | | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | |
| 17. | |  | Apply Einstein’s quantum theory of radiation to prove the existence of stimulated emission of radiation. | CO1 | | A | 12 |
|  | |  |  |  | |  |  |
| 18. | |  | Based on the materials used for manufacture and the modes of transmission of light, analyze the classification of optical fiber cables. | CO2 | | An | 12 |
|  | |  |  |  | |  |  |
| 19. | |  | Define magnetostriction effect and with a neat circuit diagram, explain how ultrasonic waves can be produced by applying magnetostriction method. | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | Suggest suitable remedies for the factors that affect the acoustics of a good auditorium. | CO4 | | An | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | Analyze in detail the differences between dia, para, and ferromagnetic materials. | CO5 | | An | 12 |
|  | |  |  |  | |  |  |
| 22. | | a. | Calculate the band gap energy for a GaAs semiconductor laser if the wavelength of laser emitted by it is 4141 Å. | CO1 | | R | 6 |
|  | | b. | A signal of 200 mW is injected into a fiber of length 2 km. The out coming signal from the other end is 80 mW. Find the absorption (attenuation loss) coefficient in dB. | CO2 | | R | 6 |
|  | |  |  |  | |  |  |
| 23. | | a. | Calculate the speed of ultrasound in mercury if the distance between two adjacent anti-nodes ‘d’ is 2.656 x 10-4 m and the frequency of the ultrasound produced is 2.73 x 106 Hz. | CO3 | | U | 6 |
|  | | b. | Calculate the reverberation time of a large auditorium whose volume is (100\*40\*20) and the total absorption coefficient is 8000 O.W.U. or sabines. | CO4 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | List the various properties of superconductors and explain them in detail. | CO6 | | R | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concept of lasers and apply laser action in food processing industries. |
| CO2 | Explain and interpret the principle of fiber optics for food quality and safety assessment. |
| CO3 | Apply non-destructive testing techniques in agro-food products. |
| CO4 | Discern the laws governing acoustics and implement the same in creating better environment for workers in food industries. |
| CO5 | Evaluate and perceive various laws governing magnetism with special reference to magnetic separation of contaminants in food industries. |
| CO6 | Create efficient industrial applications by applying the principles of superconducting materials. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 7 | 4 | 12 | --- | --- | --- | **23** |
| CO2 | 7 | 1 | 3 | 12 | --- | --- | **23** |
| CO3 | 1 | 10 | 12 | --- | --- | --- | **23** |
| CO4 | 1 | 7 | 3 | 12 | --- | --- | **23** |
| CO5 | 1 | 4 | --- | 12 | --- | --- | **17** |
| CO6 | 12 | --- | 3 | --- | --- | --- | **15** |
|  | | | | | | | **124** |



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| **Course Code** | **20PH3001** | **Duration** | **3hrs** |
| **Course Name** | **CLASSICAL MECHANICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe generalized coordinates and derive the expression for generalized velocity. | CO1 | Understand | 6 |
|  | b. | Obtain the equation for linear harmonic oscillator from Lagrange’s equation of motion. | CO1 | Apply | 14 |
|  |  | **(OR)** |  |  |  |
| 2. |  | State D’ Alembert’s principle and derive Lagrange’s equation of motion from D’ Alembert’s principle for the conservative and non-conservative systems. | CO1 | Apply | 20 |
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|  |  |  |  |  |  |
| 3. | a. | Explain the motion of particles under central force and inverse square force. | CO2 | Analyze | 4 |
|  | b. | Derive the differential equation of the orbit under a central force. | CO2 | Understand | 16 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Derive the equation of motion of particle under the influence of the central force field. | CO2 | Understand | 20 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between stable and unstable equilibrium with appropriate diagrams. | CO3 | Apply | 6 |
|  | b. | Obtain Lagrange’s equation of motion for small oscillations. | CO3 | Apply | 14 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Consider a linear triatomic molecule (such as CO2), with identical atoms each of mass m connected by two identical springs to a single atom of mass M. Find the eigenvectors and normal modes of vibration of the system. | CO4 | Apply | 20 |
|  |  |  |  |  |  |
| 7. |  | Express modified Hamilton’s principle and deduce Hamilton’s canonical equation of motion from the variational principle. | CO5 | Analyze | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define Hamiltonian ‘H’ and express Hamilton’s canonical equations of motion. | CO5 | Remember | 6 |
|  | b. | Derive the equation of motion of a simple pendulum using Hamilton’s equations of motion. | CO5 | Understand | 14 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Discuss the Lorentz transformation equations and explain the physical significance of the parameters involved. | CO6 | Understand | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the properties of Lagrangian to interpret the physical significance of linear momentum, angular momentum and energy. |
| CO2 | Interpret mathematical results in physical terms using central force problem. |
| CO3 | Demonstrate the kinematics of rigid body and oscillating system. |
| CO4 | Apply the techniques and results of classical mechanics to real time problems. |
| CO5 | Appraise the motion of physical systems with Hamilton formulation and Hamilton Jacobi equation. |
| CO6 | Correlate classical mechanics with the special theory of relativity. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 6 | 34 |  |  |  | 40 |
| CO2 |  | 36 |  | 4 |  |  | 40 |
| CO3 |  |  | 20 |  |  |  | 20 |
| CO4 |  |  | 20 |  |  |  | 20 |
| CO5 | 6 | 14 |  | 20 |  |  | 40 |
| CO6 |  | 20 |  |  |  |  | 20 |
|  | | | | | | | **180** |



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| **Course Code** | **20PH3002** | **Duration** | **3hrs** |
| **Course Name** | **STATISTICAL MECHANICS AND THERMODYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Derive Maxwell’s thermodynamical general equations and the four thermodynamical relations that connect the thermodynamic quantities. | CO1 | U | 14 |
|  | b. | Explain thermodynamic equilibrium and thermodynamic variables. | CO1 | U | 6 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Briefly explain thermodynamic potentials. | CO1 | U | 14 |
|  | b. | Write short notes on:   1. Zeroth law of thermodynamics 2. First law of thermodynamics 3. Internal energy | CO1 | R | 6 |
|  |  |  |  |  |  |
| 3. | a. | Explain the concept of ensemble. Differentiate between micro-canonical, canonical and grand-canonical ensembles. | CO2 | U | 6 |
|  | b. | Briefly explain Liouville’s theorem. | CO2 | U | 14 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Briefly explain thermodynamic probability of macrostate. How it is related to probability of occurrence of that state. How does it differ from mathematical probability? | CO2 | U | 12 |
|  | b. | Eight distinguishable particles are distributed among three compartments of equal size. Find the probability of the macrostate (i) (4, 3, 1) and (ii) (3, 3, 2). | CO6 | An | 4 |
|  | c. | Distinguish between static and dynamic systems. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 5. |  | What is the significance of partition function (Z) in statistical physics? Obtain the expression for the partition function. How it is related to different thermodynamic functions. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Derive the Boltzmann’s canonical distribution law and its evaluation term. | CO3 | U | 14 |
|  | b. | Explain Gibb’s paradox. How this paradox is solved? Discuss it by deriving necessary equations. Obtain Suckur Tetrode equation from it. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 7. | a. | Describe the Maxwell-Boltzmann energy distribution law in general form. | CO4 | An | 12 |
|  | b. | What are the limitations of the Maxwell-Boltzmann method? | CO4 | An | 4 |
|  | c. | Mention any four distinguish between Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. | CO4 | An | 4 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define Fermions? Write down the postulates of Fermi-Dirac statistics. Derive an expression for the probability distribution of particles governed by Fermi-Dirac statistics. | CO4 | U | 12 |
|  | b. | Describe the peculiar behavior of liquid helium. | CO4 | An | 4 |
|  | c. | A system consists of 5 particles arranged in two compartments. The first compartment is divided into 6 cells and the second into 8 cells. The cells are of equal size. Calculate the number of microstates in the macrostate (2, 3), if the particles obey Fermi-Dirac statistics. | CO6 | An | 4 |
| **PART – B (1X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | State the assumptions of Einstein’s theory to explain the variation of specific heat of solid with temperature. | CO5 | U | 14 |
|  | b. | What do you mean by phase transition? Discuss about the first order and second order phase transition. | CO5 | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the different thermodynamic systems based on the laws and their consequences. |
| CO2 | Illustrate the statistical description of systems of particles. |
| CO3 | Examine the applications of the partition function in thermodynamics. |
| CO4 | Understand the need for quantum statistics in thermodynamic systems. |
| CO5 | Understand the specific heat of solids and analyze the phase transitions using statistical mechanics. |
| CO6 | Apply the statistical mechanics in solving the thermodynamic problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 34 | - | - | - | - | 40 |
| CO2 | - | 32 | - | 4 | - | - | 36 |
| CO3 | - | 40 | - | - | - | - | 40 |
| CO4 | - | 12 | - | 24 | - | - | 36 |
| CO5 | - | 14 | - | 6 | - | - | 20 |
| CO6 | - | - | - | 8 | - | - | 08 |
|  | | | | | | | **180** |



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| **Course Code** | **20PH3003** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL PHYSICS I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Verify Green's theorem in the plane for  ∮(3𝑥2 - 8𝑦2) 𝑑𝑥 + (4𝑦-6𝑥𝑦) 𝑑𝑦 where c is the boundary of the region defined by (i) = √𝑥 and 𝑦 = 𝑥2(ii) x=0, y=0, x+y =1 ? | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Verify Stoke’s theorem for Ȃ = (𝑦-*z*+2) *î* + (𝑦*z* +4) *ĵ* – 𝑦*zk* where S is the surface of the cube *x*=0, *y*=0, *z*=0, *x*=2, *y* = 2, *z* = 2 above the xy plane. | CO1 | An | 20 |
|  |  |  |  |  |  |
| 3. | a. | Apply cramer’s rule to the equations  2*x*1 – *x*2 + 2*x*3 = 2  *x*1 +10*x*2 – 3*x*3 = 5  - *x*1 + *x*2 + *x*3 = -3 | CO2 | A | 10 |
|  | b. | Using Cayley Hamilton’s theorem, find the inverse of the matrix | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Find the eigen values and eigen vectors of the matrix  A = | CO6 | A | 10 |
|  | b. | https://img.brainkart.com/imagebk39/ouXNXBa.jpgFind the rank of a matrix | CO6 | A | 10 |
| 5. |  | If *xy, 2y –z2*and *xz* are the components of a covariant tensor in rectangular coordinates, then find its covariant components in spherical coordinates. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Determine div *Ai*, div *Ai* and ∇2*I* in cylindrical polar coordinates, where *Ai*and *Ai* are vectors and *I* is a scalar | CO4 | C | 20 |
|  |  |  |  |  |  |
| 7. | a. | Solve using Cauchy’s Euler equation  *x3D2 + 3x2D + 5x ) y = 2* | CO3 | E | 10 |
|  | b. | Using the method of variation of parameters, Solve  *y′′+7y′-8y = e2x* | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Solve (D2 - 3D +2)y = sin3x | CO3 | An | 10 |
|  | b. | Solve (D-2)2 y = 8 (e2x + sin 2x +x2) | CO3 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Find the mean deviations from the mean, median and mode of the following data:   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | Size of items: | 1 | 3 | 4 | 5 | 6 | 7 | | Frequency | 4 | 9 | 16 | 14 | 11 | 6 | | CO5 | A | 12 |
|  | b. | **Estimate the mean deviation about mean, median and mode for the following data.**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Classes | 0-4 | 4-8 | 8-12 | 12-16 | 16-20 | | Frequency | 4 | 6 | 8 | 5 | 2 | | CO5 | An | 8 |

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|  | **COURSE OUTCOMES** |
| CO1 | Master the complex mathematical analysis, integral theorems, complex function and residue theorem to evaluate definite integrals |
| CO2 | Solve linear systems, matrix inverses, eigen values and eigen vectors |
| CO3 | Solve ordinary differential equations of second order |
| CO4 | Express any physical law in terms of tensors and coordinate transforms |
| CO5 | learn the theory of probability, various distribution functions, errors and residuals |
| CO6 | apply the mathematical concepts to solve the problems in physics. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  |  | 40 |  |  | 40 |
| CO2 |  |  | 10 |  | 10 |  | 20 |
| CO3 |  |  |  | 20 | 20 |  | 40 |
| CO4 |  |  |  | 20 |  | 20 | 40 |
| CO5 |  |  | 12 | 8 |  |  | 20 |
| CO6 |  |  | 20 |  |  |  | 20 |
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| **Course Code** | **20PH3004** | **Duration** | **3hrs** |
| **Course Name** | **SEMICONDUCTOR PHYSICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1 | a. | Demonstrate the working of JFET with drain source characteristics and transfer characteristics. | CO1 | U | 14 |
|  | b. | Design the circuit for voltage variable resistor using FET. | CO1 | U | 6 |
| (OR) | | | | | |
| 2 |  | Demonstrate the working of Tunnel diode with equivalent circuit and the quantum mechanical tunneling mechanism with forward bias and reverse volt ampere characteristics. | CO1 | U | 20 |
| 3 | a. | Demonstrate the steps involved in monolithic integrated circuit design. | CO2 | U | 15 |
|  | b. | Apply lithographic technique to design a diode. | CO2 | AP | 5 |
| (OR) | | | | | |
| 4 | a. | Illustrate the processes involved in the fabrication of integrated chips. | CO2 | U | 15 |
|  | b. | Draw the cross section of transistor in the integrated circuit and explain the different. | CO2 | U | 5 |
|  |  |  |  |  |  |
| 5 | a. | Demonstrate the functions of linear operation amplifier with suitable diagrams. | CO3 | U | 10 |
|  | b. | Apply logical operations to design a adding and subtracting circuits and verify the results. | CO3 | AP | 10 |
| (OR) | | | | | |
| 6 | a. | Define Hall effect. | CO4 | U | 4 |
|  | b. | Evaluate the electrical properties of a materials using Hall measurements. | CO4 | Ap | 16 |
|  |  |  |  |  |  |
| 7 | a. | Classify the Photoelectric devices. | CO4 | U | 4 |
|  | b. | Demonstrate the working of Photoelectric devices with suitable schematic. | CO4 | U | 16 |
| (OR) | | | | | |
| 8 | a. | Experiment with the Piezo electric generator and explain the construction and working. | CO5 | Ap | 13 |
|  | b. | Classify the nano generators and their applications. | CO5 | U | 7 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9 | a. | Demonstrate the working of a solar cell with volt ampere characteristics. | CO5 | AP | !5 |
|  | b. | Appraise the Boolean algebra with equations. | C06 | U | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the construction, working and applications of semiconductor devices |
| CO2 | Interpret the principle and characteristics of linear integrated circuits |
| CO3 | Explain the different types of transducers and its applications. |
| CO4 | Appraise different types optoelectronic devices and its applications |
| CO5 | Illustrate the fabrication and manufacturing process involved in integrated circuits |
| CO6 | Develop and design special purpose devices using digital electronics |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 40 |  |  |  |  | 40 |
| CO2 |  | 35 | 5 |  |  |  | 40 |
| CO3 |  | 10 | 10 |  |  |  | 20 |
| CO4 |  | 24 | 16 |  |  |  | 40 |
| CO5 |  | 7 | 28 |  |  |  | 35 |
| CO6 |  | 5 |  |  |  |  | 5 |
|  | | | | | | | **180** |

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| **Course Code** | **20PH3006** | **Duration** | **3hrs** |
| **Course Name** | **MATHEMATICAL PHYSICS II** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Show that the real part u and the imaginary part v of ln z satisfy the Cauchy-Reimann equations and find through the partial derivatives of u and v. Use rectangular coordinates. | CO1 | U | 16 |
|  | b. | State whether complex numbers are necessary for solving a general algebraic equation and whether there is a need for any more number system after the complex number system. | CO1 | A | 4 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Evaluate the integral  around (a) the circle and (b) the circle . | CO1 | R | 16 |
|  | b. | Write down Dirichlet conditions. | CO1 | An | 4 |
| 3. | a. | Find the Fourier integral of  and hence show that  . | CO2 | R | 16 |
|  | b. | Write down Dirichlet conditions. | CO2 | An | 4 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | The function f(t) is defined only over the range 0 < t < 1 to be . Find the half range sine Fourier expansion of f(t). | CO2 | U | 16 |
|  | b. | Explain the behaviour of partial sum of a Fourier series at points of discontinuity. | CO2 | A | 4 |
| 5. | a. | Given the Differential Equation with the following conditions.  Boundary Conditions:- u(0,t) = 0, u(L,t) = 0  Initial Condition:- u(x,0) = f(x), ut(x,0) = 0.  Using the method of separation of variables, find the equation governing the vibration of a string fixed at both ends. | CO3 | An | 16 |
|  | b. | Describe the phenomenon of travelling waves. | CO3 | U | 4 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Derive the solution of an inhomogeneous differential equation by the introduction of Green’s Function. | CO6 | A | 16 |
|  | b. | Write down the Green’s functions for simple second order differential operators. | CO6 | An | 4 |
| 7. | a. | Let \* be an operation defined on Q by a\*b = ab/2. Prove that (Q,\*) forms an Abelian group. | CO4 | A | 16 |
|  | b. | State and Prove Cayley’s theorem of finite group. | CO4 | U | 4 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate correct to three decimal places using both the trapezoidal and Simpson’s rules. | CO4 | R | 16 |
|  | b. | State and explain Gauss’s Backward Interpolation Formula. | CO4 | U | 4 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Given the Differential Equation with the following conditions.  Boundary Conditions:- u(0,t) = 0, u(L,t) = K  Initial Condition:- u(x,0) = f(x).  Solve the equation for heat conduction when both the ends of a long rod subjected to an initial temperature distribution along its axis are at different temperature. | CO5 | An | 16 |
|  | b. | Laplace equation may be obtained by setting in the heat conduction equation . Explain the significance of the same. | CO5 | A | 4 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of complex functions and apply the principles in evaluating complex contour integration. |
| CO2 | Apply Fourier and Laplace transforms to solve mathematical problems and analyzing experimental data. |
| CO3 | Solve partial differential equations of second order by use of standard methods like separation of variables, series expansion (Fourier series) and integral transforms. |
| CO4 | Understand the fundamental concepts of group. |
| CO5 | Appraise numerical interpolation and approximation of functions, numerical integration and differentiation. |
| CO6 | Apply the mathematical concepts to solve the problems in physics. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 16 | 16 | 4 | 4 | -- | -- | 40 |
| CO2 | 16 | 16 | 4 | 4 | -- | -- | 40 |
| CO3 | -- | 4 | -- | 16 | -- | -- | 20 |
| CO4 | 16 | 8 | 16 | -- | -- | -- | 40 |
| CO5 | -- | -- | 4 | 16 | -- | -- | 20 |
| CO6 | -- | -- | 16 | 4 | -- | -- | 20 |
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| **Course Code** | **20PH3007** | **Duration** | **3hrs** |
| **Course Name** | **SPECTROSCOPY - I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Mention the different parts of electromagnetic radiation. | CO1 | R | 10 |
|  | b. | Illustrate the method of recording spectra in a spectrometer. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Apply the selection rule and draw the energy level for the fine structure of hydrogen atom. | CO1 | A | 5 |
|  | b. | Write a note on Fourier transform. | CO1 | A | 10 |
|  | c. | Estimate the electronic configuration of a hydrogen atom. | CO1 | E | 5 |
|  |  |  |  |  |  |
| 3. | a. | Estimate frequency of green light if its wavelength is 546.1 nm. | CO6 | E | 8 |
|  | b. | Illustrate the types of molecules based on moment of inertia. | CO2 | A | 12 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the intensity of spectral lines. | CO6 | An | 5 |
|  | b. | Draw the energy level diagram in case of rigid diatomic molecule and mention the types of transitions based on selection rule. | CO2 | R | 15 |
|  |  |  |  |  |  |
| 5. |  | Classify different vibrations of H2O molecule. | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Mention the types of vibration in CO2 molecule. | CO3 | R | 5 |
|  | b. | Draw the vibrations of CO2 molecule and discuss with a neat diagram. | CO3 | R | 15 |
|  |  |  |  |  |  |
| 7. | a. | Give the rule of mutual exclusion. | CO4 | R | 5 |
|  | b. | Discuss the working of Fourier Transform Infrared Spectrometer. | CO4 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write a short note onRaman scattering. | CO4 | A | 5 |
|  | b. | Define photon and explain the quantum theory of Raman scattering. | CO4 | R | 15 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the Born-Oppenheimer Approximation and give the detailed note on Franck-Condon Principle. | CO5 | U | 15 |
|  | b. | Give the applications of UV-VIS spectroscopy. | CO6 | A | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the fundamentals of spectroscopy and the atomic spectra of hydrogen atom. |
| CO2 | Appreciate the role of microwaves in rotational spectroscopy and its working principle. |
| CO3 | Experiment the use of infrared rays in finding the structure of molecules. |
| CO4 | Find the use of Raman spectroscopy in studying the matter. |
| CO5 | Analyze the structure of atoms through the electronic spectroscopy. |
| CO6 | Identify the best method to solve the spectroscopic problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 |  | 25 |  | 5 |  | 40 |
| CO2 | 15 |  | 12 |  |  |  | 27 |
| CO3 | 20 |  |  | 20 |  |  | 40 |
| CO4 | 20 | 15 | 5 |  |  |  | 40 |
| CO5 |  | 15 |  |  |  |  | 15 |
| CO6 |  |  | 5 | 5 | 8 |  | 18 |
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Graphical user interface, application

Description automatically generated with medium confidence

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| **Course Code** | **20PH3009** | **Duration** | **3hrs** |
| **Course Name** | **QUANTUM MECHANICS II** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Discuss the development of state for an isolated system which has a time dependent Hamiltonian. | CO1 | A | 15 |
|  | b. | The transition probabilities between the two states are well explained by the Fermi-Golden rule. Validate. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Derive the equation for a system that undergoes harmonic perturbation with respect to time period and discuss the selection rules. | CO1 | An | 15 |
|  | b. | Briefly explain the concept behind sudden approximation. | CO1 | An | 5 |
| 3. | a. | Let us assume that the scattering wave is small when compared to the incident wave. Apply the suitable approximation and arrive at the scattering amplitude and cross section. | CO2 | A | 15 |
|  | b. | Obtain the condition for the validity of Born approximation. | CO2 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | How will you obtain the scattering cross section for a coulomb potential on the basis of the scattering theory? | CO2 | A | 15 |
|  | b. | What do you mean by Yukawa potential? Discuss. | CO2 | A | 5 |
| 5. | a. | Apply time dependent perturbation theory to semi-classical theory of radiation. | CO3 | A | 10 |
|  | b. | Use the semi-classical theory to determine the conditions for allowed transitions. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Give an account on the density matrix and explain in detail with an application. | CO4 | A | 20 |
| 7. | a. | Develop the Klein-Gordan relativistic wave equation for a free particle. Henceforth obtain the current and probability density. | CO4 | A | 15 |
|  | b. | Write down the Klein-Gordan wave equation for a charged particle. Discuss how the equation reduces to correct non-relativistic limit with appropriate approximations. | CO5 | An | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Apply Dirac concept and obtain the equation for magnetic dipole moment of an electron under electromagnetic field. | CO5 | A | 15 |
|  | b. | Write a short note on the negative energy state of electron on the basis of theory of positron. | CO4 | U | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the quantization of wave field on the basis of classical Lagrangian equation. | CO6 | U | 10 |
|  | b. | Elaborate the classical Hamiltonian formulation. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the systems that are subjected to different time dependent perturbations such as harmonic, sudden and adiabatic. |
| CO2 | Classify the quantum problems involving scattering and interpret them using approximations such as Born, Partial wave analysis etc. |
| CO3 | Solve the quantum mechanical systems related to radiation by using the semi classical theory. |
| CO4 | Apply relativistic wave equation to study hydrogen like atom, free particle and other relativistic problems. |
| CO5 | Appraise on the quantization of wave field, non-relativistic equation, electromagnetic field energy and momentum. |
| CO6 | Develop appropriate skill in analytical, theoretical and/or practical techniques to further their understanding in the chosen topic. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 |  | 15 | 20 |  |  | 40 |
| CO2 |  |  | 40 |  |  |  | 40 |
| CO3 |  |  | 10 | 10 |  |  | 20 |
| CO4 |  | 5 | 35 |  |  |  | 40 |
| CO5 |  |  | 15 | 5 |  |  | 20 |
| CO6 |  | 20 |  |  |  |  | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **20PH3010** | **Duration** | **3hrs** |
| **Course Name** | **SPECTROSCOPY - II** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Mention the rules based on which a nuclei haszero spin, integral and half integral spin. | CO1 | R | 10 |
|  | b. | Derive the magnetic moment of a nuclei. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Apply Boltzmann distribution law to find the population of energy levels for nuclei and for electrons. | CO1 | A | 5 |
|  | b. | Write a detailed note on the working principle of NMR spectroscopy method and emphasis on the role of shielding and deshielding effects. | CO1 | A | 10 |
|  | c. | Estimate the strength of the magnetic field required to give a precessional frequency of 100 MHz for 17O nucleus. gN = -0.757; µN = 5.051 E-27 J/T; I = 5/2. | CO1 | E | 5 |
|  |  |  |  |  |  |
| 3. | a. | A free electron is placed in a magnetic field strength of 1.3 T. Estimate the resonance frequency if g = 2.0023 (h= 6.626 10-34 J.s) | CO6 | E | 8 |
|  | b. | Illustrate ESR spectrometer with a neat schematic diagram and explain its parts. | CO2 | A | 12 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Classify the NMR and ESR based on the type of source used, and the type of matter targeted. | CO6 | An | 5 |
|  | b. | Draw the energy levels of the hyperfine splitting in case of hydrogen atom using ESR spectroscopy and explain it. | CO2 | R | 15 |
|  |  |  |  |  |  |
| 5. |  | Calculate the energy of all the three transitions for the cobalt 59 nuclei with a nuclei spin of I = 7/2. | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Mention the three important conditions under which the NQR spectra could be recorded and discuss the principle behind NQR spectroscopy. | CO3 | R | 5 |
|  | b. | List the three different methods for the detection of NQR frequencies and draw the block diagram of anyone. | CO3 | R | 15 |
|  |  |  |  |  |  |
| 7. | a. | Give the three important parameters on which there is an isomer shift in case of Mossbauer nuclei. | CO4 | R | 5 |
|  | b. | Discuss the effect of applying simultaneous magnetic and electric fields in case of Fe-57 nuclei. | CO4 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write a short note on electron capture and gamma ray resonance. | CO4 | A | 5 |
|  | b. | Define Doppler effect and discuss its role in case of Mossbauer spectroscopy. | CO4 | R | 15 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the role of ionization, mass analyzer, detector and recorder in a mass spectrometer with a neat schematic diagram. | CO5 | U | 15 |
|  | b. | Write a short note on applications of mass spectrometry. | CO6 | A | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the role of nuclei spin to know the structure of matter through NMR technique. |
| CO2 | Appreciate the physics of electron spin used in ESR technique. |
| CO3 | Determine the structure of molecules using NQR spectroscopic technique. |
| CO4 | Appreciate the principles and working of Mossbauer spectroscopy. |
| CO5 | Analyze the structure of matter using mass spectroscopy. |
| CO6 | Identify the best method to solve the spectroscopic problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 |  | 25 |  | 5 |  | 40 |
| CO2 | 15 |  | 12 |  |  |  | 27 |
| CO3 | 20 |  |  | 20 |  |  | 40 |
| CO4 | 20 | 15 | 5 |  |  |  | 40 |
| CO5 |  | 15 |  |  |  |  | 15 |
| CO6 |  |  | 5 | 5 | 8 |  | 18 |
|  | | | | | | | **180** |

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| **Course Code** | **20PH3011** | **Duration** | **3hrs** |
| **Course Name** | **NUCLEAR AND PARTICLE PHYSICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Apply Schrodinger’s wave equation to the problem of a particle in a box (with special reference to an electron trapped inside an atom) and derive an expression for eigen function and eigen values. | CO1 | A | 15 |
|  | b. | A sound wave can be used to visualize a piece of chalk, whereas even a gamma ray cannot be used to visualize the size of a nucleus. Give a reason for the same. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Based on the understanding of the Weizsacker semi-empirical mass formula, arrive at an expression for the stability of the nucleus for a given atomic number A. | CO1 | U | 15 |
|  | b. | Even though Geiger and Marsden first noticed the scattering of alpha particles, Ernest Rutherford finally discovered the nucleus. List the reasons given by Rutherford supporting the existence of the nucleus. | CO1 | An | 5 |
| 3. | a. | Analyze the various properties of the nuclear force, the strongest force known to human beings in nature, in detail. | CO2 | An | 15 |
|  | b. | While studying the nature of nuclear forces, it is always better to go for easier systems. Give an example for each of the following scenarios. (a) For studying the nature of nuclear force. (b) For studying the nature of nuclear interactions. | CO2 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Hideki Yukawa, a Japanese scientist, propounded the meson theory of nuclear forces. Explain the same in detail with necessary model diagrams. | CO2 | U | 15 |
|  | b. | A thermonuclear weapon is a combination of nuclear fission and nuclear fusion devices. Explain, in brief, the Teller-Ulam design of a thermonuclear weapon. | CO2 | R | 5 |
| 5. | a. | Gamma rays, highly energetic electromagnetic waves, interact uniquely with surrounding matter. List them and explain each way of interaction in detail. | CO3 | U | 15 |
|  | b. | Explain the phenomenon of parity symmetry in a nutshell. | CO3 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain Fermi’s theory of inverse beta decay and compare the theoretical plot of beta particle energies with the experimental plot. Suggest any improvements in the theory if there is any discrepancy. | CO6 | R | 15 |
|  | b. | Geiger-Nuttal law links the range of the alpha particles with that of the disintegration constant of the parent nucleus. Discuss this idea in brief. | CO6 | An | 5 |
| 7. | a. | India has a significant resource of uranium and a vast resource of thorium. Formulate a three-stage nuclear power programme based on the vision of the Father of the Indian Nuclear Power Programme, Dr. Homi Jehangir Bhabha. | CO4 | An | 15 |
|  | b. | Write short notes on different types of direct nuclear reactions. | CO4 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | The optical model describes the atomic nuclei as a cloud of crystal balls. When it is struck by a beam of particles, absorption, scattering, and transmission happen analogous to the behaviour of light. Define the same in detail. | CO4 | R | 15 |
|  | b. | When particle radiation is directed towards a target in the form of a thin foil or a thin plate, enumerate the possible nuclear reactions. | CO4 | A | 5 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Apply the concepts of particle physics to describe the fundamental properties of the four known forces in nature and describe them in detail. | CO5 | A | 15 |
|  | b. | Discuss in brief the classification of fundamental particles as bosons and fermions. | CO5 | An | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic structure of the nucleus and apply Weizsacker semi-empirical mass formula for determining the nuclear stability. |
| CO2 | Comprehend the nature of nuclear forces and its applications to real physical systems of nuclei. |
| CO3 | Apply the radioactive properties of certain nuclides for water, food, health, and energy sectors. |
| CO4 | Analyze different types of nuclear reactions with special reference to nuclear fission and fusion reactions and their applications to nuclear power reactors. |
| CO5 | Evaluate the classification scheme of fundamental forces and particles and their relevance to various applications in physics. |
| CO6 | Create new concepts in physics by comprehending the latest research in nuclear and particle physics. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 15 | 15 | 5 | -- | -- | 40 |
| CO2 | 5 | 15 | 5 | 15 | -- | -- | 40 |
| CO3 | -- | 15 | 5 | -- | -- | -- | 20 |
| CO4 | 20 | -- | 5 | 15 | -- | -- | 40 |
| CO5 | -- | -- | 15 | 5 | -- | -- | 20 |
| CO6 | 15 | -- | -- | 5 | -- | -- | 20 |
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| **Course Code** | **20PH3012** | **Duration** | **3hrs** |
| **Course Name** | **SOLID STATE PHYSICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe the different types of bonding in solids with suitable examples. | CO1 | U | 10 |
|  | b. | Demonstrate the Clausius- Mossotti relation. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the classification of ferroelectric materials based on their chemical composition and structure. | CO2 | U | 10 |
|  | b. | Derive an expression for density of states D(E) for a crystal of finite volume. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Describe the dependence of anti-ferromagnetism on temperature and mention the applications of anti-ferromagnetic materials. | CO 3 | U | 10 |
|  | b. | Demonstrate the hysteresis loop corresponding to ferromagnetic materials. | CO 3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the type of magnetism exhibited by MnO with a suitable sketch. | CO3 | U | 10 |
|  | b. | Distinguish between anti-ferro magnetic and ferrimagnetic materials with examples. | CO 3 | U | 10 |
| 5. |  | Explain the Weiss molecular filed theory of ferromagnetism. | CO 4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain Langevin’s theory of paramagnetism and illustrate that the inverse of susceptibility varies linearly with temperature. | CO 4 | U | 20 |
|  |  |  |  |  |  |
| 7. | . | Explain the different types of point, line, and surface defects with suitable sketch. | CO 5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the process of luminescence with a suitable sketch. | CO 5 | U | 5 |
|  | b. | Explain the optical absorption in metals, insulators and semiconductors with suitable examples. | CO 5 | U | 15 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Differentiate type I and type II superconductors and mention their applications. | CO6 | U | 15 |
|  | b. | Describe the functioning of Maglev train. | CO6 | U | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the crystal properties and elementary models for bonding of atoms and molecules. |
| CO2 | Explain the concepts leading to dielectric and ferroelectric properties in detail. |
| CO3 | Interpret the fundamental ideas of magnetic properties in solid state phenomena. |
| CO4 | Describe the theories involved in the magnetic and superconducting materials phenomena. |
| CO5 | Illustrate optical properties of materials and its importance in luminescence applications. |
| CO6 | Apply the solid-state physical phenomena in the areas of superconductors and its applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 20 |  |  |  |  | 20 |
| CO2 |  | 20 |  |  |  |  | 20 |
| CO3 |  | 40 |  |  |  |  | 40 |
| CO4 |  | 40 |  |  |  |  | 40 |
| CO5 |  | 40 |  |  |  |  | 40 |
| CO6 |  | 20 |  |  |  |  | 20 |
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| **Course Code** | **20PH3013** | **Duration** | **3hrs** |
| **Course Name** | **PHYSICS OF NANOMATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | State planks hypothesis and justify the energy is discrete with graphical representation. | CO | U | 6  14 |
| b. | Apply schrodinger wave equation for a Square well potential and draw wave function. | CO | AP |
| (OR) | | | | |  |
| 2. | a. | Derive the electron wavelength using Einstein and Planks relations. | CO1 | U | 5.  15 |
| b. | Classify the quantum states with suitable diagrams depicting quantum well, wire and dot. | CO1 | AP |
| 3. | a. | Demonstrate the working of ball milling with suitable diagrams. | CO2 | U | 15 |
|  | b. | Distinguish top down and bottom up processes. | CO2 | U | 5 |
| (OR) | | | | |  |
| 4. | a. | Classify the physical chemical route of nanomaterials synthesis. | CO2 | U | 6 |
|  | b. | Illustrate the sequential steps involved in the photolithographic Process. | CO2 | U | 14 |
| 5. | a. | Differentiate the carbon nanotubes based on its chiral vectors. | CO3 | AP | 6 |
|  | b. | Apply the electrical properties of carbon nanotubes to explain van hove singularities and Step potential. | CO3 | AP | 14 |
| (OR) | | | | |  |
| 6. | a. | Analyse the electrical properties of Gold nanoparticles using thiols. | CO3 | AP | 14 |
|  | b. | State coulomb blockade effect arise due to step potential at nano scale materials. | CO3 | AP | 6 |
| 7. | a. | Classify the magnetic materials with suitable atomic magnetic moments diagrams. | CO4 | R | 5 |
|  | b. | Demonstrate Domain rotation and domain growth upon application of dc magnetic field. | CO4 | U | 15 |
| (OR) | | | | |  |
| 8. | a. | Justify the optical absorption of nano materials lead to Blue shift. | CO4 | R | 10 |
|  | b. | Describe the nano indendation method of measuring the mechanical properties of materials. | CO4 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Appraise the giant magneto resistance exhibited by nano magnetic materials. | CO5 | U | 10 |
|  | b. | Appraise the Spintronics technology with simple examples and diagrams. | CO6 | CR | 10 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Define Quantum confinement effect in nanomaterials | | | | | | | |
| CO2 | Describe the different fabrication techniques of nanomaterials | | | | | | | |
| CO3 | Examine the characteristics of nanomaterials | | | | | | | |
| CO4 | Analyse the nanodevices with different characterization tools | | | | | | | |
| CO5 | Evaluate the nanodevices for different applications | | | | | | | |
| CO6 | Design and create advanced nanodevices | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | |  | 11 | 29 |  |  |  | 40 |
| CO2 | |  | 40 |  |  |  |  | 40 |
| CO3 | |  |  | 40 |  |  |  | 40 |
| CO4 | | 15 | 25 |  |  |  |  | 40 |
| CO5 | |  | 10 |  |  |  |  | 10 |
| CO6 | |  |  |  |  |  | 10 | 10 |
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| **Course Code** | **20PH3014** | **Duration** | **3hrs** |
| **Course Name** | **FABRICATION AND TESTING OF THINFILM DEVICES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Analyze the advantages and disadvantages of rotary pump with the working principle. | CO1 | Analyze | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain in detail the vacuum system used for the thin film depositions. | CO1 | Apply | 20 |
|  |  |  |  |  |  |
| 3. |  | Illustrate the function of RF Magnetron sputtering system to deposit metal films. | CO2 | Apply | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Illustrate the function of Sol-gel process used for preparation of metal oxide nanoparticles. | CO3 | Apply | 20 |
|  |  |  |  |  |  |
| 5. |  | Illustrate the function of spin coating method to prepare a metal oxide thin film with a neat schematic. | CO3 | Apply | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the various electrical characterization techniques used for the analyzing thin films. | CO4 | Analyze | 20 |
|  |  |  |  |  |  |
| 7. |  | Discuss any Flexible devices with the fabrication and its characterizations | CO6 | Understand | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain the CNT based transistor with neat schematic. | CO6 | Analyze | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Illustrate the function of PLD system used for the thin film depositions. | CO5 | Analyze | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the vacuum pumps and measure the vacuum level. |
| CO2 | Illustrate the mechanism of thin film deposition. |
| CO3 | Apply the knowledge on the influence of substrates on the growth of thin films. |
| CO4 | Analyse the thin film characteristics through different tools. |
| CO5 | Appraise the latest thin film device fabrication and testing. |
| CO6 | Create fabrication methods for thin film based devices like solar cells and gas sensors. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 20 | 20 |  |  | 40 |
| CO2 |  |  | 20 |  |  |  | 20 |
| CO3 |  |  | 40 |  |  |  | 40 |
| CO4 |  |  |  | 20 |  |  | 20 |
| CO5 |  |  |  | 20 |  |  | 20 |
| CO6 |  | 20 |  | 20 |  |  | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **20PH3025** | **Duration** | **3hrs** |
| **Course Name** | **RADIATION TREATMENT AND PLANNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Draw a neat labeled diagram of the beam collimation system of a conventional linear accelerator and explain the functions of various parts. | CO1 | A | 15 |
|  | b. | List the differences between a cobalt-60 gamma ray source and a linear accelerator. | CO1 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain a CT simulator and a virtual simulator and give the advantages and disadvantages of CT simulator over conventional simulator. | CO1 | U | 15 |
|  | b. | Write a short note on Linear accelerator head. | CO1 | An | 5 |
|  |  |  |  |  |  |
| 3. | a. | Derive the relationship between Tissue Maximum Ratio and Percentage Depth Dose and discuss the Clarkson’s method of treatment planning in brief. | CO2 | An | 15 |
|  | b. | Describe the Batho Power Law method for inhomogeneity correction. | CO2 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the concepts of inverse square law, build-up region and depth dose maximum and hence, define percentage depth dose, tissue air ratio, scatter air ratio, tissue phantom ratio, and tissue maximum ratio. | CO2 | U | 15 |
|  | b. | Write short notes on surface dose and skin sparing effect. | CO2 | R | 5 |
|  |  |  |  |  |  |
| 5. | a. | Explain the significances of ICRU (International Commission on Radiation Units and Measurements) 50, ICRU62 and ICRU 83 reports in detail. | CO3 | U | 15 |
|  | b. | Discuss about isodose curves, wedge filters, bolus and compensating filters. | CO3 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Elaborate on the quality assurance of treatment planning system. | CO6 | R | 15 |
|  | b. | Analyze the different dosimetric indices used for treatment plan comparison. | CO6 | An | 5 |
|  |  |  |  |  |  |
| 7. | a. | State the characteristics of electron beam and explain the theory of interaction of electrons with the surrounding matter. | CO4 | An | 15 |
|  | b. | Point out the differences between Source to Axis Distance (SAD) and Source to Skin Distance (SSD) techniques. | CO4 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain a virtual source in a clinical electron beam and the two methods for determining the virtual source (virtual SSD) and point out the better method that is clinically more useful. | CO4 | R | 15 |
|  | b. | Draw 6 MeV and 12 MeV electron beam depth dose curves and compare Rmax, R85, R50, and Rp. | CO4 | A | 5 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe about treatment planning procedures of forward and inverse planning. | CO5 | A | 15 |
|  | b. | Explain the various processes of helical Tomotherapy. | CO5 | An | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the basic information about radiotherapy machines. |
| CO2 | Understand the interaction of photon beam on matter. |
| CO3 | Apply various calibration methods to ensure better quality treatment using machines. |
| CO4 | Analyze the various clinical treatment planning. |
| CO5 | Evaluate the various radiation treatment modalities. |
| CO6 | Create better treatment modalities using electron beam therapy and advanced radiotherapy treatment methods like Cyberknife. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 15 | 15 | 5 | -- | -- | 40 |
| CO2 | 5 | 15 | 5 | 15 | -- | -- | 40 |
| CO3 | -- | 15 | 5 | -- | -- | -- | 20 |
| CO4 | 20 | -- | 5 | 15 | -- | -- | 40 |
| CO5 | -- | -- | 15 | 5 | -- | -- | 20 |
| CO6 | 15 | -- | -- | 5 | -- | -- | 20 |
| Sub-Total | 45 | 45 | 45 | 45 | -- | -- |  |
| **Grand Total** | | | | | | | **180** |



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| **Course Code** | **20PH3026** | **Duration** | **3hrs** |
| **Course Name** | **MEDICAL RADIATION DOSIMETRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Write a short note on binding energy. | CO1 | A | 4 |
|  | b. | Write an essay on alpha, beta and gamma decays. | CO1 | U | 16 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Differentiate between ionizing and non-ionizing radiation with suitable examples. | CO1 | An | 4 |
|  | b. | Derive an equation for radioactive decay and an expression for half-life from the basic equation. | CO1 | R | 16 |
|  |  |  |  |  |  |
| 3. | a. | Explain Compton scattering and its relevance to the clinical application. | CO2 | An | 4 |
|  | b. | Explain the interaction of neutrons with matter with a suitable diagram. | CO2 | R | 16 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Compare the elastic and inelastic scattering of neutrons. | CO2 | A | 4 |
|  | b. | Discuss the various interactions of photons with matter. | CO2 | U | 16 |
|  |  |  |  |  |  |
| 5. | a. | Write about Bragg Gray cavity theory. | CO3 | U | 4 |
|  | b. | Discuss in detail, Burlin and Spencer Attixcavity theory. | CO3 | An | 16 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Tabulate the definition, formula and units of Flux, particle fluence, energy fluence activity and specific activity. | CO6 | An | 4 |
|  | b. | Define linear attenuation coefficient, Half Value Layer (HVL), Tenth Value Layer (TVL), and derive the relation between  (1) µ and HVL.  (2) HVL and TVL. | CO6 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | Explain Geiger-Mueller based survey meter. | CO4 | U | 4 |
|  | b. | Explain in detail about the principle, working of a Thermo-Luminescent Dosimeter (TLD) and its reader with neat diagram | CO4 | A | 16 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain with neat diagram the working of free air ionization chamber. | CO4 | U | 4 |
|  | b. | Describe the working of a gas filled detector and neat diagram. | CO4 | R | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write short notes on necessity of all correction factors applied for absolute dose absolution dose measurement with ionization chamber. | CO5 | A | 4 |
|  | b. | Discuss International Atomic Energy Agency’s (IAEA TRS 398) protocol for high energy photon beam calibration. | CO5 | An | 16 |

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|  | **COURSE OUTCOMES** |
| CO1 | Remember the basic concepts of atoms and nucleus. |
| CO2 | Understand the different types of radiation emitted from nuclear sources. |
| CO3 | Apply the interaction of radiation with matter in novel peaceful applications. |
| CO4 | Analyze and understand the various units of radiation measurements. |
| CO5 | Evaluate the different types of radiation detection and measurement. |
| CO6 | Create novel dosimetry systems for measuring different types of nuclear radiation. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 16 | 16 | 4 | 4 | -- | -- | 40 |
| CO2 | 16 | 16 | 4 | 4 | -- | -- | 40 |
| CO3 | -- | 4 | -- | 16 | -- | -- | 20 |
| CO4 | 16 | 8 | 16 | -- | -- | -- | 40 |
| CO5 | -- | -- | 4 | 16 | -- | -- | 20 |
| CO6 | -- | -- | 16 | 4 | -- | -- | 20 |
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| **Course Code** | **22PH3001** | **Duration** | **3hrs** |
| **Course Name** | **SOLID STATE IONICS AND ENERGY DEVICES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Classify solids based on types of bonding. | CO1 | U | 5 |
|  | b. | Discuss on the structures of different carbon materials like Diamond, Graphite, Fullerenes, and other types. | CO1 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Classify the synthetic and natural polymers. | CO1 | U | 5 |
|  | b. | Distinguish biodegradable and non-biodegradable polymers with suitable examples. | CO1 | U | 5 |
|  | c. | Write a note on solution casting method for polymer blending with an emphasis on the need for such kind of polymer blends. | CO1 | U | 10 |
| 3. | a. | Define superionic conductors with a detailed note on LISICON and NASICON. | CO2 | R | 15 |
|  | b. | Define mixed conductors with examples. | CO2 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe polymer membranes base on their nature such as solid, gel, composites and plasticized ones. | CO2 | R | 10 |
|  | b. | Define glass transition temperature and explain the ionic transport in polymer membranes. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 5. |  | Determine the role of AC impedance spectroscopy with suitable examples. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Illustrate the Transference number measurements using Wagner Polarization method. | CO3 | A | 15 |
|  | b. | Explain Four Probe method. | CO3 | A | 5 |
|  |  |  |  |  |  |
| 7. | a. | Compare 1 D, 2D and 3 D nanostructures. | CO4 | E | 10 |
|  | b. | Correlate the knowledge on mixed conductors, ionically conducting materials to construct a lithium ion battery. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Evaluate the advantageous effect of supercapacitors over batteries. | CO4 | E | 5 |
|  | b. | Classifythe types of supercapacitors, design a supercapacitor using carbon as the electrodes and explain its working principle. | CO5 | An | 15 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Justify the names of electrodes used in a three electrode system and explain the role of three electrode in material characterization. | CO6 | E | 10 |
|  | b. | Analyze the cyclic voltammetry and charge-discharge process of solid state devices like batteries and supercapacitors. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the types of materials based on structure. |
| CO2 | Understand the electrical properties of mixed and ionically conducting materials. |
| CO3 | Analyse the electrical and electrochemical properties of materials. |
| CO4 | Apply the knowledge of materials for making energy devices. |
| CO5 | Evaluate the energy storage devices. |
| CO6 | Create alternative energy storage devices to existing once. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 40 |  |  |  |  | 40 |
| CO2 | 40 |  |  |  |  |  | 40 |
| CO3 |  |  | 40 |  |  |  | 40 |
| CO4 |  |  |  |  | 15 |  | 15 |
| CO5 |  |  |  | 25 |  |  | 25 |
| CO6 |  |  |  | 10 | 10 |  | 20 |
|  | | | | | | | **180** |

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Description automatically generated with medium confidence

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| **Course Code** | **20FS2001** | **Duration** | **3hrs** |
| **Course Name** | **FUNDAMENTALS OF FORENSIC SCIENCE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define Forensic Science. Explain the branches of Forensic Science. | CO1 | U | 10 |
|  | b. | Explain the basic principles of Forensic Science. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write a note on history and development of Forensic Science. | CO1 | R | 10 |
|  | b. | Explain Frye and Daubert Standards. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Write a note on DFSS and its role with respect to Forensic Science. | CO3 | U | 10 |
|  | b. | Write a note on BPR&D and its divisions. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write a note on Fingerprint Bureau. | CO3 | A | 10 |
|  | b. | Write a note on NCRB and its divisions. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write a note on Central Police Organizations. | CO4 | U | 10 |
|  | b. | Write a note on DEA and DRDO. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Write a note on State Police Organizations. | CO4 | U | 10 |
|  | b. | Write a short note on any 3 Para-military forces. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | What is crime? What are the essential elements of crime? | CO5 | U | 10 |
|  | b. | Write a note on the factors leading to crime. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write a note on the nature and causes of crime. | CO5 | A | 10 |
|  | b. | Write a note on the classification of crime. | CO5 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the steps for Crime Scene Investigation. | CO6 | An | 10 |
|  | b. | What is chain of custody? Write a detailed report of what all information is added in it. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Point out the importance of forensic sciences. |
| CO2 | Understand the techniques involved in forensic sciences. |
| CO3 | Know various laboratories available to serve forensic science. |
| CO4 | Understand the importance of police organization. |
| CO5 | Describe the crime and filing a crime. |
| CO6 | Investigate the crime scene. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 |  |  |  |  |  |
| CO2 |  | 10 | 10 |  |  |  |  |
| CO3 |  | 10 | 20 |  |  |  |  |
| CO4 |  | 40 | 10 |  |  |  |  |
| CO5 |  | 20 | 20 |  |  |  |  |
| CO6 |  |  |  | 20 |  |  |  |
| 10 90 60 20 | | | | | | | **180** |

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| **Course Code** | **20FS2002** | **Duration** | **3hrs** |
| **Course Name** | **CRIME AND SOCIETY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Explain any two theories of Criminology. | CO1 | Understand | 10 |
|  | b. | Describe the Causes of crime in society in detail. | CO1 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain functionalist perspective of crime in detail. | CO2 | Understand | 10 |
|  | b. | Define Capitalism and illustrate the Marxist perspective. | CO2 | Remember | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the Deterrent and Reformative theory of Punishment in detail. | CO3 | Understand | 10 |
|  | b. | Describe Open Prison, Probation, and Parole in detail. | CO3 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain Juvenile Delinquency and correctional activities for their rehabilitation. | CO4 | Understand | 10 |
|  | b. | Describe Corporate crime with a suitable example. | CO4 | Remember | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain Dowry death with IPC section in detail. | CO5 | Understand | 10 |
|  | b. | Explain crime against Children and the POSCO act. | CO5 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Differentiate between Corporate and Organized crimes. | CO2 | Analyzing | 10 |
|  | b. | Explain organized crime with its key features. State a few examples also. | CO2 | Understand | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain New Criminology theory in detail. | CO2 | Understand | 10 |
|  | b. | Explain William Chambliss and Gordon's theory of Criminology in detail. | CO2 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the Hierarchy of Courts in India. | CO6 | Understand | 10 |
|  | b. | Define the Judicial system and power of each court. | CO6 | Remember | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain Crime against SCs, STs and DTNTs. | CO6 | Understand | 10 |
|  | b. | Explain “Labelling Theory” and “Anomie Theory” in detail. | CO1 | Understand | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the recent trends in criminology, changing profile of crime and criminals |
| CO2 | Understand the forms and recent in crime |
| CO3 | Learn the theories of Punishment and Prevention of crime |
| CO4 | Take up the professionals roles of correctional agents in agencies of criminal justice administration |
| CO5 | Understand the social and governmental regulations with regards to crime |
| CO6 | Understand about Indian Judicial system. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 20 | 10 |  |  |  |  | 30 |
| CO2 | 10 | 40 |  | 10 |  |  | 60 |
| CO3 | 10 | 10 |  |  |  |  | 20 |
| CO4 | 10 | 10 |  |  |  |  | 20 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 | 20 | 10 |  |  |  |  | 30 |
|  | | | | | | | **180** |

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| **Course Code** | **20FS2003** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC PHYSICS** | **Max. Marks** | **100** |

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|  | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Briefly explain about forensic phonetics and its types. | CO2 | An | 12 |
|  | b. | Write a note on the voice analysis process and its types. | CO2 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Mention and explain the four basic mechanisms of voice production. | CO1 | U | 10 |
|  | b. | What do you mean by speaker recognition in forensic science? Explain in detail. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Briefly explain the causes of road accidents. | CO3 | U | 10 |
|  | b. | Give a note on any 5 sources of information available for vehicle accidents. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write in detail about eye witnesses and tire marks considering it as the sources of information for vehicle accidents. | CO3 | U | 5 |
|  | b. | Explain the given sources of information for automobile accidents: Vehicle Speed, Reaction time, Time and distance. | CO3 | An | 15 |
|  |  |  |  |  |  |
| 5. | a. | Describe the history of Indian penal code and explain the sections - 337,304A and 279 | CO4 | R | 10 |
|  | b. | Write the 10 sections, offences and penalties of offenses related to the documents of Motor Vehicle Act. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Mention the objectives of Motor vehicle act, 1988. | CO3 | R | 4 |
|  | b. | Write two sections, offenses and penalties of offenses related to the number plates and horns of motor vehicle act. | CO3 | R | 4 |
|  | c. | Write the 12 sections, offences and penalties of offenses related to the driving of Motor Vehicle Act. | CO3 | R | 12 |
|  |  |  |  |  |  |
| 7. | a. | Write a short note on: Surveillance photography, Aerial Photography and High speed photography. | CO5 | An | 6 |
|  | b. | Briefly explain UV and IR Photography. | CO5 | U | 14 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Give a note on photography and its history. | CO5 | U | 4 |
|  | b. | Explain the terms Colour temperature, Aperture, Shutter speed and Depth of field. | CO5 | U | 16 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Briefly explain tool marks, characteristics of tool marks and its types with examples. | CO6 | An | 10 |
|  | b. | Write the precautions and process for the examination and matching of tool marks. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the physics of sound production. |
| CO2 | Apply phonetics and voice analysis in Forensic Science. |
| CO3 | Understand the causes and investigations done in vehicular accidents. |
| CO4 | Explain the legal provisions about forensic photography. |
| CO5 | Interpret the various methods of photographing a crime scene etc. |
| CO6 | Describe the various tool marks. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 10 | - | 10 | - | - | 20 |
| CO2 | - | 8 | - | 12 | - | - | 20 |
| CO3 | 30 | 25 | - | 15 | - | - | 70 |
| CO4 | 10 | - | - | - | - | - | 10 |
| CO5 | - | 34 | - | 06 | - | - | 40 |
| CO6 | - | 10 | - | 10 | - | - | 20 |
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| **Course Code** | **20PH1015** | **Duration** | **3hrs** |
| **Course Name** | **PHYSICS FOR ROBOTICS ENGINEERS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The rate of change of position is equal to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | [Isaac Newton](https://www.britannica.com/biography/Isaac-Newton)’s second law of motion states that the time rate of change of momentum is equal to the [acceleratio](https://www.britannica.com/science/force-physics)n acting on the particle. True/False | | CO1 | An | | 1 |
| 3. | The fractional change in the dimension of a body produced by the external stress acting on is called \_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | Rigidity modulus is defined only for solid and not for liquids and gases. True/False | | CO2 | An | | 1 |
| 5. | Give an example for a rigid body. | | CO3 | U | | 1 |
| 6. | The rotation of rigid bodies which will remain constant throughout the duration of rotation, over a fixed axis is called \_\_\_\_\_\_\_\_\_\_\_\_ motion. | | CO3 | R | | 1 |
| 7. | Torsional pendulum will execute simple harmonic motion. True/False | | CO4 | U | | 1 |
| 8. | The number of oscillations per unit time is called as \_\_\_\_\_\_\_\_.   1. Phase 2. Frequency 3. Amplitude 4. Time period | | CO4 | R | | 1 |
| 9. | The medium at which population inversion takes place is known as \_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | The refractive index of core is lesser than that of the cladding. True/False | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Discuss on energy and their types. | | CO1 | | U | 3 |
| 12. | Classify stress and explain thembriefly. | | CO2 | | U | 3 |
| 13. | Differentiate rectilinear and curvilinear translatory motion. | | CO3 | | An | 3 |
| 14. | Define damped harmonic motion. | | CO4 | | U | 3 |
| 15. | Distinguish normal and laser light. | | CO5 | | An | 3 |
| 16. | List the applications of optical fiber in various fields. | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | Develop an expression for position vector of center of mass for a three particle system. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 18. |  | Elucidate the following.   1. Young’s Modulus 2. Bulk Modulus | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Give a detailed report on rigid body and its motion with examples. | CO3 | | A | 9 |
|  | b. | Explain Euler’s two laws of motion for a rigid body. |  | | U | 3 |
|  |  |  |  | |  |  |
| 20. |  | Derive the equation of motion of a simple pendulum with necessary diagrams. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | Explain the principle, and steps involved in the holography with neat sketch. | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Derive equations of motion by integral method. | CO1 | | U | 9 |
|  | b. | Discuss work-energy theorem. | CO1 | | U | 3 |
|  |  |  |  | |  |  |
| 23. |  | Illustrate the following in the case of laser with diagrams   1. Components 2. Absorption 3. Spontaneous emission 4. Stimulated emission | CO5 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Summarize the different types of optical fibers in detail. | CO6 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply Newtonian Mechanics to solve problems. |
| CO2 | Demonstrate the ability to solve the problems based on modulus of elasticity. |
| CO3 | Analyze rigid body mechanics using transformations. |
| CO4 | Apply the fundamentals laws concerning Oscillations. |
| CO5 | Discuss about the concepts of lasers and its applications. |
| CO6 | Relate the application of fibre optics in optic devices. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 28 |  | 1 |  |  | 29 |
| CO2 | 1 | 15 |  | 1 |  |  | 17 |
| CO3 | 1 | 4 | 9 | 3 |  |  | 17 |
| CO4 | 1 | 4 | 12 |  |  |  | 17 |
| CO5 |  | 13 | 12 | 3 |  |  | 28 |
| CO6 |  | 13 | 3 |  |  |  | 16 |
|  | | | | | | | **124** |

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| **Course Code** | **20PH1017** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED PHYSICS FOR BIOTECHNOLOGY ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | | | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | |
| 1. | List any two properties of laser. | | | CO1 | | U | | 1 |
| 2. | In He:Ne laser \_\_\_\_\_\_\_\_\_\_ pumping method is used for achieving population inversion. | | | CO1 | | R | | 1 |
| 3. | In the propagation of optical fiber, if the light passes through the axis of the core it is called as \_\_\_\_\_\_\_\_\_\_ ray. | | | CO2 | | R | | 1 |
| 4. | In order to achieve total internal reflection, the incident ray must be greater than \_\_\_\_\_\_\_\_\_\_ angle. | | | CO2 | | R | | 1 |
| 5. | Ultrasonic frequency range is above \_\_\_\_\_\_\_\_\_\_ KHz | | | CO3 | | U | | 1 |
| 6. | Piezoelectric \_\_\_\_\_\_\_\_\_\_ is a device that uses the piezoelectric effect to measure by converting pressure/strain energy into an electrical charge | | | CO3 | | R | | 1 |
| 7. | Mention few characteristics of the sound ‘Noise’ in acoustics. | | | CO4 | | U | | 1 |
| 8. | In acoustics, \_\_\_\_\_\_\_\_\_\_ is defined as the sound energy flowing per unit area per unit time | | | CO4 | | R | | 1 |
| 9. | The residual magnetism (I) set up in the material represented by OB in the hysteresis curve is called \_\_\_\_\_\_\_\_\_\_. | | | CO5 | | U | | 1 |
| 10. | In the application of superconductors, \_\_\_\_\_\_\_\_\_\_ is a non-invasive technique for investigating human brain activity. | | | CO6 | | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | |
| 11. | Describe the principle of laser based on Einstein’s theory. | | | CO1 | | | An | 3 |
| 12. | Explain the propagation of light waves in optical fiber with necessary diagram. | | | CO2 | | | U | 3 |
| 13. | Define Piezoelectric effect with an example. | | | CO3 | | | An | 3 |
| 14. | Calculate the reverberation time of a hall with volume 2400 m3 and total absorption is equivalent to 72 m2. | | | CO4 | | | U | 3 |
| 15. | Distinguish hard and soft magnetic materials and its properties. | | | CO5 | | | An | 3 |
| 16. | Describe the term ‘Meissner Effect’ in superconductors and discuss its importance. | | | CO6 | | | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | | |
| 17 |  | Explain the principle, construction and working of a He:Ne laser with its energy level diagram in detail. | | | CO1 | | An | 12 |
| 18. | a. | Define the terms ‘numerical aperture and acceptance angle’ in optical fiber. | | | CO2 | | U | 4 |
|  | b. | Illustrate the types of optical fiber based on material, mode and refractive index with mention to its advantages and applications. | | | CO2 | | A | 8 |
| 19. | a. | Determine the fundamental frequency of the ultrasound generated for a nickel bar of length 24 cm with density 8.19x103 kg/m3(Young’s modulus of quartz is 8.24x1011 Nm-2). | | | CO3 | | A | 4 |
|  | b. | Explain the construction and working of a Piezoelectric oscillator in the production of ultrasonic waves with circuit diagram. | | | CO3 | | An | 8 |
| 20. |  | Assess the various factors affecting the architectural acoustics of a building in detail and discuss its remedies to overcome. | | | CO4 | | E | 12 |
| 21. | a. | Differentiate hard and soft magnetic materials based on its properties. | | | CO5 | | U | 4 |
|  | b. | Compare and contrast the important properties of dia, para and ferro magnetic materials in detail. | | | CO5 | | E | 8 |
| 22. |  | Explain the principle, construction and working of a magnetostriction oscillator in the production of ultrasonic waves with necessary circuit diagram. | | | CO3 | | An | 12 |
| 23 |  | Illustrate the hysteresis curve in detail by plotting a model graph between magnetic flux density and the magnetizing field strength. | | | CO5 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | | | |
| 24. | a. | Describe the effect of electric field and isotopes in superconductors. | CO6 | | | | A | 4 |
|  | b. | Explain different types of superconductors in detail with its graphical diagram. | CO6 | | | | An | 8 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Understand the concept of lasers and apply laser action in biotechnology related industries. | | | | | | | |
| CO2 | Explain and interpret the principle of fiber optics for biochemical processes monitoring drug design. | | | | | | | |
| CO3 | Apply non-destructive testing techniques in activation of enzymes and various other processes in  biotechnology industry. | | | | | | | |
| CO4 | Discern the laws governing acoustics and implement the same in synthetic biology and understand bioacoustics and plant acoustics. | | | | | | | |
| CO5 | Evaluate and perceive various laws governing magnetism with special reference to magnetic  separation of heavy minerals and magnetic drug delivery. | | | | | | | |
| CO6 | Create novel industrial and medical imaging applications by applying the principles of  superconducting materials. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** | |
| CO1 | | 1 | 1 |  | 15 |  |  | 17 | |
| CO2 | | 2 | 7 | 8 |  |  |  | 17 | |
| CO3 | | 1 | 1 | 4 | 23 |  |  | 29 | |
| CO4 | | 1 | 4 |  |  | 12 |  | 17 | |
| CO5 | |  | 5 |  | 15 | 8 |  | 28 | |
| CO6 | |  | 4 | 4 | 8 |  |  | 16 | |
|  | | | | | | | | **124** | |

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| **Course Code** | **20PH1018** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED PHYSICS FOR FOOD PROCESS OPERATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | The place where the emitted light is intensified and amplified is known as \_\_\_\_\_\_\_\_.  a. Optical resonating cavity b. Active medium  c. Excitation mechanism d. Standing waves in the cavity | | CO1 | R | | 1 |
| 2. | Point out the principle of laser from the following phenomena.  a. Spontaneous Emission b. Stimulated Absorption  c. Spontaneous Absorption d. Stimulated Emission | | CO1 | U | | 1 |
| 3. | The following type of optical fiber cable does not exist. Identify the same from the following list.  a. Graded Index Multi Mode b. Step Index Single Mode  c. Step Index Multi Mode d. Graded Index Single Mode | | CO2 | R | | 1 |
| 4. | \_\_\_\_\_\_\_\_is the measure of the quantity of light that can be collected by an optical fiber.  a. Acceptance Angle b. Numerical Aperture  c. Critical Angle d. Total Internal Reflection | | CO2 | U | | 1 |
| 5. | Pick out the only artificial source of infrasound from the given list.  a. Nuclear Explosion b. Earthquake c. Volcanic eruption  d. Tornadoes | | CO3 | R | | 1 |
| 6. | Ultrasound waves travel faster in solid materials. This is because \_\_\_\_\_\_\_\_  a. Ultrasound waves are transverse waves.  b. Ultrasound waves are electromagnetic waves.  c. Ultrasound waves are thermal waves.  d. Ultrasound waves are longitudinal waves. | | CO3 | U | | 1 |
| 7. | The following quantity is directly related to frequency.  a. Pitch b. Pressure c. Temperature d. Resistance. | | CO4 | R | | 1 |
| 8. | When one studies the characteristics of loudness, this is evident.   1. It depends on the vanishing of the sound wave involved. 2. It depends on the interference of the sound wave involved. 3. It depends on the amplitude of the sound wave involved. 4. It depends on the polarization of the sound wave involved. | | CO4 | U | | 1 |
| 9. | The magnetic behaviour of materials can be traced to \_\_\_\_\_\_\_\_   1. Orbital motion of the neutrons. 2. Orbital motion of the electrons. 3. Orbital motion of the protons. 4. Orbital motion of the nucleus. | | CO5 | R | | 1 |
| 10. | The magnetic susceptibility of a ferromagnetic substance is \_\_\_\_\_\_\_\_  a. Always negative and large b. Always positive and small.  c. Always positive and large. d. Always negative and small. | | CO5 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | For a semiconductor laser, the wavelength of emission is 621.2 nm. Estimate the band gap energy of the semiconductor laser. | | CO1 | | U | 3 |
| 12. | Calculate the acceptance angle of the plastic optical fiber cable which has a numerical aperture of 0.7. | | CO2 | | A | 3 |
| 13. | A quartz crystal of length 1.5 mm is vibrating at resonance. Infer its fundamental frequency. Given that the Young’s Modulus = 7.9 x 1010 N/m2 and ρ = 2650 kg/m3). | | CO3 | | U | 3 |
| 14. | A thunderstorm has an intensity of 10 dB. Predict its intensity level. [Given that the standard intensity = 10-12 W/m2.] | | CO4 | | A | 3 |
| 15. | A paramagnetic material has a magnetic field intensity of 104 A m-1. If the intensity of magnetization is 34 A m-1, calculate the flux density of the material. | | CO5 | | U | 3 |
| 16. | Tc for a metal with isotopic mass 199.5 is 4.185 K. Calculate the isotopic mass if the critical temperature falls to 4.133 K. | | CO6 | | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | |
| 17. |  | Illustrate the construction and working of a carbon di oxide laser with necessary energy level diagram. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | Deduce a relationship between numerical aperture and the acceptance angle of an optical fiber cable with a suitable diagram. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Illustrate the method of producing ultrasonic waves using magnetostriction effect with a circuit diagram. | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20. |  | For constructing an auditorium with good acoustics, some factors are very important. List four important factors that can affect the acoustics of an auditorium and suggest a few measures to improve the same. | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | Based on their response to an applied magnetic field, materials can be classified into dia, para and ferromagnetic materials. Compare the important properties between these three classes of materials. | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 22. | a. | List the basic processes that happen in a laser and define anyone these processes in brief. | CO1 | | R | 6 |
|  | b. | Distinguish between single mode and multi-mode optical fiber cables. | CO2 | | R | 6 |
|  |  |  |  | |  |  |
| 23. | a. | Describe the physical phenomena of piezoelectric effect and inverse piezoelectric effect briefly. | CO3 | | U | 6 |
|  | b. | Differentiate between a musical sound and a noise with a tabular column. | CO4 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Define Type I and Type II superconductors in detail with necessary diagrams. | CO6 | | R | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the concept of lasers and apply laser action in food processing industries. |
| CO2 | Explain and interpret the principle of fiber optics for food quality and safety assessment. |
| CO3 | Apply non-destructive testing techniques in agro-food products. |
| CO4 | Discern the laws governing acoustics and implement the same in creating better environment for workers in food industries. |
| CO5 | Evaluate and perceive various laws governing magnetism with special reference to magnetic separation of contaminants in food industries. |
| CO6 | Create efficient industrial applications by applying the principles of superconducting materials. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 7 | 4 | 12 | --- | --- | --- | **23** |
| CO2 | 7 | 1 | 3 | 12 | --- | --- | **23** |
| CO3 | 1 | 10 | 12 | --- | --- | --- | **23** |
| CO4 | 1 | 7 | 3 | 12 | --- | --- | **23** |
| CO5 | 1 | 4 | --- | 12 | --- | --- | **17** |
| CO6 | 12 | --- | 3 | --- | --- | --- | **15** |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **20PH1020** | **Duration** | **3hrs** |
| **Course Name** | **APPLICATION OF ENGINEERING MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | | **Bloom’s Level** | | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | | |
| 1. | A material is said to be allotropic, if it has \_\_\_\_\_\_\_\_\_\_\_. | | | | CO1 | | | R | 1 |
| 2. | Define space lattice. | | | | CO1 | | | R | 1 |
| 3. | Infer Dislocation in materials. | | | | CO2 | | | U | 1 |
| 4. | \_\_\_\_\_\_\_\_\_\_\_ increase in the number of dislocations inducing large residual stresses. | | | | CO2 | | | R | 1 |
| 5. | Crystalline ceramics are the \_\_\_\_\_\_\_\_\_\_\_ ceramics. | | | | CO3 | | | R | 1 |
| 6. | A \_\_\_\_\_\_\_\_\_\_\_ is a metallic alloy which can be used at high temperatures in excess of 0.8 Tm. | | | | CO3 | | | R | 1 |
| 7. | List a few reinforcement particles. | | | | CO4 | | | R | 1 |
| 8. | List few properties of matrix materials. | | | | CO4 | | | R | 1 |
| 9. | \_\_\_\_\_\_\_\_\_\_\_ solidus temperature of Lead base alloys. | | | | CO5 | | | R | 1 |
| 10. | Infer two types of losses due to corrosion. | | | | CO6 | | | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | | |
| 11. | Describe with neat sketches the arrangement of atoms in the BCC, FCC lattices. | | | CO1 | | | U | | 3 |
| 12. | Compare and contrast ductile and brittle fracture. | | | CO2 | | | E | | 3 |
| 13. | Summarize few traditional ceramics with its applications. | | | CO3 | | | E | | 3 |
| 14. | ‘Composites are anisotropic’-Justify. | | | CO4 | | | E | | 3 |
| 15. | Classify metals used for bearings and their applications. | | | CO5 | | | A | | 3 |
| 16. | List a few factors leading to corrosion. | | | CO6 | | | R | | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | | | | | |
| 17. | |  | Classify materials and elaborate on the mechanical properties of materials. | CO1 | | | A | | 12 |
|  | |  |  |  | | |  | |  |
| 18. | | a. | Compare and contrast Vicker’s and Brinell’s harness tests. | CO2 | | | A | | 6 |
|  | | b. | Explain tensile testing with a neat sketch and the results obtained. | CO2 | | | U | | 6 |
|  | |  |  |  | | |  | |  |
| 19. | |  | Appraise the thermal, tensile and flexural behavior of ceramics with neat sketches. | CO3 | | | E | | 12 |
|  | |  |  |  | | |  | |  |
| 20. | |  | Assess the fabrication process of metal matrix composites with neat sketch and also their advantages. | CO4 | | | E | | 12 |
|  | |  |  |  | | |  | |  |
| 21. | | a. | Illustrate the various parameters to be considered in tool selection process. | CO5 | | | A | | 7 |
|  | | b. | List the various properties of materials used for bearing. | CO5 | | | R | | 5 |
|  | |  |  |  | | |  | |  |
| 22. | |  | Discuss the various defects in crystals. | CO2 | | | U | | 12 |
|  | |  |  |  | | |  | |  |
| 23. | |  | Demonstrate any one strengthening mechanism with neat sketches. | CO2 | | | A | | 12 |
| **COMPULSORY QUESTION** | | | | | | | | | |
| 24. | | a. | Compare and contrast Wet and dry corrosion with suitable case studies. | CO6 | | | E | | 8 |
|  | | b | Appraise any one method of protection from corrosion. | CO6 | | | A | | 4 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply the concepts of materials science for material selections towards new product development. |
| CO2 | Evaluate behavior of metal/alloys for engineering applications. |
| CO3 | Suggest the modern ceramic materials for engineering applications. |
| CO4 | Synthesize and develop the unique customized composites for aerospace applications. |
| CO5 | Knowledge on bearing, cutting and refractory metals for special engineering applications |
| CO6 | Develop the corrosion resistance materials for marine applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 | 12 |  |  |  | 17 |
| CO2 | 1 | 19 | 18 | 6 | 3 |  | 47 |
| CO3 | 2 |  |  |  | 9 |  | 11 |
| CO4 | 2 |  |  |  | 15 |  | 17 |
| CO5 | 6 |  | 10 |  |  |  | 16 |
| CO6 | 3 | 1 | 4 |  | 8 |  | 16 |
|  | | | | | | | **124** |