**Graphical user interface, application

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| **Course Code** | **09CH201/12CH203** | **Duration** | **3hrs** |
| **Course Name** | **ENVIRONMENTAL STUDIES** | **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 manmade chemical environment. | | CO1 | R | | 1 |
| 2. | Give any two examples for effects of modern agriculture. | | CO1 | U | | 1 |
| 3. | Which \_\_\_\_\_\_\_\_\_\_ dam is the highest Concrete Gravity dam in Asia and Second Highest in the world? | | CO2 | R | | 1 |
| 4. | Write any two examples of chemical components of ecosystem. | | CO2 | R | | 1 |
| 5. | The \_\_\_\_\_\_\_\_\_ energy stored at consumer level for the next tropic level. | | CO2 | R | | 1 |
| 6. | Define ecological pyramids. | | CO2 | U | | 1 |
| 7. | Write any two examples of some national park in India. | | CO3 | R | | 1 |
| 8. | How many hotspots are in India?  a) 2 b) 3 c) 4 d) 1 | | CO3 | R | | 1 |
| 9. | Which one of the following is a Primary Pollutants?  (1) CO(2) Acid rain(3) NO2(4) SO3 | | CO4 | U | | 1 |
| 10. | Give an example for primary pollutants. | | CO4 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | How does nuclear power plant work? | | CO1 | | A | 3 |
| 12. | What is a natural resource? | | CO1 | | R | 3 |
| 13. | Mention the types of ecosystem? | | CO2 | | R | 3 |
| 14. | Define primary and secondary consumers of ecosystem. | | CO2 | | R | 3 |
| 15. | Name any two gaseous air pollutants and their effects on human. | | CO4 | | A | 3 |
| 16. | Suggest any four sources of radiation pollution. | | CO4 | | 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. | a. | Elaborate the sources, effects and control methods of flood. | CO1 | | U | 6 |
|  | b. | Differentiate renewable and non-renewable energy resources. | CO1 | | A | 6 |
| 18. | a. | Draw the flow diagram for flow of water and explain how to save water. | CO1 | | U | 6 |
|  | b. | Discuss in detail the non-renewable energy resources? | CO1 | | U | 6 |
| 19. | a. | List out biotic and abiotic components? | CO2 | | An | 6 |
|  | b. | Explain the process of ecological succession. | CO2 | | A | 6 |
| 20. | a. | Expand CFC and VOC. | CO3 | | U | 6 |
|  | b. | Narrate energy flow in the ecosystem | CO3 | | R | 6 |
| 21. | a. | Discuss in detail any one method of controlling air pollution | CO4 | | U | 6 |
|  | b. | Explain the principles of green chemistry. | CO4 | | A | 6 |
| 22. | a. | What are the cause, effect and preventive measures of water pollution? | CO5 | | R | 6 |
|  | b. | List out various threats to biodiversity. Explain in detail. | CO5 | | U | 6 |
| 23. | a. | Declare the role of an individual in prevention of pollution. | CO5 | | R | 6 |
|  | b. | Mention the need of conservation of biodiversity. | CO5 | | R | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Describe in detail the species and ecosystem biodiversity. | CO6 | | R | 6 |
|  | b. | How can you save rain water? Explain with diagram. | CO6 | | R | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the natural environment and its relationships with human activities. |
| CO2 | Acquire practical skills for solving pollution related problems. |
| CO3 | Design and evaluate strategies and apply green technologies. |
| CO4 | Identify the methods for sustainable development and for the remediation or restoration of degraded environments. |
| CO5 | Integrate facts, concepts, and methods from multiple disciplines and apply to environmental and social problems. |
| CO6 | Analyze the connectivity between the manmade activities-Pollution-environmental issues-social problems-ecofriendly solutions. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 12 |  |  |  | 32 |
| CO2 | 6 | 10 | 6 |  |  |  | 22 |
| CO3 | 6 | 6 | 2 |  |  |  | 14 |
| CO4 | 8 | 6 | 6 |  |  |  | 20 |
| CO5 | 12 |  |  |  |  |  | 12 |
| CO6 | 12 |  |  |  |  |  | 12 |
|  | | | | | | | **124** |



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| **Code :** | **09CH365** | **Duration :** | **3hrs** |  |
| **Sub. Name :** | **RESEARCH METHODOLOGY IN CHEMISTRY** | **Max. Marks :** | **100** |  |

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| **Q. No.** | **Sub Div.** | **Questions** | **Marks** |
|  |  | **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** |  |
| 1. | a. | Briefly narrate about Scientific Investigation. | 5 |
| b. | What do you mean by Research and Research Process in Chemistry? | 5 |
| c. | Illustrate how chemical database is useful for the identification of research problem. | 10 |
| **(OR)** | | | |
| 2. | a. | Discuss the various research sources available in chemistry. | 10 |
| b. | How will you use keywords to identify research problem? Explain with a flowchart. | 10 |
|  |  |  |  |
| 3. | a. | What do you mean by Literature in chemistry, what are the databases available in chemistry? | 10 |
| b. | How will you write a review in the specialized topic? Explain with an example. | 10 |
| **(OR)** | | | |
| 4. | a. | Describe the tools to select the sources from the chemical literature. | 10 |
| b. | Discuss any two chemical software and its salient features for interpretation. | 10 |
|  |  |  |  |
| 5. | a. | Elaborate Qualitative and Quantitative research in chemistry. | 10 |
| b. | What are the advantages of Chemical Databases? | 10 |
| **(OR)** | | | |
| 6. | a. | Explain how to get recent literature in the field of interest and what are the recent techniques? | 10 |
| b. | Discuss the tool to evaluate the developed research problems. | 10 |
|  |  |  |  |
| 7. | a. | Summarize the various components in the research papers. | 10 |
| b. | Discuss the applications of PowerPoint presentation in chemical research. | 10 |
| **(OR)** | | | |
| 8. | a. | Describe the multiple regression exercise using excel worksheets. | 10 |
| b. | What are objectives and how will you sharpen it? | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | |
| 9. | a. | Discuss the Binomial, Gaussian and Normal distributions of random errors. | 10 |
| b. | Explain t-tests and F-test. Compare the precision of any two methods by F-Test. | 10 |

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| **Course Code** | **11CH101/12CH201/CH106/13CH201** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED CHEMISTRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Which is the correct example of covalent compound? | | CO1 | R | | 1 |
| 2. | Atoms undergo bonding in order to \_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 3. | Hardness of water is conventionally expressed in terms of equivalent amount of \_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | All carbonate and bicarbonates are \_\_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 5. | Nylon is a \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 6. | Which is the correct example of isotactic polymer? | | CO3 | U | | 1 |
| 7. | Arrange wood, peat, lignite, bitminuous coal and anthracite in decreasing order of their moisture contents | | CO4 | R | | 1 |
| 8. | What is the approximate composition in terms of hydrocarbon containing C atoms in Petrolium Ether? | | CO4 | R | | 1 |
| 9. | A fuel cell is used to convert chemical energy into \_\_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | In HCHO → HCOOH conversion, indicate whether oxidation or reduction is occurring. | | CO5 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Explain why H-O-H bond angel in H2O molecule is shorter than 109.5o . | | CO1 | | A | 3 |
| 12. | Differentiate scale and sludges. | | CO2 | | R | 3 |
| 13. | Point out any two differences between thermosetting plastics and thermoplastics. | | CO3 | | R | 3 |
| 14. | Define fuels and how it’s forming. | | CO4 | | R | 3 |
| 15. | Explain Redox reactions with example. | | CO5 | | A | 3 |
| 16. | Write down features of absorption photometer. | | 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. | a. | Write down the electronic configurations for H2, Be2, C2 and F2 using MO theory. | CO1 | | U | 6 |
|  | b. | Draw molecular orbital diagram of O2 molecule and find out bond order and magnetic properties. | CO1 | | A | 6 |
| 18. | a. | How does the boiler corrosion happen in (DO & CO2) method? | CO2 | | U | 6 |
|  | b. | A sample of water is found to contains following dissolving salts in milligrams per litre Mg(HCO3)2 = 73, CaCl2 = 111, Ca(HCO3)2 = 81. Calculate temporary and permanent hardness and total hardness. | CO2 | | U | 6 |
| 19. | a. | Illustrate on the taxicity of polymers. | CO3 | | An | 6 |
|  | b. | Explain the role of ingredients used in moulding of plastics with examples. | CO3 | | A | 6 |
| 20. | a. | Write down calorific value and Dulong’s formula. | CO4 | | U | 6 |
|  | b. | Explain flue gas analysis by Orsat method and rocket propellants. | CO4 | | R | 6 |
| 21. | a. | Define types of combustion. | CO5 | | U | 6 |
|  | b. | Explain lead acid battery and fuel cells. | CO5 | | A | 6 |
| 22. | a. | Express the sp3 Hybridization with an example. | CO1 | | R | 6 |
|  | b. | Draw the MO diagram of N2 molecular and find its bond order and magnetic properties. | CO1 | | U | 6 |
| 23. | a. | Define addition polymer, condensation polymer and copolymer. | CO3 | | R | 6 |
|  | b. | Write down preparation, properties and uses of polyethylene, polyvinyl chloride and Bakelite. | CO3 | | R | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Arrange benzene, anapthalene, and anthracene in increasing order of λmax. | CO6 | | R | 6 |
|  | b. | Calculate (i) the frequency (ii) wave number (iii) energy in ergs for typical UV radiation of 2000 Å. | CO6 | | R | 6 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Formulate electronic structures and correlate its properties. | | | | | | | |
| CO2 | Learn the various factors in water quality and its technology. | | | | | | | |
| CO3 | Realize the potential applications of polymers. | | | | | | | |
| CO4 | Analyze the combustion process of common fuels. | | | | | | | |
| CO5 | Learn the various energy storage systems and conversion devices. | | | | | | | |
| CO6 | Apply the instrumental methods for various types of analysis. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 1 | 7 | 9 |  |  |  | 17 |
| CO2 | | 4 | 12 |  |  |  |  | 16 |
| CO3 | | 16 | 1 | 6 | 6 |  |  | 29 |
| CO4 | | 11 | 6 |  |  |  |  | 17 |
| CO5 | | 1 | 7 | 9 |  |  |  | 17 |
| CO6 | | 12 |  | 3 |  |  |  | 15 |
|  | | | | | | | | **124** |

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| **Course Code** | **12CH220/17CH2011** | **Duration** | **3hrs** |
| **Course Name** | **CHEMISTRY IN EVERYDAY LIFE** | **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 clinical pathology. | | CO1 | R | | 1 |
| 2. | Which of the following is used externally to stop the spread of pathogens: antibiotics or antiseptics? | | CO1 | R | | 1 |
| 3. | The quality controller in perfume industry is known as \_\_\_\_\_\_\_\_\_\_. | | CO 2 | U | | 1 |
| 4. | By using which reagent, the common group is incorporated in explosives like TNT, Gun Cotton and RDX? | | CO2 | U | | 1 |
| 5. | Five different tastes put together as one is known as \_\_\_\_\_\_\_\_\_\_ taste. | | CO 3 | A | | 1 |
| 6. | Give the other names given for aginomotto. | | CO3 | A | | 1 |
| 7. | The burning sensation of chilly is due to \_\_\_\_\_\_\_\_\_\_. | | CO4 | E | | 1 |
| 8. | Air is considered as one among the other ingredients in ice cream. State True/False. | | CO4 | E | | 1 |
| 9. | Reason out- why organic foods are costly? | | CO5 | R | | 1 |
| 10. | Molecule of excitement is \_\_\_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Write a note on common natural disinfectants. | | CO1 | | R | 3 |
| 12. | Stress free life reduces risk on catching diseases – comment on this. | | CO2 | | U | 3 |
| 13. | Give the advantages of microban technology used in household articles. | | CO3 | | A | 3 |
| 14. | Give reason Kitchen gas burner burns yellow when a pot of boiling water overflows? | | CO4 | | E | 3 |
| 15. | Chocolates releive depression – justify. | | CO5 | | R | 3 |
| 16. | Write a short note on dopamine. | | 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. | a. | Can cancer be detected at an early stage? Why is it detected in our country at the 3rd or 4th stage only? | CO1 | | R | 6 |
|  | b. | As an individual and engineer, what way can you help yourself and the society to avoid and eradicate so called incurable diseases like AIDS, Cancer etc as it was/is done in the case of Polio. | CO2 | | U | 6 |
|  |  |  |  | |  |  |
| 18. | a. | On what basis a drug will be categorized under ‘Banned Drug’? Give example. | CO3 | | E | 6 |
|  | b. | Write a note on ‘NOTES’ in perfume. When can you use perfume and deodorant? | CO4 | | R | 6 |
|  |  |  |  | |  |  |
| 19. | a. | Give the advantages and disadvantages natural dyes. | CO2 | | R | 6 |
|  | b. | What is aginomotto? By regularly adding aginomotto in our diets the effects like obesity, behavioral changes can be found - give reasons. | CO4 | | E | 6 |
|  |  |  |  | |  |  |
| 20. | a. | ‘Crying’ is it needed? While cutting onion, our eyes get irritated followed by tears, explain the chemistry involved in this process. How can you avoid irritation of eyes during cutting onion? | CO5 | | A | 6 |
|  | b. | Write a short notes on PAH. Are you exposed to PAH? What are the effects of it and how will you avoid the same? | CO6 | | U | 6 |
|  |  |  |  | |  |  |
| 21. | a. | Give an example for disappearing ink with the chemistry concept. | CO5 | | An | 6 |
|  | b. | Negative emotions releases a hormone ‘CORTISOL’ which destroys the immune system - How can you handle your negative emotions and help your immune system? | CO5 | | E | 6 |
|  |  |  |  | |  |  |
| 22. | a. | Explain the chemistry concepts involved in ice cream making. (emulsifier, stabilizer, depression in freezing point) | CO3 | | U | 6 |
|  | b. | Write a notes on certification marks on grains and pulses. | CO4 | | R | 6 |
|  |  |  |  | |  |  |
| 23. | a. | Cotton fabrics absorb more water. Reason out. | CO4 | | An | 6 |
|  | b. | Give the test for identification of adulterant for the following and state the effect of the adulterant. Mango, ii. Apple, iii. Ghee, iv. Pepper. | CO5 | | A | 6 |
| **Compulsory:** | | | | | | |
| 24. | a. | Iodine – an important element in controlling thyroid gland: Give the effect on its deficiency and excess, also which food items can supply the same? | CO4 | | A | 6 |
|  | b. | Write a short note on neurotransmitters. | CO6 | | E | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | The students will know the practical aspects of chemistry in day-to-day life. |
| CO2 | The students will learn the chemistry concepts in day-to-day activities. |
| CO3 | The students will think innovative and develop application oriented products. |
| CO4 | The students will gain knowledge in buying certified food products. |
| CO5 | The students will make right choice in choosing the right food. |
| CO6 | The students will gain right perspective to guard the environment |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1, 1, 3, 6 |  |  |  |  |  | 11 |
| CO2 | 6 | 1, 1, 3, 6 |  |  |  |  | 17 |
| CO3 |  | 6 | 1, 1, 3 |  | 6 |  | 17 |
| CO4 | 6, 6 |  | 6 | 6 | 1, 1, 3, 6 |  | 35 |
| CO5 | 1, 1, 3 |  | 6, 6 | 6 | 6 |  | 29 |
| CO6 | 3 | 6 |  |  | 6 |  | 15 |
| 37 23 23 12 29 | | | | | | | **124** |

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| **Course Code** | **14CH1003 / 17CH1004** | **Duration** | **3hrs** |
| **Course Name** | **ENVIRONMENTAL STUDIES** | **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. | Based on your analysis, write a detailed report on major causes and harmful effects of deforestation. | CO1 | An | 10 |
|  | b. | Describe the various effects of ground water usage. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Illustrate the uses of alternative energy sources and its limitations. | CO1 | A | 10 |
|  | b. | Discuss the major causes and effects of flood. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Classify the types of biodiversity conservation with example. | CO2 | An | 10 |
|  | b. | Discuss the structure and function of ecosystem. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Examine in detail the types of value of biodiversity. | CO2 | A | 10 |
|  | b. | Without diversity, especially biodiversity, life would become monotonous. Express in detail about the various threats to biodiversity. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the major causes, effects and control measures of air pollution. | CO3 | An | 10 |
|  | b. | List out the principles of green chemistry. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Identify the major causes, effects and control measures of water pollution. | CO3 | A | 10 |
|  | b. | Investigate the methods of solid waste management. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Discuss any two methods of water conservation with its objectives and technologies. | CO4 | U | 10 |
|  | b. | Discuss in detail the wild protection and forest protection acts. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Sustainable Development Goals (SDG) are common for all the nations. Point out the ways in which SDG can be achieved. | CO4 | An | 10 |
|  | b. | Describe in detail air protection and water protection acts. | CO4 | R | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Justify the role of information technology (IT) on environment and human health. | CO5 | A | 10 |
|  | b. | Summarize the causes, symptoms, diagnostic tests of HIV. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the natural environment and its relationship with human activities. |
| CO2 | Acquire the knowledge about biodiversity. |
| CO3 | Design and evaluate strategies and apply green technologies. |
| CO4 | Identify the methods for sustainable development and for the remediation or restoration of degraded environments. |
| CO5 | Integrate facts, concepts, and methods from multiple disciplines and apply to environmental and social problems. |
| CO6 | Analyze the connectivity between the man-made activities-Pollution-environmental issues-social problems-ecofriendly solutions |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 10 | 10 | - | - | 40 |
| CO2 | 10 | 10 | 10 | 10 | - | - | 40 |
| CO3 | 10 | - | 10 | 20 | - | - | 40 |
| CO4 | 10 | 10 | 10 | 10 | - | - | 40 |
| CO5 | - | - | 10 | - | - | - | 10 |
| CO6 | - | 10 | - | - | - | - | 10 |
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| **Course Code** | **16CH2003/17CH2003** | **Duration** | **3hrs** |
| **Course Name** | **ATOMIC STRUCTURE, THERMODYNAMICS AND ELECTROCHEMISTRY** | **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. | Briefly discuss the Quantum model of atomic structure with schematic diagram. | CO1 | Understand | 10 |
|  | b. | Write short notes on Dual nature of electron. | CO1 | Remember | 6 |
|  |  | Define the term Wave length. | CO1 | Remember | 4 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain Ruther Ford’s Gold foil experiment with neat sketch | CO1 | Understand | 10 |
|  | b. | Elaborate the Bohr’s atomic model with specific example. | CO1 | Apply | 10 |
|  |  |  |  |  |  |
| 3. | a. | State the first law of thermodynamics. Explain it. | CO2 | Remember | 10 |
|  | b. | Explain the relationship between pressure, volume and work. | CO2 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Derive Gibbs – Helmholtz equation. | CO2 | Apply | 10 |
|  | b. | Describe the following terms.  i) Isobaric ii) Isolated system iii) Endothermic process iv) Isochroic Process. | CO3 | Understand | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write short notes on concentration cell with neat diagram. | CO3 | Remember | 10 |
|  | b. | Briefly discuss the Anodic and cathodic reaction of electrochemical cell with neat diagram. | CO4 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Derive Nernst equation and give its application. | CO4 | Apply | 10 |
|  | b. | Describe the construction of lithium ion battery with advantages. | CO5 | Remember | 10 |
|  |  |  |  |  |  |
| 7. | a. | How to Calculate Energy and Wave function of a Particle in One Dimensional Box. | CO5 | Apply | 10 |
|  | b. | Write short notes on types of quantum numbers with suitable example. | CO5 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the roles of various inhibitors in controlling the corrosion. | CO6 | Understand | 10 |
|  | b. | Briefly discuss the factors influence the rate of corrosion. | CO6 | Remember | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Illustrate the rusting of iron with help of Electrochemical theory of corrosion. | CO6 | Apply | 10 |
|  | b. | Explain the oxidation corrosion with neat diagram. | CO6 | Understand | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to recognize the importance of Quantum Chemistry. |
| CO2 | Know the importance of Thermodynamics. |
| CO3 | Understand the significance of Phase rule. |
| CO4 | Know the principles of electrochemistry. |
| CO5 | Classify the various types of electrochemical cells. |
| CO6 | Apply the proper method to prevent corrosion. |

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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 | 10 |  |  |  | 30 |
| CO3 | 10 | 10 |  |  |  |  | 20 |
| CO4 |  | 10 | 10 |  |  |  | 20 |
| CO5 | 10 | 10 | 10 |  |  |  | 30 |
| CO6 | 10 | 20 | 10 |  |  |  | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **16CH2005/17CH2005** | **Duration** | **3hrs** |
| **Course Name** | **REACTION MECHANISM AND HETEROCYCLIC CHEMISTRY** | **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 Benzyne mechanism with examples. | CO1 | An | 10 |
|  | b. | Narrate the effect of leaving group and attacking nucleophile in SN1 reactions. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss SNAr mechanism with examples. | CO1 | An | 10 |
|  | b. | Narrate the effect of leaving group and attacking nucleophile in SN2 reactions. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the mechanism of SE2 with example. | CO2 | An | 10 |
|  | b. | Discuss the reactivity of Aliphatic Diazonium Coupling with example. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss the mechanism of SE1 with example. | CO2 | A | 10 |
|  | b. | Describe the Stork-Enamine Reactions with mechanism. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Summarize the Electrophilic and Free radical addition reaction to double bonds with mechanism. | CO3 | A | 10 |
|  | b. | Discuss the Micheal addition with example. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss the Mannich reaction with mechanism. | CO3 | A | 10 |
|  | b. | Illustrate Bredt’s rule with Chugaev reaction | CO3 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Describe the aromaticity of Pyrrole with structure. | CO4 | An | 10 |
|  | b. | Discuss the general preparation of heterocyclic compounds | CO4 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Illustrate the electrophilic substitution reactions of Pyrrole. | CO5 | E | 10 |
|  | b. | Summarize the preparation and reactions of pyridine | CO5 | An | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Illustrate the electrophilic substitution reactions of Imidazole. | CO6 | E | 10 |
|  | b. | Describe the aromaticity and Electrophilic substitution reaction of Pyrazole. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Elucidate the mechanisms of organic reactions. |
| CO2 | Propose more complex syntheses. |
| CO3 | Predict the reactivity of an organic compound from its structure. |
| CO4 | Develop the knowledge on the fundamental theoretical understanding of heterocyclic chemistry. |
| CO5 | Propose syntheses of heterocycles from the major classes. |
| CO6 | Get the ability to relate significant chemical properties to structure. |

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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 |  |  | 40 |
| CO3 |  |  | 20 | 20 |  |  | 40 |
| CO4 |  |  |  | 10 | 10 |  | 20 |
| CO5 |  |  |  | 10 | 10 |  | 20 |
| CO6 |  |  |  | 10 | 10 |  | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **17CH1002** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED CHEMISTRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Hardness of water is due to the presence of salts of \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | What is Zeolite? | | CO1 | R | | 1 |
| 3. | Define: spontaneity of a reaction. | | CO2 | A | | 1 |
| 4. | What is second law of thermodynamics? | | CO2 | R | | 1 |
| 5. | Provide an example for Primary cells. | | CO3 | U | | 1 |
| 6. | Define. Desalination. | | CO5 | R | | 1 |
| 7. | What are nanomaterials? | | CO6 | R | | 1 |
| 8. | What is Calgon? | | CO1 | R | | 1 |
| 9. | Define. Carnot theorem. | | CO2 | U | | 1 |
| 10. | Give an example for layered nanomaterial. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Differentiate scale and sludge. | | CO1 | | A | 3 |
| 12. | What is Hess’s Law? | | CO2 | | U | 3 |
| 13. | What is Nernst equation? Provide an application of Nernst equation. | | CO3 | | A | 3 |
| 14. | Explain the biodegradable polymers with example. | | CO5 | | U | 3 |
| 15. | List the application of electrochemical sensor. | | CO3 | | A | 3 |
| 16. | Distinguish primary cells and secondary cells. | | CO3 | | 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. |  | Explain the any one softening method of water. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | A sample of water is found to contain 40.5 mg/L of Ca(HCO3)2, 46.5 mg/L of Mg(HCO3)2 , 27.6 mg/L of MgSO4, 32.1 mg/L of CaSO4 and 22.45 mg/L of CaCl2. Calculate the temporary and permanent hardness of water. (Ca – 40, Mg – 24, S – 32). | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Describe the estimation of hardness of water by EDTA method. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 20. |  | Describe the various thermodynamic concepts. | CO2 / U | | U | 12 |
|  |  |  |  | |  |  |
| 21. |  | Derive Gibb’s Helmholtz equation. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 22. |  | Describe the construction and working mechanism of H2-O2 fuel cell. | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 23. |  | Explain the various molding constituents of plastics. | CO5 | | A | 12 |
|  |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Discuss the applications of polymers in medicine | CO5 | | A | 6 |
|  | b. | Explain any one preparation method of nanomaterials. | CO6 | | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize hard water and softening methods. |
| CO2 | Understand chemical thermodynamics. |
| CO3 | Identify the types of batteries. |
| CO4 | Explain the problems associated with corrosion. |
| CO5 | Appraise the significances of polymers. |
| CO6 | Utilize the knowledge of advanced materials. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 1 | 27 | 12 | - | - | 42 |
| CO2 | 1 | 28 | 1 | - |  |  | 30 |
| CO3 | - | 1 | 9 | - | - | - | 10 |
| CO4 | - | - | - | 12 |  |  | 12 |
| CO5 | 1 | 3 | 18 | - | - | - | 22 |
| CO6 | 1 | 1 | 6 | - | - | - | 8 |
|  | | | | | | | **124** |

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| **Course Code** | **17CH3022** | **Duration** | **3hrs** |
| **Course Name** | **MOLECULAR AND MATERIAL SELF ASSEMBLY** | **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 how SAMs are formed. | | | CO1 | Understand | 10 |
|  | b. | Give an account of SAM crystal engineering. | | | CO1 | Understand | 10 |
|  |  | **(OR)** | | |  |  |  |
| 2. |  | Explain in detail: (i) self-assembling nanorods. (ii) nanotubes from nanoporous templates. | | | CO2 | Remember | 20 |
|  |  |  | | |  |  |  |
| 3. |  | Give a detailed account of nanorod devices and nanowire smallest LED. | | | CO2 | Remember | 20 |
|  |  | **(OR)** | | |  |  |  |
| 4. |  | Give a detailed account of the following:   1. nanocrystal semiconductor alloys 2. nanocluster phase transition 3. capped gold nanoclusters | | | CO3 | Remember | 20 |
|  |  |  | | | |  |  |
| 5. | a. | With suitable illustrations, highlight the salient features of core-shell magnetic nanoclusters and water-soluble nanoclusters. |  | CO3 | | Analyze | 10 |
|  | b. | Describe the concept of electrons and holes in nanocluster boxes. |  | CO4 | | Apply | 10 |
|  |  | **(OR)** | | | |  |  |
| 6. |  | What are electrostatic super-lattices? Explain with a neat diagram the construction and working of a specific super-lattice and its possible application in device construction. |  | CO5 | | Apply | 20 |
|  |  |  | | | |  |  |
| 7. |  | Give an account of patterned multilayers and non-electrostatic self-assembly. |  | CO5 | | Analyze | 20 |
|  |  | **(OR)** | | | |  |  |
| 8. |  | With suitable illustrations explain block copolymer lithography. |  | CO6 | | Apply | 20 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | | |
| 9. |  | Give a detailed account of the preparation of nanowires from block copolymers. |  | CO6 | | Understand | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to understand the formation of self-assembly in nanomaterials. |
| CO2 | describe the process of a bottom-up approach based on self-assembly. |
| CO3 | give examples of nanocluster self-assembly. |
| CO4 | design self-assembled monolayers through different approaches. |
| CO5 | understand the fundamental principles of self-assembling block co-polymers. |
| CO6 | relate significantly self-assembled properties to nature. |

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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 | 20 | - | - | 10 | - | - | 30 |
| CO4 | - | - | 10 |  | - | - | 10 |
| CO5 | - | - | 20 | 20 | - | - | 40 |
| CO6 | - | 20 | 20 | - |  | - | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **17CH3026** | **Duration** | **3hrs** |
| **Course Name** | **SUPRAMOLECULAR CHEMISTRY** | **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. | Contrast Lock key principles and complementarity. | CO2 | U | 10 |
|  | | b. | Summarize “Supramolecular interactions in various molecules” | CO1 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 2. | | a. | Define the term Supermolecules and discuss the classification of supermolecules. | CO1 | R | 10 |
|  | | b. | Summarize the concepts in supramolecular Chemistry | CO1 | U | 10 |
|  | |  |  |  |  |  |
| 3. | | a. | Compare spherands and Katapinands with suitable examples | CO2 | A | 10 |
|  | | b. | Specify Ladders and rocks with examples. | CO3 | A | 10 |
|  | |  | **(OR)** |  |  |  |
| 4. | | a. | Interpret Guest and Host Chemistry with suitable examples. | CO3 | R | 10 |
|  | | b. | Describe high dilution methods and Cation binding. | CO3 | U | 10 |
|  | |  |  |  |  |  |
| 5. | | a. | Enumerate crown ethers. | CO4 | A | 10 |
|  | | b. | Discuss in detail about interlocked supramolecules. | CO4 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 6. | | a. | Report Zeolites structure, composition and pores size with examples. | CO5 | A | 10 |
|  | | b. | Summarize Clatharates and its examples | CO5 | U | 10 |
|  | |  |  |  |  |  |
| 7. | | a. | Highlight Catenenes, Borromeates with suitable structures | CO3 | R | 10 |
|  | | b. | Elucidate Molecular knots, Rotaxanes. | CO4 | A | 10 |
|  | |  | **(OR)** |  |  |  |
| 8. | | a. | Describe Hydroquinone and its types. | CO5 | U | 10 |
|  | | b. | Classify Dianin’s compounds with examples. | CO5 | R | 10 |
| **COMPULSORY QUESTION** | | | | | | |
| 9. | | a. | Discuss the CSD (Cambridge structural data base). | CO6 | U | 10 |
|  | | b. | Relate Metal directed Capsules and Hydrogen bonded capsules. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | understand the selectivity in supramolecule formation | | | | | | | |
| CO2 | identify the various factors affecting the formation of supramolecules | | | | | | | |
| CO3 | understand the concepts of solution host-guest chemistry | | | | | | | |
| CO4 | design the various types of supramolecular architectures | | | | | | | |
| CO5 | recognize the importance of coordination polymers | | | | | | | |
| CO6 | apply the supramolecules in various fields | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 10 | 20 | - | - | -- | - | 30 |
| CO2 | | - | 10 | 10 | - | - | - | 20 |
| CO3 | | 10 | 10 | 10 | - | - | - | 30 |
| CO4 | | - | 20 | 20 | - | - | - | 40 |
| CO5 | | 10 | 20 | 10 | - | - | - | 40 |
| CO6 | | 10 | 10 | - | - | - | - | 20 |
|  | | | | | | | | **180** |

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| **Course Code** | **18CH2001** | **Duration** | **3hrs** |
| **Course Name** | **ENVIRONMENTAL STUDIES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Peat, lignite, bituminous and anthracite are different grades of \_\_\_\_\_. | | CO1 | R | | 1 |
| 2. | Give an example of a primary consumer. | | CO1 | U | | 1 |
| 3. | In \_\_\_\_\_\_ ecosystem water moves at a constant pace in a uniform direction. | | CO1 | U | | 1 |
| 4. | Name the study of the organisms in their natural home interacting with the biotic and abiotic components. | | CO1 | R | | 1 |
| 5. | Give an example of ex-situ conservation. | | CO4 | U | | 1 |
| 6. | Variations among the genes of the same species may be termed as \_\_\_\_\_\_diversity. | | CO3 | A | | 1 |
| 7. | Name the by-products released with the production of pesticides and other industrial processes. | | CO5 | U | | 1 |
| 8. | \_\_\_\_\_\_\_is a tool for a Sustainable Future Incorporation of sustainable thinking in experimental design. | | CO4 | An | | 1 |
| 9. | A \_\_\_\_\_\_consists of a saucer- shaped catchment area with a gentle slope towards the centre where a tank is situated. | | CO5 | A | | 1 |
| 10. | Give any act which is meant for the welfare of women and children. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | List the three types of floods and define each of it. | | CO1 | | U | 3 |
| 12. | Explain the complete Carbon cycle. | | CO1 | | U | 3 |
| 13. | List any three global biodiversity hot spots in India. | | CO3 | | A | 3 |
| 14. | State the causes of soil pollution. | | CO2 | | An | 3 |
| 15. | List any three objectives of water harvesting. | | CO4 | | U | 3 |
| 16. | Give the characteristics of human rights. | | 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. | a. | Describe various energy resources in detail. | CO1 | | U | 6 |
|  | b. | List the various factors that contribute to the land degradation with explanation. | CO1 | | U | 6 |
| 18. | a. | Write note on ‘energy flow in ecosystem’. | CO1 | | A | 6 |
|  | b. | Examine the type of ecological succession. | CO3 | | An | 6 |
| 19. | a. | Discuss the ‘value of bio diversity’. | CO4 | | U | 6 |
|  | b. | Explain ex-situ conservation. | CO4 | | An | 6 |
| 20. | a. | Describe solid waste management. | CO5 | | A | 6 |
|  | b. | Explain the principles and functions of Green Chemistry. | CO3 | | A | 6 |
| 21. | a. | Discuss the objectives and benefits of watershed management. | CO5 | | An | 6 |
|  | b. | Examine the Laws that provide a framework of regulating the use of environment. | CO5 | | An | 6 |
| 22. | a. | Describe the causes for Air Pollution. | CO2 | | U | 6 |
|  | b. | Discuss the various Water Harvesting techniques. | CO4 | | U | 6 |
| 23. | a. | Explain the effects of Noise Pollution. | CO2 | | An | 6 |
|  | b. | Explain various Renewable energy resources. | CO1 | | An | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Explain the universal concept of Human Rights. | CO6 | | A | 6 |
|  | b. | Illustrate the potential of information technology in the field of environmental science. | CO6 | | A | 6 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Understand the natural environment and its relationships with human activities. | | | | | | | |
| CO2 | Acquire practical skills for solving pollution related problems. | | | | | | | |
| CO3 | Design and evaluate strategies and apply green technologies. | | | | | | | |
| CO4 | Identify the methods for sustainable development and for the remediation or restoration of degraded environments | | | | | | | |
| CO5 | Integrate facts, concepts, and methods from multiple disciplines and apply to environmental and social problems. | | | | | | | |
| CO6 | Analyze the connectivity between the man-made activities-Pollution-environmental issues-social problems-eco-friendly solutions. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 2 | 20 | 6 | 6 | - | - | 34 |
| CO2 | | - | 6 | - | 9 | - | - | 15 |
| CO3 | | - | - | 10 | 6 | -- | - | 16 |
| CO4 | | - | 16 | - | 7 | - | - | 23 |
| CO5 | | - | 1 | 7 | 12 | - | - | 20 |
| CO6 | | - | 4 | 12 | - | - | - | 16 |
|  | | | | | | | | **124** |

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| **Course Code** | **20CH1003** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED CHEMISTRY FOR FOOD PROCESSING TECHNOLOGY** | **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 degree of polymerization, is the number of \_\_\_\_\_\_\_\_\_ in a macromolecule. | | CO1 | Remember | 1 |
| 2. | Give an example of thermosetting plastics. | | CO1 | Understand | 1 |
| 3. | Dispersion of Gas in liquid is called \_\_\_\_\_\_\_\_\_\_. | | CO2 | Remember | 1 |
| 4. | Dust is an example of \_\_\_\_\_\_\_\_\_\_\_\_. | | CO2 | Understand | 1 |
| 5. | Which year National Nanotechnology Initiative launched? | | CO3 | Remember | 1 |
| 6. | Give an example for two dimensional nanomaterial. | | CO3 | Understand | 1 |
| 7. | Composites which are made up of aluminum matrix and silicon carbide as reinforcing fibres are example of \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | Remember | 1 |
| 8. | Fibre reinforced polymers are also called as \_\_\_\_\_\_\_\_\_\_\_\_. | | CO4 | Understand | 1 |
| 9. | A \_\_\_\_\_\_\_\_ is a device that converts chemical energy directly to electrical energy. | | CO5 | Understand | 1 |
| 10. | In a battery oxidation occurs at \_\_\_\_\_\_\_\_\_\_\_\_. | | CO5 | Understand | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Give any four differences between thermo and thermoset plastics. | | CO1 | Remember | 3 |
| 12. | Explain the mechanism of micelle formation. | | CO 2 | Understand | 3 |
| 13. | Write short notes on classification of nano materials with suitable example. | | CO 3 | Understand | 3 |
| 14. | Explain laminar and sandwich composite with example. | | CO 4 | Understand | 3 |
| 15. | Explain the solar and wind energy. | | CO 5 | Understand | 3 |
| 16. | Highlight the application of UV- Visible spectroscopy technique. | | CO 6 | Apply | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. | a. | Briefly discuss the classification of polymers. | CO 1 | Remember | 8 |
|  | b. | Explain the mechanism of formation of polyether ether ketone (PEEK). | CO 1 | Understand | 4 |
| 18. | a. | Enumerate the classification of colloids based on physical state and nature of interaction. | CO 2 | Apply | 8 |
|  | b. | Highlight the role of colloids in pharmaceutics. | CO 2 | Remember | 4 |
| 19. | a. | Discuss the chemical vapour deposition (CVD) method of synthesis of nano materials. | CO 3 | Understand | 6 |
|  | b. | Write short notes on graphene with suitable diagram. | CO 3 | Remember | 6 |
| 20. | a. | Classify the composite material based on the matrix and the reinforcement materials. | CO 4 | Analyze | 8 |
|  | b. | List out the properties of matrix in composite materials. | CO 4 | Remember | 4 |
| 21. | a. | Briefly discuss the secondary battery with neat schematic diagram. | CO 5 | Remember | 8 |
|  | b. | Explain the direct use of geothermal energy. | CO 5 | Understand | 4 |
| 22. | a. | Explain the renewable energy resources with suitable diagram. | CO5 | Understand | 8 |
|  | b. | Write short notes on synthesis of nanomaterial with top down approach method. | CO 3 | Analyze | 4 |
| 23. | a. | Elaborately discuss the application Nano composite in food processing technology | CO 3 | Apply | 8 |
|  | b. | Explain the difference between alloys and composites. | CO 4 | Understand | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the molecular bending vibration in IR spectroscopy. | CO 6 | Apply | 4 |
|  | b. | Briefly discuss the instrumentation of UV –Visible spectroscopy and its application. | CO 6 | Understand | 8 |

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|  | **COURSE OUTCOMES** |
| CO1 | Categorize various types of polymers used in food processing technology. |
| CO2 | Describe the applications of colloids in food processing. |
| CO3 | Summarize the use of nanomaterials in food processing technology. |
| CO4 | Apply the nanocomposites in food processing technology. |
| CO5 | Describe the use of bio-batteries. |
| CO6 | Discuss about the characterization techniques of biomolecules. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 12 | 5 |  |  |  |  | 17 |
| CO2 | 5 | 4 | 8 |  |  |  | 17 |
| CO3 | 7 | 10 | 8 | 4 |  |  | 29 |
| CO4 | 5 | 8 |  | 8 |  |  | 21 |
| CO5 | 10 | 15 |  |  |  |  | 25 |
| CO6 |  | 8 | 4 | 3 |  |  | 15 |
|  | | | | | | | **124** |

Graphical user interface, application

Description automatically generated with medium confidence

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| **Course Code** | **20CH2001** | **Duration** | **3hrs** |
| **Course Name** | **COMPLEMENTARY CHEMISTRY** | **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 various methods of expressing the concentration with examples. | CO1 | A | 10 |
|  | b. | Define the following terms with examples.   1. Oxidation (ii) Reduction (iii) Valency   (iv) pH (v) Solubility Product | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Compare the characteristics of Arrhenius, Bronsted-Lowry and Lewis acids and bases. | CO1 | An | 10 |
|  | b. | Define: Buffer solution. What is the importance of buffer solution? Elucidate with examples. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Recall the postulates of Bohr’s theory. State the merits and limitations of Bohr’s theory. | CO2 | R | 10 |
|  | b. | Summarize the significance of principal quantum number, azimuthal quantum number and magnetic quantum number. Calculate the values of l and m when n = 2 and n=3. | CO2 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Draw the structures of s, p and d orbitals. | CO2 | U | 10 |
|  | b. | Discuss the following principles and their importance.   1. Heisenberg’s uncertainty principle 2. Aufbau principle | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain the formation of ionic bond with examples. | CO3 | A | 10 |
|  | b. | Draw the molecular orbital diagrams for the molecules O2 and N2. Predict the bond order and their magnetic properties. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Define: Hybridization. Elucidate with examples. | CO4 | U | 10 |
|  | b. | Categorize the types of the hydrogen bond. Express the applications of the hydrogen bond. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the properties of the liquid. | CO4 | U | 10 |
|  | b. | Discuss the importance of phase diagrams with examples. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the following terms:   1. Surface tension (ii) Viscosity   (iii) Vapor pressure (iv) Density | CO4 | R | 10 |
|  | b. | Describe the physical properties of blood. | CO4 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Compare the characteristics of physisorption and chemisorption. | CO5 | An | 10 |
|  | b. | Describe the properties of colloids. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To realize the importance of acids and bases. |
| CO2 | To summarize the importance of the atomic structure. |
| CO3 | To understand the theories of chemical bonding. |
| CO4 | To learn the physical properties of liquid. |
| CO5 | To understand the basics of surface chemistry. |
| CO6 | To recognize the importance of colloids 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 | 10 |  |  | 40 |
| CO2 | 10 | 20 |  |  | 10 |  | 40 |
| CO3 |  | 10 | 10 | 20 |  |  | 40 |
| CO4 | 10 | 20 | 10 |  |  |  | 40 |
| CO5 |  |  |  | 10 |  |  | 10 |
| CO6 |  |  |  | 10 |  |  | 10 |
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| **Course Code** | **20CH2003** | **Duration** | **3hrs** |
| **Course Name** | **INORGANIC CHEMISTRY FOR 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. | Describe the components of the modern periodic table. | CO1 | Remember | 10 |
|  | b. | Explain about (i) Electronegativity and (ii) Ionization potential with examples. | CO1 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Recall the characteristics of periods and groups. | CO1 | Analyze | 10 |
|  | b. | Compare the characteristics of atomic radius and ionic radius. | CO1 | Analyze | 10 |
|  |  |  |  |  |  |
| 3. | a. | Compare the characteristics of ,  and  radiation | CO2 | Analyze | 10 |
|  | b. | Describe the composition of the nucleus. | CO2 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the binding energy and its relation with stability. | CO2 | Apply | 10 |
|  | b. | Distinguish between isotopes, isobars and isotones with suitable examples. | CO2 | Analyze | 10 |
|  |  |  |  |  |  |
| 5. | a. | Analyze the factors affecting the stability of coordination complexes. | CO4 | Analyze | 10 |
|  | b. | Explain valence bond theory of coordination complex. | CO3 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss Werner’s theory with examples. What are its limitation? | CO3 | Understand | 10 |
|  | b. | Describe a method for the determination of the stability of the metal complex. | CO4 | Apply | 10 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the significance of hemoglobin. | CO5 | Understand | 10 |
|  | b. | Explain enzyme action with an example. | CO5 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Elucidate the importance of metal ions in biological systems. | CO5 | Analyze | 10 |
|  | b. | Describe the working principle of sodium-potassium pump. | CO5 | Understand | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Summarize the toxicity of lead and mercury. | CO6 | Analyze | 10 |
|  | b. | Discuss about the Schiff bases and their importance in forensic science. | CO6 | Apply | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To understand the periodic properties. |
| CO2 | To learn the applications of radioisotopes. |
| CO3 | To understand the nature of bonding in coordination complexes. |
| CO4 | To predict the factors affecting the stability of metal complexes. |
| CO5 | To summarize the importance of metals in biology. |
| CO6 | To realize the role of metals 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 |  | 20 |  |  | 40 |
| CO2 |  | 10 | 10 | 20 |  |  | 40 |
| CO3 |  | 20 |  |  |  |  | 20 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 |  | 20 | 10 | 10 |  |  | 40 |
| CO6 |  |  | 10 | 10 |  |  | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **20CH2005** | **Duration** | **3hrs** |
| **Course Name** | **ANALYTICAL CHEMISTRY FOR 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. | What is Significant figures? How many significant figures are in:  i). 12.548  ii). 0.00335  iii). 504.70  iv). 4000  v). 0.10200 | CO1 | A | 10 |
| b. | Suppose that the winner of a 100-meter dash finishes the race in 9.98 seconds. The runner in second place has a time of 10.05 seconds. How many significant figures are in each measurement? Give the rules 1-4. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Calculate the mean, median and standard deviation for the following set of values: 61.45, 61.51, 61.12, and 61.40. | CO1 | A | 10 |
|  | b. | Define the terms mean, median, range and standard deviation. | CO1 | R | 10 |
| 3. | a. | Discuss briefly the theory of distillation. Describe its experimental arrangement with examples. | CO2 | U | 10 |
| b. | What is chromatography? Explain the principle involved in purification of compound by thin layer chromatography (TLC)? | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | What is the principle involved in the purification organic compounds by crystallization? | CO2 | R | 10 |
|  | b. | What is purification? Write any two methods of purification using organic compounds? | CO2 | U | 10 |
| 5. | a. | What happens when an acid dissolve in water? Write an example for Brønsted-Lowry acids and bases. | CO3 | R | 10 |
|  | b. | Calculate the strength of the following solutions.  i) 8 g of NaOH present in 250 ml of the solution.  ii) 7 g H2SO4 is present in 100 ml of the solution. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Calculate the normality of 40 g of NaOH is 350 ml of the solution. (Acidity of NaOH = 1). | CO3 | A | 10 |
|  | b. | What is complex metric titration? Which complexation reaction can be used as a volumetric technique? | CO3 | U | 10 |
| 7. | a. | Define solubility. Explain in detail the factors affecting solubility. | CO4 | R | 10 |
|  | b. | Define solubility equilibrium. Calculate the Ksp value of BaSO4 which has a solubility of 3.9x 10-5mol/L at 25 oC. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write the expression of solubility equilibrium for the following,   1. MgF2 2. CaCl2 3. NaCl | CO5 | U | 10 |
|  | b. | Define solubility equilibrium. Write difference between solubility and equilibrium. | CO5 | R | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | What is mean by Differential thermal analysis? Draw the DTA curve of calcium oxalate monohydrate. | CO5 | U | 10 |
|  | b. | The TG curve of 2.89 mg sample containing MgSO4.7H2O (mol. Wt. 246) exhibited a weight loss of 0.59 mg at a temperature of 105o C corresponding to the reaction;  MgSO4. 7H2O(s) MgSO4. H2O + 6H2O  Calculate the percentage of MgSO4. 7H2O in the sample. | CO5 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the methodology to handle chemicals, heating methods and error analysis. |
| CO2 | Understand the principle of techniques used for the purification of compounds. |
| CO3 | Know about importance of various titrimetric methods. |
| CO4 | Get knowledge about solubility criteria, precipitation titrations and gravimetric analysis. |
| CO5 | Receive the importance of thermo gravimetric, differential thermal and electro gravimetry analysis. |
| CO6 | Understand the basics of analytical chemistry for application 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 |  | 20 | 10 |  |  | 40 |
| CO2 | 20 | 20 |  |  |  |  | 40 |
| CO3 | 10 | 20 | 10 |  |  |  | 40 |
| CO4 | 10 |  | 10 |  |  |  | 20 |
| CO5 | 10 | 20 |  | 10 |  |  | 40 |
| CO6 |  |  |  |  |  |  |  |
|  | | | | | | | **180** |

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| **Course Code** | **20CH2006** | **Duration** | **3hrs** |
| **Course Name** | **ORGANIC CHEMISTRY FOR 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. | Describe the concept of Homolytic and Heterolytic cleavages with examples. | CO1 | U | 10 |
|  | b. | Narrate the electromeric effects and its types with examples. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Reason out the following   1. Trifluoroacetic acid is more acidic the Acetic acid. 2. p-nitrophenol is stronger acid than phenol. 3. Methylamine is more basic than aniline. 4. formaldehyde is more reactive than acetaldehyde. | CO1 | An | 10 |
|  | b. | Discuss the resonance effects with examples. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | (i) Explain the stability of reactions intermediates.  (ii) Discuss the aromaticity of Pyrazole and Pyridine. | CO2 | U | 10 |
|  | b. | (i) Discuss Chichibabin reactions.  (ii) How will you synthesize Thiophene and Pyridine? | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | List out the criteria of Aromaticity with examples. | CO2 | An | 10 |
|  | b. | Discuss the Electrophilic substitution reaction of pyrazole and pyrimidine with equations. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Give the mechanism of SN1 and SN2 reactions. | CO3 | A | 10 |
|  | b. | Describe Walden inversion and Markovnikov rule with examples. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss the E1 and E2 mechanisms. | CO3 | An | 10 |
|  | b. | Elaborate any two mechanism of Nucleophilic Aromatic Substitutions. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the Cahn–Ingold–Prelog Priority System. | CO4 | A | 10 |
|  | b. | Define Geometric Isomerism and explain the geometric isomerism of alkene. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | List out the four forms of Tartaric acid with structures. | CO4 | An | 10 |
|  | b. | Define the terms i) Achiral, ii) Chiral center, iii) Chiral Molecule, iv) Diastereomer, and v) Enantiomers. | CO4 | A | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe the various structure of proteins. | CO5 | R | 10 |
|  | b. | Discuss the classifications of nucleic acids. | CO6 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic principles of chemical structures and its bonding characteristics. |
| CO2 | Predict the organic reaction mechanisms of organic reactions. |
| CO3 | Understand the structures of heterocyclic compounds. |
| CO4 | Describe the reaction intermediates. |
| CO5 | Explain the principles of stereochemistry. |
| CO6 | Relate the applications of the biological molecules in various domains. |

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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 | 20 | 10 |  |  | 40 |
| CO3 |  |  | 20 | 10 | 10 |  | 40 |
| CO4 | 10 |  | 20 | 10 |  |  | 40 |
| CO5 | 10 |  |  |  |  |  | 10 |
| CO6 |  |  | 10 |  |  |  | 10 |
|  | | | | | | | **180** |

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| **Course Code** | **20CH2007** | **Duration** | **3hrs** |
| **Course Name** | **INSTRUMENTATION TECHNIQUES FOR 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. | Explain in detail about the instrumentation of IR spectroscopy. | CO1 | U | 10 |
|  | b. | Discuss electromagnetic radiations with examples. Describe spectroscopy and give four examples. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the instrumentation of NMR spectroscopy with a neat diagram. | CO1 | U | 10 |
|  | b. | Compare and contrast NMR and IR spectroscopy. | CO1 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | State Beer Lamberts law and report on the applications. | CO2 | U | 10 |
|  | b. | Discuss in detail about the applications of UV spectroscopy in Forensic Science. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Give schematic diagram of UV spectrophotometry and explain it. | CO2 | R | 10 |
|  | b. | Define the term electronic transition. List out their types with neat transition state diagram. | CO2 | E | 10 |
|  |  |  |  |  |  |
| 5. | a. | Compare and contrast fluorescence and phosphorescence with few examples. | CO3 | A | 10 |
|  | b. | Enumerate the instrumentation of Fluorescence with neat diagram. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | What is fluorescence quantum yield? Explain the two methods of calculation. | CO3 | R | 10 |
|  | b. | Explain the following  1) singlet and triplet states.  2) Non – radiative decay process. | CO3 | R | 10 |
|  |  |  |  |  |  |
| 7. | a. | Describe in detail about the various components of an electrochemical cell with a neat diagram. | CO4 | A | 10 |
|  | b. | Discuss the importance of polarography with principle and instrumentation. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Report on columetry with its applications. | CO5 | R | 10 |
|  | b. | Explain the working mechanism of ion selective electrode. List out their types and applications. | CO5 | E | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Give on account the following  1) Mechanism of Kα and Kβ radiations origin.  2) Neutron activation analysis.  3) Ilkovic equation. | CO6 | U | 10 |
|  | b. | Explain X Ray diffraction with neat diagram. Give its application. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know the importance of IR and NMR spectroscopy techniques and their application in forensic science |
| CO2 | Understand the forensic applications of UV and visible spectroscopic techniques. |
| CO3 | Know the principle and instrumentation of fluorescence and phosphorescence spectrophotometry. |
| CO4 | Understand the importance of electrochemical techniques in forensic science. |
| CO5 | Understand the principle of radio analytical techniques. |
| CO6 | Know the concepts and forensic applications of advanced techniques. |

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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 | 10 | 10 | 10 |  | 10 |  | 40 |
| CO3 | 20 |  | 20 |  |  |  | 40 |
| CO4 | 10 |  | 10 |  |  |  | 20 |
| CO5 | 10 |  |  |  | 10 |  | 20 |
| CO6 | 10 | 10 |  |  |  |  | 20 |
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| **Course Code** | **20CH2009** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC CHEMISTRY** | **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 several fractions obtained in fractional distillation of crude oil. | CO1 | U | 10 |
|  | b. | Pen down the chemical contents of gasoline and diesel. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Prepare a detailed report on the following distillations:  Simple distillation, Fractional distillation and Steam distillation. | CO3 | An | 10 |
|  | b. | Differentiate Octane Number and Cetane Number. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. |  | Illustrate the chemistry of fire, its composition and the products formed. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Pick out any three evidences from any of the fire scene with proper justification. Describe the method of collection and packing. | CO4 | E | 20 |
|  |  |  |  |  |  |
| 5. |  | Draw the graphical representation in the development of ‘flashover’ in a fire scene? Address its identification, consequences, and warning signs. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Brief on GC-MS principle and its application in analyzing a petrochemical found in a Crime Scene. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 7. | a. | Summarize the synthesis, properties and applications of RDX and PETN. | CO5 | R | 10 |
|  | b. | Explain any two case studies with a brief forensic investigation report on Molotov types of fire explosion. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Illustrate any three improvised explosive devices (IED) with examples. | CO4 | An | 10 |
|  | b. | Comment on ‘Bomb Scene Management’ by a forensic investigator. | CO6 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Clarify the different ways of the detection of hidden explosives with proper justification. | CO5 | A | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Comprehend the method of searching, collecting, preserving and analyzing arson evidence |
| CO2 | Deliver the process of post-fire analysis of materials. |
| CO3 | Realize the classification of explosives, including the synthesis and characterization of representative analogs |
| CO4 | Apply the techniques of locating hidden explosives |
| CO5 | Interpret the significance of bomb scene management. |
| CO6 | Comprehend the method of searching, collecting, preserving and analyzing arson evidence |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 10 | - | - | - | - | 10 |
| CO2 | - | 20 | - | - | - | - | 20 |
| CO3 | - | 40 | 20 | 10 | - | - | 70 |
| CO4 | - | - | - | 10 | 20 | - | 30 |
| CO5 | 10 | - | 30 | - | - | - | 40 |
| CO6 | - | 10 | - | - | - | - | 10 |
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Graphical user interface, application

Description automatically generated with medium confidence

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| **Course Code** | **20CH2010** | **Duration** | **3hrs** |
| **Course Name** | **FORENSIC TOXICOLOGY** | **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 flash point and write a detailed procedure of determination of flash point of the petroleum products with a diagram. | CO1 | Understand | 10 |
|  | b. | How will you determine the pour point and viscosity of the petroleum products? | CO1 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write the procedure to find out the acid value and lead content of the petroleum product. | CO1 | Apply | 10 |
|  | b. | How will you determine the ash content and the metal content in the petroleum products? | CO4 | Analyze | 10 |
|  |  |  |  |  |  |
| 3. | a. | Write the general characteristics, symptoms and the withdrawal symptoms of stimulants along with an example. | CO2 | Understand | 10 |
|  | b. | Write a note on dope test and excretion of drugs from the body. | CO2 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write a note on the extraction process of the visceral samples along with TLC results for acidic and basic drugs in testing narcotics, drugs and psychotropic substances. | CO2 | Apply | 10 |
|  | b. | How will you analyze the presence of drugs in breast milk, saliva and post-mortem blood? | CO3 | Analyze | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write a detailed account on alcoholic and non-alcoholic beverages. | CO3 | Remember | 10 |
|  | b. | Write short note on alcohol, illicit liquor, proof spirit and detoxication of alcohol. | CO3 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Define the terms: Ignition point, Auto-ignition point, Combustible and flammable liquids, Fire triangle and Backdraft. | CO4 | Remember | 10 |
|  | b. | Write note on fire extinguisher and degrees of arson. | CO4 | Evaluate | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a detailed account on the origin, cause and about the fire patterns. | CO5 | Create | 10 |
|  | b. | Write a detailed account on flashover. | CO5 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | How will you detect the presence arsenic, mercury and ethyl alcohol in the extracted sample? | CO5 | Analyze | 10 |
|  | b. | How will you extract the sample from the biological matrices through protein precipitation and dialysis method? | CO6 | Understand | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write a note on the preparation of solid adsorbents used for the clean-up procedure and explain how the clean-up process is done. | CO6 | Evaluate | 10 |
|  | b. | Write a detailed account on the diagnosis of poisoning in dead, selection and collection of viscera, preservation of viscera and body fluids. | CO6 | Apply | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know about chemistry of petroleum products forensic science. |
| CO2 | Know the narcotics, drugs and psychotropic substances forensic science. |
| CO3 | Know the forensic identification of illicit liquors. |
| CO4 | Know the techniques of locating hidden explosives. |
| CO5 | Understand the method of searching, collecting, preserving and analyzing arson evidence. |
| CO6 | Know about toxicology and poisons. |

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

Graphical user interface, application

Description automatically generated with medium confidence

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| **Course Code** | **20CH2012** | **Duration** | **3hrs** |
| **Course Name** | **CRIME INVESTIGATION 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 in detail the principles of column chromatographic technique. | CO1 | U | 10 |
| b. | List out any five applications of column chromatography in forensic science. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Discuss briefly the instrumentation of HPLC technique. | CO1 | A | 10 |
|  | b. | List out the advantages of using HPLC in separation procedures. | CO1 | R | 10 |
| 3. | a. | Describe in detail the method and principle of thin layer chromatographic technique. | CO2 | U | 10 |
| b. | List out any five applications of thin layer chromatographic technique in forensic lab. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Elaborate the importance of detecting reagents in TLC method. | CO2 | A | 10 |
|  | b. | Give your thoughts on choice of mobile phase and stationary phase. | CO2 | E | 10 |
| 5. | a. | Explain in detail the applications of X-ray crystallography in materials identifications with suitable examples. | CO3 | An | 10 |
|  | b. | Instrumentation of X-ray crystallography: give detailed account. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Recall the properties of X-rays with proper explanation. | CO3 | R | 10 |
|  | b. | Show the seven crystal systems with suitable notations. | CO3 | U | 10 |
| 7. | a. | Compare electron microscope and optical microscope. | CO4 | U | 10 |
|  | b. | Explain in detail how the contrast of image is enhanced in SEM and TEM. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Outline the instrumental components of electron microscope. | CO5 | U | 10 |
|  | b. | Summarize the applications of SEM and TEM in forensic science. | CO5 | R |  |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Compare the applications of optical and IR photography in crime scene investigations. | CO6 | R | 10 |
|  | b. | Explain in detail the principles and applications of photography in forensic science. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Know principle of chromatographic techniques. |
| CO2 | Know applications of chromatographic techniques. |
| CO3 | Understand the principles of X-ray diffraction techniques. |
| CO4 | Realize the importance of Electron microscopy. |
| CO5 | Understand the applications of electron microscopic techniques. |
| CO6 | Understand advance photographic methods for 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 | 10 |  |  |  | 40 |
| CO2 | 10 | 10 | 10 |  | 10 |  | 40 |
| CO3 | 10 | 10 |  | 10 | 10 |  | 40 |
| CO4 | 20 |  |  |  |  |  | 20 |
| CO5 | 10 | 10 |  |  |  |  | 20 |
| CO6 | 20 |  |  |  |  |  | 20 |
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| **Course Code** | **20CH3001** | **Duration** | **3hrs** |
| **Course Name** | **CHEMICAL KINETICS AND CHEMICAL 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. | State the limitations of I law of thermodynamics and the need for the 2nd law.  Define Hess’s law of heat of summation. | CO1 | R | 10 |
|  | b. | Find the enthalpy change for the reaction  CS2(l) + 3 O2(g) → CO2(g) + 2 SO2(g) when: C(s) + O2(g) → CO2(g); ΔHf = -393.5 kJ/mol (1) S(s) + O2(g) → SO2(g); ΔHf = -296.8 kJ/mol (2) C(s) + 2 S(s) → CS2(l); ΔHf = 87.9 kJ/mol (3) | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Give the entropy change in an isothermal expansion of an ideal gas, also state the significance of entropy.  Calculate the entropy increase in the evaporation of one mole of water at 100ºC.∆H = 2259.4 J/G | CO1 | R | 15 |
|  | b. | Calculate the change in entropy accompanying the heating of one mole of He gas (ideal) from a temperature of 298K to a temperature of 1000K at constant pressure. (assume Cv = 3/2 R) | CO1 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | Derive ClasiusClaperyon equation and give its application | CO2 | R | 10 |
|  | b. | Derive the rate constant and calculate the half-life period for the given second order reaction.  2A⟶ product | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Derive the rate constant for the following reaction and give its half-life period.  Na2CO3⟶2NaO + CO2 | CO3 | U | 12 |
|  | b. | For a reaction A ⟶pdt;the time required was one hour for the decomposition of 50% of A, calculate the rate constant. | CO3 | A | 08 |
|  |  |  |  |  |  |
| 5. |  | Derive Arrhenius equation to determine the energy of activation.  If a reaction's rate constant at 298K is 33 /M/ s and 45/ M/ s at 675 K, what is the activation energy? | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Given that the rate constant is 11/ M/ s at 345 K and the pre-exponential factor is 20/ M/s, calculate the activation energy. | CO4 | E | 8 |
|  | b. | Secondary isotope effect arises from changes in hybridization and hyper conjugation- explain this with suitable example. | CO5 | R | 12 |
|  |  |  |  |  |  |
| 7. | a. | State the difference between collision and transition state theory? | CO5 | U | 5 |
|  | b. | Write a short note on transition metal catalysts (TMC), give two organic synthesis with suitable TMC. | CO5 | U | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Differentiateorder and molecularity of a reaction. | CO5 | U | 5 |
|  | b. | Derive the Michael- Menton’s equation for an enzyme catalyzed reaction. | CO6 | U | 15 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Hydrolysis of benzoic acid with different substituents followslinear free energy relationship- Explain.  Can Hammett equation be applied to o-substituted benzoic acid hydrolysis-justify your answer. | CO6 | An | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the principles of chemical thermodynamics. |
| CO2 | Know the parameters relevant to chemical thermodynamics. |
| CO3 | Know the parameters relevant to chemical thermodynamics. |
| CO4 | Understand the types and kinetics of fast reactions. |
| CO5 | Understand the theory of acid, base catalysis. |
| CO6 | Know about the concepts of heterogeneous catalysis. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10, 15 |  | 10, 5 |  |  |  | 40 |
| CO2 | 10 | 10 |  |  |  |  | 20 |
| CO3 |  | 12 |  |  |  |  | 12 |
| CO4 |  |  | 8, 20 |  | 8 |  | 36 |
| CO5 | 12 | 5, 15, 5 |  |  |  |  | 37 |
| CO6 |  | 15 |  | 20 |  |  | 35 |
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| **Course Code** | **20CH3002** | **Duration** | **3hrs** |
| **Course Name** | **THEORIES OF CHEMICAL BONDING** | **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. | Predict the general characteristics of s, p, d and f block elements Example. | CO1 | R | 10 |
|  | b. | Briefly explain the following terms with the examples   1. Transition metals 2. Halogens 3. Noble Gases | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Sate the Reactions in Hydrofluoric acid. | CO2 | U | 10 |
|  | b. | List out the Reactions in Non-aqueous solvent - Dinitrogen tetroxide. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Describe the following terms with examples   1. Size effects. 2. Factors affecting the radii of ions. | CO3 | U | 10 |
|  | b. | Specify any two structures of Compounds of types AX | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Apply the theory and find out the hybridization and magnetism for the following [Ni(CN)4]2- complex. | CO4 | A | 10 |
|  | b. | Discuss the following terms   1. Delocalization. 2. Berry pseudorotation. | CO4 | R | 10 |
|  |  |  |  |  |  |
| 5. | a. | Elaborate the Merits and limitations of Crystal field theory. | CO5 | An | 10 |
|  | b. | Identify the sigma bond and pi bond advantages. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Mention the Bronsted–Lowry concept with two examples. | CO1 | A | 10 |
|  | b. | State the following terms with the examples   1. Amphoteric substances. 2. Symbiosis. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Enumerate the Protic solvents and Aprotic solvents with examples. | CO2 | An | 10 |
|  | b. | Compare Covalent bond with Ionic Bond with example. | CO3 | E | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Enumerate the postulates of VB Theory and evaluate the magnetic momentum and the geometry of **[Mn(CN)6]3-.** | CO4 | E | 10 |
|  | b. | Elaborate the MO Theory, draw the MO diagrams and calculate bond order, magnetic property of **CO** molecule. | CO5 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Analyze the VSEPR Theory with example. | CO4 | An | 10 |
|  | b. | Derive Born Lande Equation. | CO3 | E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Acquire the knowledge about the Acid-Base Chemistry. |
| CO2 | Understand the importance and applications of non-aqueous solvents. |
| CO3 | Acquire the knowledge about ionic bond. |
| CO4 | Recognize the theories related to covalent bond. |
| CO5 | Analyzethe theories of coordinate bond . |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 10 | - | - | - | 30 |
| CO2 | - | 30 | - | 10 | - | - | 40 |
| CO3 | - | 20 | - | - | 20 | - | 40 |
| CO4 | 10 | - | 10 | 10 | 10 | - | 40 |
| CO5 | - | 10 | - | 20 | - | - | 30 |
| CO6 | - | - | - | - | - | - | - |
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| **Course Code** | **20CH3003** | **Duration** | **3hrs** |
| **Course Name** | **ORGANIC REACTION MECHANISM AND STEREOCHEMISTRY** | **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) Derive hammett equation? Explain the terms & write uses of hammett plots. ii) What is Kinetic isotopic effect? Give one example for primary and secondary isotope effect. | CO1 | A | 10 |
|  | b. | i) Write the resonance structure of aniline, nitrobenzene, phenol and pyrrole? ii) Why do we need hyperconjugation? | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | i) Write differences between inductive effect and resonance effect?  ii) What are characteristics of resonance? | CO2 | U | 10 |
|  | b. | What are the conditions for aromaticity? Write the structure of [14]annulene, [8] annulene, [16] annulene, [6] annulene. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | i) What are the factors affecting for SN2 reaction? Give three examples for each of the following: very good, good and weak nucleophiles.  ii) Write the increasing order of stability for all types of carbocations? | CO3 | A | 10 |
|  | b. | i) Why benzyne mechanism is called elimination addition mechanism?  ii) Write properties of diazonium salts. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write a mechanism of diazonium salts from aromatic amines? | CO4 | U | 10 |
|  | b. | Explain factors affecting reactivity in aromatic nucleophilic Substitutions. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain Arenium ion mechanism and energy profile diagram. | CO5 | U | 10 |
|  | b. | Write a short note on  i) Reimer-Tiemann reaction.  ii) VilsmeierHaack reaction. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Write a short note on i) Enantiomer ii) epimer iii) geometrical isomerism iv)optical isomerism v) chirality. | CO5 | U | 10 |
|  | b. | i) What is stereochemistry of allenes? How do you assign R and S configuration to allenes?  ii)Write Conditions of Atropisomerism? Explain stereochemistry of biphenyls. | CO5 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a short note on i) Hoffmann elimination ii)Chugaev elimination iii) Cope elimination | CO6 | R | 10 |
|  | b. | What is elimination reaction & explain E1 and E2 reaction. | CO6 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | i) What is Fischer-projection and Newman project formula?  ii) What is the difference between Newman and sawhorse projection. | CO6 | U | 10 |
|  | b. | i) Write Cahn-Ingold-Prelog rules?  ii) How do you rank substituents in order of Cahn-Ingold-Prelog priorities? | CO6 | An | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe the conformation of ethane and cyclohexane. | CO6 | U | 10 |
|  | b. | i)What is Sharpless asymmetric Dihydroxylation?  ii) What is the role and importance of sharplessepoxidation? | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To understand the hammett equation and its application.  To identify the primary and secondary isotope effect |
| CO2 | To know the concept of resonance, aromaticity and annulenes |
| CO3 | To connect SN1 and SN2 reaction and its mechanism |
| CO4 | To understand the importance of diazonium salts. |
| CO5 | To consider the named reactions in organic synthesis |
| CO6 | To know the elimination reaction and its various mechanism  To understand the Cahn-Ingold-prelog rules  To evaluate the importance of sharpless dihydroxylation and epoxidation? |

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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 | 10 |  |  | 20 |
| CO4 | 10 |  |  | 10 |  |  | 20 |
| CO5 | 20 |  |  | 20 |  |  | 40 |
| CO6 | 20 | 10 | 10 | 20 |  |  | 60 |
|  | | | | | | | **180** |

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| **Course Code** | **20CH3005** | **Duration** | **3hrs** |
| **Course Name** | **COORDINATION CHEMISTRY OF TRANSITION ELEMENTS** | **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 various types of electronic transitions possible in a coordination complex. | CO1 | U | 10 |
|  | b. | Discuss the magnetic properties of coordination complexes. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain John-Teller effect with examples. | CO1 | A | 10 |
|  | b. | Describe a method to determine magnetic susceptivity. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Discuss about the various types of structural isomerism exhibited by the metal complexes. | CO3 | An | 10 |
|  | b. | Analyze the factors affecting the stability of coordination complexes. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Derive the relationship between stepwise stability constant and overall stability constant. | CO4 | A | 10 |
|  | b. | Summarize the various types of stereoisomerism exhibited by the metal complex. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain SN1 substitution reaction in metal complex with suitable example. Write the rate equation. | CO5 | U | 10 |
|  | b. | Discuss about (i) Anation reaction (ii) Isomerization reaction. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Define: Trans effect. Write the trans effect series and state its significance. | CO5 | U | 10 |
|  | b. | Compare the theories of trans effect. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the following   1. Marcus theory 2. Complementary and noncomplementary electron transfer reaction | CO5 | U | 10 |
|  | b. | Discuss the mechanism of inner sphere electron transfer reaction with suitable examples. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Elucidate the mechanism of outer sphere electron transfer reaction. | CO5 | An | 10 |
|  | b. | Summarize the applications of electron transfer reactions. | CO5 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Analyze the various types of bonds possible in complexes containing metal-metal multiple bonds. | CO6 | An | 10 |
|  | b. | Outline the applications of compounds containing metal-metal multiple bonds. | CO6 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To characterize the electronic spectra of metal complexes. |
| CO2 | To predict the magnetic properties of coordination complexes. |
| CO3 | To discuss the isomerism in coordination complexes. |
| CO4 | To summarize the factors affecting the stability of metal complexes. |
| CO5 | To categorize the types of mechanisms in reactions of metal complexes. |
| CO6 | To describe the importance of metal-metal multiple bonds. |

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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 |  |  |  | 20 |  |  | 20 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 |  | 40 | 10 | 30 |  |  | 80 |
| CO6 |  |  | 10 | 10 |  |  | 20 |
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Description automatically generated with medium confidence

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| **Course Code** | **20CH3006** | **Duration** | **3hrs** |
| **Course Name** | **PRINCIPLES OF MOLECULAR SPECTROSCOPY** | **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. | The vibration frequency of 1H35Cl is 2990.6 cm-1; without calculating the bond force constant, estimate the vibrational frequencies for 1H37Cl, 2D35Cl and 2D37Cl. | CO3 | A | 10 |
|  | b. | Explain suitable selection rules for Microwave, IR, Raman, NMR and ESR spectroscopy. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | How many normal modes of vibration are possible for the following molecules?  NH3, HCN, SO2 (bent), C2H2, C6H6, CH4, OCS (linear) | CO3 | A | 10 |
|  | b. | The first rotational line of CO occur at 3.84235 cm-1 (J=0 to J=1). Calculate the moment of inertia and bond length of CO molecule. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain the possible electronic transitions observed in polyatomic molecules with suitable example. | CO3 | U | 10 |
|  | b. | Explain the factors influencing vibrational frequencies. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the Rayleigh scattering and Raman scattering with illustration. | CO3 | A | 10 |
|  | b. | Explain the possible modes of stretching and bending vibrations observed in IR spectroscopy. | CO3 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Predict the EPR spectrum of the following compounds:  (i) •CH2-CH3 (ii) •CH3 (iii)Mn2+ (I=5/2)  (iv)  Naphthalene radical (V) Anthracene radical | CO4 | A | 10 |
|  | b. | TMS is used as a reference in NMR.Why? | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the Zeeman effect. | CO4 | A | 10 |
|  | b. | Discuss on coupling constant. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the theory and principle of Mossbauer spectroscopy. | CO5 | A | 10 |
|  | b. | Explain the theory and principle of UPS and XPS. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the following   1. Isomer shift. 2. Hyperfine splitting. 3. Quadrupole effects. 4. Mössbauer effect. | CO5 | U | 10 |
|  | b. | How will you obtain a photoelectron spectrum? Find binding energy of an electron. | CO5 | U | 10 |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain different photo processes using Jablonski diagram. | CO6 | U | 10 |
|  | b. | Discuss the following   1. Fluorescence quantum yield. 2. Fluorescence Quenching. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the principle and application of microwave spectroscopy. |
| CO2 | Relate the principle and application of microwave spectroscopy. |
| CO3 | Understand the principle and application of Vibration and Raman spectroscopy. |
| CO4 | Show the principle and application of NMR and ESR in organic and inorganic sample analysis. |
| CO5 | Examine the principle and application of Mossbauer and PES in material analysis. |
| CO6 | Explain the principle and application of electronic and emission spectroscopy. in material analysis. |

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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 | - | 20 | 40 | - | - | - | 60 |
| CO4 | - | 30 | 20 | - | - | - | 50 |
| CO5 | - | 20 | 10 | - | - | - | 30 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |

Graphical user interface, application

Description automatically generated with medium confidence

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| **Course Code** | **20CH3007** | **Duration** | **3hrs** |
| **Course Name** | **SYNTHETIC REAGENTS AND METHODOLOGY** | **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 following steps in organometallic reactions with suitable example  a) Reductive elimination ii) oxidative addition | CO1 | R | 10 |
|  | b. | i) What is Sonogashira cross-coupling reaction? Why copper is used in Sonogashira coupling?  ii) Write three applications of Rosenmund reduction. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write a short note on i) Ullmann reaction ii) Suzuki coupling. | CO2 | U | 10 |
|  | b. | Write a short note on metal hydrides in reduction reaction. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Give the synthetic uses of the following reducing agents.  i) NaBH4 ii) BH3 iii)LAH | CO3 | R | 10 |
|  | b. | i)Explain Oppenauer oxidation and its mechanism.  ii) Which alcohol is most resistant to oxidation? | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Predict the product and synthetic use of this reaction  C:\Users\pkmur\Downloads\Kim-corey.jpg | CO4 | U | 10 |
|  | b. | i) Explain Birch reduction and its mechanism.  ii) Identify the product  C:\Users\pkmur\Downloads\Bouveault-Blanc reduction 123.jpg? | CO4 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write a short note on i)Gilman’s reagent ii) NBS iii) DCC | CO5 | U | 10 |
|  | b. | Give the synthetic applications of the following reagents  i) Wittig salt ii) mCPBA iii) Tebbe reagent | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | i) How amino acids are synthesized by Strecker method? Write its mechanism ii) What test is used to identify amino acids? | CO5 | U | 10 |
|  | b. | i) Identify the product and name the reaction  C:\Users\pkmur\Downloads\Biginelli_Reaction_123.jpg  ii) Write one reaction in which diazomethane acts as base. | CO5 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a short note on  i) Pinacol-Pinacolone rearrangement.  ii) Beckmann rearrangement. | CO6 | U | 10 |
|  | b. | Identify the similarities in mechanism between Wolf and Curtius rearrangement. | CO6 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss the Beckmann rearrangement with suitable example. Which reagent cannot be used in Beckmann rearrangement? | CO6 | U | 10 |
|  | b. | Discuss the list of common acceptor Synthons and their synthetic equivalents. | CO6 | An | 10 |
| **PART – A(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Give the retrosynthetic analysis for the following three compounds. Pay special attention to the relationship between the functional groups. | CO6 | U | 10 |
|  | b. | i) How would you synthesize    ii) Name the three types of selectivity possible for any organic synthesis. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To understand the importance of metal catalyzed coupling reactions in synthesis. |
| CO2 | Describe the usefulness of multi component coupling in synthesis. |
| CO3 | To know the reagents used for oxidation and reduction reactions. |
| CO4 | To understand the retrosynthetic approach to complex target molecules. |
| CO5 | Apply modern synthetic reagents in organic synthesis. |
| CO6 | Apply retrosynthetic and selectivity approach to complex target molecules. |

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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 | 10 |  |  | 10 |  |  | 20 |
| CO4 |  | 10 |  | 10 |  |  | 20 |
| CO5 | 10 | 20 | 10 |  |  |  | 40 |
| CO6 |  | 30 | 10 | 20 |  |  | 60 |
|  | | | | | | | **180** |

Graphical user interface, application

Description automatically generated with medium confidence

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| **Course Code** | **20CH3008** | **Duration** | **3hrs** |
| **Course Name** | **GROUP THEORY AND APPLIED PHYSICAL CHEMISTRY** | **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. |  | Identify the point groups of the following molecules   1. Benzene. 2. Toluene. 3. C(FClBrI). 4. Tetrachloroplatinate (II). | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Define the following terminology with an example.   1. Abelian Group. 2. Non abelian Group. 3. Cyclic Group. 4. Sub-group. | CO1 | R | 20 |
| 3. |  | List out any five properties of a Group and draw the group multiplication table of C2V point group. | CO2 | R | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Derive the reducible representations of H2O with respect to cartesian coordinates of each atom and Construct the corresponding character table containing only area I & area II. | CO2 | A | 20 |
| 5. | a. | Explain the concepts adsorption and absorption with examples. | CO3 | U | 10 |
|  | b. | Compare physisorption and chemisorptions. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Discuss in detail the classifications of colloids with examples and applications. | CO3 | R | 20 |
| 7. |  | Elaborate Fluorescence, Phosphorescence and Delayed fluorescence. How can each of the above processes be identified. | CO4 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Discuss in detail any five important applications of photochemistry with suitable examples. | CO5 | R | 20 |
| **PART – A(4 X 20= 80 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Electrical double layer: Discuss briefly Gouy-chapmann and stern models. | CO6 | U | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Appreciate the symmetry in molecules and in nature. |
| CO2 | Able to identify and group the objects or molecules of same category based on the symmetry elements. |
| CO3 | Distinguish different isotherms. |
| CO4 | Recognize the importance of photosensitization of chemiluminescence. |
| CO5 | Understand the basic principles of electrochemistry. |
| CO6 | Know about electrokinetics. |

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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 |  |  |  | 40 |
| CO3 | 30 | 10 |  |  |  |  | 40 |
| CO4 |  | 20 |  |  |  |  | 20 |
| CO5 | 20 |  |  |  |  |  | 20 |
| CO6 |  | 20 |  |  |  |  | 20 |
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Description automatically generated with medium confidence

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| **Course Code** | **20CH3009** | **Duration** | **3hrs** |
| **Course Name** | **ORGANOMETALLIC AND BIOINORGANIC CHEMISTRY** | **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 18 electron rule with examples. What are the limitations of the 18 electron rule? | CO1 | An | 10 |
|  | b. | How are metal carbonyl complexes synthesized? Discuss the nature of bonding in metal carbonyl complexes. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | State the rules for determining the number of Metal-Metal bonds in an organometallic complex. Calculate the number of Metal-Metal bonds in the following complexes.   1. Co2(CO)9 (ii) (-I)2Mn2(CO)8 | CO1 | E | 10 |
|  | b. | Describe the spectroscopic features of metal carbonyl complexes. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the preparation and applications of metal carbonyl hydrides. | CO2 | A | 10 |
|  | b. | Explain the preparation of metal alkene complexes. Analyze their structures and factors affecting the C=C bonds in metal carbene complexes. | CO2 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Compare the characteristics of Fischer and Schrock carbenes. | CO2 | An | 10 |
|  | b. | Draw the molecular orbital diagram of Ferrocene and explain. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Describe the nucleophilic and electrophilic reactions in organometallic complexes. Illustrate with examples. | CO3 | A | 10 |
|  | b. | Explain the steps involved in Monsanto acetic acid process. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Illustrate with examples :   1. Reductive elimination reaction. 2. Migration reaction. | CO3 | U | 10 |
|  | b. | Analyze the mechanism of hydrogenation reaction. Draw the catalytic cycle and explain each step. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Discuss the structure of hemoglobin. | CO5 | U | 10 |
|  | b. | Analyze the mechanism of oxygen evolution in oxygen evolving center in photosystem-II. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the following   1. Bohr effect. 2. Cooperativity. | CO5 | U | 10 |
|  | b. | Write a detailed account on Platinum anticancer drugs. | CO5 | A | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Using a potential energy diagram, describe the various transition occurring in an excited state octahedral coordination complex. | CO6 | An | 10 |
|  | b. | Describe the applications of Ruthenium polypyridine complexes. | CO6 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To apply the 18 electron rule. |
| CO2 | To describe the structure of various types of transition metal organometallic complexes. |
| CO3 | To utilize the reactions of organometallic complexes. |
| CO4 | To practice the applications of organometallic complexes in catalysis. |
| CO5 | To discuss the role of metals in biology. |
| CO6 | To identify the metal complexes that can be used for solar energy conversion. |

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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 | 50 | - | - | 60 |
| CO3 | - | 10 | 10 | - | - | - | 20 |
| CO4 | - | - | - | 20 | - | - | 20 |
| CO5 | - | 20 | 10 | 10 | - | - | 40 |
| CO6 | - | - | 10 | 10 | - | - | 20 |
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| **Course Code** | **20CH3010** | **Duration** | **3hrs** |
| **Course Name** | **PERICYCLIC REACTIONS AND BIOMOLECULES** | **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. | Illustrate [3+3] Sigmatropic rearrangement with Mechanism. | CO1 | A | 10 |
|  | b. | Discuss the Ene reaction and Chelotropicreactions. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the mechanism of Cope and Oxy-Cope rearrangement. | CO1 | A | 10 |
|  | b. | Discuss the Electrocyclic add Diels-Alder reactions with examples. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Describe the photochemical reactions of Norrish I and II types with examples. | CO2 | An | 10 |
|  | b. | Explain the photoreduction of Benzophenone. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe the mechanism of Barton Reaction. | CO2 | An | 10 |
|  | b. | Discuss the Di-Pi Methane Rearrangement. | CO2 | A | 10 |
|  |  |  |  |  |  |
| 5. | a. | Discuss the mechanism of Fisher-Indole Synthesis. | CO3 | A | 10 |
|  | b. | Narrate the synthesis, properties and applications of Pyrazole. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | What do you learn from Reissert Synthesis and Madelung Synthesis? | CO3 | A | 10 |
|  | b. | Discuss the synthesis, properties and applications of Pyrimidine. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the structural elucidation procedure for Alkaloids. | CO4 | A | 10 |
|  | b. | Discuss the extraction technique using soxhlet apparatus. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | How will you extract the phytocompounds from natural resources? | CO5 | A | 10 |
|  | b. | Discuss the synthesis of Menthol and Nicotine. | CO5 | E | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the Ruff Degradation and Kiliani Fisher Synthesis. | CO6 | C | 10 |
|  | b. | Describe the sanger sequencing method and Edman degradation. | CO6 | C | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply the principles and applications of pericyclic reactions to predict the product. |
| CO2 | Reason out for the product formed in the photochemical reaction. |
| CO3 | Describe the synthesis of heterocycles molecules from suitable precursors. |
| CO4 | Summarize the properties and applications of heterocyclic compounds. |
| CO5 | Elaborate the extraction and structural elucidation of natural products. |
| CO6 | Explain the structure and role of biomolecules in living system. |

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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 | 10 |  |  | 20 |
| CO3 |  |  | 40 | 10 | - | - | 50 |
| CO4 |  |  | 20 | 20 |  |  | 40 |
| CO5 |  |  | - | - | 10 | - | 10 |
| CO6 |  |  | - | - | - | 20 | 20 |
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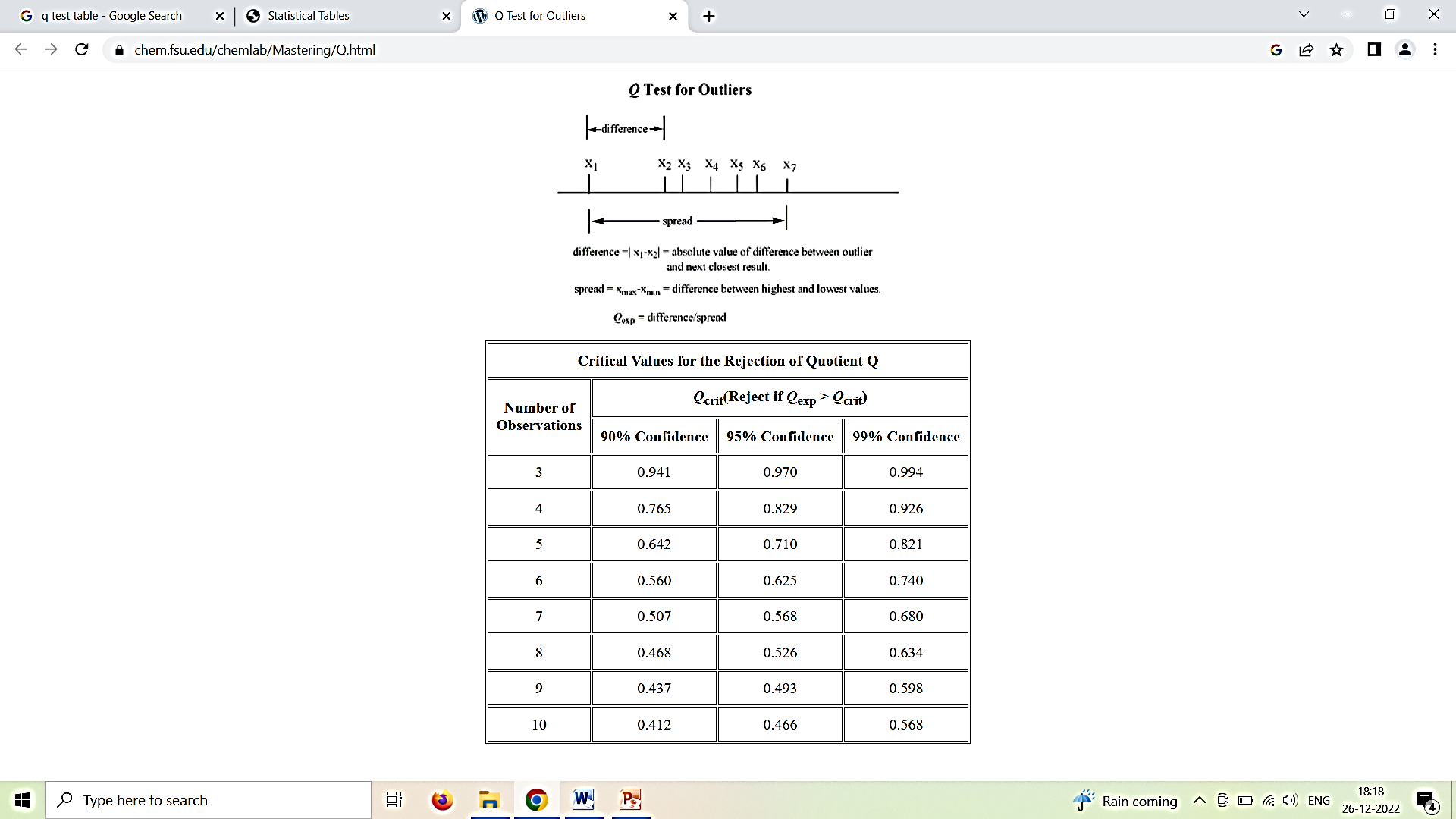
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| **Course Code** | **20CH3017** | **Duration** | **3hrs** |
| **Course Name** | **INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS** | **Max. Marks** | **100** |

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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. | Briefly explain the following terms with the example  a. Median b. Accuracy c. Precision | CO 1 | A | 10 |
|  | | b. | Specify the Determinate errors and Indeterminate errors | CO 1 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 2. | | a. | Mention the working principle of column chromatography. Evaluate the elution order of three compounds (**Alkane, Ester** and **Amide**) and explain why? | CO2 | E | 10 |
|  | | b. | Describe the working principle of ion exchange chromatography and it’s application | CO2 | U | 10 |
|  | |  |  |  |  |  |
| 3. | | a. | Explain the Principle, Instrumentation of TGA analysis with example | CO3 | U | 10 |
|  | | b. | Summarize the theory and Instrumentation of Thermometric titration | CO3 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 4. | | a. | Sate the following terms   1. Four type of X-ray Methods (ii) Crystal Tonography | CO4 | U | 10 |
|  | | b. | Elaborate the AAS principle, Instrumentation and Advantages with example | CO4 | U | 10 |
|  | |  |  |  |  |  |
| 5. | | a. | Identify the process of Paint analysis | CO5 | An | 10 |
|  | | b. | Denote the Food analysis | CO5 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 6. | | a. | Define the covariance and find out the covariance of the following data set   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **X** | **13** | **15** | **17** | **18** | **19** | | **Y** | **10** | **11** | **12** | **14** | **16** | | CO1 | A | 10 |
|  | | b. | Describe the Gas chromatography Instrumentation and application. | CO2 | U | 10 |
|  | |  |  |  |  |  |
| 7. | | a. | Narrate the theory, instrumentation and applications of DSC. | CO3 | R | 10 |
|  | | b. | Explain the Principle, Instrumentation of DTA analysis. | CO3 | U | 10 |
|  | |  | **(OR)** |  |  |  |
| 8. | | a. | Enumerate the Principle, Instrumentation of TEM analysis. | CO4 | U | 10 |
|  | | b. | Illustrate the Chemical Sensors. | CO5 | An | 10 |
| **COMPULSORY QUESTION** | | | | | | |
| 9. | | a. | Precise note on Dixon's Q-test**.** Apply the concept of Q – test to find out the given values  (**25.1, 21.2, 27.5, 22.7, 23.8, 26.3, 40.6, 22.9**)  are belong to the same population in confidence level of **95%.**  (**The Critical values of Q chart you can find in the Table. 1**) | CO1 | A | 10 |
|  | | b. | Detail about the instrumentation of HPLC and apply the concept to find out the elution order of **Diamide, Naphthol** and **Aniline** in rephrase phase column and explain it. | CO2 | E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Interpretation and gain knowledge about the Data Analysis |
| CO2 | Understand the principles of various types of chromatographic techniques |
| CO3 | Acquire the knowledge about the Thermal Methods of Analysis |
| CO4 | Recognize the Microscopy methods of Analysis |
| CO5 | Analyze the importance and applications of the instrumental techniques in various chemical Industries |
| CO6 | - |

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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 | - | - | 20 | - | 40 |
| CO3 | 10 | 30 | - | - | - | - | 40 |
| CO4 | - | 30 | - | - | - | - | 30 |
| CO5 | - | 10 | - | 20 | - | - | 30 |
| CO6 | - | - | - | - | - | - | - |
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**Table. 1 : Critical values of Q**





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| **Course Code** | **20CH3018** | **Duration** | **3hrs** |
| **Course Name** | **CHEMISTRY OF NON-TRANSITION ELEMENTS** | **Max. Marks** | **100** |

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| **Q. No.** | | **Sub Div.** | | **Questions** | **CO** | **Pattern** | **Marks** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | | | |
| 1. | | a. | | Sketch the synthetic procedure (any one) of crown ethers and cryptands | CO1 | R | 10 |
|  | | b. | | Elaborate the method of extraction of alkali metals using crown ethers | CO1 | E | 10 |
|  | | | **(OR)** | | | | |
| 2. | | a. | | What is Grignard reagent? Describe their synthetic utilities in organic chemistry. | CO1 | A | 10 |
|  | | b. | | Explain in detail about general periodic properties of elements. | CO1 | U | 10 |
|  | |  | |  |  |  |  |
| 3. | | a. | | Recite synthesis, structure and applications of fullerenes | CO2 | R | 10 |
|  | | b. | | Compare and contrast: carbon nanotubes, graphite and Diamond | CO2 | A | 10 |
|  | | | **(OR)** | | | | |
| 4. | | a. | | Discuss in detail about all the allotropes of carbon | CO2 | A | 10 |
|  | | b. | | What are various allotropes of phosphorous? Explain their chemical properties | CO2 | U | 10 |
|  | |  | |  |  |  |  |
| 5. | | a. | | Explain the synthesis, structure, properties and application of trimethylaluminium | CO3 | R | 10 |
|  | | b. | | Illustrate the structure and bonding of B2H6 | CO3 | A | 10 |
|  | **(OR)** | | | | | | |
| 6. | | a. | | Predict how many vertices are missing in the following hydroboranes   1. B5H11 (ii)B6H10 | CO3 | U | 10 |
|  | | b. | | Predict the class structure of following hydroboranes using Wades rule.   1. B2H6 (ii) [B5H5]2- | CO4 | E | 10 |
|  | |  | |  |  |  |  |
| 7. | | a. | | Give a detailed account on oxides of nitrogen | CO4 | A | 10 |
|  | | b. | | Predict the structure of following compounds   1. XeO4 (ii) XeF4 | CO5 | U | 10 |
|  | | | **(OR)** | | | | |
| 8. | | a. | | Narrate interhalogens, polyhalides and pseudohalides with suitable examples | CO5 | U | 10 |
|  | | b. | | Describe BN compounds and explain their electronic properties | CO5 | E | 10 |
|  | |  | |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | | | |
| 9. | | a. | | Elaborate the magnetic and spectroscopic properties of lanthanides | CO6 | A | 10 |
|  | | b. | | Discuss in detail about lanthanide contraction | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | discuss the importance of alkali and alkaline earth metals |
| CO2 | describe the importance of allotropy |
| CO3 | summarize the importance of compounds of p-block elements |
| CO4 | utilize the preparative methods of inorganic polymers |
| CO5 | Explain the structure and bonding in inorganic cages and clusters. |
| CO6 | compare the chemistry of lanthanides and actinides and their application |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 10 |  | 10 |  | 40 |
| CO2 | 10 | 10 | 20 |  |  |  | 40 |
| CO3 | 10 | 10 | 10 |  |  |  | 30 |
| CO4 |  | 10 |  |  | 10 |  | 20 |
| CO5 |  | 20 |  |  | 10 |  | 30 |
| CO6 |  | 10 | 10 |  |  |  | 20 |
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| **Course Code** | **20CH3019** | **Duration** | **3hrs** |
| **Course Name** | **NUCLEAR CHEMISTRY AND SOLID STATE CHEMISTRY** | **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 short notes one nuclear tunneling effect and nuclear cross section. | CO 1 | Understand | 10 |
|  | b. | Briefly discuss the factors affecting nuclear stability with suitable example. | CO 1 | Remember | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | List out the advantages of radio isotope in brain tumer and bone fracture. | CO 2 | Evaluate | 5 |
|  | b. | Describe the types of nuclear reaction with neat diagram. | CO 1 | Apply | 10 |
|  | c | Highlight the salient features of Breeder reactor. | CO 2 | Understand | 5 |
|  |  |  |  |  |  |
| 3. | a. | Highlight the application of carbon dating application in water and petroleum. | CO 2 | Remember | 10 |
|  | b. | Elaborately discuss the sterile insect technique with suitable example. | CO 2 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Write short notes on Q value and Transuranium. | CO3 | Remember | 10 |
|  | b. | Explain the thermo nuclear reaction with proton and proton and CNO cycle. | CO3 | Understand | 10 |
|  |  |  |  |  |  |
| 5. | a. | Highlight the elements of crystal in cubic crystal. | CO 3 | Remember | 10 |
|  | b. | Describe the types of crystals structures with suitable example. | CO 3 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Write short notes on dia, para, ferro and ferri magnetic materials. | CO 4 | Apply | 10 |
|  | b. | Explain the photo electric effect and peltier effect with example. | CO 4 | Analyze | 10 |
|  |  |  |  |  |  |
| 7. | a. | Highlight the advantage of high pressure synthesis method to preparation of solid state materials. | CO 5 | Apply | 10 |
|  | b. | Briefly discuss the co precipitation and sol gel method of preparation of solid state reactions. | CO 5 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write short notes on intercalation and deintercalation. | CO 5 | Remember | 10 |
|  | b. | Describe the principle and instrumentation of XRD technique. | CO 5 | Understand | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Classify the coordination polymers and application of coordination polymers. | CO 6 | Remember | 10 |
|  | b. | Explain the preparation of nanomaterials through ball milling and chemical vapour deposition method. | CO 6 | Apply | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the basic concepts of nuclear chemistry. |
| CO2 | Summarize the applications of radioisotopes. |
| CO3 | Outline the band theory of solids. |
| CO4 | Classify the various types of solid state reactions. |
| CO5 | Categorize the nanomaterials. |
| CO6 | Demonstrate the applications of coordination polymers. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 10 | 10 |  |  |  | 30 |
| CO2 | 10 | 5 | 10 |  | 5 |  | 30 |
| CO3 | 10 | 20 | 10 |  |  |  | 40 |
| CO4 |  |  | 10 | 10 |  |  | 20 |
| CO5 | 10 | 20 | 10 |  |  |  | 40 |
| CO6 | 10 |  | 10 |  |  |  | 20 |
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| **Course Code** | **20CH3020** | **Duration** | **3hrs** |
| **Course Name** | **ORGANIC SPECTROSCOPY** | **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. | Find the λmax values of the following compounds using Woodward-Fieser rules | CO1 | A | 12 |
|  | b. | Discuss the factors affecting the absorption bands in Uv-Visible spectroscopy. | CO1 | U | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the following with suitable example   1. CD spectroscopy (ii) Cotton effect (iii) Octant rule.   (iv) Axial halo ketone rule. | CO1 | U | 10 |
|  | b. | What is Fieser-Kuhn rule? Explain the importance of this rule with example. | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Discuss the following   1. Principle of FTIR spectroscopy. 2. Preparation of Samples for FTIR spectroscopy. 3. Finger print region. (iv) Combination bands. | CO2 | U | 10 |
|  | b. | Explain the factors influencing vibrational frequencies. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | How to discriminate the following functional group pairs using IR vibrational frequency?   1. Imine and Nitrile. (ii) Alcohol and Ketone.   (iii) Amine and Aldehyde. (iv) Amide and Alkane.   1. Alkene and Alkyne. | CO2 | An | 10 |
|  | b. | Explain the possible modes of stretching and bending vibrations observed in IR spectroscopy. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | What is chemical shift? Explain different factors are affecting the chemical shift. | CO3 | A | 10 |
|  | b. | TMS is used as a reference in NMR.Why? | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Comment on the following  (i) Spin – spin relaxation . (ii) Spin – lattice relaxation. (iii) *n+*1 rule  (iv) Coupling constant (v) Geminal and Vicinal coupling. | CO3 | A | 10 |
|  | b. | Show the 1H and 13C NMR spectrum for the following molecules | CO3 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Discuss the principle, instrumentation and applications of NMR spectroscopy. | CO3 | A | 10 |
|  | b. | Write a short note on the following   1. NOE Effect. (ii) COSY.   (iii) Proton-Decoupled 13C NMR Spectra  (iv) Shielding and Deshielding of protons. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the following with example  (i) DEPT spectroscopy (ii) HETCOR spectroscopy  (iii) NOESY. | CO4 | U | 10 |
|  | b. | Discuss the principle, instrumentation and applications of Mass spectroscopy. | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the following   1. McLafferty rearrangement. 2. Nitrogen rule. 3. Primary and Secondary Kinetic Isotope Effects. | CO5 | A | 10 |
|  | b. | Discuss the fragmentation pattern of 2-Butanoneand cyclohexanone with m/z value. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the principles and applications of UV-Visible spectroscopy and ORD in elucidating the structure of organic compounds. |
| CO2 | Illustrate the principle and applications of IR spectroscopy in elucidating the structure of organic compounds. |
| CO3 | Describe the basic principle and applications of NMR spectroscopy in elucidating the structure of organic compounds. |
| CO4 | Interpret proton decoupled NMR spectra, DEPT, 2D NMR and multi nuclear NMR spectroscopic analysis. |
| CO5 | Analyze the basic principle and applications of mass spectroscopy in elucidating the structure of organic compounds. |
| CO6 | Apply the combined spectroscopic data in elucidating the structure of unknown organic compounds. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 19 | 22 | - | - | - | 40 |
| CO2 | - | 20 | 10 | 10 | - | - | 40 |
| CO3 | - | 10 | 30 | 10 | - | - | 50 |
| CO4 | - | 20 | - | - | - | - | 20 |
| CO5 | - | 10 | 10 | - | - | - | 20 |
| CO6 | - | - | - | 10 | - | - | 10 |
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| **Course Code** | **20CH3021** | **Duration** | **3hrs** |
| **Course Name** | **SUPRAMOLECULAR CHEMISTRY AND GREEN CHEMISTRY** | **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 “Lock and Key Principle” with a neat sketch indicating its drawbacks. | CO1 | U | 14 |
|  | b. | Pen down the different types of Supramolecular Interactions. | CO1 | R | 6 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Exemplify Co-operativity and Complementarity with pictorial diagrams. | CO2 | A | 14 |
|  | b. | Predict the type of Supramolecular interaction in the following  C:\Users\USER\Desktop\Picture1.png | CO2 | An | 6 |
|  |  |  |  |  |  |
| 3. | a. | Examine the Hydrogen sponge and Proton sponge with examples. | CO3 | U | 14 |
|  | b. | Analyze the major differences between the Lariate Ethers from Crown Ethers. | CO3 | An | 6 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Illustrate the criteria for the construction of suitable receptors for anions with examples? | CO3 | U | 14 |
|  | b. | Prepare a brief report on Neutral molecular binding. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 5. | a. | Explain the different types of synthesis of rotaxanes. | CO4 | U | 14 |
|  | b. | Predict the general name for the following structures  C:\Users\USER\Desktop\Picture3.png | CO4 | A | 6 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discuss Racks, Ladders and Grids with pictorial representations. | CO4 | R | 14 |
|  | b. | Differentiate Borromeates and Knots. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 7. | a. | Generalize the structure, catalysis property and applications of Zeolites. | CO5 | An | 14 |
|  | b. | Summarize the Pi interactions. | CO5 | U | 6 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the structures and guest properties of Clathrate Hydrates. | CO5 | U | 14 |
|  | b. | Evaluate the importance of metal organic frameworks in Supramolecular Chemistry. | CO5 | E | 6 |
| **PART – B (1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Establish the twelve principles of Green Chemistry with relevant examples. | CO6 | U | 14 |
|  | b. | Prepare a report on creating novel Heterogeneous Catalysts. | CO6 | C | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the various types of bonding in supramolecular chemistry. |
| CO2 | Recognize the selectivity in formation of supramolecular chemistry and catalysis. |
| CO3 | Synthesize and assemble molecular structures of different shapes and dimensions. |
| CO4 | Construct supramolecular architecture based on of crystal engineering concepts. |
| CO5 | Identify the application of supramolecular chemistry in appropriate fields. |
| CO6 | Understand the importance of green chemical pathways in reactions and their applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 14 | - | - | - | - | 20 |
| CO2 | - | - | 14 | 6 | - | - | 20 |
| CO3 | - | 28 | - | 12 | - | - | 40 |
| CO4 | 14 | 14 | 12 | - | - | - | 40 |
| CO5 | - | 20 | - | 14 | 6 | - | 40 |
| CO6 | - | 14 | - | - | - | 6 | 20 |
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| **Course Code** | **20CH3028** | **Duration** | **3hrs** |
| **Course Name** | **MEDICINAL CHEMISTRY** | **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. | Recall the History of Medicinal Chemistry. | CO1 | U | 10 |
|  | b. | List out the different chemical process of Drug Metabolism. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Sketch the Mechanism of drug action on Carbohydrates and Nucleic acids. | CO4 | A | 10 |
|  | b. | Discuss the drug receptor structure. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Compare and contrast the discovery and the development of drugs. | CO5 | AN | 10 |
|  | b. | Demonstrate the Mechanism of drug absorption. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Demonstrate the Mechanism of drug elimination. | CO2 | R | 10 |
|  | b. | Explain the different drug design strategies. | CO3 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Classify antibiotics based on their mode of action. | CO5 | U | 15 |
|  | b. | Report about novel antibiotics that are currently in use for antimicrobial resistant strains. | CO5 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Elaborate the concept and the purpose of using Pro drugs. | CO4 | A | 15 |
|  | b. | Explain the different types of cardiovascular Diseases. | CO6 | U | 5 |
|  |  |  |  |  |  |
| 7. | a. | Mechanism of action of Cardiovascular drugs- Discuss. | CO6 | R | 10 |
|  | b. | What are the principles in designing soft drugs? | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define xenobiotics and explain their types. | CO5 | R | 10 |
|  | b. | Elaborate the functions of Biotransformation. | CO5 | R | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Sketch the drug discovery cycle. | CO3 | U | 10 |
|  | b. | Comment on the concepts of Lead compound and modification. | CO3 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Comprehend the basic principles of drug metabolism and pharmacokinetics. |
| CO2 | Understand the biochemical and physiological effects of drugs through pharmacodynamics. |
| CO3 | Build knowledge on the drug design with their classification and their recent developments. |
| CO4 | Acquire the importance of various enzyme structure elucidation & DNA-drug interactions. |
| CO5 | Describe the classification of various antibiotics and their mode of action. |
| CO6 | Discuss various cardiovascular diseases, mode of action of cardiovascular drugs and their side effects. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 10 |  |  |  |  | 10 |
| CO2 | 30 |  |  |  |  |  | 30 |
| CO3 | 10 | 20 |  |  |  |  | 30 |
| CO4 |  | 20 | 25 |  |  |  | 45 |
| CO5 | 20 | 20 |  | 10 |  |  | 50 |
| CO6 | 10 | 5 |  |  |  |  | 15 |
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| **Course Code** | **20CH3044** | **Duration** | **3hrs** |
| **Course Name** | **ESSENTIALS OF FORENSIC CHEMISTRY** | **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 instrumental techniques used for metallurgical analysis. | CO2 | Apply | 10 |
|  | b. | Distinguish the qualitative and quantitative analysis in forensic science. | CO1 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Enunciate the analysis of cosmetics and their role in crime investigation. | CO1 | Apply | 10 |
|  | b. | Discuss the physical and chemical examination methods of adulterated and non-adulterated oils and fats. | CO6 | Understand | 10 |
|  |  |  |  |  |  |
| 3. | a. | Clarify the test methods for adulteration of petroleum products | CO3 | Understand | 10 |
|  | b. | Explain the procedure involved in analysis of N, P and K | CO3 | Analyze | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Highlights the BIS specifications ofpetrol, kerosene and diesel, | CO3 | Understand | 10 |
|  | b. | Provide the forensic importance for analysis of dyes used in petroleum products. | CO1 | Analyze | 10 |
|  |  |  |  |  |  |
| 5. | a. | Debate the classification and forensic examination of NDPS. | CO4 | Understand | 10 |
|  | b. | Write a short note on the following  Non-alcoholic beverages ii) Breath alcohol content | CO4 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the method for the analysis of narcotic drugs and psychotropic substances | CO4 | Apply | 10 |
|  | b. | Provide the composition and analysis method of alcoholic and non-alcoholic beverages. | CO4 | Analyze | 10 |
|  |  |  |  |  |  |
| 7. | a. | What are chemical and instrumental methods used for systematic analysis of explosives and explosion residues. | CO5 | Understand | 10 |
|  | b. | Provide the characteristics of high and low explosives. | CO5 | Apply | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss about the chemistry of explosives. | CO5 | Analyze | 10 |
|  | b. | Explain the following   1. Dust explosion 2. Gas explosion 3. Improvised Explosive Device 4. Explosives Act 5. Explosive Substances Act | CO5 | Understand | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | How arson residues are analyzed by conventional and instrumental methods? Explain | CO6 | Understand | 10 |
|  | b. | Short note on flash point, fire point, ignition point, auto ignition point and vapour pressure. | CO6 | Apply | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the methods involved in forensic chemistry. |
| CO2 | Realize their significance of forensic chemistry in various fields. |
| CO3 | Analyze the various types of petroleum products. |
| CO4 | Realize the classification of beverages. |
| CO5 | Apply the techniques of locating hidden explosives. |
| CO6 | Characterize and analyze arson evidence and post-fire analysis. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 10 | 10 | 10 | - | - | 30 |
| CO2 | - | - | 10 | - | - | - | 10 |
| CO3 | - | 20 | - | 10 | - | - | 30 |
| CO4 | - | 10 | 20 | 10 | - | - | 40 |
| CO5 | - | 20 | 10 | 10 | - | - | 40 |
| CO6 | - | 20 | 10 | - | - | - | 30 |
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| **Course Code** | **20CH3046** | **Duration** | **3hrs** |
| **Course Name** | **INSTRUMENTAL METHODS OF ANALYSIS - 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. | What is electromagnetic spectrum? Explain various source of radiation their utility and limitation. | CO1 | / R | 10 |
| b. | Briefly explain Mass spectroscopy instrumentation and its applications with examples. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write short notes on the spectroscopy? Explain some of the Forensic applications in spectroscopy. | CO1 | U | 10 |
|  | b. | What is meant by the X-ray fluorescence spectroscopy? Discuss its principles and nomenclature. | CO1 | A | 10 |
| 3. | a. | What is Lambert-Beer’s law? Derive the law. | CO2 | U | 10 |
| b. | Write short notes on the Fluorescence spectroscopy? Briefly explain the Jablonski diagram with fluorescence and phosphorescence. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | What are absorption laws? How is an ultraviolet spectrum plotted? | CO2 | U | 10 |
|  | b. | Define the following terms:  1. Bathochromic Shift.  2. Hypsochromic Shift.  3. Hyperchromic Shift.  4. A Chromophore. | CO2 | R | 10 |
| 5. | a. | Bring out the differences between IR & Raman spectra. What are Stokes and Anti-Stokes lines in the Raman spectra? | CO3 | U | 10 |
|  | b. | Define IR spectroscopy. Describe the various molecular vibrations in the technique. What is the major requirement or IR absorption? | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe some of the absorption bands with their probable region and intensity for the following functional groups:   1. Primary Amines. 2. Secondary Amines. 3. Tertiary Amines.   Alcohols | CO3 | U | 10 |
|  | b. | How to determine structures of following compounds from NMR spectroscopy?  (a) C3H8  (b) CH4O  (c) C4H10  (d) C2F3HO2 | CO4 | An | 10 |
| 7. | a. | Write short notes on the NMR spectroscopy? Briefly explain the nuclear quantum numbers with examples. | CO4 | U | 10 |
|  | b. | What is mean by Redox titrations? Explain with suitable reactions. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Briefly explain general principles, instrumentation, techniques and applications of Conductometry, Potentiometry. | CO5 | U | 10 |
|  | b. | How ca you detect the methanol sample using different spectroscopy? | CO5 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Define Radiochemical methods. Write the application of radiochemical techniques in forensic science? | CO6 | U | 10 |
|  | b. | Summarize the spectroscopic techniques in forensic science applications. | CO6 | R | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To understand the principles of atomic spectroscopy. |
| CO2 | To realize the importance of IR and Raman Spectroscopy. |
| CO3 | To apply the principles of electronic spectroscopy. |
| CO4 | To understand the principles of NMR spectroscopy. |
| CO5 | To realize the importance of radiochemical methods in forensic science. |
| CO6 | To utilize the role of electrochemical methods 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 | 20 | 10 | - | - | - | 40 |
| CO2 | 20 | 20 | - | - | - | - | 40 |
| CO3 | - | 20 | 10 | - | - | - | 30 |
| CO4 | - | 10 | - | 10 |  |  | 20 |
| CO5 | - | 20 | 10 | - | - | - | 30 |
| CO6 | 10 | 10 | - | - | - | - | 20 |
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| **Course Code** | **20CH3047** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED FORENSIC TOXICOLOGY AND PHARMACOLOGY** | **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 poisons. Write its classification with flowchart and explain the types based on its mode of action. | CO2 | U | 15 |
|  | b. | Write a case history for poisoned cases along with its forensic significance. | CO1 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Write in detail the sample collection, storage and preservation for survival as well as fatal cases. | CO2 | An | 10 |
|  | b. | What is toxicology? Write about history of toxicology, areas of toxicology and roles of a forensic toxicologist. | CO1 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Considering your body as a single, kinetically, homogeneous unit, how will you derive the expressions for the rate of absorption, elimination and other parameters in the intravenous type? | CO3 | A | 15 |
|  | b. | Draw the flowchart of the extraction process of the drug from urine. | CO3 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain in detail on the interaction of chemicals and its types. | CO2 | R | 10 |
|  | b. | What is metabolism? Draw the classification flowchart and explain the Phase Ⅰ type of reactions occurring in the body. | CO5 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write note on the biological sample preparation, the process of deproteinization and deconjugation. | CO5 | A | 15 |
|  | b. | Draw the flowchart of the extraction process of the drug from blood. | CO3 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | What is pharmacokinetics? Write note on absorption of toxicants through skin and gastro intestinal tract. | CO4 | U | 10 |
|  | b. | Write note on immunoassay techniques. | CO4 | R | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write a brief note on antidotes and its classification. | CO1 | U | 12 |
|  | b. | Write note on recovery and after care of patients. | CO5 | E | 8 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write note on datura poisoning, its effects, diagnosis, antidotes used and drugs to be avoided in management of datura poisoning. | CO6 | An | 15 |
|  | b. | Give the general analysis of Marking nuts. | CO4 | A | 5 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Write note on cyanogenic glycosides and its effects on processing, soaking, fermentation, storage, cooking and drying. | CO6 | U | 15 |
|  | b. | Write the general studies and analysis of Opium. | CO6 | A | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | To understand the various types of poisoning. |
| CO2 | To understand the principles of toxicology. |
| CO3 | To summarize the methods involved in toxicological analysis. |
| CO4 | To understand the methods involved in elimination of poisons. |
| CO5 | To know the pathways of drug metabolism. |
| CO6 | To summarize the types of vegetable poison. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 10 | 12 | 5 |  |  |  | 27 |
| CO2 | 10 | 15 |  | 10 |  |  | 35 |
| CO3 | 5 | 5 | 15 |  |  |  | 25 |
| CO4 | 10 | 10 | 5 |  |  |  | 25 |
| CO5 |  |  | 15 | 10 | 8 |  | 33 |
| CO6 |  | 15 | 5 | 15 |  |  | 35 |
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| **Course Code** | **20CH3048** | **Duration** | **3hrs** |
| **Course Name** | **INSTRUMENTAL METHODS OF ANALYSIS - 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. | (i) Discuss the principle and forensic importance of thin layer  Chromatography.  (ii) Review on the identification and comparison of drugs using  TLC. | CO1 | A | 10 |
|  | b. | Explain the principle, instrumentation and forensic applications of Gas Chromatography. | CO1 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain the following  (i) Chromatography.  (ii) Retention factor.  (iii) Mobile phase and stationary phase.  (iv) Gradient elution.  (v) Isocratic elution. | CO1 | R | 10 |
|  | b. | (i) Differentiate gas-solid and gas-liquid chromatography.  (ii) What is isothermal gas chromatography? | CO1 | A | 10 |
| 3. | a. | Discuss the principle, instrumentation and forensic applications of HPLC. | CO2 | A | 10 |
|  | b. | Discuss on the principle and forensic applications of Supercritical Fluid Chromatography. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain the working principle and forensic applications of Capillary Electrophoresis technique. | CO2 | A | 10 |
|  | b. | How chromatography techniques used forensic evidence analysis? Explain with case studies. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Clarify the principle and forensic applications of the following   1. ICP-MS. 2. Atomic mass spectrometry. | CO3 | A | 10 |
|  | b. | Discuss on the principle and forensic significance of Mass spectrometry with case study. | CO3 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Discusson the following:   1. Detection Limit. 2. Signal to Noise Ratio. 3. Calibration of instrument. 4. Accuracy. 5. Qualitative and quantitative analysis. | CO3 | U | 10 |
|  | b. | Explain the principle of any two hyphenated techniques and their application in forensic toxicology. | CO4 | A | 10 |
| 7. | a. | Clarify the principle, instrumentation and forensic applications of Scanning Electron Microscopy. | CO5 | A | 10 |
|  | b. | Discuss the following with application in question document analysis   1. Light microscope. 2. Compound light microscope. 3. Stereo-zoom microscope. | CO5 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | How electron microscopy used in identification and comparison of trace evidences for forensic investigation? Explain**.** | CO5 | An | 10 |
|  | b. | Discuss the principle, instrumentation and forensic applications of Transmission Electron Microscope. | CO5 | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Deliberate the principle and forensic application of any two thermal methods. | CO6 | U | 10 |
|  | b. | Explain the principle and forensic science application of X-ray diffraction techniques. Provide a case study. | CO6 | E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Summarize the types of chromatographic techniques. |
| CO2 | Realize the importance of High Performance Liquid Chromatography. |
| CO3 | Apply the principles of mass spectrometry in forensic science. |
| CO4 | Realize the importance of hyphenated techniques. |
| CO5 | Realize the use of microscopic techniques in forensic science. |
| CO6 | Utilize the role of X-ray diffraction techniques 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 | - | 20 | 10 | - | - | 40 |
| CO2 | - | 10 | 20 | 10 | - | - | 40 |
| CO3 | - | 10 | 20 | - | - | - | 30 |
| CO4 | - | - | 10 | - | - | - | 10 |
| CO5 | - | - | 20 | 20 | - | - | 40 |
| CO6 | - | 10 | - | - | 10 | - | 20 |
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| **Course Code :** | **20CH3061** | **Duration :** | **3hrs** |
| **Course Name :** | **ENTREPRENEURSHIP AND BUSINESS PLAN** | **Max. Marks :** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome / Pattern** | **Marks** |
|  |  | **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** |  |  |
| 1. | a. | Give short notes on reference standards and matrix effect in Standard. | CO1 / A | 10 |
|  | b. | Narrate the microbial cell line culture procedure as standard protocols. | CO1/ An | 10 |
| **(OR)** | | | | |
| 2. | a. | Describe the importance of Analytical Standards. | CO1 / E | 10 |
|  | b. | Summarize the Biochemical and biological standards with examples. | CO1 / An | 10 |
|  |  |  |  |  |
| 3. | a. | Discuss the five steps of making quality plan. | CO2 / An | 10 |
|  | b. | Discuss how we can manage the quality – three process. | CO2/ A | 10 |
| **(OR)** | | | | |
| 4. | a. | Illustrate the four basic principles of quality management systems. | CO2 / E | 10 |
|  | b. | Discuss the various concepts in the control of Inspection. | CO2 / A | 10 |
|  |  |  |  |  |
| 5. | a. | Describe the concept of ISO 9000 for laboratory accreditation. | CO3/ An | 10 |
|  | b. | Summarize the NABL guidelines for Accreditations. | CO3 / E | 10 |
| **(OR)** | | | | |
| 6. | a. | Summarize the importance of ISO 14000. | CO3 / E | 10 |
|  | b. | Narrate the advantages of accreditation. | CO3 / An | 10 |
|  |  |  |  |  |
| 7. | a. | What do you mean be incubation and start-ups? List of the various types of startups. | CO4 / E | 10 |
|  | b. | What is your opinion about the factors involved in a successful business? | CO4 / A | 10 |
| **(OR)** | | | | |
| 8. | a. | Discuss the seven steps of product planning and developments. | CO6/ An | 10 |
|  | b. | Describe the various role of project manager. | CO5 / E | 10 |
|  | | **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** |  |  |
| 9. | a. | Explain the difference between project report and project appraisal. | CO6 / E | 10 |
|  | b. | Describe the various methods of Networking with Industry and Organizations. | CO5 / E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Summarize various chemical standards. |
| CO2 | Summarize various biological standards. |
| CO3 | Understand about the quality management systems. |
| CO4 | Realize the importance of various accreditation. |
| CO5 | Understand the basics of entrepreneurship. |
| CO6 | Apply the steps used for project management. |

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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 |  |  | 20 | 10 | 10 |  | 40 |
| CO3 | - | - | 5 | 15 | 20 | - | 40 |
| CO4 | - | - | 10 | - | 10 |  | 20 |
| CO5 | - | - | - | - | 20 | - | 20 |
| CO6 | - | - | - | 10 | 10 | - | 20 |
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| **Course Code** | **20OP2008** | **Duration** | **3hrs** |
| **Course Name** | **NUTRITION** | **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 history of nutrition in brief. | CO1 | U | 6 |
|  | b. | Illustrate different type of foods and food groups in detail with necessary examples. | CO1 | A | 14 |
|  |  | (OR) |  |  |  |
| 2. | a. | Discuss the limitations of daily diet for various age groups in detail. | CO1 | R | 6 |
|  | b. | Differentiate macro and micro nutrient in detail. Discuss the important functions of food nutrients in detail. | CO1 | An | 14 |
|  |  |  |  |  |  |
| 3. | a. | Describe the problems related to deficiency and excess of nutrient Carbohydrate in human body. | CO2 | R | 6 |
|  | b. | Explain the various types, sources and functions of the nutrient Carbohydrate with adequate examples. | CO2 | An | 14 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe recommended dietary allowance of carbohydrate for human eye. | CO2 | U | 6 |
|  | b. | Explain resistant starch in brief and differentiate it with regular starch. Also describe the benefits of high-fibre diet and the health conditions linked to low dietary fibre. | CO2 | A | 14 |
|  |  |  |  |  |  |
| 5. | a. | Compare and contrast complete and incomplete proteins with necessary examples. | CO3 | U | 6 |
|  | b. | Illustrate essential and non-essential amino acids in detail. Discuss various function and food sources of proteins with few examples. | CO3 | An | 14 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe the requirement of supplementary food for the health of an eye in detail. | CO3 | A | 6 |
|  | b. | Explain the three main classification of protein in detail with relevant diagrams and examples. | CO3 | An | 14 |
|  |  |  |  |  |  |
| 7. | a. | Differentiate various types of lipids based on bio-chemical classification of fats with necessary examples. | CO4 | U | 6 |
|  | b. | Illustrate saturated and unsaturated in detail. Also discuss the sources of Omega 3 fatty acids and its health benefits in brief. | CO4 | A | 14 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe energy imbalance in detail leading to obesity and starvation. | CO5 | R | 6 |
|  | b. | Explain various food sources of fats and its functions and in detail. Also, explain the total calorie requirement for different age groups and associated diseasesdue to the deficiency of fats. | CO5 | U | 14 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |  |  |  | **Compulsory**: |
| 9. | a. | Discuss vitamin deficiencies and its associated eye disorders in detail. | CO6 | A | 6 |
|  | b. | Explain the macro and micro minerals with examples. Differentiatevarious types of vitamins and discuss its importance and general functions in the health of human eye. | CO6 | An | 14 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the importance of balanced food and food groups. |
| CO2 | Classify the carbohydrates, Fats and proteins and its presence in different sources. |
| CO3 | Demonstrate the role of Macro and micro minerals associated with the eye defects. |
| CO4 | Measure the energy value of food, Energy expenditure. |
| CO5 | Calculate the total energy/calorie requirement for different age groups and diseases. |
| CO6 | Recommend suitable diet plan for a specific case related to different conditions of eye. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 6 | 14 | 14 |  |  | 34 |
| CO2 | 6 | 6 | 14 | 14 |  |  | 40 |
| CO3 |  | 6 |  | 14 |  |  | 20 |
| CO4 | 6 | 6 | 6 | 14 |  |  | 32 |
| CO5 | 6 | 14 | 14 |  |  |  | 34 |
| CO6 |  |  | 6 | 14 |  |  | 20 |
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| **Course Code** | **20OP2011** | **Duration** | **3hrs** |
| **Course Name** | **OPTOMETRIC OPTICS-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 following   1. Refraction. 2. Vertex power. 3. Vertex distance. | CO2 | Remember | 5 |
|  | b. | Summarize the cylindrical, spherical and sphero-cylindrical lenses with necessary diagrams and power cross. | CO2 | Understand | 15 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | A lens has surface curves of +12.00D and -4.00D, it has a center thickness of 8 mm and the refractive index is 1.60. Calculate the front vertex power of the lens. | CO1 | Analyze | 5 |
|  | b. | Classify and paraphrase the aberrations in ophthalmic lenses. | CO1 | Apply | 15 |
|  |  |  |  |  |  |
| 3. |  | Demonstrate the various steps involved in the fabrication of lens with a neat sketch. | CO3 | Understand | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Illustrate the following   1. Lens surfacing. 2. Surface generation processes. 3. Edging, Mounting and inspection of lens. | CO3 | Understand | 20 |
|  |  |  |  |  |  |
| 5. |  | Interpret the various defects in the material of the lens and on lens surfaces in detail. | CO3 | Analyze | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | List the characteristics of toughened lenses. | CO4 | Apply | 5 |
|  | b. | Demonstrate the thermal and chemical processing methods for the toughening of lenses. | CO4 | Understand | 15 |
|  |  |  |  |  |  |
| 7. | a. | Describe the following   1. Ophthalmic prism. 2. Units of Prism power. 3. Prentice formula. | CO6 | Remember | 5 |
|  | b. | Categorize strabismus and illustrate the neutralization of strabismus using prism. | CO6 | Evaluate | 15 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss the effect of prism on movement of eyes. | CO6 | Understand | 5 |
|  | b. | Discuss the following with examples   1. Resultant horizontal and vertical prismatic effect when prism is placed in front of the eye. 2. Prismatic effect of the lens. | CO6 | Evaluate | 15 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Elucidate the construction of spectacle frames, its measurement and markings in detail. | CO5 | Understand | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the types of optical lenses. |
| CO2 | Understand the properties of optical lenses through laws of physics. |
| CO3 | Apply the knowledge on optical properties in lens manufacturing. |
| CO4 | Analyze the quality of lenses. |
| CO5 | Identify the type of spectacle frames. |
| CO6 | Appreciate the knowledge gained on optical lenses to solve vision problems. |

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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 | 15 |  |  |  |  | 20 |
| CO3 |  | 40 |  | 20 |  |  | 60 |
| CO4 |  | 15 | 5 |  |  |  | 20 |
| CO5 |  | 20 |  |  |  |  | 20 |
| CO6 | 5 | 5 |  |  | 30 |  | 40 |
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| **Course Code** | **20OP2012** | **Duration** | **3hrs** |
| **Course Name** | **OCULAR DISEASES 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. | Describe in detail the evaluation of lacrimal system. | CO1 | R | 10 |
|  | b. | Describe in detail any 3 acquired lacrimal system obstructions and 2 congenital lacrimal system obstructions. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe in detail the chronic and acute dacryocystsis. | CO1 | R | 10 |
|  | b. | Draw the lacrimal system and label the parts, explain the physiology of tear drainage. | CO1 | R | 10 |
|  |  |  |  |  |  |
| 3. | a. | Describe in detail the following Congenital eye lid malformation i) Epicanthal folds, ii) Telecanthus iii) Blepharophemosis  iv) Epiblepharon v) Lid coloboma. | CO2 | R | 10 |
|  | b. | Write short notes on dermis and epidermis of eye lids, write short notes on chalazion. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe Bacterial eye lid infection -- (i) External hardeolum  ii) Necrotizing fasciitis, iii) Erysipelas and  Viral eye lid infection – i) Molluscumcontagiosum ii) Herpes Simples virus. | CO2 | R | 10 |
|  | b. | Describe in detail about Ptosis, classification, clinical evaluation. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 5. | a. | Write short notes on i) Orbital cellulitis and intra-orbital abscesses ii) Pre-septal cellulitis iii) Orbital mucormycosis. | CO3 | U | 10 |
|  | b. | Write about the anatomy of the Orbit, explain the exophthalmometry and its procedure. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe in detail the Grave’s Ophthalmopathy. | CO3 | U | 10 |
|  | b. | Describe in detail the blow out fracture. | CO3 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Write about Allergic conjunctivitis (i) Simple allergic conjunctivitis ii) Vernal kerato conjunctivitis, iii) Atopic kerato conjunctivitis. | CO4 | R | 10 |
|  | b. | Describe in detail the anatomy of conjunctiva. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write about bacterial conjunctivitis and any two clinical classification of bacterial conjunctivitis. | CO4 | R | 10 |
|  | b. | Write short notes on conjunctival degenerations i) Pterygium,  ii) Pinguecula. | CO4 | R | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe in detail Keratoconus. | CO5 | A | 10 |
|  | b. | Describe in detail anatomy and physiology of cornea. | CO5 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the anatomy of eye. |
| CO2 | Understand the functioning of eyes. |
| CO3 | Apply the knowledge of eye anatomy in finding the eye tumors. |
| CO4 | Analyze the quality of vision through eye anatomy. |
| CO5 | Identify the type of eye tumor, conjunctiva and cornea. |

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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 | 40 |  |  |  |  |  | 40 |
| CO5 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **100** |

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| **Course Code** | **20OP2013** | **Duration** | **3hrs** |
| **Course Name** | **VISUAL OPTICS 1** | **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 refraction at spherical surfaces in detail. | CO1 | U | 4 |
|  | b. | Explain ‘Six Cardinal points’ of an optical system in detail with appropriate diagrams. | CO1 | A | 16 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Define the terms ‘object space’ and ‘image space’ in the optical system in brief and mention few of its properties. | CO1 | R | 4 |
|  | b. | Compare and contrast the spherical refracting convex and concave surfaces along with its sign conventions in detail. | CO1 | An | 16 |
|  |  |  |  |  |  |
| 3. | a. | Define ‘optic axis’ in human eye. Discuss various axial and axis of associated with eye. | CO2 | R | 4 |
|  | b. | Describe ‘Aqueous humor’ in human eye. Explain its various composition and functions in detail. | CO2 | An | 16 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Illustrate the concept of Phakometry and its assumptions in detail. | CO2 | U | 4 |
|  | b. | Explain different layers of cornea with a neat diagram and explain its structure and functions in detail. | CO2 | A | 16 |
|  |  |  |  |  |  |
| 5. | a. | Compare and contrast various aspects and characteristics of corneal curvature and thickness of human eye. | CO3 | U | 4 |
|  | b. | Illustrate the two different methods of Phakometry in analyzing curvature of the lens in detail with necessary diagram. | CO3 | An | 16 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Articulate the basic components and uses of Keratometer. | CO3 | A | 4 |
|  | b. | Explain the construction and working of a Keratometer with its block diagram. Also, describe the measurement of the reflected image in assessing the corneal curvature of the eye in detail. | CO3 | An | 16 |
|  |  |  |  |  |  |
| 7. | a. | Describe the cause and risk factors involved due to the refractive errors in detail. | CO4 | U | 4 |
|  | b. | Illustrate the ‘Aetiology of refractive anomalies’ in detail for the refractive errors myopia, hyperopia and presbyopia. | CO4 | A | 16 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain the populating distribution of anomalies of refractive errors in children and adults in detail. | CO5 | R | 4 |
|  | b. | Describe any four treatment procedures involved in the correction of various refractive errors in detail. | CO5 | U | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |  |  |  | **Compulsory**: |
| 9. | a. | Analyze the factors and parameters involved in the growth of eye in relation to refractive error. | CO6 | A | 4 |
|  | b. | Illustrate the eye’s optical component system and its measurements with regard to ‘Cornea, Crystalline lens and the Pupil’ in detail. Also mention the characteristics and limitations of the optical components. | CO6 | An | 16 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the physical laws in geometric optics. |
| CO2 | Understand the optics of ocular structures. |
| CO3 | Apply the knowledge of optics in measurement of optical constants of the eye. |
| CO4 | Analyze the quality of vision through eye anatomy. |
| CO5 | Evaluate the refractive anomalies. |
| CO6 | Appreciate the knowledge gained on visual optics in treatment of eye problems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 6 | 6 | 14 | 14 |  |  | 40 |
| CO2 | 6 | 6 | 14 | 14 |  |  | 40 |
| CO3 |  | 6 |  | 14 |  |  | 20 |
| CO4 | 6 |  | 6 | 14 |  |  | 26 |
| CO5 | 6 | 14 | 14 |  |  |  | 34 |
| CO6 |  |  | 6 | 14 |  |  | 20 |
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| **Course Code** | **20OP2014** | **Duration** | **3hrs** |
| **Course Name** | **OCULAR ANATOMY AND OCULAR PHYSIOLOGY** | **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 and explain the origin, position, innervation of EOM of eye ball. | CO1 | U | 15 |
|  | b. | Explain the types of eye movements and their functions. | CO1 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Tabulate EOM actions and cardinal position of gaze. | CO1 | A | 15 |
|  | b. | 1. List out the parts of floor of the orbit. 2. Name the 7 EOM of eye ball. | CO1 | R | 5 |
|  |  |  |  |  |  |
| 3. | a. | Explain the layers of Cornea with diagrams. | CO2 | U | 15 |
|  | b. | Write a short note on origin of Cornea. | CO2 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain Cornea dimensions, radius of curvature and thickness. | CO2 | U | 15 |
|  | b. | 1) Explain in brief why cornea is transparent?  2) Demonstrate the lacrimal apparatus system by naming its parts. | CO2 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Draw the parts of the lens. | CO3 | A | 10 |
|  | b. | Explain different types and mechanism of accommodation. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Briefly explain each layer of lens. | CO3 | U | 10 |
|  | b. | 1) Differentiate depth of field and Pupil size.  2) Describe presbyopia and how it is treated. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Discuss the pathway of light reflex. | CO4 | U | 10 |
|  | b. | Illustrate Afferent & Efferent pathway defects. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Demonstrate the pupillary light near dissociation. | CO4 | U | 10 |
|  | b. | Describe the sympathetic pathway defect. | CO4 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain in detail the Horner’s Syndrome. | CO5 | U | 15 |
|  | b. | Write short notes on Photochemistry of Retina. | CO6 | A | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the working of eye lid, lacrimal apparatus and extra ocular muscles. |
| CO2 | Understand the cornea aqueous secretion and dynamics. |
| CO3 | Apply the knowledge of crystalline lens and accommodation for curing eye anomalies. |
| CO4 | Analyze the quality of iris and pupil. |
| CO5 | Evaluate the problems associated with retina and acuity of vision. |
| CO6 | Appreciate the knowledge gained on ocular physiology in rectifying defects in colour vision. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 20 |  | 15 |  |  | 40 |
| CO2 | 5 | 35 |  |  |  |  | 40 |
| CO3 |  | 20 | 10 | 10 |  |  | 40 |
| CO4 |  | 30 | 10 |  |  |  | 40 |
| CO5 |  | 15 |  |  |  |  | 15 |
| CO6 |  |  |  | 5 |  |  | 05 |
|  | | | | | | | **180** |

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| **Course Code** | **20OP2025** | **Duration** | **3hrs** |
| **Course Name** | **CLINICAL EXAMINATION OF VISUAL 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. | Describe about the complete history taking for the first time glaucoma patient with appropriate case scenario | CO1 | A | 10 |
|  | b. | Convert Snellen visual acuity to Log MAR visual acuity  i) 6/12= ii) 6/36= iii) 6/6= iv) 6/24= | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the complete history taking for the first time Diabetic retinopathy patient with appropriate case scenario. | CO1 | A | 10 |
|  | b. | Convert the following visual acuity from 3m to 6m  i) 3/60= , ii) 3/45= , iii) 3/36= , iv) 3/24= | CO1 | A | 10 |
|  |  |  |  |  |  |
| 3. | a. | Write short notes on Cover test, Uncover test and Alternate test with example in Squint examination? | CO2 | R | 10 |
|  | b. | Spot the findings and write tentative diagnosis. | CO2 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe in detail the Ptosis, classification, clinical evaluation. | CO2 | R | 10 |
|  | b. | Write short notes on Hirschberg test, krimsky and prism test. | CO2 | R | 10 |
|  |  |  |  |  |  |
| 5. | a. | Describe in detail the Goldmann Applanation tonometer and its principles. | CO3 | U | 10 |
|  | b. | Explain the step by step procedures during the measurement of intraocular pressure, recording the values and errors. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe in detail the principle behind gonioscopy and the structures of anterior chamber. | CO3 | U | 10 |
|  | b. | Describe in detail the examination of anterior chamber angle using gonioscopy. | CO3 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Describe in detail the anatomy of lacrimal system. | CO4 | R | 10 |
|  | b. | Describe in detail the lacrimal system evaluation. | CO4 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe in detail the direct and indirect ophthalmoscopy. | CO4 | R | 10 |
|  | b. | Spot the findings and write the tentative diagnosis.  1)DR, 2)brvo  3)CNVM4) Drusens | CO4 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe in detail about the Amsler’s chart examination, NPA and NPC. | CO5 | A | 10 |
|  | b. | Identify the instruments and write the indications for the test.   1. Schrimers test 2) 2. Gonio 4) | CO5 | A | 10 |

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|  | **COURSE OUTCOMES** |
|  |  |
| CO1 | Understand the basics of Ophthalmic subject, symptoms and testing in visual system. |
| CO2 | Examine various steps involved in Ophthalmic treatment. |
| CO3 | Illustrate the different types of lens examination and diagnosis. |
| CO4 | Describe Ophthalmoscopy and its different types of treatment methods. |
| CO5 | Appraise the concepts of Fundus and Lacrimal examinations. |
| CO6 | Demonstrate the macular functioning and testing in ophthalmological examination. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  |  | 40 |  |  |  | 40 |
| CO2 | 30 |  | 10 |  |  |  | 40 |
| CO3 |  | 40 |  |  |  |  | 40 |
| CO4 | 30 |  | 10 |  |  |  | 40 |
| CO5 |  |  | 20 |  |  |  | 20 |
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| **Course Code** | **20OP2026** | **Duration** | **3hrs** |
| **Course Name** | **CLINICAL 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. | Throw light on the scope of psychology. | CO1 | U | 10 |
|  | b. | Illustrate the concept of normality and abnormality. | CO1 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Define Psychology. Elaborate on various branches of psychology. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Write a brief note on the psychological reaction to Vision loss and illness related to sight. | CO5 | An | 10 |
|  | b. | Comment on personality integration. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | What is perception? Write a detailed note on the Gestalt principles of perception. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Write a note on the Humanistic and Existential approach to psychology. | CO3 | A | 10 |
|  | b. | What is Sigmund Freud’s contribution to understanding an individual’s personality? | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Comment on the helpee-helper relationship in counseling settings. | CO4 | U | 10 |
|  | b. | What are different assessment techniques available for patients with vision-related problems? | CO6 | R | 10 |
|  |  |  |  |  |  |
| 7. | a. | What is sensation? How is it related to perception? | CO2 | R | 10 |
|  | b. | Define Attention. Elaborate on different theories of attention. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Briefly elaborate on the characteristic traits of a therapist. | CO5 | A | 10 |
|  | b. | How do various psychological factors play role in understanding an individual’s personality? | CO3 | An |  |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Illustrate different vision-related problem which requires psychological counseling. Also, state the reason how these problems are affecting them psychologically. | CO6 | E | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basics of clinical psychology and its various methods. |
| CO2 | Analyze the various steps involved in the sensation process and determinants. |
| CO3 | Illustrate the factors involved in human psychology and personality integration. |
| CO4 | Appraise various steps in counseling therapy in clinical psychology. |
| CO5 | Describe the types of psychological reactions in patients with a disability. |
| CO6 | Identify the disability and allow the patients through the rehabilitation process. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| COs | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 40 | 10 |  |  |  | **50** |
| CO2 | 10 | 30 |  |  |  |  | **40** |
| CO3 |  |  | 10 | 10 |  |  | **20** |
| CO4 |  | 10 |  |  |  |  | **10** |
| CO5 |  | 10 | 10 | 10 |  |  | **30** |
| CO6 | 10 |  |  |  | 20 |  | **30** |
| **Total** | **20** | **90** | **30** | **20** | **20** |  | **180** |

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| **Course Code** | **20OP2027** | **Duration** | **3hrs** |
| **Course Name** | **LOW VISION AIDS** | **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 in detail the diagnostic procedures in the evaluation of low vision patient. | CO1 | A | 15 |
|  | b. | List the categories of visual impairment according to the presenting visual acuity. | CO1 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe in detail complete history taking format in low vision patient. Take an example of ocular diseases and cover all the aspects of history taking. | CO1 | A | 15 |
|  | b. | 1. Name two Distance optical devices. 2. Name two near optical devices. | CO1 | R | 5 |
|  |  |  |  |  |  |
| 3. | a. | i) Write short notes on ARMD.  ii) Describe in detail the management of central field defects. | CO2 | U | 15 |
|  | b. | Define Confrontation and its procedures. | CO2 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | i) Write short notes on Retinitis pigmentosa.  ii) Describe in detail the management of peripheral field defects. | CO2 | U | 15 |
|  | b. | Define Amsler and its procedure. | CO2 | A | 5 |
|  |  |  |  |  |  |
| 5. | a. | Describe in detail the types of magnification with example for each. | CO3 | A | 15 |
|  | b. | Write short notes on eccentric viewing. | CO3 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Calculate magnification for distance and near with formulas and example. | CO3 | A | 10 |
|  | b. | Select low vision aid for a patient with near vision need and peripheral field defects problem. | CO3 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain in detail low vision evaluation in pediatric group. | CO4 | R | 15 |
|  | b. | Identify the instrument and write its indication, magnification. | CO4 | A | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain in detail the Galilean Telescope. | CO4 | U | 10 |
|  | b. | Explain in detail the Keplerian Telescope. | CO4 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain in detail Stargardts diseases. | CO5 | R | 15 |
|  | b. | Identify the instrument and write its indication, magnification.    2. Description: 777 | CO5 | A | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Identify the diagnostic procedures in low vision patients and case management. |
| CO2 | Analyze the evaluation techniques and demonstrating aids in low vision diagnosis. |
| CO3 | Illustrate the need for taking care of the patients with teaching and guidance. |
| CO4 | Demonstrate the use of telescopes and microscopes in low vision tests. |
| CO5 | Describe the pathological conditions and to administer the patients with low vision care. |
| CO6 | Identify the right optical devices for the rehabilitation of the visually handicapped. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 | 5 | 30 |  |  |  | 40 |
| CO2 |  | 30 | 10 |  |  |  | 40 |
| CO3 |  | 5 | 35 |  |  |  | 40 |
| CO4 | 15 | 20 | 5 |  |  |  | 40 |
| CO5 | 15 |  | 5 |  |  |  | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **20OP2028** | **Duration** | **3hrs** |
| **Course Name** | **DISPENSING OPTICS** | **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 in detail the ophthalmic plastic lens materials. | CO1 | U | 15 |
|  | b. | Explain polycarbonate lens. | CO1 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain in detail the ophthalmic grass materials. | CO2 | U | 15 |
|  | b. | Differentiate ophthalmic plastic and grass materials. | CO2 | U | 5 |
|  |  |  |  |  |  |
| 3. | a. | Explain in detail the Frame materials, parts of frames & types of nose bridges. | CO3 | U | 15 |
|  | b. | Explain briefly the pupillometer. | CO3 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain in detail the facial wrap and frame selection for each shape. | CO4 | U | 15 |
|  | b. | Draw and explain Boxing system and Datum system. | CO4 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Explain in detail the process of manufacturing of ophthalmic blank & raw materials used for lens manufacturing. | CO5 | U | 15 |
|  | b. | Explain resin materials and two processes to make resin lenses. | CO5 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain in detail the Lens surfacing & glazing process. | CO5 | U | 15 |
|  | b. | Draw and explain 4 types of lens edging. | CO5 | U | 5 |
|  |  |  |  |  |  |
| 7. | a. | Explain briefly then special purpose frames and functional dispensing based on patient’s visual demand. | CO5 | U | 15 |
|  | b. | Explain visual demand for sportswear. | CO5 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain in detail the properties of lens materials   1. Abbe’s value. 2. Specific gravity. 3. Optical density. 4. Pantoscopic tilt. | CO6 | U | 15 |
|  | b. | Explain the procedure for manual IPD measurement with IPD values. | CO6 | U | 5 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain progressive addition lens design. | CO6 | U | 10 |
|  | b. | Explain in detail the steps of dispensing criteria of progressive addition lens. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the ophthalmic materials in dispensing optics and its verification. |
| CO2 | Explain the special practices in handling the lenses and frames. |
| CO3 | Illustrate the procedures and process involved in the manufacturing of lenses. |
| CO4 | Demonstrate the use of dispensing instruments in lens measurements and frame fittings. |
| CO5 | Analyze various factors involved in the instrumentation for the selection of lenses. |
| CO6 | Identify and select the right frame designs and fittings for the patients. |

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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 |
| CO4 | - | 15 | - | 5 | - | - | 20 |
| CO5 | - | 60 | - | - | - | - | 60 |
| CO6 | - | 40 | - | - | - | - | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **20OP2029** | **Duration** | **3hrs** |
| **Course Name** | **BINOCULAR VISION** | **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 3 grades of binocular single vision. | CO1 | U | 10 |
|  | b. | Define suppression, Amblyopia visual direction, corresponding and non-corresponding retinal points. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain briefly the development of binocular single vision and neural aspects of binocular single vision. | CO2 | U | 10 |
|  | b. | Explain Pannum’s space and longitudinal horopter. | CO2 | U | 10 |
|  |  |  |  |  |  |
| 3. | a. | Explain cover test diagnostic procedures. | CO3 | U | 10 |
|  | b. | Explain Krimsky, prism bar cover test, Hirschberg test. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain suppression test. | CO4 | U | 10 |
|  | b. | Explain stereopsis test. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain esodeviation, types, clinical features and treatment. | CO5 | U | 10 |
|  | b. | Explain exodeviation, types, clinical features and treatment. | CO5 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain A-Y pattern strabismus. | CO5 | U | 15 |
|  | b. | Explain accommodative convergence AC/A ratio, | CO5 | U | 5 |
|  |  |  |  |  |  |
| 7. | a. | Explain Amblyopia definition, clinical features and treatment. | CO5 | U | 15 |
|  | b. | What is eccentric fixation. | CO5 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | What is Nystagmus and explain its types. | CO6 | U | 5 |
|  | b. | Explain Orthoptic procedures for evaluation of squint. | CO6 | U | 15 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain non-surgical management of Strabismus   1. Optical treatment. 2. Medical treatment (Drug). 3. Orthoptic treatement (vision therapy). | CO6 | U | 15 |
|  | b. | Explain diplopia charting. | CO6 | U | 5 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the evolution of binocular vision and its different parameters. |
| CO2 | Explain the development of binocular vision and its neural aspects. |
| CO3 | Illustrate the visually guided behavior in the diagnosis of binocular vision and its AV phenomena. |
| CO4 | Demonstrate the various treatments and analysis of amblyopia in binocular vision. |
| CO5 | Analyze various types of strabismus and non-surgical management in binocular vision. |
| CO6 | Identify the orthoptic procedures involved in the treatment of binocular vision. |

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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 |
| CO4 |  | 20 |  |  |  |  | 20 |
| CO5 |  | 60 |  |  |  |  | 60 |
| CO6 |  | 40 |  |  |  |  | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **21CH2068** | **Duration** | **3hrs** |
| **Course Name** | **RECENT TRENDS IN FORENSIC SCIENCE** | **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 father of modern toxicology is \_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 2. | The study of insect activity associated with crime is called \_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 3. | What is crime scene? | | CO2 | R | | 1 |
| 4. | Provide the importance of “forensic linguistics”. | | CO1 | A | | 1 |
| 5. | Mention the most common method used for the identification of a human individual. | | CO3 | A | | 1 |
| 6. | What are erythrocytes? | | CO5 | U | | 1 |
| 7. | What is CFSL? | | CO1 | R | | 1 |
| 8. | Mention the techniques used in forensic toxicology. | | CO4 | A | | 1 |
| 9. | Define Furrow. | | CO2 | U | | 1 |
| 10. | The Indian evidence act enacted in the year \_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Define Forensic Science. | | CO1 | | R | 3 |
| 12. | Define “white collar crime”. | | CO2 | | U | 3 |
| 13. | Name any two types of questioned document. | | CO3 | | R | 3 |
| 14. | What is “chain of custody”? | | CO3 | | U | 3 |
| 15. | Narrate the drug addicts and crimes. | | CO5 | | U | 3 |
| 16. | Differentiate antigens and antibodies. | | 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. | a. | Explain the salient features of different branches of forensic science. | CO1 | | U | 6 |
|  | b. | Explain the scope of forensic science. | CO1 | | U | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Discuss the classification of crimes. | CO2 | | R | 6 |
|  | b. | Classify the types of fingerprint patterns. | CO3 | | U | 6 |
| 19. | a. | Write short notes on the following :   1. Forensic Toxicology. 2. Criminal justice system. 3. Blood Alcohol Content. | CO1 | | A | 6 |
|  | b. | Explain the different types of questioned documents. | CO3 | | U | 6 |
| 20. | a. | Describe the composition and function of blood. | CO5 | | U | 6 |
|  | b. | What is computer crime? Describe the types of computer crimes. | CO2 | | A | 6 |
| 21. | a. | What are the significances of crime scene management? | CO6 | | A | 6 |
|  | b. | Discuss any one case study related to forensic toxicology. | CO5 | | A | 6 |
| 22. | a. | Explain the classification of drugs. | CO4 | | R | 6 |
|  | b. | Clarify the composition, functions and forensic importance of body fluid analysis. | CO5 | | A | 6 |
| 23. | a. | Analyze the use of instrumental techniques in forensic science. | CO4 | | An | 6 |
|  | b. | Discuss the forensic significance for the analysis of chemical fertilizers. | CO6 | | An | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Give the composition of paint and varnish. Explain the significance of paint analysis in motor vehicle identification. | CO6 | | An | 6 |
|  | b. | Discuss the need for examination of electrical appliances in forensic investigation. | CO6 | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of forensic science. |
| CO2 | Know the procedures involved in Crime scene management. |
| CO3 | Recognize the importance analysis of finger prints and questioned documents. |
| CO4 | Classify the various types of toxins and their analysis. |
| CO5 | Know the importance of forensic serology. |
| CO6 | Understand the importance of forensics for workplace investigation. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 17 | - | 7 | - | - | - | 24 |
| CO2 | 7 | 5 | 6 | - | - | - | 18 |
| CO3 | 4 | 15 | 1 | - | - | - | 20 |
| CO4 | 6 | - | 1 | 6 | - | - | 13 |
| CO5 | - | 10 | 12 | - | - | - | 22 |
| CO6 | 3 | - | 6 | 18 | - | - | 27 |
|  | | | | | | | **124** |



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| **Course Code** | **CH343** | **Duration** | **3hrs** |
| **Course Name** | **INSTRUMENTAL METHODS OF ANALYSIS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Marks** |
| 1. | a. | Discuss Electromagnetic radiation and interaction of electromagnetic radiation with matter. | 10 |
|  | b. | Describe Born Oppenheimer approximation. | 10 |
|  |  | **(OR)** |  |
| 2. | a. | Enumerate Atomic absorption spectroscopy with neat diagram. | 10 |
|  | b. | Explain Flame photometry with neat diagram. | 10 |
|  |  |  |  |
| 3. | a. | Illustrate the instrumentation and application if Ultra Violet Spectroscopy. | 10 |
|  | b. | Explain Fieser Woodward rules for conjugated dienes and carbonyl compounds. | 10 |
|  |  | **(OR)** |  |
| 4. | a. | List out the applications of IR spectroscopy in structural elucidation. | 10 |
|  | b. | Describe the instrumentation of IR spectroscopy with neat diagram. | 10 |
|  |  |  |  |
| 5. | a. | Give an account on ESR instrumentation with examples. | 10 |
|  | b. | Discuss Molecular fluorescence spectroscopy. | 10 |
|  |  | **(OR)** |  |
| 6. | a. | Discuss NMR spectroscopy with the following examples i) Ethanol ii) Propane iii) M-cresol. | 10 |
|  | b. | Explain NMR instrumentation with examples. | 10 |
|  |  |  |  |
| 7. | a. | Describe the instrumentation of Mass spectroscopy with neat diagram. | 10 |
|  | b. | Compare and contrast Differential thermal analysis and Thermo gravimetry analysis. | 10 |
|  |  | **(OR)** |  |
| 8. | a. | Give an account on Gas Chromatography with neat diagram. | 10 |
|  | b. | Discuss the application and instrumentation of HPLC. | 10 |
|  |  | **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** |  |
| 9. | a. | Analyze X-ray spectroscopy with neat diagram. | 10 |
|  | b. | Discuss Scanning electron microscopy with neat diagram. | 10 |

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| **Course Code** | **17CH1004** | **Duration** | **3hrs** |
| **Course Name** | **ENVIRONMENTAL STUDIES** | **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. | What is a renewable resource? Explain different types of renewable resources? | CO1 | R | 10 |
|  | b. | Explain in detail about the soil conservation practices. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Explain in detail the deforestation. | CO1 | A | 10 |
|  | b. | Discuss in detail the advantages and disadvantages of dams. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Define Ecology. Discuss the micro and macro levels of organization with suitable examples. | CO2 | R | 10 |
|  | b. | What is mean by Ecological succession? What are the stages involved in Ecological succession? | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Define bio-diversity. Explain in detail the values of biodiversity. | CO3 | A | 10 |
|  | b. | Discuss the types of conservation of bio-diversity. | CO3 | An | 10 |
|  |  |  |  |  |  |
| 5. | a. | Explain briefly the principles of green chemistry? | CO4 | R | 10 |
|  | b. | Discuss in detail the solid waste management and its effects on Environment. | CO4 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | What is mean by air pollution? Explain the types, causes, effects and prevention of air pollution. | CO4 | A | 10 |
|  | b. | What is soil pollution? Identify the causes and effects of soil pollution. | CO4 | U | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain about rain water harvesting and water shed management. | CO5 | An | 10 |
|  | b. | Explain the air protection act and forest protection with its objectives. | CO5 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss the role of individual in prevention of pollution. | CO5 | A | 10 |
|  | b. | Explain in detail the acid rain and global warming with case studies. | CO5 | U | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | What is population growth? Discuss the causes and effects of population growth. | CO6 | U | 10 |
|  | b. | Summarize the causes, symptoms and control measures for HIV-AIDS. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the environment and its relationship with human activities. |
| CO2 | Acquire the knowledge about ecosystem. |
| CO3 | Gain information about the biodiversity. |
| CO4 | Expertise about the causes of pollution. |
| CO5 | Awareness on the environmental protection acts. |
| CO6 | Analyze the association between population and environment. |

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

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| **Course Code** | **18CH2001** | **Duration** | **3hrs** |
| **Course Name** | **ENVIRONMENTAL STUDIES** | **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 biotic component. | | CO1 | U | | 1 |
| 2. | Recall the types of fresh water resources. | | CO1 | R | | 1 |
| 3. | Differentiate food chain and food web. | | CO2 | R | | 1 |
| 4. | Give an example for Natural ecosystem. | | CO2 | R | | 1 |
| 5. | **List out any two hotspots of biodiversity in India.** | | CO3 | U | | 1 |
| 6. | Provide an example for genetic biodiversity. | | CO3 | R | | 1 |
| 7. | Determine the safe noise intensity level for humans. | | CO4 | U | | 1 |
| 8. | Which type of pollution causes minamata disease? | | CO4 | R | | 1 |
| 9. | When was the Wildlife (Protection) Act enacted? | | CO5 | U | | 1 |
| 10. | Classify the types of flood. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Discuss the advantages of dams. | | CO1 | | An | 3 |
| 12. | Explain the importance of decomposers in ecosystems and give two examples. | | CO2 | | U | 3 |
| 13. | Differentiate ‘In-situ’ and ‘Ex-situ’ conservation of biodiversity with examples. | | CO3 | | An | 3 |
| 14. | Define thermal pollution and discuss its causes. | | CO4 | | U | 3 |
| 15. | Compare ‘Kunds’ and ‘Wadis’ used in water harvesting. | | CO5 | | An | 3 |
| 16. | Discuss the principles of disaster management. | | 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. | a. | Explain in detail the soil conservation practices. | CO1 | | U | 6 |
|  | b. | Define renewable resource. Explain different types of renewable resources. | CO1 | | A | 6 |
| 18. | a. | Demonstrate the energy flow in an ecosystem. | CO2 | | U | 6 |
|  | b. | Explain the various stages of ecological succession. | CO2 | | R | 6 |
| 19. | a. | Explain the values of biodiversity with examples. | CO3 | | A | 6 |
|  | b. | Describe threats to biodiversity in detail. | CO3 | | U | 6 |
| 20. | a. | Explain the principles of green chemistry. | CO4 | | U | 6 |
|  | b. | Discuss in detail the solid waste management and its effects on Environment. | CO4 | | An | 6 |
| 21. | a. | Analyze the difficulties encountered while achieving sustainable  development. | CO5 | | An | 6 |
|  | b. | Explain the air protection act with its objectives. | CO5 | | R | 6 |
| 22. | a. | Define Environment. Write the significance of Environmental studies. | CO1 | | An | 6 |
|  | b. | What is mean by water pollution? Explain the causes, effects and control measures? | CO4 | | U | 6 |
| 23. | a. | Explain in detail the acid rain and global warming with case studies. | CO5 | | U | 6 |
|  | b. | Discuss the types of conservation of bio-diversity. | CO3 | | An | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Define population growth? Discuss the causes and effects of  population growth. | CO6 | | U | 6 |
|  | b. | Summarize the causes, symptoms and control measures for HIV-  AIDS. | CO6 | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the environment and its relationship with human activities. |
| CO2 | Acquire the knowledge about ecosystem. |
| CO3 | Gain information about the biodiversity. |
| CO4 | Expertise about the causes of pollution. |
| CO5 | Awareness on the environmental protection acts. |
| CO6 | Analyze the association between population and environment. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 7 | 6 | 9 | - | - | 23 |
| CO2 | 8 | 9 | - | - | - | - | 17 |
| CO3 | 1 | 7 | 6 | 9 | - | - | 23 |
| CO4 | 1 | 16 | - | 6 | - | - | 23 |
| CO5 | 6 | 7 | - | 9 | - | - | 22 |
| CO6 | - | 10 | - | 6 | - | - | 16 |
|  | | | | | | | **124** |

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| **Course Code** | **20CH1001** | **Duration** | **3hrs** |
| **Course Name** | **Essentials of Chemistry for Aerospace 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. | Define Pauli Exclusion Principle. | | CO1 | R | | 1 |
| 2. | Recall Rutherford’s atomic model. | | CO1 | R | | 1 |
| 3. | State the need for protecting coating. | | CO2 | R | | 1 |
| 4. | Mention the purpose of pigments in paints. | | CO2 | R | | 1 |
| 5. | Define electronegativity. | | CO3 | R | | 1 |
| 6. | List any two military grade primary explosives. | | CO4 | R | | 1 |
| 7. | State the need for salt bridge in Daniel cell. | | CO5 | R | | 1 |
| 8. | Differentiate between galvanic cell and Electrolytic cell. | | CO5 | R | | 1 |
| 9. | State the significance of Absorption Spectroscopy. | | CO6 | R | | 1 |
| 10. | Define vibrational energy | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | State the dual nature of EMR. | | CO1 | | R | 3 |
| 12. | Explain metal spraying. | | CO2 | | U | 3 |
| 13. | Write down any six characteristic of good fuel. | | CO3 | | U | 3 |
| 14. | Briefly classify explosive. | | CO4 | | U | 3 |
| 15. | Write down your understanding on standard hydrogen electrode. | | CO5 | | U | 3 |
| 16. | Differentiate between absorption and emission spectroscopic. | | 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 significance of  Principal quantum number (n),  Azimuthal Quantum Number (l) and  Magnetic orbital quantum number (ml) | CO1 | | A | 4  4  4 |
|  |  |  |  | |  |  |
| 18. | a. | State the constituents of paint and their function. | CO2 | | A | 6 |
|  | b. | Explain Pigment Volume Concentration (P.V.C) and its influence in painting. | CO2 | | A | 6 |
|  |  |  |  | |  |  |
| 19 | a. | Explain knocking with necessary diagram. | CO3 | | A | 4 |
|  | b. | Explain octane number with diagram. | CO3 | | A | 4 |
|  | c. | Explain cetane number with diagram. | CO3 | | A | 4 |
|  |  |  |  | |  |  |
| 20 |  | Explain the process of analysis of flue gas using Orsat apparatus. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. | a. | State the characteristics of explosives. | CO4 | | A | 12 |
|  | b. | Explain the precautions to be taken during storing of explosives. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | Explain the working of hydrogen oxygen fuel cell with neat sketch. | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Explain infrared spectroscopy with neat sketch. | CO6 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | State the purpose of flame photometer. | CO6 | | A | 4 |
|  | b. | Illustrate the working principle of flame photometer. | CO6 | | A | 8 |

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|  | **COURSE OUTCOMES** |
| CO1 | Formulate atomic structures and correlate its properties. |
| CO2 | Realize the potential applications of protective coating. |
| CO3 | Relate the unique properties of fuels. |
| CO4 | Analyze the combustion process of common fuels. |
| CO5 | Learn the various energy storage systems and conversion devices. |
| CO6 | Describe the techniques involved in spectroscopy. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 |  | 12 |  |  |  | 17 |
| CO2 | 2 | 3 | 12 |  |  |  | 17 |
| CO3 | 1 | 3 | 12 |  |  |  | 16 |
| CO4 | 1 | 3 | 24 |  |  |  | 28 |
| CO5 | 2 | 3 | 12 |  |  |  | 17 |
| CO6 | 2 | 3 | 24 |  |  |  | 29 |
|  | | | | | | | **124** |

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| **Course Code** | **20CH1005** | **Duration** | **3hrs** |
| **Course Name** | **PRINCIPLES OF ENVIROMENTAL CHEMISTRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Express the formula for permanent hardness. | | CO1 | U | | 1 |
| 2. | Recall the unit of alkalinity. | | CO1 | R | | 1 |
| 3. | Define flocculant. | | CO2 | R | | 1 |
| 4. | Identify the chemicals used for flocculant. | | CO2 | R | | 1 |
| 5. | Classify the parameters for water testing. | | CO3 | U | | 1 |
| 6. | Name the chemical used for disinfection. | | CO3 | R | | 1 |
| 7. | Summarize the types of wet corrosion. | | CO4 | U | | 1 |
| 8. | Define the term rust. | | CO4 | R | | 1 |
| 9. | Express the formula for hydraulic cement. | | CO5 | U | | 1 |
| 10. | Give examples for solid waste. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | A water sample is alkaline to only methyl orange but not for phenolphthalein indicator. However, its 100 ml on titration using methyl orange indicator consumed 17.2 ml of N/50 HCL. Calculate the alkalinity present in water sample in terms of Caco3 equivalent. | | CO1 | | An | 3 |
| 12. | Describe about the filtration in water treatment. | | CO2 | | U | 3 |
| 13. | Explain the chemical treatment of municipal wastewater treatment plant. | | CO3 | | An | 3 |
| 14. | Discuss galvanic corrosion. | | CO4 | | U | 3 |
| 15. | Categorize the typical constituents of Portland cement. | | CO5 | | An | 3 |
| 16. | Define zero waste system. | | 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. | a. | 100 ml of water sample gave titer value of 15ml N/50 HCL for phenolphthalein endpoint. Another water sample gave the titer value of 30 ml methyl orange endpoint. Calculate the amount and type of alkalinity present in water sample. | CO1 | | An | 6 |
|  | b. | Summarize the procedure to determine dissolved oxygen. | CO1 | | U | 6 |
| 18. | a. | Describe sedimentation tank and disinfection. | CO2 | | U | 6 |
|  | b. | Discuss the screening, disinfection and distribution. | CO2 | | U | 6 |
| 19. | a. | Discuss the sewage treatment plant. | CO3 | | U | 6 |
|  | b. | Differentiate aerobic and anaerobic treatment process with it types. | CO3 | | U | 6 |
| 20. | a. | Compare oxidation and wet corrosion. | CO4 | | U | 6 |
|  | b. | Conclude the factors and control methods of corrosion. | CO4 | | U | 6 |
| 21. | a. | Discuss the uses of cement. | CO5 | | U | 6 |
|  | b. | Describe the special types of cement. | CO5 | | U | 6 |
| 22. | a. | A water sample is alkaline to only methyl orange but not for phenolphthalein indicator. However, its 100 ml on titration using methyl orange indicator consumed 17.2 ml of N/50 HCL. Calculate the alkalinity present in water sample in terms of Caco3 equivalent. | CO1 | | An | 6 |
|  | b. | Explain settling and hardening of cement and its stages. | CO5 | | U | 6 |
| 23. | a. | Discuss the grit chamber and chlorination in municipal wastewater treatment plant. | CO3 | | U | 6 |
|  | b. | Describe the types of cement in detail. | CO5 | | U | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | Discuss the layout of municipal solid waste. | CO6 | | U | 6 |
|  | b. | Summarize the effects of solid waste. | CO6 | | U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the various factors in water quality. |
| CO2 | Learn the various water purification process and their applications. |
| CO3 | Describe the process of corrosion. |
| CO4 | Identify the methods to control corrosion. |
| CO5 | Analyze the component present in the cement. |
| CO6 | Realize the solid waste management applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 7 | - | 15 | - | - | 23 |
| CO2 | 2 | 15 | - | - | - | - | 17 |
| CO3 | 1 | 19 | - | 3 | - | - | 23 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | - | 25 | - | 3 | - | - | 28 |
| CO6 | - | 16 | - | - | - | - | 16 |
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| **Course Code** | **20CH2001** | **Duration** | **3hrs** |
| **Course Name** | **COMPLEMENTARY CHEMISTRY** | **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. | Summarize the rules to find the oxidation number of an element in a molecule. Evaluate the oxidation number of Manganese in KMnO4 and MnO2. | CO1 | Evaluate | 10 |
|  | b. | How are buffer solutions prepared? What are the various types of buffer solution? Explain with examples. | CO1 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe Bronsted Lowry acid base theory with examples and define conjugate acid-base pairs with examples. | CO1 | Apply | 10 |
|  | b. | Define the following   1. Ionic product of water (ii) Acid dissociation constant (iii) Solubility product (iv) Electrode potential | CO1 | Understand | 10 |
|  |  |  |  |  |  |
| 3. | a. | Analyze the atomic spectrum of hydrogen. | CO2 | Analyze | 10 |
|  | b. | Write the Schrodinger wave equation and explain the terms involved. Summarize the significance of the Schrodinger wave equation. | CO2 | Understand | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Discuss Somerfield’s theory and state its advantages and limitations | CO2 | Analyze | 10 |
|  | b. | Explain the following principles   1. Pauli’s exclusion principle 2. Aufbau principle | CO2 | Understand | 10 |
|  |  |  |  |  |  |
| 5. | a. | How are ionic bonds formed? Summarize the characteristics of ionic bond. Describe the types of packing in ionic crystals | CO3 | Understand | 10 |
|  | b. | Compare the characteristics of valence bond theory and molecular orbital theory. | CO3 | Analyze | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Analyze the various types of hybridization possible in covalent compounds. | CO3 | Analyze | 10 |
|  | b. | Explain the following with examples.   1. Weak forces 2. Metallic bond | CO3 | Understand | 10 |
|  |  |  |  |  |  |
| 7. | a. | Illustrate the following terms with examples   1. Surface tension 2. Optical activity | CO4 | Understand | 12 |
|  | b. | Summarize the physical properties of blood. | CO4 | Apply | 8 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe about any four physical parameters of the liquids. | CO4 | Understand | 12 |
|  | b. | Define the following with examples   1. Normality 2. Molarity | CO4 | Understand | 8 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the applications of adsorptions in various fields. | CO5 | Apply | 10 |
|  | b. | Compare the characteristics of true solution, colloidal solution and the suspension. | CO6 | Analyze | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | To realize the importance of acids and bases. |
| CO2 | To summarize the importance of the atomic structure. |
| CO3 | To understand the theories of chemical bonding. |
| CO4 | To learn the physical properties of the liquid. |
| CO5 | To understand the basics of surface chemistry. |
| CO6 | To recognize the importance of colloids 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 | 10 | - | 40 |
| CO2 | - | 20 | 10 | 10 | - | - | 40 |
| CO3 | - | 20 | - | 20 | - | - | 40 |
| CO4 | - | 32 | 8 | - | - | - | 40 |
| CO5 | - | - | 10 | - | - | - | 10 |
| CO6 | - | - | - | 10 | - | - | 10 |
|  | | | | | | | **180** |

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| **Course Code** | **20OP2001** | **Duration** | **3hrs** |
| **Course Name** | **PHYSICAL AND GEOMETRICAL OPTICS 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. | Briefly explain Huygen’s wave theory of light. | CO1 | U | 4 |
|  | b. | Write the properties of light. Explain with the help of neat diagrams. | CO1 | U | 16 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Give a note on total internal reflection with the help of a neat diagram. | CO1 | R | 8 |
|  | b. | Describe the laws of reflection and refraction with diagrams. | CO1 | U | 6 |
|  | c. | Briefly explain the concept of visible light and the eye. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 3. | a. | Summarize the two types of lenses, their anatomy and language. | CO2 | U | 12 |
|  | b. | Differentiate spherical, cylindrical and contact lens. | CO2 | An | 8 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | What do you mean by constructive and destructive interference? | CO3 | R | 4 |
|  | b. | Briefly explain the interference in thin films and wedge shaped thin films with conditions. | CO3 | U | 16 |
|  |  |  |  |  |  |
| 5. | a. | Differentiate between Fresnel and Fraunhofer diffraction with the help of neat diagrams. | CO3 | An | 10 |
|  | b. | Recall the practical applications of diffraction. | CO3 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Light of wavelength 1121Ao has wave trains of 14λ. Calculate coherence length and coherence time. | CO5 | A | 4 |
|  | b. | Elaborate the concept of polarization. Mention few of its applications. | CO3 | U | 16 |
|  |  |  |  |  |  |
| 7. | a. | What is emission and absorption spectra? | CO4 | R | 4 |
|  | b. | Explain electromagnetic spectrum with the help of a diagram. Mention the names of electromagnetic radiation and its uses. | CO1 | U | 16 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Write a note on:  (i) Photoelectric effect.  (ii) Raman effect. | CO4 | U | 6 |
|  | b. | What is glare? Give 3 examples for direct and indirect glares. Explain different types of glare in detail. | CO4 | U | 14 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Discuss the working of Michelson interferometer and Fabry-Perot interferometer. | CO6 | U | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the usage of various theories and components of light. |
| CO2 | Report the effect of interference of light on lenses. |
| CO3 | Apply the knowledge of combination of optical principles such as interference, diffraction, polarization in optical elements. |
| CO4 | Design an optical system, component to meet desired needs of optometry. |
| CO5 | Solve problems in optical physics and lens assembly. |
| CO6 | Demonstrate the techniques, skills, and modern tools necessary for optical physics in analytical instruments. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 8 | 42 | - | - | - | - | 50 |
| CO2 | - | 12 | - | 8 | - | - | 20 |
| CO3 | 14 | 32 | - | 10 | - | - | 56 |
| CO4 | 4 | 26 | - | - | - | - | 30 |
| CO5 | - | - | 4 | - | - | - | 4 |
| CO6 | - | 20 | - | - | - | - | 20 |
|  | | | | | | | **180** |

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| **Course Code** | **20OP2003** | **Duration** | **3hrs** |
| **Course Name** | **PRINCIPLES OF LIGHTING** | **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 synthesis of colors on the basis of color theory. | CO1 | A | 15 |
|  | b. | Define visual acuity and discuss the factors that affect the vision. | CO1 | U | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Give an account on color temperature and color rendering. | CO1 | R | 15 |
|  | b. | State the primary colors and explain how new colors are formed from them. | CO1 | A | 5 |
|  |  |  |  |  |  |
| 3. | a. | Give the pictorial representation of an eye with respect to vision. List the parts that control the amount of light entering and explain their performance in detail. | CO2 | A | 15 |
|  | b. | Define glare and write in short about their types. | CO2 | R | 5 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Describe luminous efficiency, luminous intensity and luminous flux? If the luminous flux of a 40 W power bulb is 400 lumens, obtain its luminous efficiency. | CO2 | A | 15 |
|  | b. | What is Light emitting diode (LED)? Briefly explain its working principle with a suitable diagram. | CO2 | U | 5 |
|  |  |  |  |  |  |
| 5. | a. | Illustrate solid angle and express it in terms of plane angle θ. | CO3 | A | 10 |
|  | b. | Compare and discuss radian and steradian. | CO3 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Elaborate onthe three laws of illumination. | CO3 | R | 12 |
|  | b. | The luminous intensity emitted by a light source is 700 candelas. What is the illuminance incident on a point directly below the source at a distance of 3m? Obtain the same on a point at an angle 60o. | CO3 | An | 8 |
|  |  |  |  |  |  |
| 7. | a. | Explain in detail about the physical and psychological considerations of lighting design. | CO5 | U | 10 |
|  | b. | Give an account on lighting system design. | CO4 | A | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Discuss about the design approach and design process. Write about the lumens method for calculating luminaries. | CO4 | U | 10 |
|  | b. | Differentiate and discuss the types of lighting. | CO5 | R | 10 |
| **PART – B(1 X 20= 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Write notes onthe structure and principle of fibre optic cables. Explain its application infibre optical communication with a neat diagram. | CO6 | A | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recall the basics concept of colour theory and light. |
| CO2 | Identify the different kinds of sources of light. |
| CO3 | Understand the illumination principles and its parameters. |
| CO4 | Design lighting systems for optometric purposes. |
| CO5 | Experiment with different types of lighting. |
| CO6 | Apply fiber optics technology in modern optical instruments. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 15 | 5 | 20 | - | - | - | 40 |
| CO2 | 5 | 5 | 30 | - | - | - | 40 |
| CO3 | 12 | 10 | 10 | 8 | - | - | 40 |
| CO4 | - | 10 | 10 | - | - | - | 20 |
| CO5 | 10 | 10 | - | - | - | - | 20 |
| CO6 | - | - | 20 | - | - | - | 20 |
|  | | | | | | | **180** |