**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **09ME101/12ME103/DME101/ME106** | **Duration** | **3hrs** |
| **Course Name** | **BASIC MECHANICAL ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define IC Engine. | | CO1 | R | | 1 |
| 2. | State the function of a steam stop valve in a boiler. | | CO1 | U | | 1 |
| 3. | ‘Barrage’ in tidal power plant means \_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 4. | Name any two Nuclear Power plant in India. | | CO1 | R | | 1 |
| 5. | Define factor of safety. | | CO1 | R | | 1 |
| 6. | Low carbon steel is known as\_\_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 7. | List few examples for gas welding. | | CO1 | U | | 1 |
| 8. | Expand the term MIG in welding. | | CO1 | R | | 1 |
| 9. | Give an example of milling machine operations. | | CO1 | U | | 1 |
| 10. | Give an example for a semiautomatic lathe. | | CO1 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Differentiate petrol engine and diesel engine. | | CO1 | | U | 3 |
| 12. | List the advantages of non-conventional energy sources. | | CO2 | | R | 3 |
| 13. | List out the properties of ferrous metals? | | CO3 | | R | 3 |
| 14. | Mention the applications of arc welding? | | CO4 | | U | 3 |
| 15. | Define casting process. | | CO5 | | R | 3 |
| 16. | Define milling machine. | | 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. | Classify the IC Engine. | CO1 | | R | 3 |
|  | b. | Explain the working of a four-stroke petrol engine with the help of neat sketches. | CO1 | | A | 9 |
|  |  |  |  | |  |  |
| 18. |  | Explain the operation of gas turbine and also state its advantages and disadvantages. | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Draw and explain the Stress-Strain curve of a ductile material. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 20. | a. | List any five molding tools. | CO1 | | A | 2 |
|  | b. | Explain briefly the arc welding process and its parts in detail. | CO1 | | An | 10 |
|  |  |  |  | |  |  |
| 21. |  | Explain the basic steps involved in sand casting. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | Explain the working of a Babcock and Wilcox boiler with the help of neat sketches. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Sketch the layout of a typical solar power plant. Discuss about its working, advantages and disadvantages. | CO1 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Briefly explain the lathe parts and their functions. | CO1 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Students will be able to get general view about Mechanical Engineering Branch. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 21 | 22 | 47 | 34 |  |  | 124 |
|  | | | | | | | **124** |



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| **Course Code :** | **09ME314** | **Duration :** | **3hrs** |
| **Course Name :** | **RESEARCH METHODOLOGY** | **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. | Differentiate between applied research and basic research. | 5 |
| b. | Differentiate between research method and research methodology. | 5 |
| c. | With a block diagram explain the step-by-step process of research. | 10 |
| **(OR)** | | | |
| 2. | a. | Enumerate the procedure to identify a research hypothesis. Draw a flowchart to explain the same. | 10 |
| b. | List the steps taken by you to identify your research problem and explain the methodology implemented to solve the problem. | 10 |
|  |  |  |  |
| 3. | a. | Categorize the sources available for literature review. List the resources that are currently available with KITS. | 10 |
| b. | Summarize the importance of literature survey towards completing a research work. Articulate with an example, how the literature survey has contributed towards your research work. | 10 |
| **(OR)** | | | |
| 4. |  | Classify the types of regression analysis and explain the procedure for carrying out a simple linear regression analysis. | 20 |
|  |  |  |  |
| 5. | a. | Illustrate the importance of research design and its contribution towards effective research. | 10 |
| b. | Have you used statistical analysis to your research work? If yes, relate the involvement of statistical analysis to completing your research work. If no, explain the places of its application in scientific research. | 10 |
| **(OR)** | | | |
| 6. | a. | Explain the process of interpretation of experimental data through a logical frame work. | 10 |
| b. | Correlate the usage of multivariate analysis to a hypothetical research statement. | 10 |
|  |  |  |  |
| 7. | a. | Enumerate the techniques involved in data interpretation. | 10 |
| b. | With a suitable example and a neat diagram, explain any one of the data interpretation techniques. | 10 |
| **(OR)** | | | |
| 8. |  | Explain how validity and reliability make an impact on the results of a research work. | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | |
| 9. | a. | List at least 10 different referencing and citation styles that are used internationally. | 10 |
| b. | With a block diagram, describe the structure of a thesis. | 10 |

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| **Course Code** | **12ME226/14ME2054** | **Duration** | **3hrs** |
| **Course Name** | **PRINCIPLES OF RESOURCE AND QUALITY MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | State the limitation of solving graphical method in solving LPP. | | CO1 | U | | 1 |
| 2. | Cite the reason for the occurrence of degeneracy in a transportation problem. | | CO1 | R | | 1 |
| 3. | Define Burst Event and indicate the same in a network. | | CO3 | R | | 1 |
| 4. | Identify the use of a dummy activity in a network. | | CO3 | R | | 1 |
| 5. | Differentiate inter arrival time and arrival rate. | | CO2 | U | | 1 |
| 6. | List any two applications of game theory. | | CO2 | R | | 1 |
| 7. | Define quality. | | CO4 | U | | 1 |
| 8. | PDCA stands for \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 9. | Is ISO certification a legal requirement to start an industry in India? | | CO4 | U | | 1 |
| 10. | ISO 14000 Certification ensures \_\_\_\_\_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | List the advantages and limitations of LPP. | | CO1 | | U | 3 |
| 12. | Determine the critical path of the following project   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-4 | 1-3 | 2-4 | 3-4 | | Duration(Weeks) | 3 | 6 | 4 | 5 | 2 | | | CO3 | | U | 3 |
| 13. | Solve the following game by arithmetic method  Player B   |  |  | | --- | --- | | 4 | 0 | | 0 | 8 |   Player A | | CO2 | | A | 3 |
| 14. | Write the dimensions of quality. | | CO2 | | U | 3 |
| 15. | Brief ISO 9000 series of standards. | | CO4 | | U | 3 |
| 16. | Differentiate slack, surplus and artificial variables. | | CO 1 | | 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. |  | Solve by using Graphical Method  Maximize Z = 3X1+2X2  Subjected to  X1-X2 ≥ 1  X1+X2 ≥ 3  With non-negative restrictions X1, X2 ≥ 0 | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | There are three factories located at places P, Q and R. .These factories supply products to whole sale agents located at places S, T and W. The weekly capacities of factories P, Q and R are 76,82 and 72 units respectively. Weekly requirements of agents S, T and W are 72,102 and 41 units respectively. the unit transportation cost in rupees from P to S, T and W are5,8  and 8 respectively, from Q to S,T and W are16,25 and 15 respectively and R to S,T and W are 9,16 and 25 respectively. use least cost method to arrive initial solution and also  Find the optimum transportation schedule | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 19. |  | A project consists of following activities.   |  |  |  |  | | --- | --- | --- | --- | | Activities | Least time(DAYS) | Greatest  time(DAYS) | Most likely  Time(DAYS) | | 1-2 | 3 | 15 | 6 | | 1-3 | 2 | 14 | 5 | | 1-4 | 6 | 30 | 12 | | 2-5 | 2 | 8 | 5 | | 2-6 | 5 | 17 | 11 | | 3-6 | 3 | 15 | 6 | | 4-7 | 3 | 27 | 9 | | 5-7 | 1 | 7 | 4 | | 6-7 | 2 | 8 | 5 |   Find i) Project length, Project Variance  ii) Probability factor of completing the project within 27 days.  iii) Due date if probability of success is 90%. | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20. |  | Find the sequence that minimizes the total elapsed time required to complete the following jobs.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Jobs | 1 | 2 | 3 | 4 | 5 | | M/c A(hrs) | 5 | 7 | 6 | 9 | 5 | | M/c B(hrs) | 2 | 1 | 4 | 5 | 3 | | M/c C(hrs) | 3 | 7 | 5 | 6 | 7 | | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | The demand per day for a belt used in the engine of an auto mobile has the following probability distribution, simulate the demand for 15 days.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | Demand/day | 3 | 4 | 5 | 6 | 7 | | Probability | 0.10 | 0.30 | 0.30 | 0.20 | 0.10 | | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | Solve the following game whose pay off matrix is given below by concept of dominance  **Player A**   |  |  |  | | --- | --- | --- | | 0 | -2 | 7 | | 2 | 5 | 6 | | 3 | -3 | 8 |   **Player B** | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Discuss the Deming’s 14 points on the implementation of Total Quality Management. | CO4 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Describe the need and implementation of ISO 9000 quality system. | CO4 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply mathematical models for physical problems to find optimal Solutions. |
| CO2 | Make use of appropriate operation research tools to ensure effective utilization of resources to realize maximum benefit. |
| CO3 | Design network models for project planning, scheduling and project management. |
| CO4 | Adopt ISO standards in industry’s quality policy to assure quality of the product/service to the end users. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 7 | 36 |  |  |  | 44 |
| CO2 | 2 | 3 | 15 | 12 |  |  | 32 |
| CO3 | 2 | 3 | 12 |  |  |  | 17 |
| CO4 | 1 | 18 | 12 |  |  |  | 31 |
|  | | | | | | | **124** |



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| **Course Code** | **12ME332** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED REFRIGERATION AND AIR CONDITIONING SYSTEMS** | **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 Standard vapour compression cycle developing 50 kW of refrigeration using refrigerant 22 operates with a condensing temperature of 35 C and an evaporating temperature of -10 C. Calculate a) the refrigerating effect in KJ/kg, b) the circulation rate of refrigerant in kg/s, c) the power required by the compressor in kW, d) the coefficient of performance, e) the volume flow rate measured at compressor suction, f)the power per kW of refrigeration, g) the compressor discharge temperature? | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain i) Thermo electric refrigeration ii) pulse tube refrigeration with a neat sketch. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | A small cold storage has the dimensions 8.5 m X 5 m X 2.5 m height. The design conditions are 43 C DBT and 27C WBT (outside) and 2 C DBT, 90% RH (inside). The transmission load is estimated as 1.5 kW. The fan motor and lighting load is assumed as 0.3 kW. The product loading is 2000kg of fruits/ vegetables every day. Assume 6 air changes per day equivalent of infiltration due to door openings, determine a) Refrigerating capacity required b) Approximate saturated suction temperature of the refrigerant c) number of air changes of supply air. | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain different air conditioning systems used in air crafts. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 5. | a. | Derive the expression for CoP of Actual vapor absorption refrigeration cycle. | CO1 | A | 10 |
|  | b. | Write the principle of operation of Li-Br vapor absorption system. | CO1 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | In an ammonia absorption system with an analyzer but without a dephlegmator the following date are given. 20.3 bar condenser pressure, 2.1 bar evaporator pressure, 156 C generator temperature, 40 C absorber temperature. Determine the following per unit mass of the vapor distilled, a) specific solution circulation rates, b) temperature to , at inlet to evaporator if the liquid from the condenser is cooled by 13 C in the liquid vapor heat exchanger, c) the refrigerating effect if the maximum refrigeration temperature 5 C, d) the heat transfer in the liquid-liquid heat exchanger, e) the heat added in the generator, f) the pump work, g) the coefficient of performance, h) the heat rejected in the absorber and condenser, i) energy balance of the system. | CO2 | An | 20 |
|  |  |  |  |  |  |
| 7. | a. | A laboratory having an unusually large latent heat gain is required to be air conditioned. The design conditions and loads are as follows:  Summer design conditions: 40 C DBT, 27 C WBT  Inside design conditions: 25 C DBT, 50 % RH  Room sensible heat: 34.9 kW  Room Latent heat: 18.6 kW  The ventilation air requirement is 85 cm. Determine the following:  i) ventilation load ii) Room and effective sensible heat factors,  iii) Apparatus dew point and amount of reheat for economical design, iv) supply air quantity, v) condition of air entering and leaving coil and supply air temperature, vi) Grand total heat | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | What are the factors influencing the thermal comfort and write the summary of procedures for estimating heating and cooling loads. | CO1 | U | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Write the characteristics of centrifugal and axial fans used in HVAC systems. | CO2 | A | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | The students will understand various aspects of the heating, ventilation and air-conditioning systems. |
| CO2 | The students will be able to design HVAC Systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 70 | 10 | - | - | - | 80 |
| CO2 | - | - | 20 | 80 | - | - | 100 |
|  | | | | | | | **180** |



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| **Course Code** | **12ME352/15ME3008** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED INSTRUMENTATION IN THERMAL ENGINEERING** | **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. |  | Consider an axial conductivity guarded heat flux probe made of an alloy material of thermal conductivity equal to 45 W/m°C. The two thermocouples are placed 1 cm apart. The incident heat flux isknown to be 105 W/m2. The probe has a diameter of 25mm.Determine the indicated temperature difference ∆T and the heat Q that needs to be removed from the back surface of the probe? | CO1 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain Method of least squares and Multivariable regression. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | Describe the measurement of field quantities by intrusive and non-intrusive techniques. | CO3 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain different types of errors in measurment and state the sources that causes them. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | Explain the methods of measuring the surface tension and heat capacity. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the method of measuring the heat flux using Gardon gauge with a neat sketch. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 7. |  | Explain different methods to determine the thermal conductivity of fluids. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Describe the process to measure the viscosity of liquids and gases. | CO3 | A | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | Write the functions of various major components of Data acquisition System. | CO1 | U | 20 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Analyze experimental data and predict correlation. | | | | | | | |
| CO2 | Quantify uncertainties and errors in various measurements. | | | | | | | |
| CO3 | Apply measurement techniques of intensive and extensive properties. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | - | 20 | - | 20 | - | - | 40 |
| CO2 | | - | 40 | 20 | - | - | - | 60 |
| CO3 | | - | 40 | 40 | - | - | - | 80 |
| CO4 | | - | - | - | - |  |  | - |
| CO5 | | - | - | - | - | - | - | - |
| CO6 | | - | - | - | - | - | - | - |
|  | | | | | | | | **180** |

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| **Course Code** | **13ME103/14ME1003/17ME1001** | **Duration** | **3hrs** |
| **Course Name** | **BASIC MECHANICAL ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define the term EC Engine. | | CO1 | R | | 1 |
| 2. | State the function of a steam stop valve in a boiler. | | CO1 | U | | 1 |
| 3. | ‘Barrage’ in tidal power plant means \_\_\_\_\_\_\_\_\_. | | CO2 | R | | 1 |
| 4. | Name any two Nuclear Power plant in India. | | CO2 | A | | 1 |
| 5. | Define factor of safety. | | CO3 | A | | 1 |
| 6. | Low carbon steel is known as\_\_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 7. | List few examples for arc welding. | | CO4 | U | | 1 |
| 8. | Expand the term TIG in welding. | | CO4 | R | | 1 |
| 9. | Give an example of milling machine operations. | | CO5 | U | | 1 |
| 10. | Give an example for a semiautomatic lathe. | | CO6 | A | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Differentiate two stroke engine and four stroke engine. | | CO1 | | U | 3 |
| 12. | List the advantages of non-conventional energy sources. | | CO2 | | R | 3 |
| 13. | List out the properties of non-ferrous metals. | | CO3 | | R | 3 |
| 14. | Mention the applications of arc welding. | | CO4 | | U | 3 |
| 15. | Define casting process. | | CO5 | | R | 3 |
| 16. | Define milling machine. | | 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. | Classify the boiler. | CO1 | | R | 3 |
|  | b. | Explain the working of a four-stroke petrol engine with the help of neat sketches. | CO1 | | A | 9 |
|  |  |  |  | |  |  |
| 18. |  | Give a schematic layout of a storage type hydro-electric power plant and explain the function of each component of the power plant. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Draw and explain the Stress-Strain curve of a ductile material. | CO3 | | A | 12 |
|  |  |  |  | |  |  |
| 20 |  | Explain briefly the arc welding process and its parts in detail. | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | Explain the basic steps involved in sand casting. | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 22. |  | Explain the working of a Babcock and Wilcox boiler with the help of neat sketches. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Sketch the layout of a typical solar power plant. Discuss about its working, advantages and disadvantages. | CO3 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Briefly explain the lathe parts and their functions. | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Describe the working principle of Engines and Turbines. |
| CO2 | Classify Boilers and identify different types of engines. |
| CO3 | Distinguish conventional and non- conventional power plants. |
| CO4 | Examine various types of engineering materials. |
| CO5 | Select different types of metal forming and joining process. |
| CO6 | Analyze metal machining processes. |

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

**Graphical user interface, application

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| **Course Code** | **14ME2015/17ME2011** | **Duration** | **3hrs** |
| **Course Name** | **THERMAL ENGINEERING I** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | \_\_\_\_\_\_\_\_\_\_ is an example for fire tube boiler. | | | | CO1 | U | 1 |
| 2. | Define factor of evaporation. | | | | CO1 | R | 1 |
| 3. | The effect of friction in nozzle is to \_\_\_\_\_\_\_\_ dryness friction. | | | | CO2 | U | 1 |
| 4. | List different types of nozzles. | | | | CO2 | R | 1 |
| 5. | An example of velocity compounded impulse turbine is \_\_\_\_\_\_\_\_. | | | | CO3 | U | 1 |
| 6. | Illustrate Reheat Rankine cycle. | | | | CO4 | R | 1 |
| 7. | Volumetric efficiency of a reciprocating air compressor is defined as the ratio of actual volume to \_\_\_\_\_\_\_\_. | | | | CO5 | R | 1 |
| 8. | In a reciprocating air compressor the compressor work is minimum during \_\_\_\_\_\_\_\_ process. | | | | CO5 | U | 1 |
| 9. | The refrigerant used in water-lithium bromide absorption system is \_\_\_\_\_\_\_\_. | | | | CO6 | R | 1 |
| 10. | In a refrigeration system, heat rejection takes place in \_\_\_\_\_\_\_\_. | | | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Name the heat losses in the boiler plant. | | | CO1 | | R | 3 |
| 12. | Why nozzles are made convergent – divergent? | | | CO2 | | U | 3 |
| 13. | Draw the velocity diagram of a single stage steam turbine. | | | CO3 | | U | 3 |
| 14. | List the advantages of Regeneration cycle. | | | CO4 | | U | 3 |
| 15. | Sketch the block diagram of a two stage reciprocating air compressor. | | | CO5 | | U | 3 |
| 16. | Differentiate refrigeration and air-conditioning. | | | 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 |  | In a boiler test 1250 kg of coal are consumed in 24 hours. The mass of water evaporated is 13000 kg an the mean effective pressure is 7 bar. The feed water temperature was 40°C, heating value of coal is 30000 kJ/kg. The enthalpy of 1 kg of steam at 7 bar is 2570.7 kJ. Determine:   1. Equivalent evaporation per kg of coal 2. Efficiency of the boiler. | | | CO1 | A | 12 |
| 18. |  | Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2.0 bar. If the dryness fraction of discharge steam is 0.96, what will be the final velocity of steam? Neglect initial velocity of steam. If 10% of heat drop is lost in friction, find the percentage reduction in the final velocity. | | | CO2 | A | 12 |
| 19. |  | Explain the working of an impulse steam turbine with a neat sketch. | | | CO3 | An | 12 |
| 20. |  | Explain the working of a single Rankine cycle with suitable sketches. | | | CO4 | An | 12 |
| 21. |  | Air is to be isentropically compressed at the rate 1 m3/s from 1 bar and 20°C to 10 bar.Find the work of compression and the volumetric efficiency if the clearance volume is 4% of stroke volume for all the cylinders for the following cases:   1. Single stage and 2. Two stage. | | | CO5 | A | 12 |
| 22. |  | A 50 tonne refrigeration system using R12 works between 258 K and 318 K. Evaluate the COP, power required to drive the compressor and mass flow rate of the refrigerant. Assume simple vapour compression cycle for calculations. Take Cp of 318 K = 0.7. | | | CO6 | E | 12 |
| 23. |  | Derive an expression for the work done per kg of air for a reciprocating air compressor without clearance. | | | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. |  | | With a neat sketch explain the working principle of vapour compression refrigeration system. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Estimate the performance of a steam generator. |
| CO2 | Analyze the flow through steam nozzles. |
| CO3 | Determine the efficiency of the impulse and reaction turbine using velocity triangles. |
| CO4 | Describe vapour power cycles. |
| CO5 | Calculate the efficiency of a reciprocating air compressor. |
| CO6 | Evaluate Coefficient of performance of Refrigeration systems. |

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

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **14ME2019/16ME2011/17ME2024/18ME2010** | **Duration** | **3hrs** |
| **Course Name** | **HEAT AND MASS TRANSFER** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | | |
| 1. | \_\_\_\_\_\_\_\_ is the driving force for heat transfer. | | | | CO1 | R | | 1 |
| 2. | Fin effectiveness is generally \_\_\_\_\_\_\_\_\_\_\_\_ than one. | | | | CO1 | R | | 1 |
| 3. | Write the expression for conduction shape factor. | | | | CO2 | R | | 1 |
| 4. | Rayleigh number is a product of \_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_ . | | | | CO2 | R | | 1 |
| 5. | Radiation shield should have \_\_\_\_\_\_\_\_\_\_\_\_ reflectivity. | | | | CO3 | U | | 1 |
| 6. | A radiation shield with emissivity of 0.05 on both sides is placed between two large black parallel black planes. The thermal resistance is \_\_\_\_\_\_\_\_\_. | | | | CO3 | A | | 1 |
| 7. | List the classification of heat exchangers based on flow direction. | | | | CO4 | R | | 1 |
| 8. | For a condenser the effectiveness was found as 0.61. The value of NTU is \_\_\_\_\_\_\_\_\_\_\_\_. | | | | CO4 | A | | 1 |
| 9. | Draw the boiling curve for pool boiling of water. | | | | CO5 | U | | 1 |
| 10. | Give some examples of Diffusion mass transfer. | | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | |
| 11. | State Newton’s law of cooling. | | | | CO1 | | R | 3 |
| 12. | A chromel-alumel thermocouple (diameter 0.71 mm) is used to measure the temperature of a gas stream for which h=600 W/m2K. Estimate the time constant of the thermocouple. What is the time period after which an acceptable reading of temperature can be recorded? Take C= 430 J/kg K, density = 8600 kg/m3. | | | | CO2 | | A | 3 |
| 13. | Explain the term “Radiosity”. | | | | CO3 | | R | 3 |
| 14. | Discuss the advantage of NTU method over the LMTD Method. | | | | CO4 | | U | 3 |
| 15. | Define film wise and drop wise condensation. | | | | CO5 | | U | 3 |
| 16. | Explain Fick’s law of diffusion. | | | | 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 240 mm steam main, 210 metres long is covered with 50mm of high temperature insulation (k=0.092 W/m0C) and 40 mm of low temperature insulation (k=0.062 W/m0C). The inner and outer surface temperatures as measured are 3900C and 400C respectively. Calculate: i) the total heat loss per hour, ii) the heat loss per m2 of pipe surface, iii) the total loss per m2 of outer surface, and iv) the temperature between two layers of insulation. Neglect heat conduction through pipe material. | | CO1 | | A | 12 |
|  | |  |  | |  | |  |  |
| 18. | |  | A wall of 0.5m thickness is to be constructed from a material which has an average thermal conductivity of 1.4 W/mK. The wall is to be insulated with a material having an average thermal conductivity of 0.35W/mK so that the heat loss per square metre will not exceed 1450 W. Assuming that the inner and outer surface temperatures are 12000C and 150C respectively. Calculate the thickness of insulated material. | | CO1 | | A | 12 |
|  | |  |  | |  | |  |  |
| 19. | |  | A long steel cylinder 12.0 cm in diameter and initially at 200C is placed into a furnace at 8200C with a local heat transfer coefficient h=140 W/m2K. Calculate the time required for the axis temperature to reach 8000C. Also calculate the corresponding temperature at the radius of 5.4 cm at that time. The physical properties of steel [α= 6.11 x 10-6 m2/s, k =21 W/mK, ρ=2700 kg/m3, c=0.9 kJ/kg.K] | | CO2 | | A | 12 |
|  | |  |  | |  | |  |  |
| 20. | |  | Water at 250C flows through a tube of 50 mm diameter. Determine the flow rate that will result in a Reynolds number of 1600. The tube is provided with a nichrome heating element on its surface and receives a constant heat flux of 800 W/m length of the tube. Determine the average heat transfer coefficient between the water and the tube wall, assuming fully developed conditions. Also determine the length of the tube for the bulk temperature of water to rise from 250C to 500C. | | CO2 | | A | 12 |
|  | |  |  | |  | |  |  |
| 21. | |  | A thin aluminium sheet with an emissivity of 0.1 on both sides is placed between two very large parallel plates that are maintained at uniform temperatures T1 = 800 K and T2 = 500 K and have emissivities ε1= 0.2 and ε2= 0.2, respectively. Determine the net rate of radiation heat transfer between the two plates per unit surface area of the plates and compare the result to that without the shield. | | CO3 | | An | 12 |
|  | |  |  | |  | |  |  |
| 22. | |  | A thin walled concentric tube heat exchanger is used to cool engine oil from 1600C to 600C and water, which is available at 250C acts as coolant. The oil and water flow rates are each 2kg/s and the diameter of the inner tube is 0.5m and the corresponding value of overall heat transfer coefficient is 250 W/m2K. How long must the heat exchanger to accomplish the desired cooling? Take, Cp of water = 4.187 kJ/kgK, Cp of engine oil = 2.035 kJ/kg.K. | | CO4 | | An | 12 |
|  | |  |  | |  | |  |  |
| 23. | |  | Explain the various regimes in boiling heat transfer with neat sketches. | | CO5 | | U | 12 |
| **COMPULSORY QUESTION** | | | | | | | | |
| 24. | |  | | Dry air at 270C and 1 atm flows over a wet flat plate 50cm long at a velocity of 50m/sec. Calculate the mass transfer coefficient of water vapor in air at the end of the plate.  Take D=0.26 x 10-4m2/sec, β=1.14 kg/m3, µ=184.6 x 10-7 Ns/m2, Pr=0.707. | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Formulate and analyze a heat transfer problem involving any of the three modes of heat transfer. |
| CO2 | Obtain exact solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer. |
| CO3 | Evaluate radiation heat transfer between black, gray surfaces and the surroundings. |
| CO4 | Design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary. |
| CO5 | Apply boiling and condensation correlations to two phase flow processes. |
| CO6 | Apply mass transfer correlations to process–based problems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 5 |  | 24 |  |  |  | 29 |
| CO2 | 5 |  | 24 |  |  |  | 29 |
| CO3 | 3 | 2 | 1 | 12 |  |  | 18 |
| CO4 | 1 | 3 | 1 | 12 |  |  | 17 |
| CO5 |  | 15 |  |  |  |  | 15 |
| CO6 | 3 | 1 | 12 |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **14ME2026** | **Duration** | **3hrs** |
| **Course Name** | **MECHANICS OF MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Describe the term ‘Degrees of freedom’. | | CO1 | U | | 1 |
| 2. | Attachment of a car mirror is an example of \_\_\_\_\_\_\_ pair. | | CO1 | A | | 1 |
| 3. | The component of acceleration, parallel to the velocity of the particle at a given instant is\_\_\_\_\_\_\_ component. | | CO2 | A | | 1 |
| 4. | Discuss on centripetal or radial component. | | CO2 | U | | 1 |
| 5. | Tell about a cam and follower. | | CO3 | R | | 1 |
| 6. | Define an oscillating follower. | | CO3 | R | | 1 |
| 7. | Discus the term ‘dedendum’ in a gear. | | CO4 | U | | 1 |
| 8. | Define train value of the gear train. | | CO4 | R | | 1 |
| 9. | State about a journal bearing. | | CO5 | U | | 1 |
| 10. | Describe on the tight side in belt. | | CO5 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Differentiate a machine and a structure. | | CO1 | | U | 3 |
| 12. | Write the Coriolis component of acceleration. | | CO2 | | A | 3 |
| 13. | Mention the types of motion of the follower. | | CO3 | | R | 3 |
| 14. | Describe about idle gears. | | CO4 | | R | 3 |
| 15. | Define Creep of Belt. | | CO5 | | R | 3 |
| 16. | Distinguish sliding and rolling friction. | | CO5 | | 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. | Sketch and explain any two inversions of a single slidercrank chain. | CO1 | | A | 6 |
|  | b. | A designer has developed a four-bar crank rocker mechanism with the following link lengths and claims one of the links is capable of making full revolution: i) Link 2 = 35 mm, ii)Link 3 = 110 mm iii) Link 4 = 70 mm and iv) Link 1 = 65 mm. Correlate his claim using Grashoff’s Law. | CO1 | | An | 6 |
|  |  |  |  | |  |  |
| 18. |  | Angular velocity of **crank** OA is 300 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD. The dimensions of various links are: OA = 30 mm; AB = 45 mm ; BC 50 mm ; and BD = 46 mm, as shown in Fig (a). The distance between the centres of rotation O and C is 60 mm. The path of travel of the slider is 10 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical.  Fig (a) | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | A cam is to be designed for a knife edge follower when the axis of the follower passes through the axis of cam shaft with the following data:   1. Follower to move outwards through 40 mm during 60º of cam rotation, 2. Dwell for the next 45°. 3. Follower to return to its original position during next 90º, 4. Follower to dwell for the rest of the cam rotation.   The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of the cam is 50 mm. If the cam rotates at 300 rpm, determine the maximum velocity and acceleration of the follower during the outward stroke and return stroke. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. | a. | Write the advantages and disadvantages of Gear Drive. | CO4 | | A | 4 |
|  | b. | A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20 degree pressure angle, 12 mm module and 10 mm addendum. Evaluate the length of path of contact, arc of contact and the contact ratio. | CO4 | | An | 8 |
|  |  |  |  | |  |  |
| 21. | a. | Chart the important factors upon which the selection of belt drive depends. | CO5 | | A | 4 |
|  | b. | Calculate the power transmitted by a belt running over a pulley of 600 mm diameter at 200 r.p.m. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160 degree and maximum tension in the belt is 2500 N. | CO5 | | An | 8 |
|  |  |  |  | |  |  |
| 22. |  | A cam is to give the following motion to a roller (diameter 16 mm) follower :   1. Outstroke during 120° of cam rotation ; 2. Dwell for the next 30° of cam rotation ; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 150° of cam rotation.     Fig (b)  The stroke of the follower is 40 mm and the minimum radius of the cam is 30 mm. The follower moves with simple harmonic motion during both the ascent and descent. Use the displacement diagram shown in Fig (b). Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 300 r.p.m. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 23. | a. | Explain Compound Gear Train with a diagram. | CO4 | | A | 4 |
|  | b. | In an epicyclic gear train as shown in the Fig (c), the number of teeth on wheels A, B and C are 48, 24 and 50 respectively. If the arm rotates at 400 rpm clockwise, find: (i) Speed of the wheel C when A is fixed, and; (ii) Speed of wheel A when C is fixed.  Fig (c) | CO4 | | An | 8 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. | a. | A single plate clutch effective on both sides, is required to transmit 25 kW at 3000 rpm. Determine the outer and inner radii of frictional surface if the coefficient of friction is 0.25, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm2. Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. | CO5 | | An | 6 |
|  | b. | A multiplate clutch has three pairs of contact surfaces. The outer and inner radii of the contact surfaces are 100 mm and 50 mm respectively. The maximum axial spring force is limited to 1 kN. If the coefficient of friction is 0.35 and assuming uniform wear, calculate the power transmitted by the clutch at 1500 rpm. | CO5 | | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand different mechanisms and calculate the mobility. |
| CO2 | Analyze position, velocity and acceleration of links in mechanisms. |
| CO3 | Design cam motion profiles, for different types of follower motions. |
| CO4 | Understand gear nomenclature and analysis gear trains. |
| CO5 | Design transmission devices considering frictional aspects. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 4 | 7 | 6 | - | - | 17 |
| CO2 | - | 1 | 4 | 12 | - | - | 17 |
| CO3 | 5 | - | - | 24 | - | - | 29 |
| CO4 | 4 | 1 | 8 | 16 | - | - | 29 |
| CO5 | 3 | 5 | 4 | 20 | - | - | 32 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **14ME2029/17ME2020/18ME2016** | **Duration** | **3hrs** |
| **Course Name** | **DESIGN OF MACHINE ELEMENTS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Describe stress. | | CO1 | R | | 1 |
| 2. | Describe hardness. | | CO1 | U | | 1 |
| 3. | Write the importance of principal stresses. | | CO2 | U | | 1 |
| 4. | Write the use of the Soderberg equation. | | CO2 | A | | 1 |
| 5. | List out a few types of couplings. | | CO3 | R | | 1 |
| 6. | Distinguish between shaft, axle and spindle. | | CO3 | U | | 1 |
| 7. | Mention a few examples of permanent and temporary joints. | | CO4 | R | | 1 |
| 8. | Write the uses of leaf springs. | | CO4 | U | | 1 |
| 9. | Write the material of the connecting rod. | | CO5 | R | | 1 |
| 10. | Mention the essential property of the friction material of the clutch. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Write short notes on shock loading. | | CO1 | | U | 3 |
| 12. | List the various types of rolling contact bearing. | | CO2 | | R | 3 |
| 13. | Compare solid and hollow shafts. | | CO3 | | An | 3 |
| 14. | Write short notes on Threaded fasteners. | | CO4 | | An | 3 |
| 15. | State the use of connecting rod and crankshaft. | | CO5 | | U | 3 |
| 16. | Sketch a piston and show its parts. | | 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. |  | Describe the various theories of failures in detail with suitable examples. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 18. |  | A bearing for an axial flow compressor is used to support a radial load of 2500N and a thrust (axial) load of 1500N.The service required is 5years at the rate of 40 hrs per week. The speed of the shaft is 1000rpm.Select a suitable ball bearing for the purpose. The diameter of the shaft is 50mm. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10 000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | Design a knuckle joint for transmitting an axial load of 55 kN for the following stresses: in tension 80 MPa, in compression 90 MPa, in shear 50 MPa. Tabulate the specification. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | The turning moment diagram for a petrol engine is drawn to the following scales:  Turning moment, 1 mm = 5 N-m; Crank angle, 1 mm = 1º.  The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line, taken in order are 295, 685, 40, 340, 960, 270 mm2.  Determine the mass of the 300 mm diameter flywheel rim when the coefficient of fluctuation of speed is 0.3% and the engine runs at 1800 r.p.m. Also determine the cross-section of the rim when the width of the rim is twice of thickness. Assume the density of rim material as 7250 kg / m3. | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35.  The following permissible stresses may be used:  Shear stress for shaft, bolt and key material = 40 MPa  Crushing stress for bolt and key = 80 MPa  Shear stress for cast iron = 8 MPa | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | A semi-elliptical laminated vehicle spring to carry a load of 6000 N is to consist of seven leaves 65 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to the axle by two U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume design stress for spring material as 350 MPa. Determine :  1. Thickness of leaves, 2. Deflection of spring, 3. Diameter of the eye, 4. Length of leaves, and 5. Radius to which leaves should be initially bent. Sketch the semi-elliptical leaf-spring arrangement.  The standard thickness of leaves are : 5, 6, 6.5, 7, 7.5, 8, 9, 10, 11 etc. in mm. | CO4 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 r.p.m. Determine the outer and inner diameters of the frictional surface if the coefficient of friction is 0.255, the ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm2. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the standard design procedure for Design of machine elements. |
| CO2 | Analyze stresses acting on components and determine the size based on theories of failure. |
| CO3 | Design machine components for a given load condition using design data hand books. |
| CO4 | Decide specifications as per standards given in design data and select standard components to improve interchangeability. |
| CO5 | Design and develop nonstandard machine components. |
| CO6 | Prepare a detail design layout and drawing of machine components |

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

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18ME2012** | **Duration** | **3hrs** |
| **Course Name** | **STRENGTH OF MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Define stress and strain. | | CO1 | R | | 1 |
| 2. | Modulus of elasticity is defined as the ratio of \_\_\_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | Name the types of beams. | | CO2 | U | | 1 |
| 4. | Define shear force. | | CO2 | R | | 1 |
| 5. | In simple bending, \_\_\_\_\_\_\_\_\_ is constant | | CO3 | R | | 1 |
| 6. | For any part of the beam, between two concentrated load Shear force diagram is a \_\_\_\_\_\_\_\_\_ line. | | CO3 | U | | 1 |
| 7. | Write the methods to find the slope and deflection at a section. | | CO4 | U | | 1 |
| 8. | Write an expression for deflection by moment area method. | | CO4 | R | | 1 |
| 9. | Define torque. | | CO5 | R | | 1 |
| 10. | The cylinder has a tendency to split up along \_\_\_\_\_\_\_\_\_ due to circumferential stress. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Draw the stress strain diagram for mild steel and indicate the salient points. | | CO1 | | U | 3 |
| 12. | Show the different types of loads acting on beams with neat sketch. | | CO2 | | A | 3 |
| 13. | Define the terms: bending stress in beam, neutral axis and section modulus. | | CO3 | | U | 3 |
| 14. | Derive the equation for the deflection when a point load applied at the free end of cantilever beam. | | CO4 | | A | 3 |
| 15. | The shearing stress of a solid shaft is not exceed 40 N/mm2 when the torque transmitted is 20000 N-m. Determine the minimum diameter of the shaft. | | CO5 | | An | 3 |
| 16. | Define thin cylinders and name the stresses set up in a thin cylinder subjected to internal fluid pressure. | | 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 member ABCD is subjected to point loads P1, P2, P3& P4 is shown in Figure 1. Calculated the force P2 necessary of equilibrium if P1 = 45 kN, P3 = 450 kN& P4 = 130 kN. Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1 x 105 N/mm2.    Fig. 1 | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 18. |  | A cantilever beam of length 2m carries the point loads as shown in Figure 2 and draw the shear force and B.M. diagram for the cantilever beam.  C:\Users\Praveen\AppData\Local\Microsoft\Windows\INetCache\Content.Word\New Picture (3).png  Fig. 2 | CO2 | | E | 12 |
|  |  |  |  | |  |  |
| 19. |  | A steel plate of width 120 mm and of thickness 20 mm is bent in to a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take E = 2 x 105 N/mm2. | CO3 | | E | 12 |
|  |  |  |  | |  |  |
| 20. |  | A cantilever of length 3 m is carrying a point load of 50 kN at a distance of 2 m from the fixed end. If I = 108 mm4 and E = 2x105 N/mm2, find (i) slope at the free end and (ii) deflection at the free end. | CO4 | | An | 12 |
|  |  |  |  | |  |  |
| 21. |  | A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its center. If E = 105 N/mm2 and I = 108 mm4 for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end. | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | A simply supported beam of length 6 m, carries a point load of 3 kN and 6 kN at a distance of 2 m and 4 m from the left end. Draw the shear force and bending moment diagrams for the beam. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 23. |  | A hollow shaft, having an internal diameter 40 % of its external diameter, transmits 562.5 kW power at 100 rpm. Determine the external diameter of the shaft if the shear stress not to exceed 60 N/mm2 and the twist in a length of 2.5 m should not exceed 1.3°, assume maximum torque = 1.25 mean torque and modulus of rigidity = 9 x 104 N/mm2. | CO4 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Calculate: (i) the change in diameter, (ii) change in length and (iii) change in volume of a thin cylindrical shell 100 cm diameter, 1 cm thick and 5 cm long when subjected to internal pressure of 3 N/mm2. Take the value of E = 2 x 105 N/mm2 and Poisson’s ratio, µ = 0.3. | CO6 | | E | 12 |
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|  | **COURSE OUTCOMES** |
| CO1 | Recognize various types loads applied on machine components. |
| CO2 | Understand the nature of internal stresses that will develop within the components. |
| CO3 | Analyse the stresses acting simple geometry of structures. |
| CO4 | Evaluate the strains and deformation due to the elastic stresses developed. |
| CO5 | Compute inertia, slopes and deflection in beams. |
| CO6 | Determine the torsional stresses of shaft and hoop stresses in cylinders. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 3 |  | 12 |  |  | 17 |
| CO2 | 1 | 1 | 3 | 12 | 12 |  | 29 |
| CO3 | 1 | 4 |  |  | 12 |  | 17 |
| CO4 | 1 | 1 | 3 | 24 |  |  | 29 |
| CO5 | 1 |  |  | 15 |  |  | 16 |
| CO6 |  | 4 |  |  | 12 |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18ME2028** | **Duration** | **3hrs** |
| **Course Name** | **HYDRAULICS AND PNEUMATICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | List the types of fluids used in hydraulic and pneumatic system. | | CO1 | U | | 1 |
| 2. | State Pascal's law. | | CO1 | R | | 1 |
| 3. | State the purpose of accumulators in hydraulic system. | | CO2 | U | | 1 |
| 4. | Draw the symbol of 5/2 directional control valve. | | CO2 | R | | 1 |
| 5. | Name the hydraulic piping materials. | | CO3 | R | | 1 |
| 6. | Write the use of regenerative circuit. | | CO3 | U | | 1 |
| 7. | Draw the graphical symbol of FRL unit. | | CO4 | R | | 1 |
| 8. | Sketch the symbol of single acting cylinder spring return. | | CO4 | R | | 1 |
| 9. | Write principle of a displacement step diagram in pneumatic system. | | CO5 | U | | 1 |
| 10. | State the function of programmable logic controller | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | List the applications of hydraulic and pneumatic systems. | | CO1 | | A | 3 |
| 12. | Describe about hydraulic actuators and list all the types. | | CO2 | | U | 3 |
| 13. | List the types and applications of hydraulic power pack. | | CO3 | | U | 3 |
| 14. | List out the pneumatics system components with basic pneumatic circuit. | | CO4 | | A | 3 |
| 15. | Show the elements of a closed loop system with neat sketch. | | CO5 | | A | 3 |
| 16. | Draw the symbol of proximity sensor and explain working process. | | 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. | Draw the shear stress and strain rate diagram for hydraulic fluids. | CO1 | | An | 8 |
|  | b. | Illustrate the differences in graphic symbols of hydraulic and pneumatic system. | CO1 | | A | 4 |
| 18. | a. | Design a hydraulic circuit for accumulator used as a compensator for internal or external leakage in the system. | CO2 | | E | 8 |
|  | b. | Design and describe the hydraulic system reservoir. | CO2 | | A | 4 |
| 19. | a. | Develop hydraulic circuit for drilling operation by using sequencing valve. | CO3 | | An | 6 |
|  | b. | Design and describe hydraulic circuit for synchronizing two cylinder movements with matching pumps. | CO3 | | An | 6 |
| 20. | a. | List out the advantages and disadvantages of FRL unit. | CO4 | | U | 4 |
|  | b. | Describe in detail the key factors in the selection of pneumatic actuators. | CO4 | | An | 8 |
| 21. | a. | Show the displacement step diagram of pneumatic circuit for conveyor shifting process. | CO5 | | E | 8 |
|  | b. | Mention the types of methods used for designing multi cylinder pneumatic circuit. | CO5 | | U | 4 |
| 22. | a. | List out the types of hydraulic motors and explain the working principle of gear type motor. | CO2 | | A | 8 |
|  | b. | A positive displacement pump has an overall efficiency of 88% and a volumetric efficiency of 92%. What is the mechanical efficiency? | CO2 | | E | 4 |
| 23. | a. | Design a fail-safe circuit for hydraulic system to protect from overload. | CO3 | | An | 6 |
|  | b. | Design a meter-in circuit for hydraulic system and give an example. | CO3 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Design and discuss the ladder diagram connections for a dual cylinder sequencing circuit for the following sequence of operations: A+B+B-A-. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the salient features and constructional details of both hydraulic and Pneumatic systems. |
| CO2 | Understand the various types of actuation modes and control system design procedures for design of circuits and to control them. |
| CO3 | Understand the concepts of servo and proportional valves. |
| CO4 | Analyze various application circuits. |
| CO5 | Apply the above outcomes to design pneumatic and hydraulic circuits. |
| CO6 | Build a PLC programme for a particular application. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 7 | 8 |  |  | 17 |
| CO2 | 1 | 4 | 12 |  | 12 |  | 29 |
| CO3 | 1 | 4 | 6 | 18 |  |  | 29 |
| CO4 | 2 | 4 | 3 | 8 |  |  | 17 |
| CO5 |  | 5 | 3 |  | 8 |  | 16 |
| CO6 |  | 4 |  | 12 |  |  | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18ME2034** | **Duration** | **3hrs** |
| **Course Name** | **OPERATIONS RESEARCH** | **Max. Marks** | **100** |

**Use of standard normal distribution table is permitted**

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | List the 3 ‘M’s used as resources in any business. | | | CO1 | R | | 1 |
| 2. | In an assignment problem, when the number of squared Zeros are more than the number of rows or columns, it means the optimal solution is reached. True / False | | | CO1 | R | | 1 |
| 3. | Vogel’s approximation method is also known as \_\_\_\_\_\_\_\_\_\_\_ method. | | | CO2 | R | | 1 |
| 4. | Find the coordinates of X intercept and Y intercept when the corresponding equation is 2X + Y = 100. | | | CO2 | U | | 1 |
| 5. | If an activity is repeated a number of times, then the most probable time is likely to occur\_\_\_\_\_\_ times more than the optimistic and Pessimistic times. | | | CO3 | R | | 1 |
| 6. | Identify the method of allocation followed :  a)  b) | | | CO4 | U | | 1 |
| 7. | What is meant by transportation inventory? | | | CO4 | R | | 1 |
| 8. | Define total slack. | | | CO4 | R | | 1 |
| 9. | The control of class A items is done only annually to save time, paper work and money. True or False. | | | CO5 | R | | 1 |
| 10. | \_\_\_\_\_\_\_\_\_\_\_ system is a Japanese manufacturing system in which the supply of components is regulated through the use of an instruction card sent along the production line. | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Detail how the key column and key row is chosen in a simplex problem. | | | CO1 | | R | 3 |
| 12. | Balance the transportation problem given below. | | | CO2 | | U | 3 |
| 13. | What is the probability of completion of an activity, if the due date is 89 days, estimated time of completion is 80 days with a standard deviation of 3. | | | CO3 | | U | 3 |
| 14. | Define free slack. | | | CO4 | | R | 3 |
| 15. | Compare and contrast the characteristics of a transient and steady-state queuing system. | | | CO5 | | U | 3 |
| 16. | List the several applications of Queuing model. | | | 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. | |  | Solve the following problem by Simplex method.  Maximize  Z = X1 – X2 + 3X3  Subject to  2X1 + X2 + X3 ≤ 10  2X1 – X3 ≤ 2  2X1 – 2X2 + 3X3 ≥ 0  Also, X1, X2, X3 ≥ 0 | CO1 | | Apply | 12 |
|  | |  |  |  | |  |  |
| 18. | |  | There are 5 jobs and 5 machines. The associated cost of allocating a job to the machines is given in the table.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | M1 | M2 | M3 | M4 | M5 | | J1 | 11 | 17 | 8 | 16 | 20 | | J2 | 9 | 7 | 12 | 6 | 15 | | J3 | 13 | 16 | 15 | 12 | 16 | | J4 | 21 | 24 | 17 | 28 | 26 | | J5 | 14 | 10 | 12 | 11 | 15 |   It is required to assign one job to each of the 5 machines. Determine the optimal assignment of jobs so that the total cost of processing all the jobs is minimized. | CO2 | | Apply | 12 |
|  | |  |  |  | |  |  |
| 19. | |  | The various time estimates of activities involved in a project are in the table.   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Activities | 1-2 | 1-3 | 2-4 | 2-3 | 3-4 | 3-5 | 4-6 | 5-6 | | to | 2 | 4 | 2 | 2 | 0 | 3 | 6 | 1 | | tm | 6 | 8 | 0 | 4 | 3 | 6 | 10 | 3 | | tp | 10 | 12 | 4 | 6 | 0 | 9 | 14 | 5 |  1. Determine the expected completion time of the project. 2. Determine the variance and standard deviation of the project. 3. Determine the probability of completion of the project within 23 days. 4. What due date has about 75% of chances of being next ? 5. If the due date is 25 days, what is the probability of not meeting the due date? 6. What is the probability that the project will be completed atleast 5 days earlier than expected? | CO3 | | Apply | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | The maintenance of a machine consists of 10 jobs (activities). The precedence relationship of these jobs have been listed with the help of their node numbers.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | Job | 1-2 | 2-3 | 2-4 | 3-5 | 3-6 | 4-6 | 4-7 | 5-8 | 6-8 | 7-8 | | Duration (Days) | 2 | 3 | 5 | 4 | 1 | 6 | 2 | 8 | 7 | 4 |  1. Draw an arrow diagram for the project and calculate 2. Early Start ii) Early Finish iii) Late Start iv) Late Finish v) Total Slack vi) Free Slack 3. If job 2-3 takes 6 days instead of 3 days, how will it affect the completion date of the project?. | CO3 | | Apply | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | Obtain the initial basic feasible solution using Vogel’s approximation and optimize the transportation cost using UV method.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | D1 | D2 | D3 | D4 | Supply | | O1 | 1 | 2 | 1 | 4 | 30 | | O2 | 3 | 3 | 2 | 1 | 50 | | O3 | 4 | 2 | 5 | 9 | 20 | | Demand | 20 | 40 | 30 | 10 |  | | CO4 | | Apply | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | A Tyre manufacturing plant has a supply of 12,000 tyres / year to an automobile company. The demand is fixed and known. Shortage cost is assumed to be infinite. The inventory holding cost is Rs. 0.15 / tyre/month and set-up cost per run is Rs. 325.  Determine  a) Optimum run size  b) Optimum scheduling period  c) Minimum total expected yearly cost | CO5 | | Apply | 12 |
|  | |  |  |  | |  |  |
| 23. | |  | In a medium scale industry, a tool and cutter grinder operator finds that the time spent on each tool has an exponential distribution with mean 25 minutes. If he grinds tools in the order in which they come in and arrival of tools for grinding is approximately Poisson with an average rate of 11 per 8 hours day, what is the operators expected idle time each day. How many jobs are ahead of the average tool just brought in ? | CO6 | | Apply | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | |  | There are 6 jobs which are supposed to undergo processing on 5 machines A, B, C, D, E in the order A-B-C-D-E. The processing time in minutes is given in the table. Determine the a) optimal sequence, b) minimum elapsed time and c) idle time of each machine.   |  |  | | --- | --- | | **Jobs** | **Machine** | | **A** | **B** | **C** | **D** | **E** | | **1** | 8 | 3 | 1 | 3 | 8 | | **2** | 7 | 4 | 4 | 3 | 6 | | **3** | 5 | 1 | 4 | 2 | 3 | | **4** | 4 | 3 | 3 | 1 | 5 | | **5** | 7 | 2 | 2 | 2 | 8 | | **6** | 8 | 1 | 1 | 2 | 6 | | CO2 | | Apply | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Correlate this subject knowledge with the engineering problems. |
| CO2 | Construct flexible approximate mathematical models to represent physical Problems. |
| CO3 | Schedule their engineering projects by using network analysis. |
| CO4 | Analyze the transportation problem and optimize resources and output. |
| CO5 | Apply knowledge in solving their engineering queuing problems. |
| CO6 | Develop their skills in decision making analysis by allocating resources. |

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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 | 1 | 4 | 24 | - | - | - | 29 |
| CO3 | 1 | 3 | 24 | - | - | - | 28 |
| CO4 | 5 | 1 | 12 | - | - | - | 18 |
| CO5 | 1 | 3 | 12 | - | - | - | 16 |
| CO6 | 1 | 3 | 12 | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18ME2040** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTATIONAL FLUID DYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | According to Newton’s second law, the rate of increase of momentum of fluid particle is equal to \_\_\_\_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | Write the different types of forces acting on a fluid particle. | | CO1 | R | | 1 |
| 3. | Define curl and write the significance. | | CO2 | U | | 1 |
| 4. | What are the basic properties of discretization schemes? | | CO2 | U | | 1 |
| 5. | Write the condition for implicit discretization of the unsteady conductive heat transfer? | | CO3 | R | | 1 |
| 6. | Define the term “diffusion”. | | CO3 | R | | 1 |
| 7. | The flow in which property which is not varying with time is called \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 8. | Define explicit scheme of discretization. | | CO4 | U | | 1 |
| 9. | SIMPLER stands for \_\_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | What is the non-dimensional number which is used to differentiate the type of flow’ laminar or turbulent? | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Write the differential form of general transport equation. | | CO1 | | U | 3 |
| 12. | Differentiate uniform and non-uniform grids. | | CO2 | | U | 3 |
| 13. | Write the differential form of 2D unsteady diffusion. | | CO3 | | R | 3 |
| 14. | Write the differential form of steady convection diffusion equation. | | CO4 | | U | 3 |
| 15. | Write the two main problems associated with the solution of momentum and continuity equation. | | CO5 | | An | 3 |
| 16. | Explain the different regions of boundary layer in a pipe flow. | | 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. |  | Derive the three-dimensional mass conservation equation for a compressible fluid. | CO1 | | An | 12 |
| 18. |  | Explain the different types of discretization techniques using finite difference methods. | CO2 | | A | 12 |
| 19. |  | Derive the discretized form of equation for 1D steady diffusion problem. | CO3 | | A | 12 |
| 20. |  | Derive the discretized equation for convection diffusion using upwind difference scheme. | CO4 | | A | 12 |
| 21. |  | Explain staggered grid in detail explaining the concept of correct prediction of pressure field. | CO5 | | An | 12 |
| 22. |  | Consider the problem of source free heat conduction in an insulated rod whose ends are maintained at constant temperatures of 100℃ and 500℃ respectively. Calculate the steady state temperature distribution in the rod if the length of the rod is 0.5 m, thermal conductivity equals to 1000 W/mK, and cross-sectional area is 10-2 m2. Divide the rod into five equal control volumes and solve the problem. | CO3 | | An | 12 |
| 23. |  | Describe the method of solving discretization equations using SIMPLER algorithm. | CO5 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | What is the criterion for a turbulence model to be useful in a CFD code? Explain two equation turbulence model. | CO6 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Formulate the required governing equations for flow and heat transfer problems. |
| CO2 | Discretize the governing equations of flow and heat transfer problems. |
| CO3 | Solve the diffusion equations. |
| CO4 | Solve the diffusion-convection equations. |
| CO5 | Use appropriate algorithms to solve the discretized equations. |
| CO6 | Apply turbulence models to accurately predict the variables based on the flow characteristics. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | - | 12 | - | - | 17 |
| CO2 | - | 5 | 12 | - | - | - | 17 |
| CO3 | 5 | - | 12 | 12 | - | - | 29 |
| CO4 | 1 | 4 | 12 | - | - | - | 17 |
| CO5 |  | 1 | 12 | 15 | - | - | 28 |
| CO6 | 1 | 15 | - | - | - | - | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

Description automatically generated with medium confidence**

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| **Course Code** | **18ME2044** | **Duration** | **3hrs** |
| **Course Name** | **REFRIGERATION AND AIR CONDITIONING** | **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 COP of the refrigerating system is the ratio of heat absorbed from the system to the \_\_\_\_\_\_\_\_\_ on the system. | | CO1 | | U | | 1 |
| 2. | State the function of capillary coil. | | CO1 | | R | | 1 |
| 3. | Name few secondary refrigerants. | | CO2 | | R | | 1 |
| 4. | Reveal the lowest temperature produced by adiabatic demagnetization process? | | CO2 | | U | | 1 |
| 5. | What is dry ice? | | CO3 | | R | | 1 |
| 6. | Moist air is the mixture of dry air and \_\_\_\_\_\_\_\_\_. | | CO3 | | R | | 1 |
| 7. | Define infiltration. | | CO4 | | U | | 1 |
| 8. | Enumerate the RH at dew point temperture. | | CO4 | | R | | 1 |
| 9. | What is the basis for estimating the capacity of refrigeration plant? | | CO5 | | U | | 1 |
| 10. | Name any one of the refrigerant used in Ice Plant. | | CO6 | | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Define unit of refrigeration. | | CO1 | | | A | 3 |
| 12. | Compare the flooded type evaporator and dry evaporators. | | CO2 | | | An | 3 |
| 13. | Summarize the important characteristics of absorbers in vapour absorption system. | | CO3 | | | U | 3 |
| 14. | State the term “effective temperature”. | | CO4 | | | U | 3 |
| 15. | Describe the factors that affects the human comfort. | | CO5 | | | An | 3 |
| 16. | Clarify pasteurization. | | 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. | A dense air refrigeration machine works on the Bell-Coleman cycle with 10 TR capacity. The cooler pressure is 4.2 bar and refrigerator pressure is 1.4 bar. The air is cooled to temperature of 50°C in the cooler. The temperature of air at inlet to compressor is -20°C. Determine the COP of the system. | | CO1 | | A | 8 |
|  | b. | Describe the boot-strap cycle of air refrigeration system? Draw T-S diagram. | | CO1 | | U | 4 |
| 18. |  | Explain the working principle and function of a refrigerant compressors with a neat sketch. | | CO2 | | U | 12 |
| 19. |  | Discuss briefly about the followings:   1. By-pass factor of heating and cooling coil 2. Efficiency of heating and cooling coil 3. Humidification and dehumidification processes. | | CO3 | | A | 12 |
| 20. | a. | State the factors that determine human comfort. | | CO4 | | An | 4 |
|  | b. | Atmospheric air at a DBT of 16°C and 25% R.H passes through a furnace and then through a humidifier, in such a way that the final DBT is 30°C and 50% R.H. Find the heat and moisture added to the air. | | CO4 | | An | 8 |
| 21. |  | Explain the summer air conditioning system with a sketch. | | CO5 | | E | 12 |
| 22. |  | The following data refer to an air conditioning system of a cinema hall for winter conditions:  Outdoor conditions = 10°C DBT, 60% R.H  Required comfort conditions = 22°C DBT, 60% R.H  Seating capacity of hall = 2000  Amount of outdoor air supplied = 0.25 m³/min/person. The required condition is achieved by heating, humidifying and then again by heating, Find the capacity of the humidifier, heating capacity of the first heater and surface temperature of the coil if the by-pass factor is 0.3. The air coming out of the humidifier is having 75% R.H. | | CO4 | | C | 12 |
| 23. |  | Discuss briefly the different types of heat loads which have to be taken into account in order to estimate the total heat load of a large restaurant for summer air conditioning. | | CO5 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. |  | Discuss the applications of air conditioning in textile and food industry. | CO6 | | | A | 12 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Understand various refrigeration systems. | | | | | | | |
| CO2 | Demonstrate the working of refrigeration equipment. | | | | | | | |
| CO3 | Understand various psychrometric processes. | | | | | | | |
| CO4 | Estimate the space cooling load. | | | | | | | |
| CO5 | Design the air-conditioning equipments. | | | | | | | |
| CO6 | Select suitable refrigeration and air-conditioning systems for various applications. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 1 | 5 | 11 | - | - | - | 17 |
| CO2 | | 1 | 13 | - | 3 | - | - | 17 |
| CO3 | | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | | 1 | 4 | - | 12 | - | 12 | 29 |
| CO5 | | - | 1 | - | 3 | 24 | - | 28 |
| CO6 | | - | 4 | 12 | - | - | - | 16 |
|  | | | | | | | | **124** |

**Graphical user interface, application

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| **Course Code** | **18ME2055** | **Duration** | **3hrs** |
| **Course Name** | **COMPUTER AIDED DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | GKS means\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | U | | 1 |
| 2. | IGES stands for\_\_\_\_\_\_\_\_\_\_\_. | | | CO1 | R | | 1 |
| 3. | List four widely used graphics standards. | | | CO2 | R | | 1 |
| 4. | Write the application of Bresenham’s algorithms. | | | CO2 | R | | 1 |
| 5. | Define wireframe in geometric modelling. | | | CO3 | U | | 1 |
| 6. | What are the advantages of B-Spline curves? | | | CO3 | R | | 1 |
| 7. | Expand the term CRT | | | CO4 | U | | 1 |
| 8. | Define the term CAD. | | | CO4 | R | | 1 |
| 9. | Write the application of FEM in various fields. | | | CO5 | U | | 1 |
| 10. | Define Reverse Engineering. | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Write short notes on reasons for implementing CAD. | | | CO1 | | R | 3 |
| 12. | Explain Translation with an example. | | | CO2 | | U | 3 |
| 13. | List out the properties of Bezier curves. | | | CO3 | | R | 3 |
| 14. | Discuss the raster scanning techniques. | | | CO4 | | U | 3 |
| 15. | Define shape function in finite element method. | | | CO5 | | R | 3 |
| 16. | Write short notes on laser and non-laser process of RPT. | | | 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 briefly about the advantages and limitations of CAD. | CO1 | | A | 8 |
|  | | b. | How the CAD / CAM overlaid by product cycle? | CO1 | | U | 4 |
|  | |  |  |  | |  |  |
| 18. | |  | Explain briefly the DDA and Bresenham’s algorithms. | CO2 | | An | 12 |
|  | |  |  |  | |  |  |
| 19. | |  | Describe the parametric representation of Bezier curve, B-spline and rational curves. | CO3 | | A | 12 |
|  | |  |  |  | |  |  |
| 20. | |  | Discuss the stages in the product life cycle and the importance of each stage. | CO4 | | A | 12 |
|  | |  |  |  | |  |  |
| 21. | |  | Discuss the step by step procedure of the finite element method. | CO5 | | A | 12 |
|  | |  |  |  | |  |  |
| 22. | |  | Explain in detail the CSG techniques with example. | CO3 | | An | 12 |
|  | |  |  |  | |  |  |
| 23. | |  | Describe CRT and DVST. | CO4 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Explain various RPT processes with neat sketch. | CO6 | | U | 9 |
|  | | b. | Define STL. Write its significance. | CO6 | | R | 3 |

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the basic structure and components of CAD. |
| CO2 | Outline the process of representing graphical entities in a CAD environment. |
| CO3 | Construct the geometric model using different techniques to represent a product. |
| CO4 | Illustrate various techniques and devices involved in CAD hardware. |
| CO5 | Analyze the models for design solutions using FEM. |
| CO6 | Discuss the various computer aided tools implemented in various industrial applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 4 | 5 | 8 | - | - | - | 17 |
| CO2 | 2 | 3 | - | 12 | - | - | 17 |
| CO3 | 4 | 1 | 12 | 12 |  |  | 29 |
| CO4 | 1 | 4 | 24 | - |  |  | 29 |
| CO5 | 3 | 1 | 12 |  |  |  | 16 |
| CO6 | 3 | 13 |  |  |  |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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| **Course Code** | **18ME2058** | **Duration** | **3hrs** |
| **Course Name** | **MECHATRONICS SYSTEM** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | |
| 1. | Name different types of Industrial Automation. | CO1 | R | 1 |
| 2. | Illustrate the LVDT principle. | CO2 | U | 1 |
| 3. | Abbreviate the following: PLC and ABS. | CO1 | R | 1 |
| 4. | Define Mechatronics according to NEMA. | CO3 | R | 1 |
| 5. | Draw the simple sketch of shunt type DC motor. | CO2 | U | 1 |
| 6. | Define protective relay. | CO4 | R | 1 |
| 7. | Name different types of electromechanical devices. | CO4 | R | 1 |
| 8. | List various applications of PLC. | CO6 | U | 1 |
| 9. | Draw the the pin diagram of any microprocessor and name it. | CO5 | U | 1 |
| 10. | State the principle of piezoelectric effect. | CO5 | R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | Identify the various elements that might be present in a control system involving a thermostatically controlled electric heater. | CO1 | A | 3 |
| 12. | Elaborate the working principle of inductive type proximitysensor. | CO2 | E | 3 |
| 13. | Illustrate the components of a basic pneumatic system. | CO3 | A | 3 |
| 14. | Discuss about Shape Memory Alloy. | CO4 | U | 3 |
| 15. | Describe the working of a magneto stricture transducers. | CO5 | A | 3 |
| 16. | Analyse the scanning the instructions in PLC controllers. | CO6 | An | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23)** | | | | | |
| 17. | a. | Describe an interdisciplinary nature of Mechatronics. | CO1 | E | 6 |
| b. | Elaborate various levels of integration in Mechatronics systems. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Identify the various elements that might be present in acontrol system involving a thermostatically controlled electric heater. | CO2 | An | 8 |
| b. | Analyze one application of mechatronics systems like washing machine. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Describe in detail the principle, application and the uses of potentiometer. | CO3 | U | 8 |
| b. | Describe the working of optical encoder with neat diagram. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate stepper motor basics, types, uses and working principles with neat diagram. | CO6 | E | 6 |
| b. | Demonstrate the principle of operation for variable reluctance stepper motor. | CO6 | E | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe the concept of Piezoelectric Effect with neat drawing and discuss the working principle. | CO5 | U | 6 |
| b. | Narrate the working of a magneto restrictive transducer. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the working of Electro-hydraulic power steering system in automobile with neat diagram. | CO4 | A | 6 |
| b. | Describe some of the I/O devices used for PLC. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Describe the basic principle of Anti-lock Braking Systemwith neat diagram. | CO5 | E | 6 |
| b. | Discuss the working of SMA sensor with an example. | CO5 | E | 6 |
|  |  |  |  |  |  |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Draw the block diagram of PLC and describe the function of various components. | CO6 | A | 6 |
| b. | Devise a system, using a PLC, which can be used to control the movement of a piston in a cylinder so that when a switch is momentarily pressed, the piston moves in one direction and when a second switch is momentarily pressed, the piston moves in the other direction. Hint: consider using a 4\_2 solenoid-controlled valve. | CO6 | R | 6 |

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| **COURSE OUTCOMES** | |
| After completing the course, the student will be able to | |
| CO1 | Summarize and recall the overview of mechatronics applications. |
| CO2 | Demonstrate knowledge of electrical circuits and logic design. |
| CO3 | Develop and formulate engineering solutions and techniques to solve design problems. |
| CO4 | Design mechatronic components and systems. |
| CO5 | Classify and select various micro-sensors and microprocessors for a specific problem. |
| CO6 | Develop PLC programs for a given task. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 0 | 9 | 0 | 6 | 0 | 17 |
| CO2 | 0 | 2 | 4 | 8 | 3 | 0 | 17 |
| CO3 | 1 | 12 | 3 | 0 | 0 | 0 | 16 |
| CO4 | 2 | 3 | 12 | 0 | 0 | 0 | 17 |
| CO5 | 1 | 13 | 3 | 0 | 12 | 0 | 29 |
| CO6 | 6 | 1 | 6 | 3 | 12 | 0 | 28 |
| **Total** | 12 | 31 | 37 | 11 | 33 | 0 | **124** |

**Graphical user interface, application

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| **Course Code** | **18ME2060** | **Duration** | **3hrs** |
| **Course Name** | **INDUSTRIAL SAFETY ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the term OSHA. | | CO1 | U | 1 |
| 2. | MSDS stands for \_\_\_\_\_\_\_\_\_\_. | | CO1 | R | 1 |
| 3. | Tabulate the functions of safety trip control. | | CO2 | R | 1 |
| 4. | Define guarding. | | CO2 | R | 1 |
| 5. | Quote few examples for fusion welding. | | CO3 | U | 1 |
| 6. | The eye protective equipment used during welding process is \_\_\_\_\_\_\_\_\_\_. | | CO3 | R | 1 |
| 7. | List the short- term health effects undergone by labor in paint shop. | | CO4 | U | 1 |
| 8. | Give some examples for Acid corrosives. | | CO4 | R | 1 |
| 9. | PEL stands for \_\_\_\_\_\_\_\_\_\_. | | CO5 | U | 1 |
| 10. | The process of modifying a metal’s properties is called \_\_\_\_\_\_\_\_\_\_. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Distinguish between accidents and injuries. | | CO1 | An | 3 |
| 12. | State the working principle of pull back device. | | CO2 | U | 3 |
| 13. | List the factors to be considered while identifying the causes of accident. | | CO3 | An | 3 |
| 14. | Tabulate the advantages of presence sensing device. | | CO4 | A | 3 |
| 15. | Quote some common electrical hazards faced by a worker. | | CO5 | An | 3 |
| 16. | State the safety precautions to be followed during electroplating process. | | 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. |  | Assess the various roles and responsibilities of safety engineer and safety department in an industry. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. |  | Describe the various safety committees to be formed in an organization. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Interpret the various safe guarding special attachment used in industries and its advantages. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Articulate the various safety principles to be followed during Arc welding process and name some protective equipments used. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | List out the various health and environmental hazard faced by a worker during handling of various chemicals in chemical industry. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Assess the safety requirements recommended in an industry for the use of power press by a safety director. | CO5 | E | 8 |
|  | b. | Quote any four safety principles that should be practiced during  Gas welding process. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 23. |  | Explain the various safety principles to be followed in heat treatment process. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | List various safety factors to be considered during Hydro testing process. | CO6 | E | 6 |
|  | b. | Identify the various safety protocols to be followed and implemented in paint shop. | CO6 | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understanding the importance of safety in process industries. |
| CO2 | Understanding the ethical issues that may arise from industrial processes. |
| CO3 | Communicate the difference between Hazard and Risk. |
| CO4 | Be able to express Safety in terms of Risk and to recognize unacceptable/inappropriate levels of Risk. |
| CO5 | Be able to Assess & identify the potential hazards in process industries. |
| CO6 | Appreciation and applying safety procedures in process industries. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 |  | 3 | 12 |  | 17 |
| CO2 | 2 | 3 |  | 12 |  |  | 17 |
| CO3 | 1 | 1 | 16 | 3 |  |  | 21 |
| CO4 | 1 | 1 | 3 | 12 | 12 |  | 29 |
| CO5 |  | 1 |  | 15 | 8 |  | 24 |
| CO6 |  | 1 | 9 |  | 6 |  | 16 |
|  | | | | | | | **124** |

**Graphical user interface, application

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| **Course Code** | **18ME2063** | **Duration** | **3hrs** |
| **Course Name** | **RAPID MANUFACTURING TECHNOLOGIES** | **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 of a Rapid Prototyping process. | | CO1 | U | | 1 |
| 2. | Recite the expansion of STL. | | CO1 | R | | 1 |
| 3. | Name the software used for CAD model slicing. | | CO2 | R | | 1 |
| 4. | State any one application of reverse engineering. | | CO2 | R | | 1 |
| 5. | Express the basic principle of SLA. | | CO3 | U | | 1 |
| 6. | State True or False: SGC is a liquid based RP system. | | CO3 | R | | 1 |
| 7. | Discover any one application of LOM. | | CO4 | U | | 1 |
| 8. | Recall the process variables of FDM systems. | | CO4 | R | | 1 |
| 9. | Differentiate SLS and 3DP. | | CO5 | U | | 1 |
| 10. | Recognize the expansion of LENS. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Explain the applications of Rapid Tooling. | | CO1 | | An | 3 |
| 12. | State the use of digitization techniques in CAD modelling. | | CO2 | | U | 3 |
| 13. | Evaluate the recoating issues occurring in SLA. | | CO3 | | An | 3 |
| 14. | Illustrate the construction of a FDM system with a neat sketch. | | CO4 | | U | 3 |
| 15. | Estimate the strengths and weaknesses of 3DP systems. | | CO5 | | An | 3 |
| 16. | Give examples for indirect tooling methods. | | 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. |  | Compile the features of RP process chain. | CO1 | | C | 12 |
|  |  |  |  | |  |  |
| 18. |  | Explain Part orientation and support generation in RP systems. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. | a. | Develop photo polymerization of SL resins. | CO3 | | A | 6 |
|  | b. | Construct the strengths, weaknesses and applications of SGC. | CO3 | | A | 6 |
|  |  |  |  | |  |  |
| 20. |  | Express the details of processes and materials used in LOM. | CO4 | | C | 12 |
|  |  |  |  | |  |  |
| 21. |  | Estimate the strengths, weaknesses and applications of powder based 3DP systems. | CO5 | | E | 12 |
|  |  |  |  | |  |  |
| 22. | a. | Discover the different types of FDM systems. | CO4 | | A | 6 |
|  | b. | Determine the products developed using LOM systems. | CO4 | | A | 6 |
|  |  |  |  | |  |  |
| 23. |  | Deduce the process involved in tool path generation for CAD modelling. | CO2 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Appraise the working of Controlled Metal Build-up (CMB) with neat sketch. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Differentiate conventional and rapid manufacturing approach. |
| CO2 | Demonstrate the knowledge of Rapid Manufacturing technologies. |
| CO3 | Understand the need and place for RP in an integrated manufacturing environment. |
| CO4 | Get exposed to commercial Rapid Prototyping systems. |
| CO5 | Possess knowledge on Rapid Prototyping software. |
| CO6 | Model and manufacture RP components. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | - | 3 | - | 12 | 17 |
| CO2 | 2 | 3 | - | 24 | - | - | 29 |
| CO3 | 1 | 1 | 12 | 3 | - | - | 17 |
| CO4 | 1 | 4 | 12 | - | - | 12 | 29 |
| CO5 | - | 1 | - | 3 | 12 | - | 16 |
| CO6 | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |

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| **Course Code** | **18ME2067** | **Duration** | **3hrs** |
| **Course Name** | **AUTOMOBILE ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Identify the difference between petrol engine and diesel engine. | | CO1 | U | | 1 |
| 2. | State the functions of cylinder liners. | | CO1 | R | | 1 |
| 3. | State the function of flywheel in an automobile. | | CO2 | R | | 1 |
| 4. | Recall the function of a universal joint. | | CO2 | R | | 1 |
| 5. | Identify the difference between understeer and oversteer. | | CO3 | U | | 1 |
| 6. | Recall the difference between dampers and springs in a vibrating system. | | CO3 | R | | 1 |
| 7. | State any two advantages of Common Rail Direct Injection System. | | CO4 | U | | 1 |
| 8. | Identify the function of foot valve in pneumatic braking system. | | CO4 | R | | 1 |
| 9. | Identify the role of turbocharger in diesel engine. | | CO5 | U | | 1 |
| 10. | Indicate how hybrid vehicles differs from other vehicles. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Compare four wheel drive and two wheel drive. | | CO1 | | An | 3 |
| 12. | Identify the functions of a clutch in an automobile. | | CO2 | | U | 3 |
| 13. | Distinguish dependent and independent suspension systems. | | CO3 | | An | 3 |
| 14. | Identify the roles of Traction Control System (TCS) in automobiles. | | CO4 | | U | 3 |
| 15. | Compare mechanical injection system and Electronic injection system. | | CO5 | | An | 3 |
| 16. | Indicate how air can be used as a fuel in automobiles. | | 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. | Internal combustion engine's performance and efficiency have been governed by variable valve control technology. Justify the statement. | CO1 | | E | 6 |
|  | b. | Discuss the functions, components and working of valve actuating mechanism. | CO1 | | U | 6 |
| 18. | a. | Outline how automated Hotchkiss drive differs from Torque tube Drive. List their advantages and limitations. | CO2 | | An | 6 |
|  | b. | Discuss the requirements, types and advantages of propeller shaft in a transmission system. | CO2 | | U | 6 |
| 19. | a. | Explain the working of hydro elastic suspension system. | CO3 | | U | 6 |
|  | b. | Compare hydraulic power steering system with electronic power steering. | CO3 | | An | 6 |
| 20. | a. | Anti-lock braking system has become a vital safety feature even in common vehicles. Justify the statement highlighting its working principle and advantages. | CO4 | | E | 6 |
|  | b. | Compare pressed steel disc wheels with alloy wheels highlighting their advantages and limitations. | CO4 | | An | 6 |
| 21. | a. | Compare transistor based coil ignition system and capacitive discharge ignition systems in terms of working principle. | CO5 | | An | 6 |
|  | b. | Common Rail Direct Injection system provides improved overall engine performance and better fuel efficiency. Justify. | CO5 | | E | 6 |
| 22. | a. | Compare the constructional features and merits of Tubeless tyres over Tubed Tyres. | CO4 | | An | 6 |
|  | b. | Electronic brake force distribution improves stability of automobiles during braking. Justify. | CO4 | | E | 6 |
| 23. | a. | Illustrate in detail the components of an IC engine with neat sketch. | CO1 | | A | 6 |
|  | b. | Compare front engine rear wheel drive layout and rear engine rear wheel drive layout. | CO1 | | An | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Compare hydrogen fuel cell vehicles and electric vehicles in terms of principle, working, advantages, limitations and applications. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand different types of internal combustion engines. |
| CO2 | Demonstrate the functions of clutch and gear box systems. |
| CO3 | Describe the types of steering and suspension systems |
| CO4 | Summarize the construction and operating principles of brakes and tyres |
| CO5 | Express the functions and components of fuel injection and ignition systems. |
| CO6 | Analyze the performance & emissions of alternate fuels. |

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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 | 6 | - | 29 |
| CO2 | 2 | 9 | - | 6 | - | - | 17 |
| CO3 | 1 | 7 | - | 9 | - | - | 17 |
| CO4 | 1 | 4 | - | 12 | 12 | - | 29 |
| CO5 | - | 1 | - | 9 | 6 | - | 16 |
| CO6 | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | **124** |



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| **Course Code** | **18ME3024** | **Duration** | **3hrs** |
| **Course Name** | **ENERGY CONSERVATION AND MANAGEMENT** | **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 different types of primary and secondary energy sources. | CO1 | U | 10 |
|  | b. | Briefly describe the present status of the national energy scenario. | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Describe various forms and grades of energy with a case study of electricity tariffs. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Briefly list down the need for an energy audit. | CO3 | U | 10 |
|  | b. | Explain different types of tools used in an energy audit. | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain the energy conservation in thermal systems -Boiler and furnace. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain with a neat sketch how energy conservation happens in electric motors. | CO5 | A | 10 |
|  | b. | List down various tips for making electrical equipment energy efficient. | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Describe the energy conservation areas in buildings. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Explain different forms of energy and elaborate on the thermal energy strategy. | CO2 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Distinguish between commercial and non-commercial energy resources. | CO1 | A | 10 |
|  | b. | List down various energy strategies for the future. | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Explain the methods in energy management principles of life cycle costing. | CO6 | A | 10 |
|  | b. | Briefly explain financial management, Simple payback period. | E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the present status of national energy scenario. |
| CO2 | Compare the different forms of energy. |
| CO3 | Apply various energy auditing methods. |
| CO4 | Analyze the energy conservation areas in thermal systems. |
| CO5 | Estimate the energy conservation areas in electrical systems. |
| CO6 | Choose the different financial management methods |

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



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| **Course Code** | **18ME3025** | **Duration** | **3hrs** |
| **Course Name** | **SOLAR ENERGY UTILIZATION** | **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 energy alternatives with a neat block diagram. | CO1 | U | 10 |
|  | b. | Discuss about extra-terrestrial radiation with neat sketch. | A | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Derive the energy balance equation for the solar collectors. Also derive the heat transfer factors. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 3. | a. | Explain different types of collectors and analyze the performance of parabolic concentrator. | CO3 | U | 10 |
|  | b. | Explain the shape, orientation and performance of concentrating collectors. | A | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain the performance analysis of conventional air heater. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 5. | a. | Explain different types of solar storage plants with a neat sketch. | CO5 | A | 10 |
|  | b. | Elaborate the practical difficulties in extraction of thermal energy application of solar ponds. | R | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the testing procedure of solar air heater. | CO4 | An | 20 |
|  |  |  |  |  |  |
| 7. |  | Derive the thermal analysis of flat plate collector and useful heat gained by the fluid. | CO2 | E | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Explain about clear sky irradiation. | CO1 | A | 10 |
|  | b. | Estimate of average solar radiation on tilted surface. | An | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe the working principle of solar electric power generation with a neat sketch | CO6 | A | 10 |
|  | b. | Explain the thermo electric refrigeration system. | E | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Discuss the present status of national energy scenario. |
| CO2 | Compare the different forms of energy. |
| CO3 | Apply various energy auditing methods. |
| CO4 | Analyze the energy conservation areas in thermal systems. |
| CO5 | Estimate the energy conservation areas in electrical systems. |
| CO6 | Choose the different financial management methods. |

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

**Graphical user interface, application

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| **Course Code** | **19ME1003** | **Duration** | **3hrs** |
| **Course Name** | **ENGINEERING MECHANICS** | **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 study of the effect of a force system acting on a particle or rigid body at rest is called as \_\_\_\_\_\_\_. | | CO1 | U | | 1 |
| 2. | The relation F= ma is based on \_\_\_\_\_\_\_. | | CO1 | R | | 1 |
| 3. | Define concurrent force system. | | CO2 | R | | 1 |
| 4. | In free body diagram, a cable is always represented by \_\_\_\_\_\_\_ force | | CO2 | R | | 1 |
| 5. | Where is the center of gravity of a semicircle? | | CO3 | U | | 1 |
| 6. | The relation used by the parallel axis theorem is \_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 7. | The number of component of reaction at hinge support are \_\_\_\_\_\_\_. | | CO4 | U | | 1 |
| 8. | The coefficient of restitution for inelastic bodies is \_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 9. | The frictional force is directly proportional to the \_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | Define the coefficient of friction. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Find the moment with respect of the point O in the given figure | | CO1 | | An | 3 |
| 12. | Force AB of 12N joins the points of coordinates A (6,5,3) and B (3,5,9). Express the force in vector form. | | CO2 | | U | 3 |
| 13. | Find the resultant of the following force system | | CO3 | | An | 3 |
| 14. | Classify the types of friction. | | CO4 | | U | 3 |
| 15. | Recall the moment of inertia of a triangle and semi-circle. | | CO5 | | An | 3 |
| 16. | Rephrase the term rigid bodies. | | 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. |  | Knowing that the tension in cable BC is 725N, determine the resultant of the three forces exerted at point B of the beam AB.  Internal 1 EM | CO1 | | E | 12 |
|  |  |  |  | |  |  |
| 18. |  | The tension in the supporting cable AB is 10KN. Write the force which the cable exerts on the beam BC as a vector T. Determine the angles of vector T form with the positive x, y and z axis. | CO2 | | A | 12 |
|  |  |  |  | |  |  |
| 19. |  | Three smooth pipes each weighing 20 kN and of diameter 60 cm are to be placed in a rectangular channel with horizontal base as in the fig.4. Calculate the reactions at the points of contacts between the pipes and between the channel and the pipes. Take, width of the channel as 160 cm. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | Calculate the moment of inertia of the figure. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | Two planes AC and BC are inclined at 60° and 30° to the horizontal meet at C. A load of 1500 N rests on the plane BC and is tied by a rope passing over a frictionless pulley to a block weighing W N and resting on the plane AC as in the fig.5. The coefficient of friction between 1500 N weight and plane BC is 0.3 and between W and plane AC is 0.27. Determine the least and greatest values of W for the equilibrium of the system. | CO5 | | E | 12 |
|  |  |  |  | |  |  |
| 22. |  | 2 weights are connected by a string and move along the rough horizontal plan under action of force 40 N, applied to the first weight as in the fig.8. The coefficient of friction between sliding surfaces of weights and the plane is 0.3. Determine the acceleration of weights in tension in the string using D’Alembert’s principle. | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 23. |  | A cable is wound around a 20 kg cylinder of radius 220 mm as in the fig.9 and its free end is subjected to a constant horizontal pull of 10 N. What is the angular velocity of the cylinder 5 s after the commencement of motion from rest. There is no slip between the cylinder and the plate. | CO6 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | A uniform ladder weighing 100N and 5 meters long has lower end B resting on the ground and upper end A resting against a vertical wall as shown in fig.the inclination of the ladder with horizontal is 60°.if the coefficient of the friction at all surfaces of contact is 0.25, determine how much distance up long the ladder a man weighing 600N can ascent without causing it to slip. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Determine the resultant force and moment for a given system of forces. |
| CO2 | Understand basics of the equilibrium of rigid bodies |
| CO3 | Determine the centroid and second moment of area of simple solids. |
| CO4 | Apply fundamental concepts of kinematics and kinetics to the analysis of simple / practical problems. |
| CO5 | ﻿Understand basic kinematics concepts – displacement, velocity and acceleration. |
| CO6 | Determine friction and its effects as per the laws of friction. |

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

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| **Course Code** | **19ME2025** | **Duration** | **3hrs** |
| **Course Name** | **ENGINEERING THERMODYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome / Pattern** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Zeroth law of thermodynamics explains about   1. Entropy b) Enthalpy c) Temperature equilibrium d) Heat engines | | CO1/R | | 1 |
| 2. | In closed system \_\_\_\_\_\_\_\_\_\_\_\_ only transfer | | CO1/U | | 1 |
| 3. | Nozzle is used to increase the \_\_\_\_\_\_\_\_\_\_\_\_\_ and decrease the \_\_\_\_\_\_\_\_\_\_\_ | | CO2/Ap | | 1 |
| 4. | Entropy deals with   1. Excess energy b) Waste of energy c) Useful energy d) Enthalpy | | CO2/Ap | | 1 |
| 5. | An ideal gas is one which obeys the law pv=RT at all pressures and temperatures.  a) true b) false | | CO3/U | | 1 |
| 6. | Heat can transfer from \_\_\_\_\_\_\_\_\_ temperature to \_\_\_\_\_\_\_\_\_ temperature automatically. | | CO3/R | | 1 |
| 7. | In which the chemical compositions are in equilibrium  a) Pure substance b) Impure substance c) Latent heat d) Sensible heat | | CO4/An | | 1 |
| 8. | The gas constant value R=\_\_\_\_\_\_\_\_ | | CO4/R | | 1 |
| 9. | The study about moist air is called\_\_\_\_\_\_\_\_\_\_\_ | | CO5/Un | | 1 |
| 10. | For the same maximum pressure and temperature, what is the relation among the efficiencies of the Otto cycle, the Diesel cycle and the Dual cycle?   1. ηDual>ηDiesel>ηOtto b) ηDiesel>ηDual>ηOtto   c) ηDiesel>ηOtto>ηDual d) ηOtto>ηDiesel>ηDual | | CO6/E | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | What is mean by Quasi-Static process? | CO1/U | | 3 | |
| 12. | State the Clausius and Kelvin-Plank statements. | CO2/R | | 3 | |
| 13. | What are all the modes of heat transfer? | CO3/R | | 3 | |
| 14. | Write the Dalton’s law of Partial pressure. | CO4/U | | 3 | |
| 15. | Define relative humidity. | CO5/C | | 3 | |
| 16. | Draw the P-V and T-S diagram foe diesel cycle and write the processes names. | CO6/An | | 3 | |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | A piston- cylinder device contains 0.15 kg of air initially at 2 MPa and. The air is first expanded isothermally to 500 kPa, then compressed polytropically with a polytropic exponent of 1.2 to the initial pressure and finally compressed at the constant pressure to the initial state. Determine the boundary work for each process and network of the cycle. | CO1 / E | 12 |
|  |  |  |  |  |
| 18. | a. | Derive the steady flow energy equation for nozzle and turbine. | CO2 / C | 12 |
|  |  |  |  |  |
| 19. | a. | A vessel of volume contains a mixture of saturated water and steam at a temperature of. The mass of the liquid present is 9 kg. Find the pressure, mass, specific volume, enthalpy, entropy and internal energy. | CO3 /An | 12 |
|  |  |  |  |  |
| 20. | a. | Explain the triple point with suitable diagram. | CO4 / U | 6 |
| b. | Draw the P-V-T surface for water. | CO4 / R | 6 |
|  |  |  |  |  |
| 21. | a. | Explain adiabatic mixing process? | CO5 / A | 6 |
| b. | Briefly discuss about evaporate cooling process | CO6 /A | 6 |
|  |  |  |  |  |
| 22. | a. | The sling psychrometer in a laboratory test recorded the following readings Dry bulb temperature = 25°C, Wet bulb temperature = 15°C, Barometer readings = 760 mm of Hg, Partial pressure = 10 mm of Hg, Determine the specific humidity and saturation ratio? | CO6 / E | 12 |
|  |  |  |  |  |
| 23. | a. | In an oil engine working on dual cycle the heat supplied at constant pressure is twice that of the heat supplied at constant volume.The compression and expansion ratios are 8 and 5.3.The pressure and at the beginning of compression are 0.93 bar and 27oC .Find the efficiency of the cycle and mean effective pressure.TakeCp and Cv as 1.005 kJ/kgK and 0.718 kJ/kg K. | CO6 /An | 12 |
|  |  | **Compulsory:** | | |
| 24. | a. | Derive an expression for an air standard efficiency and mean effective pressure of Diesel cycle | CO1/An | 12 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Understand the basic concepts in thermodynamics and energy balance to systems and control volumes, in situations involving heat and work interactions. | | | | | | | |
| CO2 | Differentiate between high grade and low grade energies. | | | | | | | |
| CO3 | Evaluate changes in thermodynamic properties of pure substances. | | | | | | | |
| CO4 | Apply gas laws to solve problems related to gas mixtures. | | | | | | | |
| CO5 | Create psychrometric chart to perform moist air process calculations | | | | | | | |
| CO6 | Recognize the significance of I law for reacting systems and heating value of fuels. | | | | | | | |
| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 1 | 4 | - | 12 | 12 | - | 29 |
| CO2 | | 3 | - | 2 | - | - | 12 | 17 |
| CO3 | | 4 | 1 | - | 12 | - | - | 17 |
| CO4 | | 7 | 9 | - | 1 | - | - | 17 |
| CO5 | | - | 1 | 6 | - | - | 3 | 10 |
| CO6 | | - | - | 6 | 15 | 13 | - | 34 |
|  | | | | | | | | **124** |

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| **Course Code** | **19ME2026** | **Duration** | **3hrs** |
| **Course Name** | **APPLIED THERMODYNAMICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | \_\_\_\_\_\_\_\_\_\_ is an example for water tube boiler. | | CO1 | U | | 1 |
| 2. | Define evaporative capacity. | | CO1 | R | | 1 |
| 3. | Define thermal efficiency of Rankine cycle. | | CO2 | R | | 1 |
| 4. | The effect of friction in nozzle is to \_\_\_\_\_\_\_\_\_\_ dryness friction. | | CO3 | U | | 1 |
| 5. | State the function of steam nozzle. | | CO3 | R | | 1 |
| 6. | Volumetric efficiency of a reciprocating air compressor is defined as the ratio of actual volume to \_\_\_\_\_\_\_\_\_\_. | | CO4 | R | | 1 |
| 7. | In a reciprocating air compressor the compressor work is maximum during \_\_\_\_\_\_\_\_\_\_ process. | | CO4 | U | | 1 |
| 8. | The refrigerant used in water-lithium bromide absorption system is \_\_\_\_\_\_\_\_\_\_. | | CO5 | R | | 1 |
| 9. | In a refrigeration system, heat rejection takes place in \_\_\_\_\_\_\_\_\_\_. | | CO5 | U | | 1 |
| 10. | An example of velocity compounded impulse turbine is \_\_\_\_\_\_\_\_\_\_. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Classify the steam generators. | | CO1 | | U | 3 |
| 12. | Illustrate the advantages of Reheat Rankine cycle. | | CO2 | | U | 3 |
| 13. | Sketch the effect of friction for flow through nozzle in h-s diagram. | | CO3 | | U | 3 |
| 14. | List the advantages of Multistage reciprocating air compressor. | | CO4 | | R | 3 |
| 15. | Differentiate between refrigeration and air-conditioning. | | CO5 | | U | 3 |
| 16. | Differentiate between impulse and reaction turbine. | | 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 |  | In a boiler test 1250 kg of coal are consumed in 24 hours. The mass of water evaporated is 13000 kg and the mean effective pressure is 7 bar. The feed water temperature is 40°C, heating value of coal is 30000 kJ/kg. The enthalpy of 1 kg of steam at 7 bar is 2570.7 kJ. Determine:   1. Equivalent evaporation per kg of coal 2. Efficiency of the boiler. | CO1 | | A | 12 |
| 18. |  | A simple Rankine cycle works between pressure of 30 bar and 0.04 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. | CO2 | | A | 12 |
| 19. |  | Dry saturated steam at 10 bar is expanded isentropically in a nozzle to 0.1 bar. Using steam tables, find the dryness fraction of the steam at exit. Also find the velocity of steam leaving the nozzle when (i) initial velocity is negligible and (ii) initial velocity of the steam is 135 m/s. | CO3 | | A | 12 |
| 20. |  | Demonstrate the working of single stage single acting reciprocating air compressor with a neat sketch. | CO4 | | A | 12 |
| 21. |  | Demonstrate the working of vapour absorption refrigeration system with a neat sketch. | CO5 | | A | 12 |
| 22. |  | Explain any two methods of compounding of steam turbines with neat sketches. | CO6 | | An | 12 |
| 23. |  | Derive an expression for the work done per kg of air for a reciprocating air compressor without clearance. | CO4 | | An | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Explain the working principle of vapour compression refrigeration system with a neat sketch. Show the processes on a T-S and p-h diagram. | CO5 | | An | 12 |

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|  | **COURSE OUTCOMES** | | | | | | | |
| CO1 | Estimate the performance of a steam generator. | | | | | | | |
| CO2 | Carry out analysis of vapour power cycles. | | | | | | | |
| CO3 | Conduct analysis of steam nozzles and turbines. | | | | | | | |
| CO4 | Evaluate performance of reciprocating compressors. | | | | | | | |
| CO5 | Apply principles of refrigeration and air conditioning for analysis and performance evaluation. | | | | | | | |
| CO6 | Design turbine and nozzles and compressors. | | | | | | | |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | | |
| CO / P | | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | | 1 | 4 | 12 | - | - | - | 17 |
| CO2 | | 1 | 3 | 12 | - | - | - | 16 |
| CO3 | | 1 | 4 | 12 | - | - | - | 17 |
| CO4 | | 4 | 1 | 12 | 12 | - | - | 29 |
| CO5 | | 1 | 4 | 12 | 12 | - | - | 29 |
| CO6 | | - | 4 | - | 12 | - | - | 16 |
|  | | | | | | | | **124** |

**Graphical user interface, application

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| **Course Code** | **20ME1006** | **Duration** | **3hrs** |
| **Course Name** | **PROFESSIONAL ETHICS** | **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 ‘Ethics’. | | CO1 | R | | 1 |
| 2. | Define Scientific discipline. | | CO1 | R | | 1 |
| 3. | Explain the principle of duty ethics. | | CO2 | U | | 1 |
| 4. | Define Code of Ethics. | | CO3 | R | | 1 |
| 5. | Illustrate the concept of Uncertainty. | | CO4 | U | | 1 |
| 6. | State the term Falsified data. | | CO4 | R | | 1 |
| 7. | Define collective bargaining. | | CO5 | R | | 1 |
| 8. | Define the term Intellectual Property | | CO5 | R | | 1 |
| 9. | State Accountability. | | CO5 | R | | 1 |
| 10. | List any two examples of unethical behaviour. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Illustrate the need for engineering ethics. | | CO1 | | A | 3 |
| 12. | List some examples of Improved Safety. | | CO2 | | R | 3 |
| 13. | List the limitations of code of ethics. | | CO3 | | R | 3 |
| 14. | Distinguish between a copyright and patent. | | CO4 | | U | 3 |
| 15. | Discuss about safe and unsafe risk. | | CO5 | | U | 3 |
| 16. | Explain about Reporting Misconduct. | | 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. |  | Discuss in detail the different models of Professional roles. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 18. | a. | Differentiate and explain about ethical and official responsibility. | CO2 | | U | 6 |
| b. | Explain the importance of the ethical responsibility of an individual in the work environment. | CO2 | | U | 6 |
|  |  |  |  | |  |  |
| 19. |  | Describe the roles played by the code of ethics set by professional societies. | CO3 | | R | 12 |
|  |  |  |  | |  |  |
| 20. |  | Explain the process of collecting the research data. | CO4 | | U | 12 |
|  |  |  |  | |  |  |
| 21. | a. | Describe the concept of risk benefit analysis. | CO5 | | U | 6 |
| b. | Explain various measures for assessing and reducing risk. | CO5 | | U | 6 |
|  |  |  |  | |  |  |
| 22. |  | Write the expected confidentiality to be maintained by a mechanical engineer while he shifts his job on career advancement. | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Illustrate some common unethical behaviour in the work environment. | CO6 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Report how an occupational crime affects the progress of the work environment. | CO6 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the ethical framework in professional life. |
| CO2 | Know the psychology and philosophy of ethics. |
| CO3 | Recognize the ethics in scientific and engineering society. |
| CO4 | Diagnose the code of ethics and ethical standards. |
| CO5 | Understand the integrity in research. |
| CO6 | Realize the Enforcement of Code of Ethics. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 12 | 3 | - | - | - | 17 |
| CO2 | 3 | 13 | - | - | - | - | 17 |
| CO3 | 16 | - | - | - | - | - | 16 |
| CO4 | 1 | 16 | - | - | - | - | 17 |
| CO5 | 3 | 15 | 12 | - | - | - | 30 |
| CO6 | 1 | 15 | 12 | - | - | - | 28 |
|  | | | | | | | **124** |

**Graphical user interface, application

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| **Course Code** | **20ME1007** | **Duration** | **3hrs** |
| **Course Name** | **3D PRINTING 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. | Define a prototype. | | | CO1 | R | | 1 |
| 2. | Classify the rapid prototyping systems. | | | CO1 | U | | 1 |
| 3. | Discuss on product development cycle. | | | CO2 | U | | 1 |
| 4. | Define a STL file. | | | CO2 | R | | 1 |
| 5. | Name any one disadvantage of using SLA. | | | CO3 | R | | 1 |
| 6. | Name the support material used in Rapid Freeze Prototyping. | | | CO3 | R | | 1 |
| 7. | Tell any two materials used in LOM process. | | | CO4 | R | | 1 |
| 8. | Discuss the merits of fused deposition modeling. | | | CO4 | U | | 1 |
| 9. | The type of rapid prototyping system which uses a laser to fuse powdered metals, plastics, or ceramics is \_\_\_\_\_\_\_\_\_\_\_\_\_. | | | CO5 | U | | 1 |
| 10. | State an application of Shape Deposition Manufacturing (SDM). | | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | |
| 11. | Discuss on the term ‘Digital manufacturing’. | | | CO1 | | U | 3 |
| 12. | Explain the concept occurring errors in SH files. | | | CO2 | | A | 3 |
| 13. | Discuss projection stereolithography. | | | CO3 | | U | 3 |
| 14. | List out different structures used as infill pattern in FDM. | | | CO4 | | R | 3 |
| 15. | State the process LENS. | | | CO5 | | R | 3 |
| 16. | Describe Electron beam machining. | | | 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 a short note on the history of 3D printing (3DP) technology. | CO1 | | A | 6 |
|  | | b. | Explain the product development cycle with a neat sketch. | CO1 | | An | 6 |
| 18. | | a. | Evaluate on how part orientation plays a role in reducing the need of support structures. | CO2 | | An | 6 |
|  | | b. | Examine STL / CLI / SLC Formats for creating a CAD model. | CO2 | | A | 6 |
| 19. | | a. | Write a short note on part building process in Stereo Lithography Apparatus (SLA). | CO3 | | A | 4 |
|  | | b. | Illustrate the process of Solid Ground Curing (SGC), its strength and weakness. | CO3 | | A | 8 |
| 20. | | a. | Describe the principle of FDM with its advantages. | CO4 | | R | 4 |
|  | | b. | Sketch the process flow of LOM and list out its practical applications. | CO4 | | A | 8 |
| 21. | | a. | Discuss on Selective Laser Sintering and its applications. | CO5 | | U | 4 |
|  | | b. | Illustrate the process of LENS with a neat sketch. | CO5 | | An | 8 |
| 22. | |  | Explain the procedure of modeling, STL file creation and layering steps before printing 3D model in RP machine for the following types of models (i) Economical model. (ii) Precision model. | CO2 | | An | 12 |
| 23. | | a. | Sketch the process of Shape Deposition Manufacturing (SDM) and its applications. | CO6 | | A | 8 |
|  | | b. | Discuss Three-Dimensional Printing (3DP) process and its applications. | CO6 | | U | 4 |
| **COMPULSORY QUESTION** | | | | | | | |
| 24. | | a. | Explain Wire Arc Additive Manufacturing with a neat sketch. | CO6 | | An | 6 |
|  | | b. | Write the applications of 3D Printing in relation to the Medical field. | CO6 | | A | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Conceptualize the product development cycle and identify the role of 3D Printing in industries. |
| CO2 | Illustrate appropriate 3D Printing techniques for developing products. |
| CO3 | Articulate the working principles of various 3D Printing Technologies. |
| CO4 | Identify suitable applications for every classification of 3D Printing Technology. |
| CO5 | Correlate the process variables with the quality of products built using 3D Printing Processes. |
| CO6 | Design materials for 3D Printing Process to solve real time industrial problems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 4 | 6 | 6 | - | - | 17 |
| CO2 | 1 | 1 | 9 | 18 | - | - | 29 |
| CO3 | 2 | 3 | 12 | - | - | - | 17 |
| CO4 | 8 | 1 | 8 | - | - | - | 17 |
| CO5 | 3 | 5 | - | 8 | - | - | 16 |
| CO6 | 1 | 4 | 17 | 6 | - | - | 28 |
|  | | | | | | | **124** |

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| **Course Code** | **20ME2002** | **Duration** | **3hrs** |
| **Course Name** | **CNC PROGRAMMING** | **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 repeatability of the NC machine depends on \_\_\_\_\_\_\_\_\_ errors. | | CO1 | R | | 1 |
| 2. | In an \_\_\_\_\_\_ positioning programming system, the next tool location must be defined with reference to the previous tool location. | | CO1 | R | | 1 |
| 3. | Which direction of motion is always the axis of the main spindle of the machine? | | CO2 | R | | 1 |
| 4. | The use of a stepper motor considerably simplifies the system as \_\_\_\_\_\_\_ devices are not used. | | CO2 | R | | 1 |
| 5. | \_\_\_\_\_\_\_ interpolation method, in which interpolation is carried out using a computer program | | CO3 | R | | 1 |
| 6. | \_\_\_\_\_\_\_ G-code is used to specify feed per minute in milling and drilling | | CO3 | R | | 1 |
| 7. | Define Position error. | | CO5 | R | | 1 |
| 8. | The adaptive control module plays the role of increasing \_\_\_\_\_\_\_ and decreasing machining time to increase productivity. | | CO5 | R | | 1 |
| 9. | In an NC machining operation, the tool has to be moved from point (5, 4) to point (7, 2) along a circular path with center at (5, 2). Before starting the operation, the tool is at (5, 4). Write the CNC statement for this operation. | | CO6 | R | | 1 |
| 10. | In a CNC program block, N002 GO2 G91 X40 Z40……, GO2 and G91 refer to \_\_\_\_\_\_\_\_. | | CO6 | R | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Draw the configuration of Machine Control Unit (MCU). | | CO1 | | U | 3 |
| 12. | How hunting can be minimized? | | CO2 | | U | 3 |
| 13. | List the interpolator characteristics so that it can generate the displacement and speed successfully for multiple axes. | | CO3 | | U | 3 |
| 14. | Infer how does a control architecture with a cascade design help to reach the actual position? | | CO5 | | U | 3 |
| 15. | Why CNC system is widely used for the position control of different positioning machines? | | CO5 | | U | 3 |
| 16. | State the limitations of the cutter radius compensation. | | 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 NC control systems and the interpolation techniques. | CO1 | | U | 12 |
|  |  |  |  | |  |  |
| 18. |  | Analyse the response of a feed drive in achieving the target position with a servo controller. | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | Explain servo motor and its types. Also mention the required characteristics to be a feed/ spindle drive. | CO2 | | U | 12 |
|  |  |  |  | |  |  |
| 20. |  | Explain the software interpolator and compare its types. | CO3 | | U | 12 |
|  |  |  |  | |  |  |
| 21. |  | Explain the elements of Programmable logic control and why it is preferred for real time applications. | CO4 | | U | 12 |
|  |  |  |  | |  |  |
| 22. |  | Develop the CNC Program for machining the 30 mm thick block as shown in figure. | CO6 | | A | 12 |
|  |  |  |  | |  |  |
| 23. |  | Construct the CNC program for the profile shown in figure. | CO6 | | A | 12 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Explain the three-tire CNC architecture and servo controller. | CO5 | | U | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the control systems for CNC machine tool and select the components of CNC architecture. |
| CO2 | Articulate the principles of motors, Feedback devices and hydraulic system. |
| CO3 | Compare the interpolation methods in CNC control system. |
| CO4 | Propose the PLC programming Languages. |
| CO5 | Recommend PID controllers, servo controller, Numerical control Kernel types. |
| CO6 | Design and evaluate CNC programming techniques for various industrial applications. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 15 |  |  |  |  | 17 |
| CO2 | 2 | 3 | 12 | 12 |  |  | 29 |
| CO3 | 2 | 15 |  |  |  |  | 17 |
| CO4 |  | 12 |  |  |  |  | 12 |
| CO5 | 2 | 18 |  |  |  |  | 20 |
| CO6 | 2 | 3 | 24 |  |  |  | 29 |
|  | | | | | | | **124** |

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| **Course Code** | **20ME2007** | **Duration** | **3hrs** |
| **Course Name** | **AUTOMATION OF PRODUCT LIFE CYCLE MANAGEMENT** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome / Pattern** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | |
| 1. | Select which is not an element of an automated system.  (a) Power Source (b) Service (c) Program (d) Control system | CO1/ A | 1 |
| 2. | Cellular Manufacturing: It is a manufacturing philosophy in which similar parts are identified and grouped together (True/False) | CO1/ U | 1 |
| 3. | Write one example for passive devices. | CO2/ Ap | 1 |
| 4. | Laminar-turbulent flow devices = Jet destruction devices (True/False). | CO2/ A | 1 |
| 5. | List any two modern tools used in manufacturing automation. | CO3/ U | 1 |
| 6. | Robots cannot be reprogrammed. (Yes/No). | CO3/ R | 1 |
| 7. | A product data management (PDM) system consists of computer software that provides links between \_\_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_\_\_\_. | CO4/ R | 1 |
| 8. | PLM software helps organizations to develop new products and bring them to market. (True/False). | CO4/ U | 1 |
| 9. | Expand the term FMEA. | CO5/ R | 1 |
| 10. | One of the computer-aided process planning system approaches is (a) Generative CAPP (b) Formulated CAPP (c) Structured CAPP (d) Programmed CAPP. | CO6/ A | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | |
| 11. | List the advantages of automation. | CO1/ R | 3 |
| 12. | What is a pneumatic amplifier? Mention its purposes. | CO2/ U | 3 |
| 13. | List a few applications of fuzzy logic controls. | CO3/ A | 3 |
| 14. | Write the benefits of PLM. | CO4/ R | 3 |
| 15. | What is meant by concurrent engineering? | CO5/ R | 3 |
| 16. | Why process planning is required? | CO6/ A | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23. Q.No 24 is Compulsory)** | | | | |
| 17. | a. | Discuss the different levels of automation adopted in industrial plant. | CO1/ U | 6 |
| b. | What is FMS? How the elements of FMS is implemented in industries? | CO1/ R | 6 |
|  |  |  |  |  |
| 18. | a. | With a neat sketch, describe the method of designating components in hydraulic circuits. | CO2/ A | 6 |
| b. | Draw the pneumatic circuit to control the process of die casting machine. | CO2/ C | 6 |
|  |  |  |  |  |
| 19. | a. | Explain how the artificial neural networks used in the automation of manufacturing industries. | CO3/ A | 6 |
| b. | How the robots helps in automation? Discuss in detail. Write the few applications of robots. | CO3/ A | 6 |
|  |  |  |  |  |
| 20. | a. | Elaborate the different elements of product life cycle management (PLM). | CO4/ U | 6 |
| b. | Discuss the different principles of product life cycle management strategy. | CO4/ R | 6 |
|  |  |  |  |  |
| 21. | a. | What is quality function deployment (QFD)? How this QFD play a role in customer requirements. | CO5/A | 6 |
| b. | What are the different phases adopted in general design process? | CO5/A | 6 |
|  |  |  |  |  |
| 22. | a. | Explain the three problem areas occurred in the analysis and design of automated transfer lines. | CO1/ E | 6 |
| b. | Draw a basic block of a circuit showing the reservoir, accessories, pressure relief valve, and the pump and tank lines. | CO2/ U | 6 |
|  |  |  |  |  |
| 23. | a. | How to build a mathematical model of a manufacturing plant? Explain briefly. | CO4/ C | 6 |
| b. | Discuss how you will develop a new product design for portable chair through brainstorming. | CO5/ C | 6 |
|  |  | **Compulsory:** | | |
| 24. | a. | Describe PDM functions, and explain the architectures of PDM systems. | CO6/ R | 6 |
| b. | Discuss the following: Bill of Materials and virtual product development tools for machines and manufacturing plants. | CO6/ U | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Explain various strategies and technologies adapted in industrial automation. |
| CO2 | Select appropriate evaluation methods used in the automation. |
| CO3 | Apply modern tools like AI, ANN and Fuzzy logics in the building of automation systems. |
| CO4 | Apply the concept of New Product Development and its structuring |
| CO5 | Analyse the virtual product development |
| CO6 | Develop new product development, product structure and supporting systems. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 9 | 7 | - | 1 | 6 | - | 23 |
| CO2 | - | 9 | 7 | 1 | - | 6 | 23 |
| CO3 | 1 | 1 | 15 | - | - | - | 17 |
| CO4 | 10 | 7 | - | - | - | 6 | 23 |
| CO5 | 4 | - | - | 12 | - | 6 | 22 |
| CO6 | 6 | 6 | - | 4 | - | - | 16 |
|  | | | | | | | **124** |

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| **Course Code** | **20ME2010** | **Duration** | **3hrs** |
| **Course Name** | **KINEMATICS AND DYNAMICS OF MACHINERY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Discuss the inversion of a mechanism. | | CO1 | U | | 1 |
| 2. | Determine the number of degrees of freedom for a five bar mechanism. | | CO1 | A | | 1 |
| 3. | The velocity at any point on a rigid link with respect to any other point on the same link is \_\_\_\_\_\_\_\_\_\_\_ to the link. | | CO2 | R | | 1 |
| 4. | Cite an expression for length of the belt in case of cross belt drive. | | CO2 | U | | 1 |
| 5. | State the phenomena of ‘creep’ in a belt drive. | | CO3 | R | | 1 |
| 6. | Define module in a gear. | | CO3 | R | | 1 |
| 7. | Discuss an ‘epicyclic gear train’. | | CO4 | U | | 1 |
| 8. | Define the term ‘sensitiveness’ relating to a governor. | | CO4 | R | | 1 |
| 9. | The engine of an aeroplane rotates in clockwise direction when seen from the tail end and the aeroplane takes a left turn. State the effect of the gyroscopic couple in the aeroplane. | | CO5 | U | | 1 |
| 10. | Generalize as to why balancing of rotating parts is necessary for high speed engines. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | Differentiate lower pair and higher pair. | | CO1 | | U | 3 |
| 12. | Illustrate how velocity of a slider is obtained in a slider crank mechanism. | | CO2 | | A | 3 |
| 13. | A rope drive transmits 600 kW from a pulley of effective diameter 4 m, which runs at a speed of 90 rpm. The difference between the tight side and slack side tension is 240 N. Find the number of ropes required. | | CO3 | | An | 3 |
| 14. | Describe the law of gearing. | | CO4 | | R | 3 |
| 15. | Discuss on the types of cams. | | CO5 | | U | 3 |
| 16. | Differentiate free and forced vibration. | | 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. |  | Sketch and explain any two inversions of a double slidercrank chain. | CO1 | | A | 12 |
|  |  |  |  | |  |  |
| 18. |  | The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively, as shown in the Fig (a). The crank makes 360 rpm. in the clockwise direction. When it has turned 45° from the inner dead centre position, evaluate: (a) velocity of piston, and (b) angular velocity of connecting rod.  Fig (a) | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 19. |  | A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter running at 250 rpm. The angle embraced is 165º and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1000 kg/m3 and thickness of the belt is 10 mm, estimate the width of the belt, taking centrifugal tension into account. | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | The following data relate to a pair of 20º involute gears in mesh:  Module = 6 mm; Number of teeth on pinion = 17; Number of teeth on gear = 49; Addendum on pinion and gear wheel = 1 module.  Determine: (i) The number of pairs of teeth in contact; (ii) The angle turned through by the pinion when one pair of teeth is in contact, and; (iii) the ratio of sliding to rolling motion when the tip of a tooth on the larger wheel is just making contact. | CO4 | | A | 12 |
|  |  |  |  | |  |  |
| 21. |  | A Proell governor has all four arms of length 250 mm. The upper and lower ends of the arms are pivoted on the axis of rotation of the governor. The extension arms of the lower links are each 100 mm long and parallel to the axis when the radius of the ball path is 150 mm. The mass of each ball is 4.5 kg and the mass of the central load is 36 kg. Determine the equilibrium speed of the governor. | CO5 | | An | 12 |
|  |  |  |  | |  |  |
| 22. |  | The mass of the turbine rotor of a ship is 20 tonnes and has a radius of gyration of 0.6 m. Its speed is 2000 rpm. The ship pitches 6º above and 6º below the horizontal position. A complete oscillation takes 30 seconds and the motion is simple harmonic. Calculate: (i) Maximum gyroscopic couple;  (ii) Maximum angular acceleration of the ship during pitching, and; (iii) The direction in which the bow will tend to turn when rising, if the rotation of the rotor is clockwise when looking from the stern. | CO5 | | A | 12 |
|  |  |  |  | |  |  |
| 23. | a. | A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young’s modulus for the shaft material is 200 GN/m2. Estimate the frequency of longitudinal and transverse vibrations of the shaft. | CO6 | | An | 06 |
|  | b. | A vibrating system consists of a mass of 200 kg, a spring of stiffness 80 N/mm and a damper with a damping coefficient of 800 N/m/s. Determine the frequency of vibration of the system. | CO6 | | A | 06 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | Four masses A, B, C and D as shown below are to be completely balanced.    The planes containing masses B and C are 300 mm apart. The angle between planes containing B and C is 90°. B and C make angles of 210° and 120° respectively with D in the same sense. Evaluate:  i. The magnitude and the angular position of mass A ; and  ii. The position of planes A and D. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the basic concepts of Mechanisms, Machines and their relative motions, then apply it to appropriate environments. |
| CO2 | Carry out kinematic analysis (Displacement, Velocity and Acceleration) of simple mechanisms (Single slider Crank Mechanism and four bar Mechanisms) by graphical and analytical method. |
| CO3 | Construct & Design different CAM profiles for given conditions using graphical & Theoretical methods. |
| CO4 | Apply the concept of balancing and use it for reducing the unbalanced forces in rotating masses and reciprocating engines under operating conditions exposure to IS standards. |
| CO5 | Acquire knowledge on types of vibrations in different systems and damping methods to minimize vibrations. |
| CO6 | Understand, apply and analyze the control mechanisms in Governors and Gyroscopes. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 4 | 13 | - | - | - | 17 |
| CO2 | 1 | 1 | 3 | 12 | - | - | 17 |
| CO3 | 2 | - | - | 15 | - | - | 17 |
| CO4 | 4 | 1 | 12 | - | - | - | 17 |
| CO5 | - | 4 | 12 | 12 | - | - | 28 |
| CO6 | - | 4 | 6 | 18 | - | - | 28 |
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| **Course Code** | **20ME2011** | **Duration** | **3hrs** |
| **Course Name** | **FINITE ELEMENT METHODS IN ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | What do you mean by the term “finite element”? | | CO1 | U | 1 |
| 2. | List any two finite element analysis software. | | CO6 | An | 1 |
| 3. | Mention the types of node. | | CO1 | R | 1 |
| 4. | List the application of finite element analysis in thermal engineering. | | CO5 | A | 1 |
| 5. | Write the interpolation polynomial equation for 1D cubic element. | | CO3 | C | 1 |
| 6. | List the stages of finite element analysis according to software implementations. | | CO6 | An | 1 |
| 7. | Define serendipity element. | | CO1 | R | 1 |
| 8. | Mention the types of boundary condition in FEA. | | CO3 | R | 1 |
| 9. | Define Incompressible flow. | | CO5 | U | 1 |
| 10. | Write the different modes of heat transfer. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define Weighted residual method and write its advantages. | | CO2 | U | 3 |
| 12. | List the properties of shape function. | | CO2 | R | 3 |
| 13. | Mention the purpose of using local co-ordinate system. | | CO1 | E | 3 |
| 14. | Differentiate between scalar field problem and vector field problem. | | CO3 | U | 3 |
| 15. | Define inter-element compatibility. | | CO1 | A | 3 |
| 16. | Write the general stiffness matrix and force vector for 1-D heat  transfer in a fin. | | CO5 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No 17 to 23, Q.No 24 is Compulsory)** | | | | | |
| 17. |  | With neat sketch and illustration, explain the step by step procedure of Finite Element Analysis. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Find the stresses induced in the axially loaded stepped bar shown in Figure 1. The bar has cross sectional areas A1 and A2 over the lengths L1 and L2 respectively. Assume the following datas: A1= 2cm2 and A2= 1cm2, L1=L2=10cm, E1=E2=2x107N/cm2, P=100N.  2  10 cm  10 cm  1  3  P  Figure1 | CO5 | E | 12 |
|  |  |  |  |  |  |
| 19. |  | Consider the differential equation for the problem as ; 0 ≤x ≤ 1 ; with the boundary conditions y (0) = 0 and y(1) = 0. Find the solution of the problem using Galerkin’s method, point collocation method, sub domain method and least square method. Use one coefficient trial function as y=a1x(1-x3). Compare the solutions obtained using weighted residual method with exact solution | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | For the triangular element shown in Fig. 2, the nodal values of displacement are:  u1 = 2.0 ; u2 = 3.0 ; u3 = 5.0  v1 = 1.0; v2 = 2.0 ; v3 = 3.0  Obtain the displacements of point P (2, 2) within the element.  (All Dimensions are in mm)  (1,1) 1  2 (3,1)  3 (2, 3)  •  v  u  pu  Fig. 2 | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Derive the shape functions for 2D rectangular element (use local coordinate system). | CO2 | C | 12 |
|  |  |  |  |  |  |
| 22. | a. | Derive the stiffness matrix for 1D link element. | CO2 | C | 8 |
|  | b. | With example, explain the properties of Stiffness matrix. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 23. |  | With illustration, explain the importance of higher order element and derive the shape functions for any one higher order element | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the temperature distribution in a one dimensional fin with the physical properties given in Figure3. The fin is rectangular in shape and is 8cm long, 4cm wide and 1cm thick. Assume that convection heat loss occurs from the right end of the fin. (use 2 element idealization)  ;  L=8 cm  80°C  4cm  1cm  Figure3 | CO5 | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Acquire the fundamental theory of finite element analysis and develop characteristic equation. |
| CO2 | Derive element matrix equation by applying basic laws in mechanics and integration by parts. |
| CO3 | Apply suitable boundary conditions to a global equation for field problems. |
| CO4 | Analyse scalar and vector variable problems. |
| CO5 | Understand the application and use FE method for solving heat transfer, fluid mechanics and  structural problems. |
| CO6 | Use professional level finite element software to solve engineering problems. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | 1 | 15 | - | 3 | - | 21 |
| CO2 | 7 | 3 | - | - | - | 20 | 30 |
| CO3 | 1 | - | - | - | 12 | 1 | 14 |
| CO4 | - | 3 | - | - | 12 | - | 15 |
| CO5 | - | 2 | 1 | 12 | 15 | - | 30 |
| CO6 | - | - | - | 14 | - | - | 14 |
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| **Course Code** | **20ME2014** | **Duration :** | **3hrs** |
| **Course Name** | **INDUSTRIAL SAFETY AND QUALITY STANDARDS** | **Max. Marks :** | **100** |

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| **Q. No.** | | **Questions** | **Course Outcome** | | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | | |
| 1. | Infer the motto of OSHA? | | | CO1 | | U | 1 |
| 2. | \_\_\_\_\_\_\_\_\_\_\_ is used as the eye protecting equipment d during welding or spray painting process | | | CO1 | | U | 1 |
| 3. | List a few safety protocols followed during maintenance. | | | CO2 | | R | 1 |
| 4. | Mention the 2 types of chemical hazards. | | | CO2 | | R | 1 |
| 5. | Welding shields primarily protect against \_\_\_\_\_\_\_\_\_\_\_. | | | CO3 | | U | 1 |
| 6. | Classify the types of flames. | | | CO3 | | An | 1 |
| 7. | In traditional management, individual employees are held accountable for the presence of a defect.(T/F) | | | CO4 | | U | 1 |
| 8. | RPN stands for \_\_\_\_\_\_\_\_\_\_\_. | | | CO4 | | U | 1 |
| 9. | Define criticality analysis. | | | CO5 | | R | 1 |
| 10. | Metal Nickel used for Electroplating. (T/F). | | | CO5 | | R | 1 |

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| **PART – B (6 X 3 = 18 MARKS)** | | | | |
| 11. | List out any 3 safety management functions. | CO1 | R | 3 |
| 12. | Write sources and protection of Noise hazards. | CO2 | A | 3 |
| 13. | Summarize the various health hazards associated with welding. | CO3 | R | 3 |
| 14. | Define Pareto diagram. | CO4 | R | 3 |
| 15. | List the various stages in FTA. | CO5 | R | 3 |
| 16. | Define Quality Function Deployment. | CO6 | R | 3 |

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| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.no 17 to 23)** | | | | | |
| 17. | a. | Discuss different safety organizations and their role and objectives. | CO1 | U | 6 |
| b. | Safety at Work Increase Productivity of Industry: Justify. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Assess the importance to follow the procedure in handling materials and equipment at the workplace. | CO2 | U | 6 |
| b. | Discuss in detail about the general safety rules in metal working industry. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Elaborate on the various safety precautions during Electroplating. | CO3 | R | 6 |
| b. | Analyze the common hazards in welding and the safety precautions to eliminate the same. | CO3 | An | 6 |
|  |  |  |  |  |  |
| 20. | a. | Outline the dimensions of product and service quality. | CO4 | R | 6 |
| b. | State and explain the barriers to TQM implementation in an organization. | CO4 | R | 6 |
|  |  |  |  |  |  |
| 21. | a. | Define a control chart. Discuss two control charts with neat sketches. | CO5 | An | 8 |
|  | b | Explain the Failure Mode And Effect Analysis. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Compare and contrast various machining guards. | CO2 | U | 6 |
| b. | Describe about safety measures adopted in turning machines. | CO3 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Elaborate on the safe practices for storing hazardous substances. | CO5 | A | 6 |
| b. | Recall ISO 9000 quality standards? Give any five elements of ISO 9000. | CO2 | R | 6 |
|  |  | **COMPULSORY QUESTION** | | | |
| 24. | a. | Examine the general requirements of quality management system? Draw the documentation pyramid. | CO6 | U | 6 |
| b. | Categorise the seven principles of reengineering. | CO6 | An | 6 |

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|  | **COURSE OUTCOMES** |
| CO1 | Apply safety principles, protocols and Personnel protective equipments (PPE) to engineering processes. |
| CO2 | Assess risk in manufacturing processes in term of Risk Priority Number (RPN) , manage and mitigate them. |
| CO3 | Apply quality principles and control charts to maintain quality of the processes and products. |
| CO4 | Appraise quality costs in products and minimize failure and reworks. |
| CO5 | Experimenting failure analysis thereby improve the production process and develop fool proof. |
| CO6 | Adapting Total Quality Management tools such as Quality function deployment, Benchmarking and Business process reengineering to realize quality standards. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 3 | 8 |  | 6 |  |  | 17 |
| CO2 | 23 |  |  |  |  |  | 23 |
| CO3 | 15 | 5 |  | 7 |  |  | 28 |
| CO4 | 15 | 3 |  |  |  |  | 18 |
| CO5 | 5 | 4 | 8 | 6 |  |  | 23 |
| CO6 | 3 | 6 |  | 6 |  |  | 15 |
|  | | | | | | | **124** |

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| **Course Code** | **20ME2016** | **Duration** | **3hrs** |
| **Course Name** | **FLUID MECHANICS AND FLUID MACHINES** | **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 Surface Tension. | | CO1 | R | | 1 |
| 2. | Distinguish Newtonian and non-Newtonian fluid. | | CO1 | U | | 1 |
| 3. | Describe stream function. | | CO2 | R | | 1 |
| 4. | For the ideal fluid, the shear stress is equal to \_\_\_\_\_\_\_\_\_. | | CO2 | U | | 1 |
| 5. | Give an example for vortex flow. | | CO3 | U | | 1 |
| 6. | The application of venturi meter is to measure the \_\_\_\_\_\_\_\_\_. | | CO3 | R | | 1 |
| 7. | How Bernoulli’s equation is derived from Euler equation? | | CO4 | R | | 1 |
| 8. | Write the dimension of Velocity. | | CO4 | U | | 1 |
| 9. | Define Froude number. | | CO5 | U | | 1 |
| 10. | Provide an example for impulse turbine. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | The capillary rise in the glass tube is not to exceed 0.2 mm of water. Determine its minimum size, given that the surface tension for water in contact with air is 0.0725 N/m. | | CO1 | | A | 3 |
| 12. | The velocity potential function is given by . Calculate the velocity components at the point (4, 5). | | CO2 | | An | 3 |
| 13. | Find the expression for the power P, developed by a pump when ‘P’ depends upon the head ‘H’, the discharge ‘Q’ and specific weight ‘w’ of the fluid. | | CO3 | | A | 3 |
| 14. | Water is flowing through a pipe of diameter 200mm with a velocity of 3m/s. Find the head lost due to friction for a length of 5m if the coefficient of friction is given by ƒ = 0.02 + , where Re is Reynolds number. The kinematic viscosity of water is 0.01 stroke. | | CO4 | | A | 3 |
| 15. | A jet of water of diameter 50mm moving with a velocity of 40m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet of water in the direction of the jet, if the jet is deflected through an angle of 1200 at the outlet of the curved plate. | | CO5 | | An | 3 |
| 16. | How are high head achieved in submersible pumps used bore well? | | 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 differential manometer is connected at the two points A and B of two pipes as shown in figure. The pipe A contains a liquid of sp. gr. = 1.5 while pipe B contains a liquid of sp. gr. = 0.9. The pressures at A and B are 1 kgf/cm2 and 1.8 kgf/cm2 respectively. Find the difference in mercury level in the differential manometer. | CO1 | | An | 12 |
|  |  |  |  | |  |  |
| 18. | a. | Write short notes on Stream line, Streak line and Path line. | CO2 | | C | 6 |
|  | b. | The water is ﬂowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 litres/s. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24N/cm2, ﬁnd the intensity of pressure at section 2. | CO2 | | An | 6 |
|  |  |  |  | |  |  |
| 19. | a. | State Buckingham’s -theorem. | CO3 | | R | 2 |
|  | b. | The efficiency η of a fan depends on density , dynamic viscosity of the fluid, angular velocity , diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. | CO3 | | An | 10 |
|  |  |  |  | |  |  |
| 20. |  | Determine the rate of ﬂow of water through a pipe of diameter 20cm and length 50m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of water in the tank is 4m above the center of the pipe. Consider all minor losses and take ƒ = 0.009 in the formula . Also draw Hydraulic Gradient Line (H.G.L) and Total Energy Line (T.E.L) for this case. | CO4 | | E | 12 |
|  |  |  |  | |  |  |
| 21. |  | Explain in detail various minor losses in pipes with neat sketches. | CO4 | | E | 12 |
|  |  |  |  | |  |  |
| 22. |  | A nozzle of 50mm diameter delivers a stream of water at 20m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find:  (i) the force on the plate.  (ii) the work done, and  (iii) the efficiency of jet. | CO5 | | A | 6 |
|  |  | A 7.5cm diameter jet having a velocity of 30 m/s strikes a ﬂat plate, the normal of which is inclined at 450 to the axis of the jet. Find the normal pressure on the plate: (i) when the plate is stationary, and (ii) when the plate is moving with a velocity of 15m/s and away from the jet. Also determine the power and efficiency of the jet when the plate is moving. | CO5 | | C | 6 |
|  |  |  |  | |  |  |
| 23. | a. | Elucidate the working principle, operation and components of centrifugal pump in detail with neat sketch. | CO5 | | A | 6 |
|  | b. | Explain the operation of two stage impellor pumps connected in series and parallel with a neat sketch. | CO5 | | A | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | A Pelton wheel has a mean bucket speed of 10 meters per second with a jet of water flowing at the rate of 700 liters/s under a head of 30 meters. The buckets deﬂect the jet angle of 1600. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. | CO6 | | A | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Recognize the important fluid properties and determine forces acting on immersed bodies. |
| CO2 | Solve fluid flow problems using Conservation principles. |
| CO3 | Analyze the characteristics of boundary layer and relationship between different physical quantities of fluid flow. |
| CO4 | Determine rate of flow and calculate flow losses through pipes. |
| CO5 | Evaluate the performance of pumps. |
| CO6 | Evaluate the performance of turbines. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 1 | 1 | 3 | 12 | - | - | 17 |
| CO2 | 1 | 1 | - | 9 | - | 6 | 17 |
| CO3 | 3 | 1 | 3 | 10 | - | - | 17 |
| CO4 | 1 | 1 | 3 | - | 24 | - | 29 |
| CO5 | - | 1 | 18 | 3 | - | 6 | 28 |
| CO6 | - | 4 | 12 | - | - | - | 16 |
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| **Course Code** | **20ME3008** | **Duration** | **3hrs** |
| **Course Name** | **NON-DESTRUCTIVE TESTING AND INSPECTION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(5 X 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. |  | Illustrate the suitable methods to find out the cracks in engineering components; explain with suitable sketches. | CO1 | A | 16 |
|  |  |  |  |  |  |
| 2. |  | Explain the working principles of ultrasonic testing with necessary examples; also discuss the types of waves used in ultrasonic testing. | CO2 | R | 16 |
|  |  |  |  |  |  |
| 3. |  | Explain the working procedure of Radiography testing. Also, discuss the types of Radiography testing methods. | CO3 | R | 16 |
|  |  |  |  |  |  |
| 4. |  | What is Time-of-Flight Diffraction testing? How do you find out the welding defects with this technique? | CO4 | A | 16 |
|  |  |  |  |  |  |
| 5. |  | Discuss the importance of algorithms. Explain any two algorithms for solving data processing and validation. | CO5 | An | 16 |
|  |  |  |  |  |  |
| 6. |  | Illustrate the importance and working method of Visual Testing with suitable sketches. Also list the merits and demerits. | CO1 | U | 16 |
|  |  |  |  |  |  |
| 7. |  | Discuss the importance and testing method of the phased Array technique. | CO4 | U | 16 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Define computed tomography testing? How do you find out the geometries and properties by this technique? | CO6 | An | 10 |
|  | b. | Discuss the Acoustic emission inspection to identify defects in materials. | CO6 | An | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures. |
| CO2 | Have a basic knowledge of ultrasonic testing which enables them to perform inspection of samples. |
| CO3 | Have a complete theoretical and practical understanding of the radiographic testing, interpretation and evaluation. |
| CO4 | Differentiate various defect types and select the appropriate NDT method for inspecting the component. |
| CO5 | Understand the recent developments in NDE and their application in various industries. |
| CO6 | Apply all the NDE methods on a component and compare the best technique for specific applications. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 16 | 16 | - | - | - | 32 |
| CO2 | 16 | - | - | - | - | - | 16 |
| CO3 | 16 | - | - | - | - | - | 16 |
| CO4 | - | 16 | 16 | - | - | - | 32 |
| CO5 | - | - | - | 16 | - | - | 16 |
| CO6 | - | - | - | 20 | - | - | 20 |
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| **Course Code** | **20ME3009** | **Duration** | **3hrs** |
| **Course Name** | **NEW-AGE MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(5 X 16= 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Summarize the application areas of smart systems. | CO1 | U | 8 |
|  | b. | Interpret associated stimulus-response behaviour with respect to smart systems. | CO1 | A | 8 |
|  |  |  |  |  |  |
| 2. | a. | Illustrate the various ‘Mechanisms and Applications’ associated with smart systems. | CO2 | U | 8 |
|  | b. | Articulate biomorphs and energy-harvesting applications. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 3. | a. | Appraise the various functions of shape memory ceramics and also shape memory polymers. | CO3 | An | 8 |
|  | b. | Explain Industrial and medical applications of shape memory alloys. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 4. | a. | Distinguish Halochromism and Solvatochromism. | CO4 | An | 8 |
|  | b. | Infer the properties, functions and applications of High Entropy Alloys (HEA). | CO4 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | Examine the importance and relevance of Protein-based smart polymers in the new age applications. | CO5 | A | 8 |
|  | b. | Justify the use of smart polymers for drug delivery administration applications. | CO5 | E | 8 |
|  |  |  |  |  |  |
| 6. | a. | Examine the mechanical, magnetic properties of Magneto- Rheological materials and their industrial applications. | CO4 | A | 8 |
|  | b. | Discuss the manufacturing methods of Metallic glasses and their engineering applications. | CO 4 | U | 8 |
|  |  |  |  |  |  |
| 7. | a. | Explain how mechanical properties of shape memory alloy foams could be tailored for different applications. | CO3 | U | 8 |
|  | b. | Infer the unique thermo-mechanical properties of Ni-Ti shape memory alloys and their applications. | CO 3 | U | 8 |
| **PART – B (1 X 20 = 20 MARKS)**  **(Compulsory Question)** | | | | | |
| 8. | a. | Establish how ‘MEMS’ add value in the advanced sectors of applications. | CO6 | A | 10 |
|  | b. | Survey how ‘Elastic memory composites’ provide enhanced performance, improved economics and reduced safety concerns. | CO6 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understanding of the physical principles underlying the behaviour of advanced and new-age materials. |
| CO2 | The basic principles and mechanisms of the stimuli-response for the most important smart materials. |
| CO3 | Propose improvement on the design, analysis and manufacturing of advanced and new-age materials. |
| CO4 | Command on Shape memory materials fabrication and shape memory effects. |
| CO5 | Smart polymers and new-age materials usage in space applications. |
| CO6 | Identifying the application issues involved in integrating advanced and new-age materials to engineering smart structures and products. |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 |  | 8 | 8 |  |  |  | 16 |
| CO2 |  | 8 | 8 |  |  |  | 16 |
| CO3 |  | 16 | 8 | 8 |  |  | 32 |
| CO4 |  |  | 16 | 16 |  |  | 32 |
| CO5 |  |  | 8 |  | 8 |  | 16 |
| CO6 |  |  | 20 |  |  |  | 20 |
|  | | | | | | | **132** |



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| **Course Code** | **20ME3010** | **Duration** | **3hrs** |
| **Course Name** | **PROCESS SAFETY MANAGEMENT IN INDUSTRY** | **Max. Marks** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome** | **Bloom’s Level** | **Marks** |
| **PART – A(4 X 20= 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Explain in detail line and staff functions for safety. | CO1 | R | 20 |
| **(OR)** | | | | | |
| 2. |  | Discuss the ergonomic principles. Also write short notes on workbenches and seating arrangements. | CO2 | U | 20 |
|  |  |  |  |  |  |
| 3. |  | Illustrate the significance of Job Safety Analysis and Safety Audit. | CO3 | A | 20 |
| **(OR)** | | | | | |
| 4. | a. | Discuss the principles of accident prevention. | CO4 | R | 14 |
| b. | Write short notes on reportable and non-reportable accidents. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 5. | a. | Explain the Calculation of accident indices. Also discuss the various techniques to reduce industrial accidents. | CO5 | An | 14 |
| b. | Discuss the importance of the safety “t” score. | CO5 | A | 6 |
| **(OR)** | | | | | |
| 6. |  | Explain the various avoidable and unavoidable accidents in Manufacturing Industries. Also, suggest a few prevention methods. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | Explain 3 E’s of safety related to Industries. | CO6 | R | 14 |
| b. | Write short notes on the safety incentive scheme. | CO6 | R | 6 |
| **(OR)** | | | | | |
| 8. |  | Explain the various safety procedures required to prevent accidents in Lathe operations, Grinding, Milling and Welding Operations. | CO5 | R | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss the various methods of promoting safe practice. | CO6 | U | 10 |
| b. | Correlate the benefits of safety training and safety education in Engineering Industries. | CO6 | A | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the importance of safety. |
| CO2 | Practice ergonomic principles to reduce accidents. |
| CO3 | Apply latest safety techniques |
| CO4 | Investigate and report the causes and remedies of industrial accidents. |
| CO5 | Monitor the safety performance |
| CO6 | Ensure safety through safety education and training. |

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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 | 14 | 6 | 20 | - | - | - | 40 |
| CO5 | 20 | - | 6 | 14 | - | - | 40 |
| CO6 | 20 | 10 | 10 | - | - | - | 40 |
|  | | | | | | | **180** |

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| **Course Code** | **21ME2002** | **Duration** | **3hrs** |
| **Course Name** | **STRENGTH OF MATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **Course Outcome** | **Bloom’s Level** | | **Marks** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | | |
| 1. | Describe the term Poisson’s ratio. | | CO1 | R | | 1 |
| 2. | State the Hooke’s law. | | CO1 | R | | 1 |
| 3. | Tell the different types of loads acting on a beam. | | CO2 | R | | 1 |
| 4. | Describe a cantilever beam. | | CO2 | R | | 1 |
| 5. | Interpret the term neutral axis. | | CO3 | U | | 1 |
| 6. | Write the bending equation. | | CO3 | A | | 1 |
| 7. | Define the term polar modulus. | | CO4 | U | | 1 |
| 8. | Write torsional equation. | | CO4 | A | | 1 |
| 9. | Discuss any one advantage of Macaulay’s method over direct integration method. | | CO5 | U | | 1 |
| 10. | Discuss slenderness ratio in a column. | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | |
| 11. | For a material, Young’s modulus is given as 1.2 x 105 N/mm2 and Poisson’s ratio is 0.25. Calculate the Bulk modulus. | | CO1 | | A | 3 |
| 12. | Sketch the shear force and bending moment diagrams for a cantilever beam of length L carrying a uniformly distributed load of *w* per m length, over its entire length. | | CO2 | | A | 3 |
| 13. | Discuss section modulus for a hollow rectangular section. (Assume the parameters). | | CO3 | | U | 3 |
| 14. | List the assumptions made in the theory of torsion. | | CO4 | | R | 3 |
| 15. | A spherical vessel 1.5 m diameter is subjected to an internal pressure of 2 N/mm2. Determine the thickness of the plate required if the maximum stress is not to exceed 150 N/mm2 and joint efficiency is 70%. | | CO5 | | A | 3 |
| 16. | Name the assumptions made in Euler’s column theory. | | 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. | A load of 2 MN is applied on a short concrete column 500 mm x 500 mm. The column is reinforced with four steel bars of 10 mm diameter, one in each corner.Predict the stresses in the concrete and steel bars. Take Young’s modulus for steel as 2.1 x 105 N/mm2 and for concrete as 1.4 x 105 N/mm2. | CO1 | | A | 6 |
|  | b. | A rod is 2 m long at a temperature of 20º C. Find the expansion of the rod when the temperature is raised to 65º C. Calculate the temperature stresses produced (i) when the expansion of the rod is prevented, and (ii) when the rod is permitted to expand by 5.8 mm. Take E = 2.0 x 105 N/mm2 and α = 12 x 10-6 per ºC. | CO1 | | An | 6 |
|  |  |  |  | |  |  |
| 18. | a. | Estimate the value of Young’s modulus and Poisson’s ratio of a metallic bar of length 300 mm; breadth 40 mm; depth 40 mm when the bar is subjected to an axial compressive load of 400 kN. The decrease in length is given as 0.75 mm and the increase in breadth is 0.03 mm. | CO1 | | An | 6 |
|  | b. | A member formed by connecting a steel bar and an aluminium bar is shown in Fig (a). Calculate the magnitude of force P that will cause the total length of member to decrease 0.25 mm. The Young’s modulus for steel and aluminium are 2.1 x 105 N/mm2 and 7 x 104 N/mm2respectively.  Fig (a) | CO1 | | An | 6 |
|  |  |  |  | |  |  |
| 19. |  | A simply supported beam of length 10 m carries a uniformly distributed load and two point loads as shown on the Fig (b). Draw the shear force and bending moment diagram for the beam. Also calculate position and magnitude of the maximum bending moment.  Fig (b) | CO2 | | An | 12 |
|  |  |  |  | |  |  |
| 20. |  | A cast iron beam is of T-section as shown in Fig (c). The beam is simply supported for a span of 8 m. If the beam carries a uniformly distributed load of 1.5 kN/m length on the entire span, analyze the maximum tensile and compressive stresses.  Fig (c) | CO3 | | An | 12 |
|  |  |  |  | |  |  |
| 21. | a. | A hollow shaft 450 mm external diameter and 250 mm internal diameter is subjected to a torque of 400 kNm. Calculate the shear stresses at the outer and inner surfaces of the shaft. Also predictthe twist in a length of 2.5 m of the shaft. Take C = 8 x 104 N/mm2. | CO4 | | A | 6 |
|  | b. | The external and internal diameters of a hollow shaft are 400 mm and 200 mm. Evaluate the strain energy stored in the hollow shaft if the maximum allowable shear stress is 50 N/mm2 and the length of the shaft is 5 m. Take C = 8 x 104 N/mm2. | CO4 | | An | 6 |
|  |  |  |  | |  |  |
| 22. | a. | A beam of length 8 m is simply supported at its ends. It carries a uniformly distributed load of 40 kN/m as shown in Fig (d). Estimate the deflection of the beam at its mid-point using Macaulay’s method. Take E = 2 x 105 N/mm2 and I = 4.3 x 108 mm4.  Fig (d) | CO5 | | E | 6 |
|  | b. | Calculate: (i) change in diameter; (ii) change in length and (iii) change in volume of a thin cylindrical shell 1000 mm diameter, 10 mm thick and 5 m long, when subjected to an internal pressure of 3 N/mm2. Take E = 2 x 105 N/mm2 and Poisson’s ratio µ = 0.3. | CO5 | | An | 6 |
|  |  |  |  | |  |  |
| 23. | a. | Summarize and derive an expression for the Euler’s crippling load for a long column when one end is fixed and the other end is free. | CO6 | | E | 6 |
|  | b. | A strut 2.5 m long is 60 mm in diameter. One end of the strut is fixed while its other end is hinged. Calculate the safe crippling load for the member using Euler’s formula, allowing a factor of safety of 3.5. Take E = 2.1 x 105 N/mm2. | CO6 | | An | 6 |
| **COMPULSORY QUESTION** | | | | | | |
| 24. |  | A 1.5 m long column has a circular cross-section of 50 mm diameter. One of the ends of the column is fixed and the other end is free. Taking factor of safety as 3, estimate the safe load using:   1. Rankine’s formula; take yield stress σc = 560 N/mm2 and α = for pinned ends. 2. Euler’s formula; Young’s modulus for CI = 1.2 x 105 N/mm2. | CO6 | | An | 12 |

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate fundamental knowledge about various types of loading and stresses induced. |
| CO2 | Draw the SFD and BMD for different types of loads and support conditions. |
| CO3 | Analyze the stresses induced in basic mechanical components. |
| CO4 | Estimate the strain energy in mechanical elements. |
| CO5 | Analyze the deflection in beams. |
| CO6 | Evaluate buckling and bending phenomenon in columns, struts and beams. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 | - | 9 | 18 | - | - | 29 |
| CO2 | 2 | - | 3 | 12 | - | - | 17 |
| CO3 | - | 4 | 1 | 12 | - | - | 17 |
| CO4 | 3 | 1 | 7 | 6 | - | - | 17 |
| CO5 | - | 1 | 3 | 6 | 6 | - | 16 |
| CO6 | 3 | 1 | - | 18 | 6 | - | 28 |
|  | | | | | | | **124** |



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| **Course Code :** | **21ME3004** | **Duration :** | **3hrs** |
| **Course Name :** | **MANUFACTURING SYSTEM AND SIMULATION** | **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. |  | Explain in detail various types of simulation. | CO1 / R | 20 |
| **(OR)** | | | |  |
| 2. | a. | Discuss the importance of job shop scheduling with suitable examples. | CO2 / U | 14 |
| b. | Write short notes on dispatching rules. | CO2 / U | 6 |
|  | | | | |
| 3. |  | Explain Montecarlo simulation to solve inventory problems in Industries. | CO3 / A | 20 |
| **(OR)** | | | |  |
| 4. |  | Explain in detail the General Purpose Simulation System (GPSS). | CO4 / R | 20 |
|  | | | | |
| 5. | a. | Discuss the various types of material handling systems. | CO5 / A | 14 |
|  | b. | Write the importance of ARENA Simulation. | CO5 / A | 6 |
| **(OR)** | | | |  |
| 6. |  | Explain the various types of scheduling Processes. | CO4 / A | 20 |
|  | | | | |
| 7. |  | Explain the basic concepts of SIMFACTORY software used for industrial process simulation? Also mention the highlights. | CO6 / R | 20 |
| **(OR)** | | | | |
| 8. |  | Discuss in detailFlexible Manufacturing Systems (FMS)? Also indicate the salient features. | CO5 / R | 20 |
|  | | **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** |  |  |
| 9. |  | Discuss the significance of Verification and validation algorithms in themanufacturing sector. | CO6 / U | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Create model of the real manufacturing system. |
| CO2 | Generate random numbers for simulation experiments. |
| CO3 | Resolve practical problems in manufacturing sectors using simulation. |
| CO4 | Analyze material handling problem and to give solutions. |
| CO5 | Optimize the performance of a discrete system. |
| CO6 | Verify and validate the simulation model |

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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 | - | - | - | 40 |
| CO5 | 20 | - | 20 | - | - | - | 40 |
| CO6 | 20 | 20 | - | - | - | - | 40 |
|  | | | | | | | **180** |



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| **Course Code** | **21ME3009** | **Duration** | **3hrs** |
| **Course Name** | **ADVANCED METAL CUTTING THEORY** | **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. | |  | Explain merchant’s theory with the help of suitable sketches. | CO1 | An | 20 |
|  | |  | **(OR)** |  |  |  |
| 2. | | a. | In an orthogonal turning operation the following data was obtained:  Cutting speed = 80 m/min,  feed = 0.2 mm/rev,  chip thickness = 0.4 mm,  back rake angle = 15°,  cutting force = 20 kg and  feed force = 8 kg.  Evaluate (a) Shear angle (b) work done in shear and  (c) Shear strain. | CO1 | E | 15 |
|  | | b. | Differentiate between orthogonal and oblique cutting. | CO1 | U | 5 |
|  | |  |  |  |  |  |
| 3. | |  | Explain the nomenclature of single point cutting tool with sketch. | CO2 | U | 20 |
|  | |  | **(OR)** |  |  |  |
| 4. | |  | Explain the nomenclature of plain milling cutter with sketch. | CO2 | U | 20 |
|  | |  |  |  |  |  |
| 5. | |  | Explain any two methods of measuring cutting temperature in metal cutting. | CO3 | A | 20 |
|  | |  | **(OR)** |  |  |  |
| 6. | |  | Explain about different types of tool materials with its essential properties and features. | CO4 | An | 20 |
|  | |  |  |  |  |  |
| 7. | |  | Explain the various types of equipment used for force measurement during metal cutting. | CO5 | A | 20 |
|  | |  | **(OR)** |  |  |  |
| 8. | | a. | A tool life of 90 min is obtained at a cutting speed of 25 m/min and 20 min at 60 m/min. Determine the (i) Tool life equation and (ii) cutting speed for 60 min tool life. | CO4 | An | 10 |
|  | | b. | Discuss the types of cutting fluids used in machining. | CO3 | U | 10 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | | |
| 9. | | a. | Explain the tool wear mechanism with suitable sketches. | CO6 | An | 10 |
|  | | b. | Discuss the factors effecting chatter in machining. | CO6 | U | 10 |

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|  | **COURSE OUTCOMES** |
| CO1 | Understand mechanism and theories of metal cutting. |
| CO2 | Select the cutting tool based on the operation to be done. |
| CO3 | Understand thermal aspects in machining |
| CO4 | Analyze tool materials and tool life. |
| CO5 | Measure cutting forces during machining processes. |
| CO6 | Diagnose tool wear, vibration and chatter. |

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



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| **Course Code** | **22ME3001** | **Duration** | **3hrs** |
| **Course Name** | **ERGONOMICS AND STANDARDS FOR DESIGNING PUBLIC TRANSPORT VEHICLES** | **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 human anatomy in terms of anthropometry with neat diagram. | CO1 | An | 10 |
|  | b. | Discuss in detail about (i) Skeletal system (ii) Body Planes. | CO1 | C | 10 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | State anthropometry and illustrate the development of anthropometry with respect to industries. | CO2 | U | 10 |
|  | b. | Illustrate the incompatible anthropometric design implications in Indian industrial context. | CO2 | U | 10 |
| 3. | a. | Define the following with respect to human body parts:  Cervical, Mid shoulder, Acromion, Supra Sternum and Sub-sternum | CO3 | R | 10 |
|  | b. | Describe the tissue loads and response of tissues to forceswith neat sketches if any. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 KN at a speed of 300 mm / min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw threads is 0.1. Estimate the power of the motor. | CO4 | E | 10 |
|  | b. | Discuss on the design of automotive beam sections with suitable sketches. | CO4 | A | 10 |
| 5. | a. | Illustrate the functions of a safety organization. | CO5 | U | 10 |
|  | b. | Describe on the safety of the intended function with the six levels of automation. | CO5 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Discuss the industrial standards followed for design of hand rails and hand holds. | CO6 | C | 20 |
| 7. |  | Discuss briefly on the automotive industry standards of passenger vehicles. | CO6 | C | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Elaborate the general requirements of bus body design and the standards to be followed. | CO6 | C | 20 |
| **PART – B (1 X 20 = 20 MARKS)**  **COMPULSORY QUESTION** | | | | | |
| 9. |  | The mean diameter of the square threaded screw having pitch of 10 mm is 50 mm. A load of 20 kN is lifted through a distance of 170 mm. Find the work done in lifting the load and the efficiency of the screw, when  1. The load rotates with the screw, and  2. The load rests on the loose head which does not rotate with the screw.  The external and internal diameter of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw and the bearing surface may be taken as 0.08. | CO6 | E | 20 |

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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the philosophies of design for special population. |
| CO2 | Relate the principles of Ergonomics for Industrial Personnel. |
| CO3 | Apply the laws of Biomechanics of human body movement. |
| CO4 | Analyze the elements of automobile structure. |
| CO5 | Design ergonomically safe automobile structure. |
| CO6 | Develop appropriate standards and regulations related to automobile design. |

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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 | - | 10 | - | - | 20 |
| CO6 | - | - | - | - | 20 | 60 | 80 |
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| **Course Code** | **19ME1003** | **Duration** | **3hrs** |
| **Course Name** | **ENGINEERING MECHANICS** | **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 statics. | | | | CO1 | R | | 1 |
| 2. | State principle of resolution. | | | | CO1 | R | | 1 |
| 3. | Write the equations for dynamic equilibrium conditions. | | | | CO2 | U | | 1 |
| 4. | Force F in space written in vectorial form is \_\_\_\_\_\_\_\_\_\_. | | | | CO2 | U | | 1 |
| 5. | What is axis of symmetry? | | | | CO3 | U | | 1 |
| 6. | The moment of inertia of a rectangle about the base is \_\_\_\_\_\_\_\_\_\_ times that of through the center of gravity. | | | | CO3 | A | | 1 |
| 7. | To convert a dynamic problem into a static problem \_\_\_\_\_\_\_\_\_\_ principle is used. | | | | CO4 | An | | 1 |
| 8. | The unit of moment of inertia is \_\_\_\_\_\_\_\_\_\_. | | | | CO4 | R | | 1 |
| 9. | State the law of conservation of energy. | | | | CO5 | U | | 1 |
| 10. | Define limiting friction. | | | | CO6 | U | | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | | | | |
| 11. | Two concurrent forces of 12N and 18N are acting at an angle of 60 °. Find the resultant force. | | | | CO1 | | An | 3 |
| 12. | Write short notes on the varignons theorem. | | | | CO2 | | U | 3 |
| 13. | State the perpendicular axis theorem. | | | | CO3 | | An | 3 |
| 14. | Write short notes on rectilinear motion with uniform acceleration. | | | | CO4 | | U | 3 |
| 15. | A car initially moving at 45km/hr has to cover a distance of 7.6km in 8 minutes. With what acceleration, should it be speeded up so that it covers the distance exactly in time? | | | | CO5 | | An | 3 |
| 16. | State the advantages and disadvantages of friction. | | | | 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. | | As part of the design of a new sailboat, it is desired to determine the drag force which may be expected at a given speed. To do so, a model of the proposed hull is placed in a test channel and three cables are used to keep its bow on the centerline of the channel. Dynamometer readings indicate that for a given speed, the tension is 40 lb in cable AB and 60 lb in cable AE. Determine the drag force exerted on the hull and the tension in cable AC. | CO1 | | A | 6 |
|  | | b. | | Determine the x and y components of each of the forces shown. | CO1 | | A | 6 |
|  | |  | |  |  | |  |  |
| 18. | | a. | | The tension in cables AB and AC are 100N and 120N respectively as shown in figure below. Determine the magnitude of the resultant force acting at A.  49_0 | CO2 | | An | 6 |
|  | | b. | | Three smooth pipes each weighing 20 kN and of diameter 60 cm are to be placed in a rectangular channel with a horizontal base as in the figure. Calculate the reactions at the points of contact between the pipes and between the channel and the pipes. Take, the width of the channel as 160 cm. | CO2 | | An | 6 |
|  | |  | |  |  | |  |  |
| 19. | |  | | Calculate the moment of inertia of the figure. | CO3 | | E | 12 |
|  | |  | |  |  | |  |  |
| 20. | | a. | | A bus starts to move with an acceleration of 0.3 m/s2. When a man who is 15 m behind the bus starts running at 3 m/s2 to catch the bus. After how many seconds, the man will catch the bus. | CO4 | | A | 6 |
|  | | b. | | 2 weights are connected by a string and move along the rough horizontal plan under the action of force 40 N, applied to the first weight as in figure. The coefficient of friction between the sliding surfaces of weights and the plane is 0.3. Determine the acceleration of weights in tension in the string using D’Alembert’s principle. | CO4 | | An | 6 |
|  | |  | |  |  | |  |  |
| 21. | |  | | Two blocks A and B of weight 80 N and 60 N are connected by a string, passing through a smooth pulley as in fig. Calculate the acceleration of the body and the tension in the string. Use the work-energy equation. | CO5 | | A | 12 |
|  | |  | |  |  | |  |  |
| 22. | |  | | Locate the moment of inertia of the sectioned area shown in the figure. | CO3 | | E | 12 |
|  | |  | |  |  | |  |  |
| 23. | |  | | A cantilever beam as in figure is fixed at A and free at B. Determine the reactions when it is loaded. | CO2 | | E | 12 |
| **COMPULSORY QUESTION** | | | | | | | | |
| 24. | |  | | A uniform ladder weighing 100N and 5 meters long has lower end B resting on the ground and upper end A resting against a vertical wall as shown in fig. The inclination of the ladder with horizontal is 60°.if the coefficient of friction at all surfaces of contact is 0.25, determine how much distance up long the ladder a man weighing 600N can ascend without causing it to slip. | CO6 | | E | 12 |
|  | | | **COURSE OUTCOMES** | | | | | |
| CO1 | | | Determine the resultant force and moment for a given system of forces. | | | | | |
| CO2 | | | Understand basics of the equilibrium of rigid bodies. | | | | | |
| CO3 | | | Determine the centroid and second moment of area of simple solids. | | | | | |
| CO4 | | | Apply fundamental concepts of kinematics and kinetics to the analysis of simple / practical problems | | | | | |
| CO5 | | | Understand basic kinematics concepts – displacement, velocity and acceleration. | | | | | |
| CO6 | | | Determine friction and its effects as per the laws of friction | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| CO / P | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | 2 |  | 12 | 3 |  |  | 17 |
| CO2 |  | 5 |  | 12 | 12 |  | 29 |
| CO3 |  | 1 | 1 | 3 | 24 |  | 28 |
| CO4 | 1 | 3 | 6 | 7 |  |  | 17 |
| CO5 |  | 1 | 12 | 3 |  |  | 16 |
| CO6 |  | 4 |  |  | 12 |  | 16 |
|  | | | | | | | **124** |