Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **14FP2024** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MECHANICAL SYSTEMS FOR FOOD PROCESSING** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | The outer and inner diameters of a centrifugal pump are 64 cm and 32 cm respectively. The pump runs at 1200 rpm and works against a total head of 70 m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are set back at an angle30° at the outlet. If the width of the impeller at outlet is 6 cm, determine (a) Vane angle at inlet, (b) Work done by the impeller/s, and (c) Manometric efficiency. | CO1 | 20 |
| (OR) | | | | |
| 2. | a. | A single-acting reciprocating pump, running at 50 r.p.m., delivers 0.01 m3 /s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine:(i) The theoretical discharge of the pump, (ii) Co-efficient of discharge, and (iii) Slip and the percentage slip of the pump. | CO1 | 12 |
| b. | The diameter of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump if it works against a head of 30 m. | CO3 | 8 |
|  |  |  |  |  |
| 3. | a. | A hollow circular shaft 12 m long is required to transmit 100 kW power when running at a speed of 300 rpm. If the maximum shearing stress allowed in the shaft is 80 N/mm2 and the ratio of inner diameter to the outer diameter is 0.75, find the dimensions of the shaft and also the angle of twist of one end of the shaft relative to the other end. Modulus of rigidity of the material is 85 kN/mm2. | CO2 | 10 |
| b. | Describe the design, working, velocity ratio and applications of various gear drives used in power transmission. | CO2 | 10 |
| (OR) | | | | |
| 4. | a. | Explain the design and working of flat belt drives used for power transmission with neat labelled diagrams. | CO2 | 15 |
| b. | Summarize the requirements for a good shaft coupling. | 5 |
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| 5. |  | A shaft rotating at 200 rpm drives another shaft at 300 rpm and transmits 6kW through the belt. The belt is 100mm wide and 10mm thick. The distance between the shaft is 4m. The smaller pulley is 0.5m and the larger pulley is 0.75m in diameter respectively. Calculate the stress in the belt, if it is.   1. An Open Belt Drive 2. Cross Belt Drive. Take μ = 0.3. | CO3 | 20 |
| (OR) | | | | |
| 6. | a. | Draw a neat diagram of Fusible plug used in steam boilers and discuss its working in brief. | CO2 | 5 |
| b. | A boiler generates steam at 12 bar pressure and temperature of 220°C from feedwater at temperature of 50°C. The steam generation rate is 7 kg/kg of coal which has the calorific value of 30 MJ/kg. The boiler has equivalent evaporation of 2500 kg/h. Determine(i) steam generation rate, (ii) coal consumption rate and (iii) thermal efficiency of the boiler. | 15 |
|  |  |  |  |  |
| 7. |  | Write in detail about types of equipment used, operation and application in food industries of the following:   1. Liquid Freezing. 2. Individual Quick Freezing. | CO2 | 10  10 |
| (OR) | | | | |
| 8. |  | A refrigerator using NH3 works between the temperatures -100°C and 250°C.The gas is dry at the end of compression and there is no undercooling of liquid. Calculate the theoretical C.O.P. of the cycle. The properties of NH3 are given below:   |  |  |  |  | | --- | --- | --- | --- | | Temperature  (0C) | Liquid heat (hf)  (kJ/kg) | Liquid heat (hfg)  (kJ/kg) | Liquid entropy(sf)  (kJ/kg) | | 25  -10 | 298.9  135.37 | 1166.94  1297.8 | 1.1242  0.5443 | | CO3 | 20 |
|  | |  |  |  |
|  | | **Compulsory:** |  |  |
| 9. |  | Explain the construction, operational mechanics and demonstrate the applications the following with a neat sketch:   1. Belt Conveyors. 2. Bucket Conveyors. | CO2 | 10+10 |