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



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18FP3014** | **Duration :** | **3hrs** |
| **Sub. Name :** | **REFRIGERATION AND COLD STORAGE ENGINEERING** | **Max. Marks :** | **100** |

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| **Q. No.** | **Sub Div.** | **Questions** | **Course Outcome** | **Marks** |
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| 1. | a. | Define refrigeration and explain vapour compression refrigeration cycle with T-S and P-h diagram. | CO1 | 8 |
| b. | Ice is formed at 0°C from water at 20°C. The temperature of the brine is– 8°C. Find out the kg of ice formed per kWh. Assume that the refrigeration cycle used is perfect reversed Carnot cycle. Take latent heat of ice as 335 kJ/kg. | CO2 | 8 |
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| 2. | a. | What is an insulator? Discuss about the desirable thermal properties of insulating material. | CO4 | 6 |
| b. | A cold storage room has walls constructed of a 20cm layer of cork board contained between wooden walls each 2cm thick. Find the rate of heat loss in kcal/hr m2 if the wall surface temperature is -12°C inside the room and 30°C outside the room. Thermal conductivities of cork board and wood respectively are 0.036 and 0.092 kcal/hmK. What would be the heat loss, if the cork board thickness is decreased to 10 cm. | CO2 | 10 |
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| 3. |  | An air water mixture at 20°C and 1 bar has relative humidity of 80%. Calculate i. partial pressure of the vapour and air, ii. specific humidity, iii. saturation ratio iv. dew point temperature v. density of the air vi. If the mixture is cooled at constant pressure to a temperature of 10°C, find the amount of water vapour condensed per kg of dry air. | CO4 | 16 |
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| 4. | a. | Write short notes on freezing curve and growth rate of ice crystals. | CO5 | 9 |
| b. | Explain Cryogenic freezing. | CO4 | 7 |
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| 5. | a. | What is evaporative cooling and direct expansion techniques in chilling process and state its importance. | CO3 | 8 |
| b. | Illustrate the important factors to be considered for the Chilled food transport. | CO5 | 8 |
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| 6. |  | A cold storage plant is required to store 20 tonnes of fish. The temperature of the fish when supplied = 25°C; storage temperature of fish required = – 8°C; specific heat of fish above freezing point = 2.93 kJ/kg°C; specific heat of fish below freezing point = 1.25 kJ/kg°C. freezing point of fish = – 3°C. Latent heat of fish = 232 kJ/kg. If the cooling is achieved within 8 hours; find out:  (i) Capacity of the refrigerating plant.  (ii) Carnot cycle C.O.P. between this temperature range.  (iii) If the actual C.O.P. is 1/3 rd of the Carnot C.O.P.,find out the power  required to run the plant. | CO2 | 16 |
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| 7. | a. | Write short note on optimum temperature for storage of different food products. | CO3 | 6 |
| b. | Calculate the rate of heat loss through a 15 cm thick wall composed of 5cm pine wood (K = 1.05), 1.25 cm of asbestos (K = 1.55) and 8.75 cm of mineral wool (K= 0.042). The inside and outside surfaces are at 20°C and 50°C respectively. Also calculate the temperature drop through each of these layers. The unit of K are W/m K. | CO6 | 10 |
| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | |
| 8. | a. | Discuss the cooling chain summary and packaging in detail. | CO2 | 10 |
| b. | Write short notes on Traceability and barcode. | CO3 | 10 |