**Q1-**It is need to design a cylindrical vessel ( diam. 1.5 m) (H= 3m) contain 4 m3 lubricant oil discharge within one hour at 250 C and 10 bar (absolute ) the material of construction will be carbon steel ,weld will be fully radio graphed ,corrosion allowance should be used ,estimate :

1- The thickness of the cylindrical wall (stainless steel 304).

2- The thickness of the hemispherical bottom head, (stainless steel 304)

3- The flat top head (carbon steel).

Prepare data sheet for vessel.

**Q2-** Design a horizontal separator ( with a demister ) to separate 10000 kg/ h of liquid ,liquid density 1000 kg/m3 from 20000 kg/h of vapor ,vapor density 20 kg /m3 ,the vessel operating pressurewill be 21 bar and temperature 50 C o  ,the end of the separator are torispherical , welding efficiency 80 %, estimate vessel thickness and prepare a data sheet for the designed separator.

**Q3-** Find the physical properties of the following materials by using the Appendix D for (aniline and xylene).

1. Molecular weight

2. Liquid density

3. Viscosity

4. Heat capacity at 30 C

5. Heat of vaporization at normal boiling point.

**Q4-**Chooce the right pump types for the following fluid:

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Fluid type | Pump type | Reasons |
| 1 | water at 50 C |  |  |
| 2 | water at 90 C |  |  |
| 3 | lubricant oil at 70 C |  |  |
| 4 | tomato paste |  |  |
| 5 | liquefied petroleum gas at 15 atm and 10 C |  |  |
| 6 | blood |  |  |
| 7 | toluene at 25 C |  |  |

Q5- difference between external pressure vessels and internal pressure vessels.