Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, July 2020

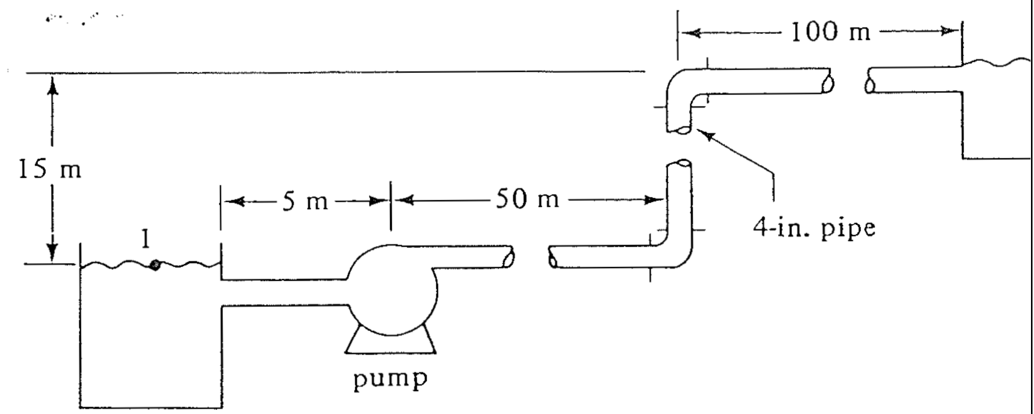
Programme Name: B. Tech. CERP **Semester : IV**
Course Name : Fluid Mechanics **Time : 3 hrs**
Course Code : MECH 2007 **Max. Marks: 100**
Nos. of page(s) : 02
Instructions : Assume any missing data. Draw the diagrams, wherever necessary.

Instructions for students:

- **Assignment** should be attempted on **blank white sheets** (A4 size) with all the details like program, semester, course name, course code, Enrollment Number, SAP ID at the top and signature at the bottom (right hand side bottom corner)
- Assignments should be uploaded in PDF format on Blackboard on or before ***13th July 2020*** by **1:59 PM**.
- Assignments submitted through WhatsApp and E-mail will not be entertained.
- No submission shall be entertained after 24 Hrs.

(Answer all questions)

1.	A tubular centrifugal bowl with an inside diameter **150 mm**, rotating at **800 rpm**, is used to separate **chlorobenzene** of density **1109 kg/m^3** and **aqueous wash liquid** of density **1020 kg/m^3**. The free-liquid surface inside the bowl is **40 mm** from the axis of rotation. If the centrifugal bowl is to contain **equal volumes** of the two liquids, what should be the radial distance from the rotational axis to the top of the overflow dam of heavy liquid?	**15**	**CO1**
2.	Water at **20^{O}C** is being pumped from a tank to an elevated tank at a rate of **5 x10^{-3} m^3/s**. All of the piping in figure is **Schedule Number 40 pipe**. The pump has an efficiency of **65%.** Calculate the power needed by the pump. density of water is **998.2 kg/m^3**, viscosity is **1x10^{-3}** pa.s, **ε = 4.6x10^{-5} m, K_f = 0.75** **Ws = -η Wp (J/kg),** where **Ws** is shaft work, **Wp** is pump work, **η** is efficiency of pump	**25**	**CO5**

			
3.	It is desired to agitate a liquid having viscosity of **1.5×10^{-3} Pa.s** and a density of **969 kg/m^3** in a tank having diameter of **0.91 m**. The agitator will be a **six-bladed** open turbine having a diameter of **0.305 m** operating at **180 rpm**. The tank has **four** vertical baffles with a **width J** of **0.076 m** and also **W = 0.0381 m**, Calculate the required **kW**	**15**	**CO6**
4.	Soybean oil is being pumped through a uniform diameter pipe at a steady mass flow rate. A pump supplies **209.2 J/kg** mass of fluid flowing. The entrance absolute pressure in the inlet pipe to the pump is **103.4 kN/m^2**. The exit section of the pipe downstream from the pump is **3.35 m** above the entrance and exit pressure is **172.4 kN/m^2**. Exit and entrance pipes are of same diameter. The fluid is in turbulent flow. Calculate the friction losses in the system. The temperature of Soybean oil is **303 K**. The density of Soybean at **303 K** is **919 kg/m^3**	**20**	**CO4**
5.	A packed bed is composed of cubes of **0.02 m** on a side. The bulk density of packed bed is **980 kg/m^3**. The density of solid cubes is **1500 kg/m^3**. (i) Calculate void fraction, effective diameter and specific surface area (ii) repeat the same conditions but for cylinders having diameter of **0.02 m** and length of **1.5 D**	**10**	**CO2**
6.	A heavy oil at **20^{O}C** having a density of **900 kg/m^3** and a viscosity of **6 cp** is flowing in a **4” Schedule 40 pipe**. When the flow rate is **0.0174 m^3/s** it is desired to have a pressure drop reading across the manometer equivalent to **0.93 x 105 Pa**. What size orifice should be used if the orifice coefficient is assumed to be **0.61**? What is the permanent pressure losses?	**15**	**CO3**