VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: E1+TE1

SCHOOL OF MECHANICAL ENGINEERING
DIGITAL ASSIGNMENT – I
WINTER SEMESTER 2023-2024

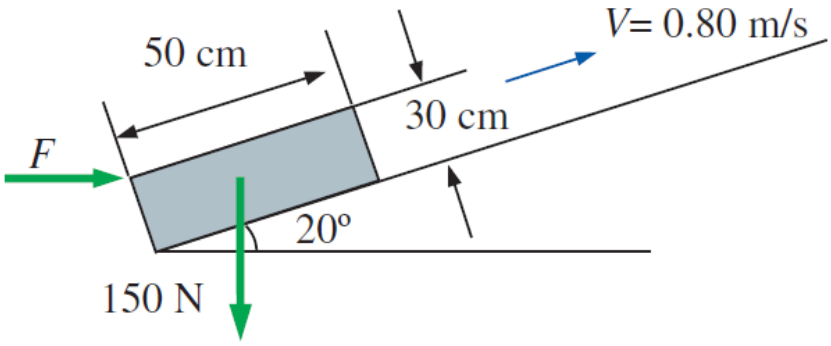
Programme Name & Branch	**:**	**B.Tech. - Mechanical**
Course Code	**:**	**BMEE204L**
Course Name	**:**	**Fluid Mechanics and Machines**
Faculty Name(s)	**:**	**Prof. R. Thundil Karuppa Raj**
Last date of submission	**:**	**25/08/2024**
Class numbers	**:**	**VL2024250103842**

1. A fluid that occupies a volume of x1 L weighs y1 N at a location where the gravitational acceleration is 9.81 m/s^2. Determine the mass, specific weight and density of the fluid. Refer Table 1. For getting values of x1 and y1 corresponding to your registration number at the last page.

2. The pressure in an automobile tire depends on the temperature of air in the tire. When the air temperature is 25°C, the pressure gauge reads 210 kPa. If the volume of the tire is 0.025 m^3, determine the pressure rise in the tire when the air temperature inside the tire raises to x2 °C. Also determine the amount of air that must be bled off to restore pressure to its original value at this temperature. Assume the atmospheric pressure to be 100000 Pa.

3. Two pistons of a hydraulic lift have diameters of Z4 cm and Z5 cm. What is the force exerted by the larger piston when 60 N is placed on the smaller piston? Refer Table for 1. For getting values of Z4 and Z5.

4. A 50 cm X 30 cm X 20 cm block weighing 150 N is to be moved at a constant velocity of 0.8 m/s, on an inclined surface with a friction coefficient of 0.27. Determine the force that should be applied on the horizontal direction also if a x4 mm thick film with a dynamic viscosity of 0.012 Pas is applied between the block and the inclined surface, determine the percent reduction in the required force.



5. (a) The surface tension of water in contact with air at 20ºC is 0.0725 N/m. The pressure inside a droplet of water is to be 0.02 N/cm^2 greater than the outside pressure. Calculate the diameter of the droplet of the water. (b) Find the surface tension in a soap bubble of x5 mm diameter when the inside pressure is 2.5 N/m^2 above atmospheric pressure.
6. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 Poise. The diameter of the shaft is 0.4 m and rotates at x6 rpm. Calculate the power lost in the bearing for a sleeve length of y6 mm. The thickness of the oil film is 1.5 mm.

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: E1+TE1

SCHOOL OF MECHANICAL ENGINEERING
DIGITAL ASSIGNMENT – I
WINTER SEMESTER 2023-2024

---

7. Calculate the capillary rise/fall in a glass tube of x7 mm diameter when immersed vertically in (a) water and (b) mercury. Take surface tension σ = 0.0725 N/m for water and σ= 0.52 N/m for mercury in contact with air. Specific gravity of mercury is 13.6 and the angle of contact is y7 degree.

8. A differential manometer is connected at the two points between A and B as shown in below Figure. 1. At B the air pressure is x8 N/cm2 (abs), find the absolute pressure at A.

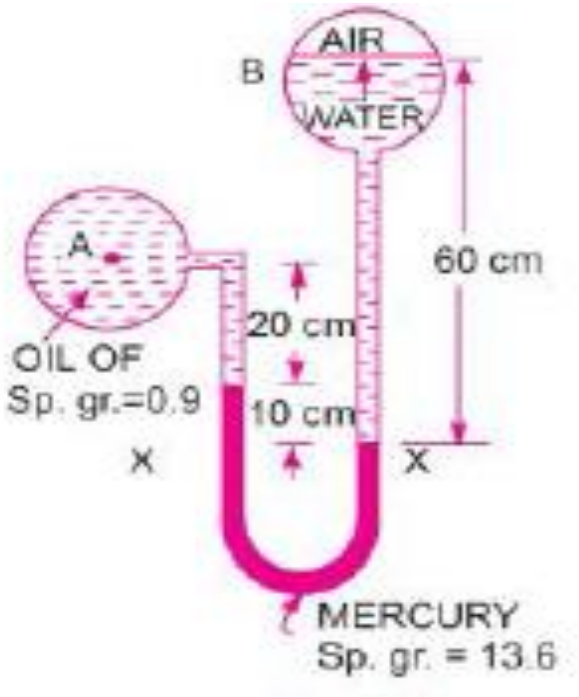


Fig. 1 Differential manometer between two liquids and air.

9. The water in a tank is pressurized by air, and the pressure is measured by a multifluid manometer as shown in Fig. 2. Determine the gauge pressure of air in the tank if h1 = 0.4 m, h2 = 0.6 m and h3 = 0.8 m. Take the densities of water, oil and mercury to be 1000 kg/m^3, x9 kg/m^3 and 13,600 kg/m^3 respectively.

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: E1+TE1

SCHOOL OF MECHANICAL ENGINEERING
DIGITAL ASSIGNMENT – I
WINTER SEMESTER 2023-2024

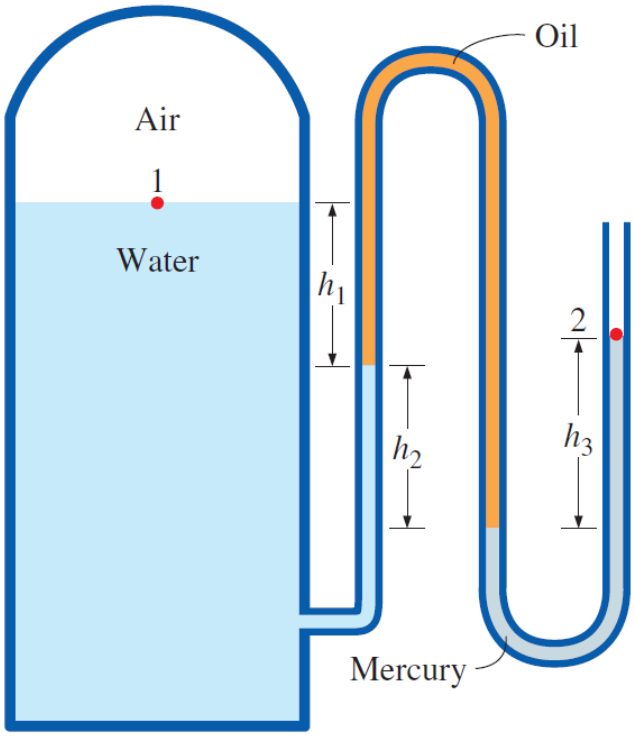


Fig. 2 Schematic sketch of a compound manometer.

10. The inverted u-tube manometer contains oil with specific gravity as x10 and water as shown in Fig.3. The pressure differential between pipes A and B (p_A- p_B) is -0.5 kPa . Determine the differential height 'h'.

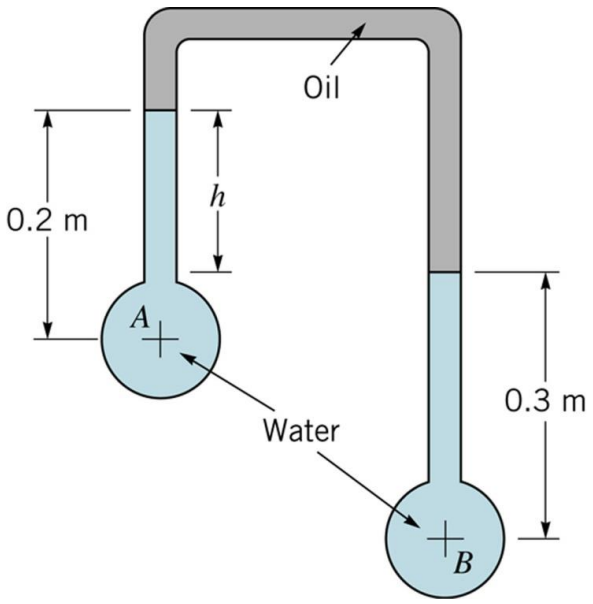


Fig.3 Inverted U-tube manometer

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: E1+TE1

SCHOOL OF MECHANICAL ENGINEERING
DIGITAL ASSIGNMENT – I
WINTER SEMESTER 2023-2024

---

11. Gate AB in Fig. 4 is x11 m long and y11 m depth (normal to the paper). Neglecting atmospheric pressure effects, compute the force F on the gate and the centre of pressure position.

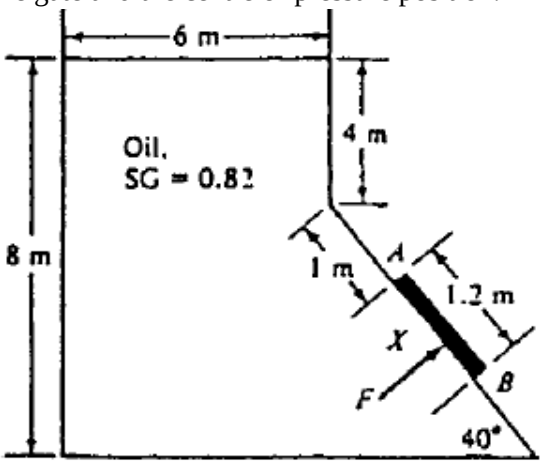


Fig. 4 Hydrostatic force on an inclined gate surface.

12. The density of a liquid is to be determined by an old x12 cm diameter cylindrical hydrometer who division marks are completely wiped out. The hydrometer is first dropped in water, and the water level is marked. The hydrometer is then dropped into the other liquid, and it is observed that the mark for water has risen 0.3 cm above the liquid-air interface as shown in Fig. 5. If the height of the original water mark is 12.3 cm, determine the density of the liquid.

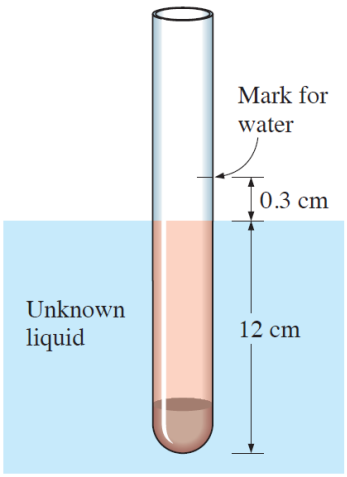


Fig. 5 Hydrometer

(P.T.O)

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: E1+TE1

SCHOOL OF MECHANICAL ENGINEERING
DIGITAL ASSIGNMENT – I
WINTER SEMESTER 2023-2024

Table 1: Key values of various properties

REGISTER NO	x1	y1	x2	Z4	Z5	x4	x5	x6	y6	x7
21BME0020	24	225	40	60	5	0.4	40	190	90	1.5
21BME0071	24.1	226	40.2	61	6	0.41	40.5	191	90	1.52
21BME0612	24.2	227	40.4	62	7	0.42	41	192	90	1.54
23BMA0026	24.3	228	40.6	63	8	0.43	41.5	193	90	1.56
23BME0001	24.4	229	40.8	64	9	0.44	42	194	90	1.58
23BME0016	24.5	230	41	65	10	0.45	42.5	195	90	1.6
23BME0018	24.6	231	41.2	66	11	0.46	43	196	90	1.62
23BME0037	24.7	232	41.4	67	12	0.47	43.5	197	90	1.64
23BME0073	24.8	233	41.6	68	13	0.48	44	198	90	1.66
23BME0100	24.9	234	41.8	69	14	0.49	44.5	199	90	1.68
23BME0103	25	235	42	70	15	0.5	45	200	90	1.7
23BME0124	25.1	236	42.2	71	16	0.51	45.5	201	90	1.72
23BME0127	25.2	237	42.4	72	17	0.52	46	202	90	1.74
23BME0129	25.3	238	42.6	73	18	0.53	46.5	203	90	1.76
23BME0135	25.4	239	42.8	74	19	0.54	47	204	90	1.78
23BME0137	25.5	240	43	75	20	0.55	47.5	205	90	1.8
23BME0151	25.6	241	43.2	76	21	0.56	48	206	90	1.82
23BME0160	25.7	242	43.4	77	22	0.57	48.5	207	90	1.84
23BME0161	25.8	243	43.6	78	23	0.58	49	208	90	1.86
23BME0164	25.9	244	43.8	79	24	0.59	49.5	209	90	1.88
23BME0170	26	245	44	80	25	0.6	50	210	90	1.9
23BME0171	26.1	246	44.2	81	26	0.61	50.5	211	90	1.92
23BME0175	26.2	247	44.4	82	27	0.62	51	212	90	1.94
23BME0180	26.3	248	44.6	83	28	0.63	51.5	213	90	1.96
23BME0204	26.4	249	44.8	84	29	0.64	52	214	90	1.98
23BME0212	26.5	250	45	85	30	0.65	52.5	215	90	2
23BME0239	26.6	251	45.2	86	31	0.66	53	216	90	2.02
23BME0248	26.7	252	45.4	87	32	0.67	53.5	217	90	2.04
23BME0249	26.8	253	45.6	88	33	0.68	54	218	90	2.06
23BME0250	26.9	254	45.8	89	34	0.69	54.5	219	90	2.08
23BME0256	27	255	46	90	35	0.7	55	220	90	2.1
23BME0258	27.1	256	46.2	91	36	0.71	55.5	221	90	2.12
23BME0260	27.2	257	46.4	92	37	0.72	56	222	90	2.14
23BME0279	27.3	258	46.6	93	38	0.73	56.5	223	90	2.16
23BME0283	27.4	259	46.8	94	39	0.74	57	224	90	2.18
23BME0293	27.5	260	47	95	40	0.75	57.5	225	90	2.2
23BME0305	27.6	261	47.2	96	41	0.76	58	226	90	2.22

VIT®
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SLOT: E1+TE1

SCHOOL OF MECHANICAL ENGINEERING
DIGITAL ASSIGNMENT – I
WINTER SEMESTER 2023-2024

23BME0319	27.7	262	47.4	97	42	0.77	58.5	190	95	2.24
23BME0323	27.8	263	47.6	98	43	0.78	59	191	95	2.26
23BME0327	27.9	264	47.8	99	44	0.79	59.5	192	95	2.28
23BME0357	28	265	48	100	45	0.8	60	193	95	2.3
23BME0375	28.1	266	48.2	101	46	0.81	60.5	194	95	2.32
23BME0380	28.2	267	48.4	102	47	0.82	61	195	95	2.34
23BME0384	28.3	268	48.6	103	48	0.83	61.5	196	95	2.36
23BME0385	28.4	269	48.8	104	49	0.84	62	197	95	2.38
23BME0416	28.5	270	49	105	50	0.85	62.5	198	95	2.4
23BME0421	28.6	271	49.2	106	51	0.86	63	199	95	2.42
23BME0436	28.7	272	49.4	107	52	0.87	63.5	200	95	2.44
23BME0438	28.8	273	49.6	108	53	0.88	64	201	95	2.46
23BME0444	28.9	274	49.8	109	54	0.89	64.5	202	95	2.48
23BME0453	29	275	50	110	55	0.9	65	203	95	2.5
23BME0457	29.1	276	50.2	111	56	0.91	65.5	204	95	1.5
23BME0472	29.2	277	50.4	112	57	0.92	66	205	95	1.52
23BME0476	29.3	278	50.6	113	58	0.93	66.5	206	95	1.54
23BME0483	29.4	279	50.8	114	59	0.94	67	207	95	1.56
23BME0484	29.5	280	51	115	60	0.95	67.5	208	95	1.58
23BME0511	29.6	281	51.2	116	61	0.96	68	209	95	1.6
23BME0523	29.7	282	51.4	117	62	0.97	68.5	210	95	1.62
23BMM0004	29.8	283	51.6	118	63	0.98	69	211	95	1.64
23BMM0008	29.9	284	51.8	119	64	0.99	69.5	212	95	1.66
23BMM0009	30	285	52	120	65	1	70	213	95	1.68
23BMM0010	30.1	286	52.2	121	66	1.01	70.5	214	95	1.7
23BMM0027	30.2	287	52.4	122	67	1.02	71	215	95	1.72
23BMM0031	30.3	288	52.6	123	68	1.03	71.5	216	95	1.74
23BMM0036	30.4	289	52.8	124	69	1.04	72	217	95	1.76
23BMM0037	30.5	290	53	125	70	1.05	72.5	218	95	1.78
23BMM0050	30.6	291	53.2	126	71	1.06	73	219	95	1.8