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SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

END SEM/~~RE-EXAM~~ EXAMINATION MAY / JUNE 2025

Program: B.Tech (Working Professionals) ~~Civil~~ Mech **Duration: 3 Hours**

Course Code: PC-BTM402 **Maximum Points: 100**

Course Name: Fluid Mechanics **Semester: IV**

Notes:

26/5/25

1. Attempt **any 5 questions** out of the given 7.
2. **Each question carries 20 marks** (2 sub-questions of 10 marks each).
3. If you choose to attempt **Q.1(a)**, you must also attempt **Q.1(b)** — sub-questions **must be answered in pairs.**

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	State Newton's law of viscosity and explain its importance in fluid mechanics. Discuss the influence of viscosity on fluid motion. Also, describe how temperature affects the viscosity of water and air, respectively.	10	1	2	1
Q1(b)	Two square plates with each side measuring 400 mm are placed parallel to each other with an oil film thickness of 1 cm between them. The top plate moves at a speed of 180 cm/s and requires a force of 6 kgf to maintain the motion. The density of the oil is 850 kg/m³. Determine: a) The dynamic viscosity of the oil in poise. b) The kinematic viscosity of the oil in stokes.	10	3	3	1
Q2(a)	State and Prove Pascal's Law.	10	1	2	1
Q2(b)	Find the differential reading 'h' of an inverted U-tube manometer containing oil of specific gravity 0.7 as the manometric fluid, when connected across pipes A and B (as shown in the figure), conveying liquids of specific gravities 1.2 and 1.0, respectively, and both immiscible with the manometric fluid. Pipes A and B are located at the same level, and the pressures at points A and B are assumed to be equal.	10	3	3	2

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	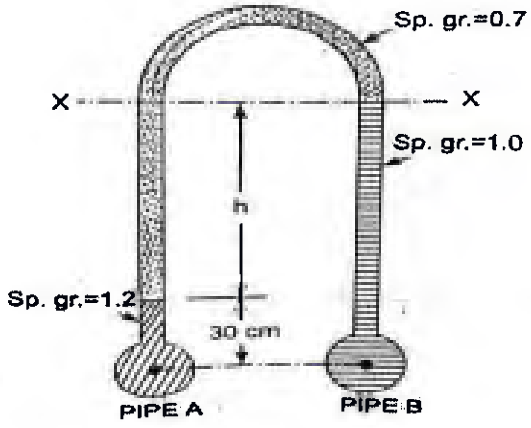				
Q3(a)	The velocity potential function for a two-dimensional, incompressible, irrotational flow is given by: $\phi(x, y) = y^2 - 3x$ (a) Determine the velocity vector at the point P(2, 1). (b) Also, find the corresponding value of the stream function ψ at the same point.	10	3	3	3
Q3(b)	Explain the following terms in the context of fluid flow: a) Path Line b) Streak Line c) Stream Line d) Properties of Velocity Potential Function e) Properties of Stream Function	10	1	2	3
Q4(a)	Starting from Euler's equation for inviscid, incompressible, and steady flow along a streamline, derive the Bernoulli's equation. Clearly state all assumptions made during the derivation.	10	3	3	4
Q4(b)	A 45° bend is installed in a horizontal plane, with the cross-sectional areas at the inlet and outlet of the bend being 1.2 m^2 and 0.6 m^2, respectively. The velocity of the fluid at the inlet is 12 m/s, and the pressure at the inlet and outlet are 45 kN/m^2 and 35 kN/m^2, respectively. Calculate: 1. The magnitude of the force required to hold the bend in position. 2. The direction of the force exerted on the bend.	10	3	4	4

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Q5(a)	A horizontal Venturi meter is used to measure the flow of oil. The inlet diameter of the Venturi meter is 40 cm, and the throat diameter is 15 cm. The pressure intensity at the inlet is 10.562 N/cm², and the vacuum pressure head at the throat is 45 cm of mercury. There is a 3% loss in the differential head between the inlet and the throat. Calculate: 1. The rate of flow of oil through the Venturi meter. 2. The coefficient of discharge of the Venturi meter.	10	3	4	5
Q5(b)	Water flows through a horizontal pipe at a rate of 0.4 m³/s. The diameter of the pipe is 150 mm and is suddenly enlarged to 300 mm. The pressure intensity in the smaller pipe is 15 N/cm². Calculate: 1. The loss of height due to sudden enlargement. 2. The pressure intensity in the larger pipe. 3. The power loss due to the enlargement.	10	3	4	5
Q6(a)	An aircraft is flying at a cruising speed of 250 m/s at an altitude of 5000 m, where the atmospheric pressure is 54.05 kPa and the ambient air temperature is 255.7 K. Before entering the compressor, the ambient air is decelerated in a diffuser. Assume both the diffuser and the compressor operate under isentropic conditions. Determine the following: a) The stagnation pressure at the compressor inlet (i.e., at the outlet of the diffuser). b) The compressor work per unit mass required, if the stagnation pressure ratio across the compressor is 8.	10	3	4	6

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Q6(b)	Define Mach number. Explain the classification of high-speed flows based on Mach number and discuss the physical significance of each regime.	10	1	2	6
Q7(a)	Describe the working principle of a centrifugal fan or blower with the help of a clear diagram. Additionally, explain the Fan Laws used for performance prediction and scaling purposes.	10	3	3	7
Q7(b)	With the aid of neat sketches, explain the operating principles of the following impulse and reaction-type hydraulic turbines: a)Pelton Turbine b)Reaction Turbine Also, mention the ideal operating conditions and typical applications for each	10	3	3	7

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END SEM/~~REGULAR~~ EXAMINATION MAY / ~~JUNE~~ 2025(WP)

Program: BTECH (MECH.ENGG.) S.Y. COMP **Duration:** 3 hrs

Course **Code:** MI-BT021 Sem IV **Maximum Points:** 100

Course Name: Internet of Things (IOT) **Semester:** IV

- All questions are compulsory
- Figures to the right indicate full marks
- Provide figures wherever necessary

21/5/25

Q.No.	Questions	Points	CO	BL	PI
1	**a)** Explain IOT-Block chain integration ecosystem with neat figure **b)** Explain the following sensors with figures 1) Pressure sensor 2) Temperature sensor	[10] [10]	1,2,3	2	3.2.1, 5.1.2
2	**a)** Explain the following two enabling technologies of IOT with figures? • Big data analytics • Cloud computing **b)** Explain the following 1) Role of AI based signal processing in multi modal sensing 2) Raspberry Pi controller with GPIO pins	[10] [10]	1,2,3	2	3.2.1, 5.1.2
3	Write short notes on (any three) • ZIGBEE • ZWAVE • SIGFOX • NB-IOT • LORA & LORAWAN	[20]	2,3	2	5.1.2
4	**a)** Consider a smart city traffic monitoring system with cameras and sensors installed at multiple junctions. Explain how an IOT gateway helps manage data traffic, ensure local processing, and maintain reliable communication with cloud servers. Include a figure to show the data flow architecture **b)** As an IoT system architect for a smart agriculture project, you are tasked with designing a system that integrates sensors across vast farmlands to monitor soil moisture, temperature, and weather conditions in real-time. (1) Propose a hybrid architecture using Edge, Fog, and Cloud computing for this application. (2) Justify where and why each computing layer (Edge, Fog, Cloud) should be placed in your architecture.	[[10] {10]	2,3	2	5.1.2

	(3) Draw a neat diagram of your proposed architecture and highlight how latency, bandwidth, and power consumption are optimized across the layers.				
5	**a)** What is the significance of an IIOT platform? What is the difference between an IOT & IIOT platform? List the various types of IIOT platform? Explain any one IIOT platform in detail along with neat figure of its framework? **b)** Explain the disadvantages of microcontrollers & microprocessors as compared to an IOT ecosystem?	[15] [05]	2,3	2	5.1.2
6	**a)** Explain the following IOT protocols with neat figure • MQTT • AMQP • COAP • HTTP **b)** Explain new business markets in IOT	[15] [05]	3,4	2	5.1.2
7	**a)** Explain the following in an IOT ecosystem • Data acquisition & storage • Data processing & analytics • Data visualization & reporting **b)** Write a note on emerging IOT technologies	[15] [05]	3,4	2	5.1.2
********** All the Best **********					

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END SEMSTER / RE-EXAMINATION, TERM-II, A.Y. 2024-25 ; MAY 2025

Program: Working Professional B. Tech. Mechanical (S.Y. B.Tech / Sem IV) **Duration: 3 Hours**

Course Code: PCC-BTM 403 **Maximum Points: 100**

Course Name: Mechanical Measurement and Control **Semester: IV**

23/5/25

Notes:

1) **Solve: Any FIVE Questions.**
2) Answers must be **SPECIFIC** and in **legible** handwriting.
3) **Draw neat, labelled system diagrams/sketches** wherever asked or necessary.
4) **Illustrate your answers with suitable examples** wherever asked or necessary.
5) **Assume suitable data wherever necessary and state the same.**

Q. No.	Question	Points	CO	BL	Module
1.	**a) Explain**: Functional elements of a generalized measurement system. **Draw:** Block diagram. **Illustrate:** Your answer with the example of a bourdon tube pressure gauge. **Draw:** neat sketch and block diagram of it.	**10**	1,3	II, III, IV	1,4
	b) The stress in the mild steel flat circular diaphragm is given by equation $S = \frac{3\,D^2.P}{16\,t^2}$ (N/m^2). Where, D and t are the diameter and thickness respectively, each in m, P is the applied pressure in N/m^2. **Evaluate:** i) The magnitude of stress S, ii) Absolute error in S and iii) Probable error in S, if D = 0.02 m ± 1%, t = 0.002 m ± (6x10^{-6}) and P = 40x10^4 N/m^2 ± 1%.	**10**	1	VI	1
2.	**a) Explain:** The principle of working of a strain gauge. **Define:** Gauge factor of strain gauge and **Derive:** the Expression, Gauge factor= $1 + 2\nu$, where, ν is the Poisson's ratio of strain gauge material. **State:** the assumption/s made in the derivation of expression.	**10**	2,3	I, II, VI	2
	b) Explain: Classification of strain gauges describing their material, working, arrangement, advantages and disadvantages. **Draw:** Neat schematic diagrams as necessary.	**10**	2,3	II, III	2

A

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END SEMSTER / ~~BE~~-EXAMINATION, TERM-II, A.Y. 2024-25 MAY 2025

3.	[redacted] various types of transducers for displacement measurement. **Explain**: Arrangement, Working, advantages and disadvantages of LVDT for displacement measurement. **Draw:** Neat sketch.	**10**	2,3	I,II, III	3
	b) Explain: Working, advantages and disadvantages of stroboscope. **Draw:** Neat sketches. While measuring the speed of turbine with a stroboscope, stationary images were observed for four consecutive stroboscope setting of 20000, 15000, 12000 and 10000 flashes per minute. **Determine:** The true rotational speed of the turbine.	**10**	2,3	I, II, III, VI	3
4.	**a) State:** Various types of accelerometers. **Explain:** arrangement and working of **any one** of them and **Draw:** its neat sketch. A seismic instrument is mounted on a machine running at 1000 rpm. The natural frequency of the seismic instruments is 20 rad/s. The instrument records the relative amplitude of 0.5 mm. **Evaluate:** the actual displacement of the machine. Neglect the damping in the seismic instrument.	**10**	2,3	I, II, III, VI	3
	b) State: Various types of flow measurement transducers. **Explain:** Working, advantages and disadvantages of rotameter. **Draw:** Neat sketch.	**10**	2,3	I, II, III	4
5.	**a) Explain:** Construction, working, advantages and disadvantages of RTD. A Pt_{100} RTD shows resistance of 141Ω at 70°C. **Evaluate:** i) Resistance at a temperature of 300°C and ii) Temperature when the resistance is 181Ω.	**10**	2,3	II, VI	4
	b) Distinguish between: Open loop and closed loop control systems with respect to principle, working, advantages, disadvantages and applications, etc. **Draw:** Block diagram of both the systems.	**10**	4	I, III, IV	5
6.	**a) Discuss:** Mathematical model of a typical second order control system of spring, mass and damper. **Draw:** Neat schematic diagram. **Derive:** Expression for transfer function of this system for step response in Laplace transform form.	**10**	4	II, III, VI	5
	b) A second order control system has its characteristic equation given as $F(s) = s^2 + 2.4s + 9$. If a step input is applied to it, Evaluate: Time	**10**	4	III, VI	6

A

	domain (transient) specifications of the system. Draw: Neat sketch of the response of the system.				
7.	**a) Explain:** Various types of standard input signals in transient (time domain) analysis. **Draw:** Neat sketches of each.	**06**	4	II, III	1,6
	b) Define: steady state error. **Derive:** The general expression for the steady state error of a typical closed loop control system.	07	4	I, VI	6
	c) State: Various types of amplifiers for signal conditioning. **Explain:** Any one of them. **Draw:** Neat circuit diagram.	**07**	4	I,II, III	7

(B)

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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2025

Program: Mechanical Sem IV (Working Professional) **Duration:** 3 Hrs

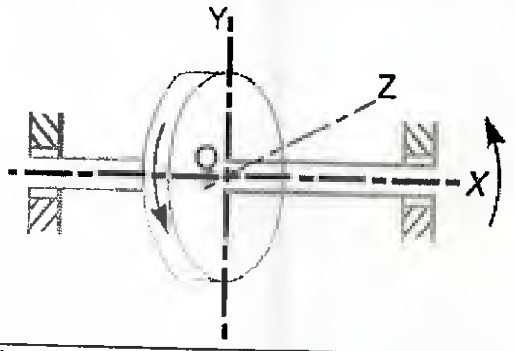
Course Code: PC-BTM 405 **Maximum Points:** 100

Course Name: Dynamics of Machinery **Semester:** IV

Notes: Solve ANY FIVE

Assume suitable data

19/5/25

Q.No.	Questions	Points	CO	BL	Module No.
1 a	Explain Proney brakes and Rope brakes in detail	10	2	IV	I
1b	Discuss Epicyclic-train dynamometers, Belt transmission and torsion dynamometers with neat sketch	10	3	V	I
2a	Discuss the effect of Gyroscope couple on a naval ship in detail	10	2	VI	2
2 b	A uniform disc of 150 mm diameter has a mass of 5 kg. It is mounted centrally in bearings which maintain its axle in a horizontal plane. The disc spins about it axle with a constant speed of 1000 r.p.m. while the axle precesses uniformly about the vertical at 60 r.p.m. The directions of rotation are as shown in Fig. If the distance between the bearings is 100 mm, find the resultant reaction at each bearing due to the mass and gyroscopic effects. 	10	I	IV	2
3a	Discuss the Flywheel in detail with coeff. of fluctuation of speed, energy stored in a flywheel. The mass of flywheel of an engine is 6.5 tonnes and the radius of gyration is 1.8 metres. It is found from the turning moment diagram that the fluctuation of energy is 56 kN-m. If the mean speed of the engine is 120 r.p.m., find the maximum and minimum speeds.	10	1	V	3

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3 b	Explain in detail Watt governor and Porter governor in detail. The arms of a Porter governor are each 250 mm long and pivoted on the governor axis. The mass of each ball is 5 kg and the mass of the central sleeve is 30 kg. The radius of rotation of the balls is 150 mm when the sleeve begins to rise and reaches a value of 200 mm for maximum speed. Determine the speed range of the 410governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve, determine how the speed range is modified.	10	2	VI	3
4a	Discuss the internal expanding brake and simple band brake in detail	10	2	IV	4
4b	Explain cone clutch and centrifugal clutch in detail with neat sketch	10	3	V	4
5a	Explain Four different methods used to obtain vibrations of a system.	10	4	IV	5
5b	Discuss various causes of vibration and various types of vibration	10	4	IV	5
6a	Derive an expression for Coulomb's damping	10	4	V	5
6b	Derive an expression for Viscous damping in detail	10	4	IV	6
7a	Explain balancing of masses in same plane and different planes	10	3	V	7
7 b	A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions.	10	3	IV	7

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WP_END SEM EXAMINATIONS (Even SEM) May 2025_V1

S.Y.

Program : BTech Mechanical engg (WP) Sem IV **Duration: 3.00 hr**

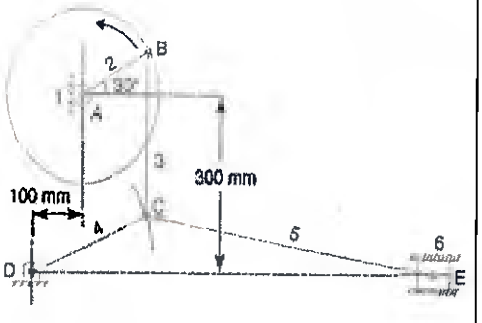
Course Code: PC-BTM 404 **Maximum Points: 100**

Course Name: Kinematics of Machinery **Semester: IV**

Notes:

1. Question number **ONE is compulsory** solve any **four** out of remaining
2. **Question nos. 1,2,3 and 4 should be solved on drawing sheet.**
3. Answers to each sub-questions are grouped together
4. Use of scientific calculator is allowed
5. Begin answer to each question on new page.
6. **Candidates should write the answers legibly**

Q	Description	Pts	Cos	BL	Md
1	Explain the following : a) Kennedy's theorem b) Mobility of Mechanism c) Mechanism d) Grashoff's law e) Types of Inversion of simple four bar chain (4R-0P) f) The criteria of classification of kinematic pair g) Interference in gear mesh h) Pitch point on cam profile i) Coriollis component of acceleration j) Contact ratio in gear	20	1 2	1,2	1,2,4 ,5,6
2	a) A crank-rocker linkage has a 100 mm frame, a 25 mm crank, a 90 mm coupler and a 75 mm rocker. For the given links draw the minimum and maximum transmission angle. Also draw both the toggle position and measure corresponding crank angles and transmission angles. (Solve graphically). b) In a slider crank mechanism crank is 25 mm long and connecting rod is 110 mm long. Find velocity of the slider by relative velocity method if crank is making an angle of 45^0 with horizontal in ccw direction and rotating with the uniform angular velocity of 10 rad/sec in cw direction. If C.G. of connecting rod is at 50 mm from crank end, find velocity of the same.	12 08	1	3,4	2,3

3	a) Use following data in drawing the displacement, velocity, acceleration verses theta (θ) diagram for a cam in which a ***roller*** follower is raised with SHM and is lowered with SHM: least radius of cam 20 mm, lift 45 mm, angle of ascent 150^0, angle of descent 90^0, dwell between ascent and descent 30^0, cam rotation 60 rpm. Determine the maximum velocity and acceleration during ascent and descent. b) Draw the cam profile for the above details.	10 10	4	3	5
4	Locate all the instantaneous centers of the mechanism as shown in Fig. The lengths of various links are: AB = 150 mm; BC = 300 mm; CD = 225 mm; and CE = 500 mm. When the crank AB rotates in the anticlockwise direction at a uniform speed of 240 rpm. Find: Velocity of the slider E, and angular velocity of the links BC and CE. Using: a) IC method (take 1:10 scale and locate all IC's) b) Relative velocity method. 	 12 8		3	6
5	a) State the fundamental law of gearing, deduce the expression for the same. b) A 6 mm module 24 teeth pinion is to drive a 36 teeth gear. The gears are cut on the 20° full-depth involute system. Find and tabulate the addendum, dedendum, clearance, circular pitch, base pitch, base circle radii, length of paths of approach and recess, and contact ratio.	8 12	4	3	6
6	a) Deduce the expression for minimum number of teeth on gear wheel. b) A driving shaft of a Hooke's joint rotates at a uniform speed of 400 rpm. If the maximum variation in the driven shaft is ±5% of the mean speed, determine the greatest permissible angle between the axes of the shafts. What are the maximum and minimum speeds of the driven shaft?	10 10	4	4	6
7	a) State the advantages of gear drive over the belt drive. b) State and prove condition for correct steering. c) State the conditions for straight line generating mechanism. Sketch the Peaucellier mechanism and prove that the tracing point 'P' describes the straight line.	5 5 10	1,2	3	4

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End Semester Examination/ ~~Re-Examination~~ – May/~~June~~ 2025

Program: S.Y.B.Tech (Mechanical)_Working Professionals **Duration: 3 Hours**

Course Code: ES-BTM401 **Maximum Points: 100**

Course Name: Statistics, Probability and Laplace Transforms **Semester: IV**

Note:

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

		Questions	Points	CO	BL	Module
1	a	Evaluate $L^{-1}\left\{\log\left(\frac{s^2+a^2}{s^2+b^2}\right)\right\}$	6	CO1	BL5	2
	b	Evaluate $L\left\{e^{-3t}\int_0^t \frac{\sin 3u}{u}du\right\}$	6	CO1	BL5	1
	c	A random variable X has the following probability distribution: X: 1, 2, 3, 4, 5, 6, 7 P(X): k, 2k, 2k, 3k, k^2, $2k^2$, $7k^2+k$ Determine (*i*) k (*ii*) $P(3 < X \le 6)$ (*iii*) $P(X < 5)$ (*iii*) *Mean*	8	CO2	BL3	4
2	a	The mean height and the S.D of the height of eight randomly chosen soldiers are 166.9 cm and 8.29 cm respectively. The corresponding values of six randomly chosen sailors are 170.3 cm and 8.50 cm respectively. Based on this data, can we conclude that soldiers are, in general, shorter than sailors?	6	CO3	BL5	6
	b	Evaluate $L\left\{\frac{d}{dt}\left(\frac{e^{-at}-e^{-bt}}{t}\right)\right\}$	6	CO1	BL2	2
	c	Let X denotes the sum of the numbers obtained when two fair dice are rolled. Find the variance and standard deviation of X.	8	CO2	BL3	4

End Semester Examination/ ~~Re-Examination~~ – May/~~June~~ 2025

3	a	Evaluate $L^{-1}\left\{\frac{2s+3}{(s-1)(s-2)(s+3)}\right\}$	6	CO1	BL4	2
	b	A potential buyer of light bulbs bought 50 bulbs each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hours with S.D of 80 hours, brand B had a mean life of 1208 hours with S.D of 94 hours. Can the buyer be quite certain that the mean of the two brands differ?	6	CO3	BL5	6
	c	Find constant k such that the function $f(x)=\begin{cases}k(1-x^2), & \text{if } 0\le x\le 1\\ 0 & \text{elsewhere}\end{cases}$ is a density function. Also find $P(0.1\le X\le 0.2)$ and $P(X\ge 0.5)$	8	CO2	BL5	5
4	a	Evaluate $L\{t\cdot e^{-3t}f(2t)\}$, if $L\{f(t)\}=\frac{2s+1}{s^2-3s+4}$	6	CO1	BL5	1
	b	An aptitude test for selecting officers in a bank is conducted on 1000 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the scores, find (i) The numbers of candidates whose scores exceed 60. (ii) The numbers of candidates whose score lie between 30 and 60.	6	CO2	BL3	5
	c	Evaluate $L^{-1}\left\{\frac{s}{(s^2+1)(s^2+4)(s^2+9)}\right\}$	8	CO1	BL3	2
5	a	Certain pesticide is packed into bags by a machine. A random sample of 10 bags is drawn and their contents are found to weigh (in kg) as follows 50, 49, 52, 44, 45, 48, 46, 45, 49, 45	6	CO3	BL4,5	7

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End Semester Examination/ ~~Re-Examination~~ – May/~~June~~ 2025

		Test if average packing can be taken to be 50 kg at 5% LOS.				
	b	Prove that $\int_0^{\infty} \frac{\sin 2t + \sin 3t}{te^t} dt = \frac{3\pi}{4}$ Use $\tan^{-1} A + \tan^{-1} B = \tan^{-1}\left(\frac{A+B}{1-A \cdot B}\right)$	6	CO1	BL4	1
	c	Two independent samples of sizes 8 and 7 contained the following values Sample I: 19, 17, 15, 21, 16, 18, 16, 14 Sample II: 15, 14, 15, 19, 15, 18, 16 Is the difference between the sample means significant?	8	CO3	BL2, BL4	7
6	a	Test the significance of the difference between the means of samples drawn from two normal populations with the same S.D from the following data. Sample 1: Size 100, Mean 61, S.D 4 Sample 2: Size 200, Mean 63, S.D 6	6	CO3	BL5	6
	b	A machine is set to produce metal plates of thickness 1.5 cm with standard deviation 0.2 cm. A sample of 100 plates produced by the machine gave an average thickness of 1.2 cm. Is the machine fulfilling the purpose?	6	CO3	BL3	6
	c	Using Convolution Theorem, Evaluate $L^{-1}\left\{\frac{s^2}{(s^2+1)(s^2+4)}\right\}$	8	CO1	BL3, BL5	2

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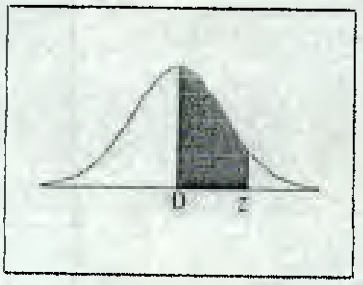
End Semester Examination/ ~~Re-Examination~~ – May/~~June~~ 2025

7	a	Two random sample gave the following data Sample No | Size | Mean | Variance 1 | 1500 | 67.42 | 2.58 2 | 2000 | 67.25 | 2.5 Is the difference between standard deviation significant?	6	CO3	BL2, BL3	6
	b	The marks obtained by students in a certain examination follow a normal distribution with mean 45 and standard deviation 10. If 1000 students appeared at an examination, calculate the number of students scoring (i) less than 40 marks (ii) more than 60 marks.	6	CO2	BL5	5
	c	Using Laplace Transform, solve the following Differential Equation $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = 4e^{2t}$, whrere $y(0) = -3$ *and* $y'(0) = 5$	8	CO1	BL1, BL3	3

Standard Normal Distribution Table

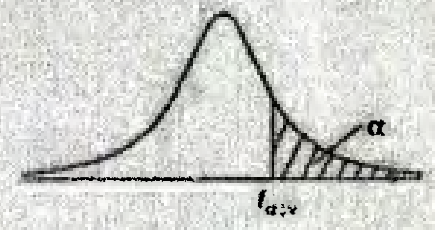


z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998

Eric Cleckner. Typeset with LaTeX on April 20, 2006.

Table of the Student's *t*-distribution

The table gives the values of $t_{\alpha;\nu}$ where
$\Pr(T_\nu > t_{\alpha;\nu}) = \alpha$, with ν degrees of freedom



ν \ α	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
1	3.078	6.314	12.076	31.821	63.657	318.310	636.620
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

~~End Semester Examination~~/ Re-Examination ~~May~~/June 2025

Program: S.Y.B.Tech (Mechanical)_Working Professionals **Duration: 3 Hours**

Course Code: ES-BTM401 **Maximum Points: 100**

Course Name: Statistics, Probability and Laplace Transforms **Semester: IV**

23/6/25

Note:

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

		Questions	Points	CO	BL	Module
1	a	Evaluate $L^{-1}\left\{\frac{s}{(s+1)(s+2)(s+3)}\right\}$	6	CO2	BL5	2
	b	A manufacturer of electric bulbs, according to certain process, finds the S.D. of the life of lamps to be 100 hours. He wants to change the process, if the new process results in a smaller variation in the life of lamps. In adopting a new process, a sample of 150 bulbs gave S.D of 95 hours. Is the manufacturer justified in changing the process?	6	CO1	BL5	1
	c	A random variable X has the following probability distribution: X: 0 | 1 | 2 | 3 | 4 | 5 | 6 P(X): k | 3k | 5k | 7k | 9k | 11k | 13k Determine (i) k (ii) $P(2 < X \leq 5)$ (iii) $P(X < 4)$ (iii) $Mean$	8	CO1	BL3	2
2	a	Evaluate $L\left\{e^{-4t}\int_0^t \frac{\sin 2u}{u}du\right\}$	6	CO1	BL5	1
	b	Evaluate $L^{-1}\left\{\log\left(\frac{s^2+4}{s^2+9}\right)\right\}$	6	CO1	BL2	1

~~End Semester Examination~~/ Re-Examination – ~~May~~/June 2025

	c	Two independent samples of sizes 8 and 7 contained the following values Sample I: 19, 17, 15, 21, 16, 18, 16, 14 Sample II: 15, 14, 15, 19, 15, 18, 16 Is the difference between the sample means significant?	8	CO3	BL3	5
3	a	Evaluate $L\left\{\frac{d}{dt}\left(\frac{\sin t}{t}\right)\right\}$	6	CO2	BL4	2
	b	A potential buyer of light bulbs bought 50 bulbs each of 2 brands. Upon testing the bulbs, he found that brand A had a mean life of 1282 hours with S.D of 80 hours, brand B had a mean life of 1208 hours with S.D of 94 hours. Can the buyer be quite certain that the mean of the two brands differ?	6	CO3	BL5	4
	c	Let X denotes the sum of the numbers obtained when two fair dice are rolled. Find the variance and standard deviation of X.	8	CO1	BL5	2
4	a	Evaluate $\int_0^\infty t^2 e^{-4t} \sin 2t dt$	6	CO1	BL5	1
	b	An aptitude test for selecting officers in a bank is conducted on 1000 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the scores, find (i) The numbers of candidates whose scores exceed 60. (ii) The numbers of candidates whose score lie between 30 and 60.	6	CO2	BL3	3
	c	Let X be a continuous random variable with probability density function $f(x)=\begin{cases} Ke^{-3x}, & x>0 \\ 0 & x\le 0 \end{cases}$ Find (i) K (ii) $P(1\le X\le 2)$ (iii) $P(X\ge 3)$ (iv) Mean	8	CO1	BL3	3

~~End Semester Examination~~/ Re-Examination – ~~May~~/June 2025

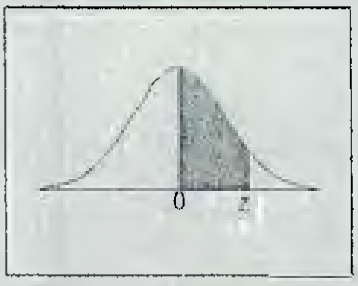
5	a	Tests made on the breaking strength of 10 pieces of a metal gave the following results: 578, 572, 570, 568, 572, 570, 570, 572, 596 and 584 kg. Test if the mean breaking strength of the wire can be assumed as 577 kg.	6	CO3	BL4,5	4
	b	Evaluate $L\{t\cdot e^{2t}f(3t)\}$, if $L\{f(t)\}=\frac{2s-1}{s^2-3s+7}$	6	CO2	BL4	2
	c	Using Convolution Theorem, Evaluate $L^{-1}\left\{\frac{s}{(s^2+9)(s^2+4)}\right\}$	8	CO1	BL2, BL4	1
6	a	In a random sample of size 500, the mean is found to be 20. In another independent sample of size 400, the mean is 15. Could the sample have been drawn from the same population with S.D = 4?	6	CO1	BL5	1
	b	An ambulance service claims that it takes on an average 8.9 minutes to reach its destination in emergency calls. To check on this claim, the agency which licenses ambulance services has them timed on 50 emergency calls, getting a mean of 9.3 minutes with standard deviation of 1.6 minutes. What can they conclude at the 5% level of significance?	6	CO3	BL3	4
	c	The distribution of marks obtained by a group of students may be assumed to be normal with mean 50 marks and standard deviation 15 marks. Estimate the proportion of students with marks less than 35. If 15% of the students secured more than K marks, determine K.	8	CO2	BL3, BL5	3
7	a	Two random sample gave the following data Is the difference between standard deviation significant?	6	CO3	BL2, BL3	4

Sample No	Size	Mean	Variance
1	1500	67.42	2.58
2	2000	67.25	2.5

End Semester Examination/ Re-Examination – May/June 2025

	b	The marks obtained by students in a certain examination follow a normal distribution with mean 45 and standard deviation 10. If 5000 students appeared at an examination, calculate the number of students scoring (i) less than 50 marks (ii) more than 65 marks.	6	CO2	BL5	3
	c	Using Laplace Transform, solve the following Differential Equation $\frac{d^2y}{dt^2}+2\frac{dy}{dt}+y=1$, whrere $y(0)=1$ *and* $y'(0)=-2$	8	CO1	BL1, BL3	1

Standard Normal Distribution Table



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
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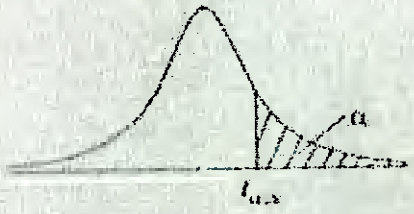
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998

Table of the Student's *t*-distribution



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4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
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14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
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22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
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25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

END SEM/RE-EXAM EXAMINATION MAY / JUNE 2025

Program: B.Tech (Working Professionals)

Duration: 3 Hours

Course Code: PC-BTM402

Maximum Points: 100

Course Name: Fluid Mechanics

Semester: IV

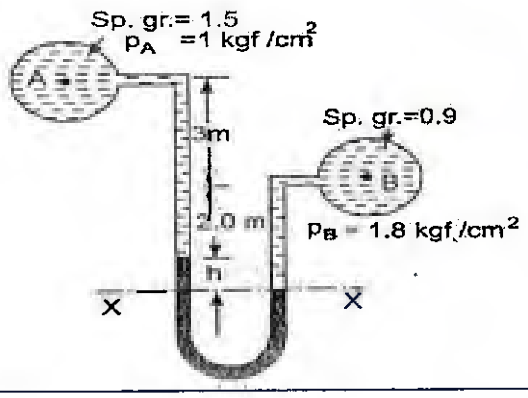
Notes:

24/6/25

1. Attempt **any 5 questions** out of the given 7.
2. **Each question carries 20 marks** (2 sub-questions of 10 marks each).
3. If you choose to attempt **Q.1(a)**, you must also attempt **Q.1(b)** — sub-questions **must be answered in pairs.**

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	Define and explain the different types of fluids based on their flow characteristics. Provide one suitable example for each type. Also, sketch a shear stress vs. velocity gradient graph to support your explanation.	10	1	2	1
Q1(b)	A rectangular plate measuring 50 cm × 70 cm slides down a lubricated inclined surface at an angle of 25°. The thickness of the oil film between the plate and surface is 2 mm. The mass of the plate is 20.4 kg, and it slides at a uniform speed of 25 cm/s. Calculate the dynamic viscosity of the oil in Pa·s. A self-drawn schematic is expected.	10	3	3	1
Q2(a)	Define metacentric height. Explain its significance in determining the stability of floating bodies and distinguish between stable, unstable, and neutral equilibrium.	10	1	2	2
Q2(b)	A differential manometer is connected at the two points A and B of the two pipes as shown in the figure. The pipe A contains a liquid of specific gravity 1.5 while the pipe B contains a liquid of specific gravity 0.9. The pressure at A and B are 1 kgf /cm2 and 1.8 kgf /cm2 respectively. Find the difference in the mercury level in the differential manometer.	10	3	3	2

~~END SEM~~/RE-EXAM EXAMINATION ~~MAY~~ / JUNE 2025

					
Q3(a)	A velocity field of a fluid flow is given by: $\vec{V} = (x^2 - yz)i + (xy + z^2)j + (xz - y^2)k$ (a) Show that the given velocity field represents a case of steady incompressible flow. (b) Find the velocity vector and the acceleration vector at the point (1, 2, −1).	10	3	4	3
Q3(b)	Explain the following terms as applicable to fluid motion: a) Linear Translation b) Linear Deformation c) Pure Rotation d) Vorticity e) Circulation	10	2	2	3
Q4(a)	Starting from Euler's equation for inviscid, incompressible, and steady flow along a streamline, derive the Bernoulli's equation. Clearly state all assumptions made during the derivation.	10	2	3	4
Q4(b)	A pipe of 500 mm diameter is conveying 0.50 m^3/s of water and contains a right-angled bend lying in a horizontal plane. The pressure at the inlet of the bend is 30 N/cm^2, and at the outlet, it is 28 N/cm^2.Determine the resultant force exerted on the bend.	10	4	3	4
Q5(a)	Water is flowing through a horizontal Venturi meter. The Venturi meter has an inlet diameter of 30 cm and a throat diameter of 15 cm. A differential manometer, connected between the inlet and the throat, shows a mercury column reading of 20 cm. The coefficient of discharge of the Venturi meter is 0.95. Calculate the discharge of water through the Venturi meter.	10	3	3	5

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Q5(b)	Three pipes with diameters of 500 mm, 250 mm, and 350 mm are connected in series to form a compound pipe. The lengths of these pipes are 500 m, 300 m, and 400 m, respectively. The ends of this compound pipe are connected to two reservoirs, which have a difference in water level of 20 m. The coefficient of friction for all pipes is the same and equal to 0.004. Neglect the minor losses.	10	3	4	5
Q6(a)	Define Mach number. Explain the classification of high-speed flows based on Mach number and discuss the physical significance of each regime.	10	2	2	6
Q6(b)	An aircraft is flying at a cruising speed of 250 m/s at an altitude of 5000 m, where the atmospheric pressure is 54.05 kPa and the ambient air temperature is 255.7 K. Before entering the compressor, the ambient air is decelerated in a diffuser. Assume both the diffuser and the compressor operate under isentropic conditions. Determine the following: a) The stagnation pressure at the compressor inlet (i.e., at the outlet of the diffuser). b) The compressor work per unit mass required, if the stagnation pressure ratio across the compressor is 8.	10	3	4	6
Q7(a)	Describe the different characteristic curves associated with a centrifugal pump. Explain the importance of each curve and how they assist in evaluating the pump's performance under varying operating conditions.	10	2	3	7
Q7(b)	Describe the different types of losses that occur in a centrifugal compressor. Include mechanical, aerodynamic, and thermodynamic losses, and explain the impact of each on the overall efficiency of the compressor.	10	2	3	7