



SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEMESTER EXAMINATION MAY 2026 / RE - EXAM JULY 2026(WP)

Program: Mechanical

Second Year B.Tech
W.P

Duration: 3 hours

Course Code: ES-BTM401

Maximum Points: 100

Course Name: Statistics probability & Laplace transforms

Semester: IV

Notes: 1) Attempt any 5 out of 7 questions.

2) Use of scientific calculator is allowed.

25/05/2026

Q.No.	Questions	Points	CO	BL	Modu No.														
1a)	Prove that: $L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)^2} \right\} = \frac{1}{2a} (\sin at + at \cos at)$ using convolution theorem	10	3	2,4,5	7														
1b)	A & B throw alternately with a pair of ordinary dice, 'A' wins if he throw '6' before 'B' throw '7' and B wins if he throws '7' and B wins before 'A' throws '6'. If A begins. Find their respective chances of winning	10	1	2,4,5	3														
2a)	Assume that on the average one telephone number out of fifteen called between 2:00 pm and 3:00 pm on week days is busy. What is the probability that if 6 randomly selected telephone numbers are called i. Not more than three ii atleast three of them will be busy	6	1	3,4,5	2														
2b)	Compute spearman's rank coorelation coefficient for the following data <table border="1"> <tr> <td>X</td> <td>10</td> <td>12</td> <td>18</td> <td>18</td> <td>15</td> <td>40</td> </tr> <tr> <td>Y</td> <td>12</td> <td>18</td> <td>25</td> <td>25</td> <td>50</td> <td>25</td> </tr> </table>	X	10	12	18	18	15	40	Y	12	18	25	25	50	25	6	1	2,4,5	1
X	10	12	18	18	15	40													
Y	12	18	25	25	50	25													
2c)	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	8	1	3,4,5	3														
3a)	Evaluate: $L^{-1} \left\{ \frac{27 - 12s}{(s + 4)(s^2 + 9)} \right\}$	10	3	2,4,5	7														



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3b	Ten individuals are chosen at random from a population and their heights are found to be (in inches): 63, 63, 66, 67, 68, 69, 70, 70, 71 & 72. In the light of the data discuss the suggestion that the mean height in the population is 66 inches.	10	2	2,4,5	4																
4a	Find Laplace transform of $L \left\{ \int_0^t \frac{1-e^{-u}}{u} du \right\}$	6	3	1,4,5	6																
4b	In a partially destroyed laboratory record of an analysis of correlation data. the following results only are legible: Variance of X = 9 Regression equations: $8x - 10y + 66 = 0$ $40x - 18y = 214$ What are i. Mean, value of x and y ii. Standard deviation of y. iii. Coefficient of correlation between x and y	6	1	2,4,5	1																
4c	Fit a Poisson distribution for the following distribution <table><tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>Total</td></tr><tr><td>f(x)</td><td>142</td><td>156</td><td>69</td><td>27</td><td>5</td><td>1</td><td>400</td></tr></table>	X	0	1	2	3	4	5	Total	f(x)	142	156	69	27	5	1	400	8	1	2,4,5	2
X	0	1	2	3	4	5	Total														
f(x)	142	156	69	27	5	1	400														
5a	Prove that $\int_0^{\infty} e^{-t} \frac{\sin^2 t}{t} dt = \frac{1}{4} \log 5$	10	3	1,4,5	6																
5b	Two bad eggs are mixed accidentally with 10 good ones. Find the probability distribution of the number of bad eggs in 3, drawn at random, without replacement from this lot.	10	1	2,4,5	2																
6a	In an experiment on pea - breeding mendel obtained the following frequencies of seeds. 315 Round and Yellow 101 Wrinkled and Yellow 108 Round and Green 32 Wrinkled and Green According to his theory of heredity the numbers should be in population 9:3:3:1. Is there any evidence to doubt the theory at 5% Los?	10	2	3,4,5	4																
6b	To verify whether a course in accounting improved performance, a similar test was given to 12 participants both before and after the course. The original marks recorded in alphabetical order of the participants were 44, 40, 61, 52, 32, 44, 70, 41, 67, 72, 53 and 72. After the course, the marks were in the same order 53, 38, 69, 57, 46.	10	2	2,4,5	5																



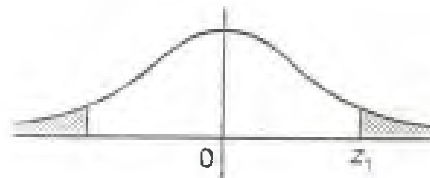
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	39, 73, 48, 73, 74, 60 & 78. Was the course useful?				
7a	A crv X has PDF defined as $f(x) = \begin{cases} A+Bx, 0 \leq x \leq 1 \\ 0, elsewhere \end{cases}$ If the mean of the distribution is 1/3. Find A & B.	10	2	2,4,5	5
7b	Solve $y''(t) - y(t) = e^t$ Given $y(0) = 0$ $y'(0) = 0$ using laplace	10	3	3,4,5	7

Percentage Points of t -distribution

Example

For $\Phi = 10$ d. o. f.

$$P(|t| > 1.812) = 0.1$$

P	0.20	0.10	0.05	0.02	0.01
1	3.078	6.314	12.706	31.812	63.657
2	1.886	2.920	4.303	6.965	9.925
3	1.638	2.353	3.182	4.541	5.841
4	1.533	2.132	2.776	3.747	4.604
5	1.476	2.015	2.571	3.365	4.032
6	1.440	1.943	2.447	3.143	3.707
7	1.415	1.895	2.365	2.998	3.499
8	1.397	1.860	2.306	2.896	3.355
9	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.287
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.325	2.576

Percentage Points of χ^2 - Distribution



Example

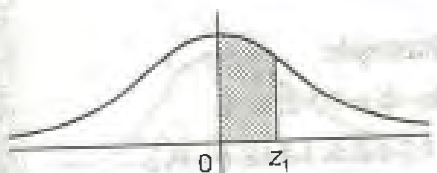
For $\Phi = 10$ d. o. f.

$$P(\chi^2 > 15.99) = 0.10$$

0.01
63.657
9.925
5.841
4.604
4.032
3.707
3.499
3.355
3.250
3.169
3.106
3.055
3.012
2.977
2.947
2.921
2.898
2.878
2.861
2.845
2.831
2.819
2.807
2.797
2.287
2.779
2.771
2.763
2.756
2.750
2.704
2.660
2.617
2.576

P	0 = .99	0.95	0.50	0.10	0.05	0.02	0.01
F							
1	.000157	.00393	.455	2.706	3.841	5.214	6.635
2	.0201	.103	1.386	4.605	5.991	7.824	9.210
3	.115	.352	2.366	6.251	7.815	9.837	11.341
4	.297	.711	3.357	7.779	9.488	11.668	13.277
5	.554	1.145	4.351	9.236	11.070	13.388	15.086
6	.872	1.635	5.348	10.645	12.592	15.033	16.812
7	1.339	2.167	6.346	12.017	14.067	16.622	18.475
8	1.646	2.733	7.344	13.362	15.507	18.168	20.090
9	2.088	3.325	8.343	14.684	16.919	19.679	21.666
10	2.558	3.940	9.340	15.987	18.307	21.161	23.209
11	3.053	4.575	10.341	17.275	19.675	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	27.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.349	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36.415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.953	18.493	29.336	40.256	43.773	47.962	50.892

Area Under Standard Normal Curve



The table gives the area under the standard normal curve from $z = 0$ to $z = z_1$ which is the probability that z will lie between $z = 0$ and $z = z_1$.

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	.2703	.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	.4415	.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



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Program: B. Tech (Working Professionals) Second year Duration: 3 hrs

Course Code: PC-BTM402

Mechanical

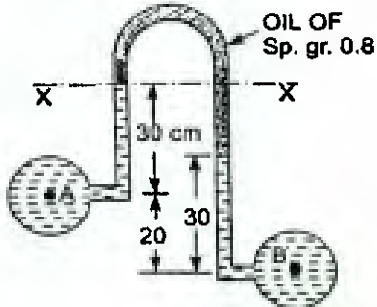
Maximum Points: 100

Course Name: Fluid Mechanics

Semester: IV

28/05/2026

- Notes:-
1. Attempt any five questions out of seven.
 2. Each question carries 20 marks.
 3. Draw neat and labelled diagrams wherever required.
 4. State suitable assumptions clearly wherever necessary.

Q.No.	Questions	Points	CO	BL	Module No.
Q1) (A)	Classify fluids into ideal fluid, real fluid, Newtonian fluid, non-Newtonian fluid, and ideal plastic fluid. Explain the characteristics of each type. Also draw the shear stress versus velocity gradient diagram showing the behavior of these fluids.	10	02	02	01
Q1) (B)	The space between two square parallel plates is filled with oil. Each side of the plate is 60 cm, and the oil film thickness is 12.5 mm. The upper plate moves with a velocity of 2.5 m/s and requires a force of 98.1 N to maintain this speed. Determine the dynamic viscosity of oil in poise and the kinematic viscosity in stokes, if the specific gravity of oil is 0.95.	10	03	03	01
Q2) (A)	State Archimedes' principle. Define buoyancy and centre of buoyancy. Explain the conditions for stability of floating bodies using the concept of metacentric height.	10	02	02	02
Q2) (B)	An inverted differential manometer is connected between two pipes A and B carrying water, as shown in the figure. The manometric fluid is oil having specific gravity 0.8. Using the given levels shown in the figure, determine the pressure difference between points A and B. 	10	03	03	02



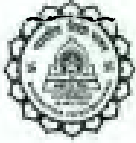
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Q3) (A)	Explain the motion of fluid particles with reference to translation, linear deformation, angular deformation, rotation, vorticity, and circulation with suitable sketches.	10	02	02	03
Q3) (B)	The velocity vector in a fluid flow is given by $\vec{V} = 5x^3i - 8x^2yj + 3tk$. Determine the velocity and acceleration of a fluid particle at the point (2, 1, 3) at time $t = 1$ s.	10	03	03	03
Q4) (A)	A non-uniform part of a pipe, 5 m long, is laid at a slope of 2 in 5. Two pressure gauges fitted at the upper and lower ends read 20 N/cm ² and 12.5 N/cm ² , respectively. If the diameters at the upper and lower ends are 15 cm and 10 cm, respectively, determine the quantity of water flowing per second. Draw a neat labelled diagram of the pipe arrangement.	10	03	03	04
Q4) (B)	A horizontal Venturimeter with an inlet diameter of 20 cm and throat diameter of 10 cm is used to measure the flow of water. The pressure at the inlet is 17.658 N/cm ² and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through the Venturimeter. Take $C_d = 0.98$.	10	03	03	04
Q5) (A)	Explain the following in pipe flow: (i) major and minor losses in pipes, and (ii) water hammering in pipes. Also mention the causes and effects of water hammering.	10	02	02	05
Q5) (B)	Three pipes of 400 mm, 200 mm, and 300 mm diameters have lengths of 400 m, 200 m, and 300 m, respectively. They are connected in series to form a compound pipe. The ends of the compound pipe are connected to two tanks whose difference in water level is 16 m. If the coefficient of friction for all pipes is the same and equal to 0.005, determine the discharge through the compound pipe by neglecting minor losses first and then including minor losses. Draw a neat labelled diagram of the pipe arrangement.	10	03	03	05
Q6) (A)	Explain the concept of compressible flow and distinguish it from incompressible flow with suitable examples. Define Mach number and classify fluid flow into different regimes based on Mach number. Discuss the significance of each regime in practical engineering applications.	10	02	02	06
Q6) (B)	Air enters a converging-diverging nozzle at a stagnation pressure of 1.0 MPa and stagnation temperature of 800 K. The inlet velocity is negligible. The flow is steady, one-dimensional, and isentropic. The specific heat ratio for air is $k = 1.4$ and gas constant $R = 0.287$ kJ/kg.K. For an exit Mach number of $Me = 2$ and throat area of 20 cm ² , determine: (i) throat conditions, (ii) exit plane conditions	10	04	04	06



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	including exit area, and (iii) mass flow rate through the nozzle. Use the following isentropic flow data: at throat condition, $M = 1$, $P^*/P_0 = 0.5283$, $T^*/T_0 = 0.8333$, $\rho^*/\rho_0 = 0.6339$; at exit condition, $Me = 2$, $P_e/P_0 = 0.1278$, $T_e/T_0 = 0.5556$, $p_e/p_0 = 0.2300$, $A_e/A^* = 1.6875$. Draw a neat labelled diagram of the nozzle.				
Q7) (A)	Explain the working of Pelton turbine and Francis turbine with neat labelled sketches. Also mention their suitable operating conditions and typical applications.	10	02	02	07
Q7) (B)	Explain the various characteristic curves of a centrifugal pump. Discuss the significance of each curve and explain how these curves help in determining pump performance under different operating conditions.	10	04	04	07



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END SEMESTER EXAMINATION MAY 2026 / ~~RE-EXAM~~ JULY 2026

Second Year B.Tech mech. W.P

Program: Mechanical Engineering Working Professional

Duration: 03 Hours.

Course Code: PC-BTM403

Maximum Points: 100

Course Name: Mechanical Measurement and Control

Semester: IV

Notes:

1. Question no 1 is compulsory
2. Attempt any **four** questions from the remaining six questions.
3. If necessary **assume** suitable data with justification
4. Draw **neatly** labeled sketches wherever required.

01/06/2026

Q. No.	Questions	Points	CO	BL	Module No.
1A	A strain gauge is bonded to a steel bar of length 150 mm and cross-sectional area 400 mm ² . The resistance of the strain gauge is 220 Ω and its gauge factor is 2.2. Due to an applied axial force, the resistance changes by 0.018 Ω . Calculate: a) strain in the bar, b) change in length of the bar, c) applied force. Take $E = 200$ GPa. Also explain why strain gauges are commonly used in force sensors.	10	2	3,4	2
1B	Explain the working principle of a diaphragm pressure gauge in brief. A diaphragm pressure gauge is constructed of a spring steel to measure differential of 7 MN/m ² . The diameter of diaphragm is 12.5 mm. Calculate the thickness of diaphragm, if the maximum deflection of 0.333 of thickness. Also calculate the natural frequency of diaphragm. Given: Young's modulus=200 GN/m ² , Poisson's ratio=0.28 and density of steel=7800 kg/m ³ .	10	3	3,4	4
2A	With the help of a neat block diagram, apply the concept of a generalized measurement system to a pressure measurement system. Identify the input stage, signal conditioning stage, output stage, desired input, interfering input, and modifying input.	10	1	4,5	1
2B	A machined component is inspected for form error and surface finish. Explain the meaning of form error and surface roughness in brief. Also mention any two causes of poor surface finish in machining. During surface roughness measurement, the deviations of the surface profile from the mean line are recorded as: +4, -3, +5, -2, +3, -4, +2, -1 μ m. Calculate the average roughness value, R_a .	10	3	3,4	4

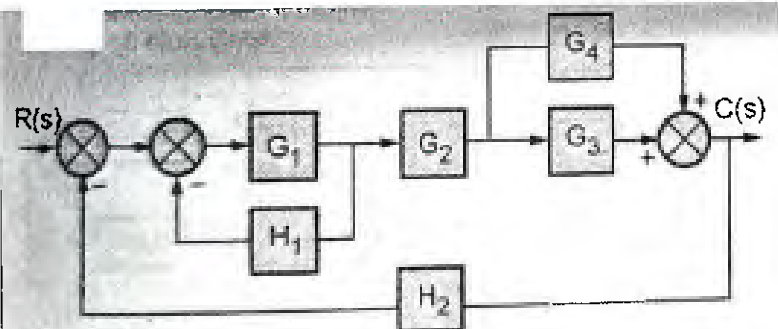


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3 A	A 0 to 200 kPa pressure gauge has a guaranteed limiting error of $\pm 1.5\%$ of full-scale reading. The gauge indicates a pressure of 80 kPa. Calculate: a) limiting error in kPa, b) percentage relative limiting error at the measured value, and c) comment on the accuracy of the instrument at this reading. d) Why does percentage relative limiting error increase at lower measured values?	10	1	4	1
3B	A seismic type accelerometer uses an LVDT with signal conditioning to measure displacement. The sensitivity of the LVDT system is 0.31 mV/mm. The maximum measurable core displacement is ± 20 mm. The accelerometer has a spring constant of 240 N/m and a seismic mass of 0.05 kg. Using the given data, determine: a) Natural angular frequency of the accelerometer in rad/s b) Natural frequency of the accelerometer in Hz c) Maximum measurable acceleration in m/s^2 d) Corresponding maximum output voltage of the LVDT system e) Comment on the suitability of the accelerometer for measuring high acceleration signals	10	2	4,5	3
4A	Explain the working principle of a Linear Variable Differential Transformer (LVDT). Describe its construction, operation at null position, and output response when the core moves toward secondary winding S1 and S2. Also mention any two advantages and two applications of LVDT.	10	2	4	3
4B	An operational amplifier is used as a signal conditioning circuit for a sensor output. Explain the working of an op-amp as an inverting amplifier. Derive the expression for voltage gain and state its practical use in measurement systems.	10	3	4	7
5A	For the block diagram shown in Figure, determine the overall transfer function $\frac{C(s)}{R(s)}$ using the block diagram reduction technique. Clearly show all intermediate reduction steps, including inner feedback loop reduction, parallel block reduction, and outer feedback loop reduction. 	10	4	4	5



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5B	Explain standard test signals used in control systems. Describe step input, ramp input, and impulse input with their significance in time response analysis.	10	4	4	6
6A	Explain the modelling of a mechanical translational system using basic mechanical elements such as mass, spring, and damper. Describe the force-voltage analogy or force-current analogy in brief. Also write the standard differential equation for a spring-mass-damper system and explain the physical meaning of each term.	10	4	4	5
6B	Explain the meaning of time response of a control system. Differentiate between transient response and steady state response with suitable examples.	10	4	3	6
7A	Differentiate between metallic strain gauges and semiconductor strain gauges based on construction, gauge factor, temperature sensitivity, and applications. Also state one advantage and one limitation of semiconductor strain gauges. A resistance strain gauge of resistance $100\ \Omega$ and gauge factor 2.4 is bonded to a steel component. The elastic limit stress of the steel is $300\ \text{MN/m}^2$ and the modulus of elasticity is $200 \times 10^9\ \text{N/m}^2$. Calculate the change in resistance when the applied stress is equal to $1/15$ of the elastic limit stress.	10	2	4,5	2
7B	A temperature measurement system is to be developed using a sensor, signal conditioning circuit, ADC, and computer. Explain how a Data Acquisition System can be used for this application. Draw a neat block diagram and explain the function of each block.	10	3	3,4	7



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✓
END SEM/RE-EXAM-EXAMINATION MAY / JUNE 2026

Program: Mechanical [WP] **Second year B.Tech** Duration: 3 Hrs

Course Code: PC BTM 404

W.P

Maximum Points: 100

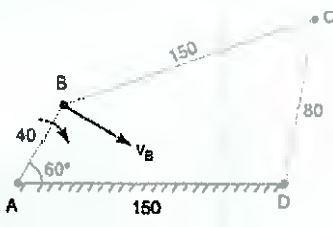
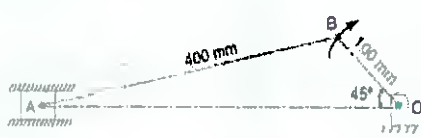
Course Name: Kinematics of Machinery

Semester: IV

Notes: Solve ANY FIVE questions

03/06/2026

Assume Suitable Data

Q.No		Questions	Points	CO	BL	Module No.
1	a	Differentiate mechanism and structure and discuss binary joints, ternary joints and quaternary joints	10	1	IV	1
	b	In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°. 	10	3	V	7
2	a	Locate all the instantaneous centres of the slider crank mechanism as shown in Figure. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. Velocity of the slider A, and 2. Angular velocity of the connecting rod AB. 	10	2	VI	2
	b	Discuss the motion of link and velocity of a point on a link by relative velocity method with rubbing velocity at a pin joint.	10	1	V	6
3	a	In the mechanism shown in Figure, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s ² . The dimensions of various links are AB = 3 m inclined at 45° with the vertical and BC = 1.5 m inclined at 45° with the horizontal. Determine: 1. the magnitude of vertical and horizontal component	10	3	IV	3

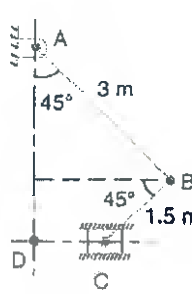


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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2026

		of the acceleration of the point B, and 2. the angular acceleration of the links AB and BC.				
						
	b	Discuss the Kutzbach Criterion and Grubler's Criterion to Plane mechanisms and Grubler's Criterion	10	2	VI	5
4	a	Discuss different types of kinematic chains in details	10	1	V	4
	b	Review a recent industrial application of mechanism design and explain the engineering problem and proposed solution.		3	IV	3
5	a	Explain and derive straight line mechanisms made up of turning pairs	10	2	V	5
	b	Explain Watts's mechanisms and Modified Scott-Russel mechanisms	10	2	VI	3
6	a	Classify Followers and Cams with neat sketch	10	1	IV	2
	b	A cam is to give the following motion to a knife-edged follower : 1. Outstroke during 50° of cam rotation ; 2. Dwell for the next 30° of cam rotation ; 3. Return stroke during next 50° of cam rotation, and 4. Dwell for the remaining cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when (a) the axis of the follower passes through the axis of the cam shaft, and (b) the axis of the follower is offset by 20 mm from the axis of the cam shaft.	10	2	VII	6
7	a	Discuss various gear materials and terms used in the gears.	10	3	V	7
	b	Discuss law of gearing and explain involute gears and cycloidal gears	10	3	IV	1



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Program: Mechanical [WP] **Second Year B.Tech** Duration: 3 Hrs

Course Code: PC BTM 405

W.P

Maximum Points: 100

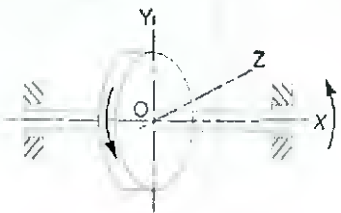
Course Name: Dynamics of Machinery

Semester: IV

Notes: Solve ANY FIVE questions

Assume Suitable Data

05/06/2026

Q.No		Questions	Points	CO	BL	Module No.
1	a	Discuss the classification transmission dynamometers	10	1	IV	1
	b	i) Fluctuation of energy and speed ii) A torsion dynamometer is fitted to a propeller shaft of a marine engine. It is found that the shaft twists 2° in a length of 20 metres at 120 r.p.m. If the shaft is hollow with 400 mm external diameter and 300 mm internal diameter, find the power of the engine. Take modulus of rigidity for the shaft material as 80 GPa.	10	3	V	7
2	a	Effect of the Gyroscopic Couple on an Aeroplane	10	2	VI	2
	b	i) A uniform disc of diameter 350 mm and of mass 4 kg is mounted on one end of an arm of length 500 mm. The other end of the arm is free to rotate in a universal bearing. If the disc rotates about the arm with a speed of 200 r.p.m. clockwise, looking from the front, with what speed will it precess about the vertical axis? ii) A uniform disc of 100 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 its axle with a constant speed of 900 r.p.m. while the axle precesses uniformly about the vertical at 60 r.p.m. The directions of rotation are as shown in Figure. If the distance between the bearings is 100 mm, find the resultant reaction at each bearing due to the mass and gyroscopic effects.	10	1	V	6
						
3	a	Discuss the force analysis of Porter Governor and performance characteristics of governor stability.	10	3	IV	3
	b	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	10	2	VI	5



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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2026

		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 governor. If the friction at the sleeve is equivalent of 20 N of load at the sleeve, determine how the speed range is modified.				
4	a	Explain construction and working of disc brake and compare it with drum brake.	10	1	V	4
	b	Compare mechanical, hydraulic, and pneumatic braking systems and explain construction, working, advantages, and applications of shoe brakes		3	IV	3
5	a	Define static balancing and derive the condition for complete static balancing of rotating masses.	10	2	V	5
	b	Discuss practical applications of static balancing in engineering systems.	10	2	VI	3
6	a	Compare longitudinal, transverse, and torsional vibration systems.	10	1	IV	2
	b	Explain vibration and oscillation. Discuss various causes and effects of vibration with suitable engineering examples.	10	2	VII	6
7	a	Explain combined viscous and Coulomb damping and derive the governing equation.	10	3	V	7
	b	Define Logarithmic Decrement. Derive the expression for logarithmic decrement and explain how it is used to determine damping ratio.	10	3	IV	1



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END SEM/RE-EXAM EXAMINATION MAY / JUNE 2026 (WP)

Program: BTECH (MECH. ENGG.) *Second year* **Duration:** 3 hrs

Course Code: MI-BT021 *B.Tech WP* **Maximum Points:** 100

Course Name: Internet of Things (IOT)

Semester: IV

- Solve any 5 questions out of 7
- Figures to the right indicate full marks
- Provide figures wherever necessary

08/06/2026

Q.No.	Questions	Points	CO	BL	PI
1	a) Explain the role of the Internet of Things (IoT) in product development. Discuss how IoT enables smart product design, real-time monitoring, data-driven improvements, predictive maintenance, customer-centric innovation, and lifecycle management with suitable examples. b) With the help of suitable figures, explain the following stages in an advanced IoT ecosystem: • Smart Data Acquisition, Edge Sensing & Cloud Storage • Real-Time Data Processing, AI/ML Analytics & Predictive Intelligence • Interactive Data Visualization, Digital Dashboards & Automated Reporting	[10] [10]	1,2,3	2	3.2.1
2	a) Explain the concept of IoT communication protocols. Compare various IoT protocols such as MQTT, HTTP, CoAP, XMPP in terms of architecture, working principle, advantages, limitations, and industrial applications. b) In a smart farming system, sensors collect data such as soil moisture, temperature, and humidity. Explain the role of an IoT gateway in connecting these sensors to the cloud. Also, draw a neat labeled diagram showing the flow of data from sensors to the cloud through an IoT gateway	[10] [10]	1,2,3	2	5.1.2
3	a) Enlist the following two enabling technologies of IOT with figures? • Big data analytics • MEMS b) Write short notes on (any two) • Arduino Uno • Raspberry PI • SIGFOX • LORA & LORAWAN • Z-WAVE	[10] [10]	1,2,4	2	5.1.2

**END SEM/RE-EXAM EXAMINATION MAY / JUNE 2026 (WP)**

	• ZIGBEE				
4	Write short notes on (Any three) • Edge, fog & cloud computing • Technological challenges faced by IOT Devices • Consideration of the mounting requirements for sensors • Vibration sensor • Ultrasonic sensor	[20]	1,2,3	3	5.1.2
5	Explain the concept of an Industrial Internet of Things (IIoT) platform with a neat architecture diagram. Discuss in detail the major components of an IIoT platform including sensors, edge devices, gateways, communication protocols, cloud infrastructure, data analytics, visualization dashboards, and cybersecurity mechanisms. Also explain the role of IIoT platforms in smart manufacturing, predictive maintenance, Digital Twins, and Industry 4.0 applications with suitable examples.	[20]	1,2,3	3	5.1.2
6	a) Discuss the various IoT design opportunities in modern engineering and industrial applications. Explain how IoT enables innovation in smart homes, smart cities, healthcare, agriculture, Industry 4.0, and intelligent transportation systems, along with the benefits and future potential of IoT-based solutions. Explain how the Internet of Things (IoT) is creating new business markets. Discuss emerging IoT-based business models and the impact of AI, cloud computing, blockchain, 5G, and Digital Twins on future business ecosystems.	[10]	3,4	3	5.1.2
7	a) Explain the significance of visualization tools in data analytics. Discuss various visualization techniques, dashboard systems, and their role in decision-making, predictive analytics, and Industry 4.0 applications. IOT – Block Chain Integration with neat labelled figure b) Describe the concept of data acquisition in IoT. Explain the stages involved in IoT data acquisition and discuss additional dimensions such as edge computing, AI integration, Digital Twins, cybersecurity, and scalability.	[10] [10]	3,4	3	5.1.2
***** All the Best *****					