13/05/19 Lab 1:30

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

May 2019

End semester examination

Maximum Points: 100 **Duration: 3 hours**

Class: S.Y.B.Tech **Semester: IV** **Program: MECHANICAL**

Name of the Course: Applied Mathematics-IV **Course Code : BS-BTM401**

Instructions:

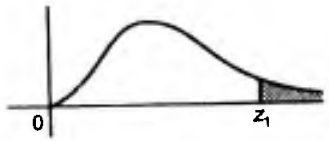
- **Question Number.1 is compulsory.**
- **Attempt any FOUR questions out of remaining SIX questions.**
- **Answers to all sub questions should be grouped together.**
- **Use of nonprogrammable calculator is allowed.Answer in detail.**

<table>
<tr><th>Q</th><th>QUESTIONS</th><th>POINTS</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1A)</td><td>Derive one dimensional wave equation .State all assumptions clearly.</td><td>06</td><td>1</td><td>1</td><td>1.2.1</td></tr>
<tr><td>1B)</td><td>The mean height of random sample of 100 individuals from a population is 160.The S.D. of the sample is 10.Would it be reasonable to suppose that the mean of the population is 165?</td><td>06</td><td>3</td><td>2,3,4</td><td>2.4.1</td></tr>
<tr><td>1C)</td><td>Twelve dice were thrown 4096 times and the number of appearance of "6" each time was noted.
<table>
<tr><td>NO. OF SUCCESSES</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6 & above</td></tr>
<tr><td>FREQUENCY</td><td>447</td><td>1145</td><td>1181</td><td>786</td><td>380</td><td>115</td><td>32</td></tr>
</table>
Fit a binomial distribution when the dice are unbiased.</td><td>08</td><td>2</td><td>2,3,4</td><td>2.4.3</td></tr>
<tr><td>2A)</td><td>In an experiment on pea – breading 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?</td><td>06</td><td>3</td><td>2,4,5</td><td>2.4.2</td></tr>
<tr><td>2B)</td><td>A manufacturer finds that the average demand per day for the</td><td>06</td><td>2</td><td>3,4,5</td><td>2.4.4</td></tr>
</table>

	mechanic to repair his new production is 1.5.Over a period of one year the demand per day is distributed as Poisson distribution.He employs two mechanics.On how many days in one year i) both mechanics would be free ii) some demand is refused.				
2C)	A tightly stretched string with fixed end points x = 0 and x = l is initially in a position given by $y = y_0\sin^3(\pi x/l)$. If it is released from rest from this position, find the displacement y(x, t).	08	2	2,3	2.4.3
3A)	The following data represents the biological values of protein from cow's and buffalo's milk at a certain level. Cow'milk: 1.82, 2.02, 1.88, 1.61, 1.81, 1.54 Buffalo's milk: 2.00, 1.83, 1.86, 2.03, 2.19, 1.88 Examine if the average values of protein in the two samples in the two samples significantly differ.LOS 5%.	06	3	4,5,6	2.4.2
3B)	Two random samples gave the following data: Sample no. 1: Size 8, Mean 9.6, Variance 1.2 Sample no. 2: Size 11, Mean 16.5, Variance 2.5 Can we conclude that the two samples have been drawn from the same normal population?LOS 5%.	06	3	5,6	2.4.4
3C)	Verify Divergence Theorem for $\vec{F}=4x\hat{i}-2y^2\hat{j}+z^2\hat{k}$ taken over the bounded by the cylinder $x^2+y^2=4$, z = 0, z = 3	08	2	2,3,4	1.4.1
4A)	In an examination marks obtained by students in mathematics, physics and chemistry are normally distributed with means 51,53 and 46 with standard deviations 15,12,16 respectively. Find the probability of securing total marks (i) 180 or more (ii) 90 or below.	06	2	3,4	2.4.3
4B)	A man buys 100 electric bulbs of each of two well known makes taken at random from stock for testing purpose.He finds that make "A" has a mean life of 1300 hours with a S.D. of 82 hours and make "B" has a mean life of 1248 hours with S.D. of 93 hours.Discuss the significance of these results.	06	3	4,5	1.3.1
4C)	Calculate the correlation coefficient for the following data: X: 9, 8, 7, 6, 5, 4, 3, 2, 1 Y: 15, 16, 14, 13, 11, 12, 10, 8, 9	08	1	2,3	2.4.1
5A)	Fit a Poisson distribution for the following distribution X: 0, 1, 2, 3, 4, 5, Total f: 142, 156, 69, 27, 5, 1, 400	06	2	2,3,4	2.4.3
5B)	Solve one dimensional heat equation completely.	06	1	4,5	2.4.4
5C)	Verify Stoke's theorem for the vector field $\vec{F}=(x^2-y^2)\hat{i}+2xy\hat{j}$ over the box bounded by planes x = 0, x = a, y = b, z = C if the face z = 0 is cut.	08	1	2,3,4	1.1.1

6A)	A crv X has PDF defined as $f(x)=\begin{cases}0, x\le 2\\ \frac{2x+3}{18}, 2\le x\le 4\\ 0, 4\le x\end{cases}$. Find mean & variance.	06	2		1.1.1
6B)	From the following data calculate the coefficient of rank correlation between x & y X: 32, 55, 49, 60, 43, 37, 43, 49, 10, 20 Y: 40, 30, 70, 20, 30, 50, 72, 60, 45, 25	06	1		2.4.3
6C)	The mean consumption of food grains among 400 sampled middle class consumers is 380 grams per day per person with a standard deviation of 120 grams.A similar sample survey of 600 working class consumers gave a mean of 410 grams with a standard deviation of 80 grams.Are we justified in saying that the difference between the averages of the two classes is 40?LOS 5%	08	3	3,4	2.4.4
7A)	Prove that $\bar{F}=(ye^{xy}\cos z)\hat{i}+(xe^{xy}\cos z)\hat{j}-(e^{xy}\sin z)\hat{k}$ is conservative and find the scalar potential Φ.	06	1	2,5	2.4.1
7B)	A machine is claimed to produce nails of mean length 5 cm and standard deviation of 0.45 cm.A random sample of 100 nails gave 5.1 cm as their average length.Does the performance of the machine justify the claim?LOS 5%	06	3	5,6	2.4.3
7C)	1000 students are graded according to their I.Q. & their economic conditions.Use chi-square test to find out whether there is any association between economic conditions and the level of I.Q. Economic Conditions / I.Q.: High, Medium, Low Rich: 160, 300, 140 Poor: 140, 100, 160	08	3	4,5	2.4.4

Percentage Points of χ^2 - Distribution



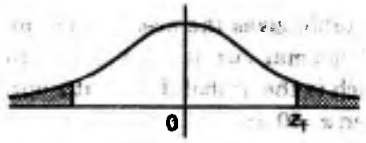
Example

For Φ = 10 d. o. f.

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

Φ \ P	0 = .99	0.95	0.50	0.10	0.05	0.02	0.01
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	22.818	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
16	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	38.415	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	28.336	36.741	40.113	44.140	46.963
26	13.565	16.928	27.338	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

Percentage Points of t - distribution



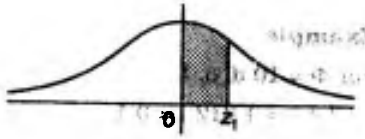
Example

For Φ = 10 d. o. f.

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

Φ \ 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	1.363	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	1.841	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	1.816	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

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	.4841	.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	.4560	.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

15/5/19
exam

[1:30]

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

END-SEM _MAY2019

PCC-BTM402 – Kinematics of Machinary

Class/sem: Second year B.Tech. (Mechanical-Engg)/ IV

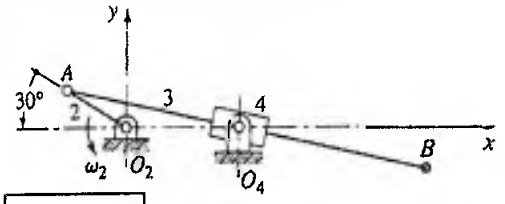
Duration: 3 hours **Marks: 100**

Note:

- **Question no. 1 is compulsory, solve any four question out of remaining six.**
- Assume suitable data if required and state it clearly.
- Answers to all sub-questions should be grouped together.

MM= Max. Marks, CO= course outcome, PI= performance Indices

Q. no		MM	CO	PI
1	**Answer in brief the following:** a) Why tooth profile involute is widely used in gears? b) What is interference in gears and means to avoid it? c) Why is a cycloidal motion most suitable for high speed cams? d) Define pitch point and pitch circle related to cam. e) What are the conditions to be satisfied by any straight-line generating mechanism to generate a straight line? f) Give the reasons for using Ackermann steering gear in automobiles most widely. g) Define *instantaneous centre of rotation* and rules to locate it by inspection related to kinematics of a planar motion. h) Explain *redundant degree of freedom* in a mechanism with suitable sketch. i) Define *transmission angle* and *toggle position* in a four bar chain mechanism. j) Draw the neat sketch of *Tchebicheff Mechanism* and show the link proportions.	2x10	1,2,3	
2	a) Link 2 of the mechanism is driven uniformly at $\omega_2 = 60$ rad/s ccw, Determine: 1. Angular velocity of link 3 and velocity of point B.(use relative velocity method.) 2. Angular velocity of link 3 and velocity of point B.(use IC method.) b) Obtain angular acceleration of link 3 and 4 (use relative acceleration method).	5 5 10	1	



$R_{AO_2} = 75$ mm, $R_{BA} = 400$ mm, $R_{O_4O_2} = 125$ mm.

3	a) A crank rocker mechanism has 70-20-50-70 units as frame-crank-coupler-rocker. Draw the mechanism and determine the maximum and minimum transmission angle. Locate the two toggle positions and find corresponding crank angle and transmission angle. b) A four link mechanism with following details is subjected to external forces. Determine the input torque on link 2 for static equilibrium of the mechanism. *Note: Use theorem of superposition and scale 1:10.* **Link** | **Length in mm** | **Force in N** | **Point of application of force** AB (2) | 500 | F_2= 80 ∟73.5^0 | 325 from A BC (3) | 660 | F_3= 80 ∟58^0 | 297 from B CD (4) | 560 | F_4= 80 ∟42^0 | 373 from D AD (1) | 1000 | Fixed link | --	10 10	2,4	
4	a) Deduce an expression for the minimum number of teeth on wheel to avoid interference. *Support your expression with suitable sketch and assumption.* b) Two 20^0 involute gears having velocity ratio 2.5 mesh externally. The module is 4mm and addendum is 1.23 *module. The pinion rotates at 150 rpm. Find the minimum number of teeth on each wheel to avoid the interference c) The addendum on each wheel of two mating gears is to be such that the line of contact on each side of the pitch point is half the maximum possible length. The number of teeth on each gear is 24 and 48. The teeth are 20^0 pressure angle involute with a module of 12 mm. Determine addendum for the pinion and the gear. Also find the arc of contact and contact ratio.	10 3 7	3	
5	Draw the displacement, velocity and acceleration w.r.t. time or angle diagram for follower motion of CYCLOIDAL during ascent and SHM during descent for the data given below: Lift = 63mm, angle of ascent= 150^0, angle of dwell= 30^0, angle of descent = 100^0, speed of cam= 120 rpm. What will be the maximum velocity and acceleration of the follower during lift and the return?	20	1	
6	a) Explain the procedure for epicyclic gear train analysis. b) An epicyclic gear train consists of a pinion, a wheel of 40 teeth and annulus with 84 internal teeth concentric with wheel. The pinion gears with the wheel and annulus. The arm that carries the axis of the pinion rotates at 100 rpm. If the annulus is fixed, find the speed of the wheel; if wheel is fixed find the speed of annulus. c) Two gears having an angular velocity ratio 3:1 are mounted on shafts whose centers are 136 mm apart. If the module of the gears is 4 mm. How many teeth are there on each gear?	5 10 5	3	
7	a) A tangent cam with a base circle diameter of 50 mm operates a roller follower 20 mm in diameter. The line of stroke of the roller follower passes through the axis of the cam. The angle between the tangential faces of the cam is 60^0, speed of the cam shaft is 200 rpm and the lift of the follower is 15mm. Calculate the main dimensions of cam and acceleration of follower at beginning of lift. b) Deduce the expression for correct steering in case of Davis steering gear.	10 10	1	

Lab

17/5/19

[1:30]

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER EXAMINATION, MAY 2019

B.Tech. (Mechanical Engineering) — Duration: **Three Hour**
Code: PCC **BTM 403** — Maximum Points :**100**
Course: **FLUID MECHANICS** — Semester : **IV**

Notes

- Answer any FIVE from seven questions,
- Answers to all sub questions should be grouped together for evaluation,
- Make suitable assumption if needed with proper reasoning,
- Data shown under column CO, BL and PI are only for academic evaluation
  (CO: Course Outcome, BL: Blooms Taxonomy, PI: Performance Indicator)

		Points	CO	BL	PI
1.	**A.** Explain and differentiate between- a. Lift and Drag coefficients, b. Laminar and turbulent boundary layer, c. Major and Minor losses, d. Developing and Developed flow.	**[10]**	1	1	
	B. An oil with density 900 kg/m^3 and dynamic viscosity 0.18 Ns/m^2 flows between two horizontal plates 10 mm apart. A constant pressure gradient of -1000 Pa/m drives the flow. The upper plate is moving with a uniform speed, while lower one is kept stationary. **Develop** a general expression for the velocity and **apply** it to find the velocity of the upper so that a. the flow is zero, b. the shear stress at the upper plate is zero.	**[10]**	3,4	3	
2.	**A.** What is the significance of boundary layer theory? **Analyze** the flow over a flat plate with zero pressure gradients and derive Von Karmon momentum integral equation for this case. Discuss its important features.	**[10]**	1,2	1,2	
	B. Consider flow over a flat plate with velocity U at y=0, which acquires following velocity profile inside the boundary layer. $\frac{u}{U} = \frac{y}{\delta}$, notations carry their usual meaning a. Estimate the growth of δ as function of x(distance from leading edge) b. Find an expression for total shear force on one side of the plate	**[10]**	4	3	
3.	**A.** Answer following (*in not more than two sentences*). a. What is fundamental difference between solid and fluid? b. Why continuum is fundamental assumption of present fluid mechanics? c. Why non-Newtonian fluids are also known as power law fluids? d. Rise and fall of liquid in a capillary tube depends on angle of contact. Why? e. What is intensity of pressure required to suck milk (SG:1.08) by a straw through a height of 200mm from an open vessel?	**[10]**	1,2	4	
	B. Lubricating oil at a velocity of 1 m/s (average) flows through a pipe of 100 mm ID. Determine whether the flow is laminar or turbulent. Calculate velocity at the centre line and the velocity at a radius of 2.5 cm. What is head loss for a length of 10 m. What will be the entry length? Also **evaluate** the wall shear. What should be the velocity for the flow to turn turbulent? Density = 930 kg/m^3 . μ = 0.1 Ns/m^2	**[10]**	4	4,5	
4.	**A.** Bernoulli's Equation is an special case of general energy equation. Discuss and list down assumptions behind the evolution of Bernoulli's Equation. Starting with general form of Navier-Stoke's equation, obtain Bernoulli's Equation along a streamline.	**[10]**	1	1,2	

	B. From a water tank open to atmosphere two identical jets issue at distances H_1 and H_2 from the water level at the top. Both reach the same point at the ground level of the tank. If the distance from the ground level to the jet levels are y_1 and y_2. **Analyze** the situation and show that $H_1y_1 = H_2y_2$.	**[10]**	3	4,5
5.	**A.** Explain following terms: a. Characteristics of a turbulent flow, b. Turbulent velocity profile, and c. Darcy friction factor	**[10]**	1	1,2
	B. A 30 degree reducing elbow is shown in figure below. The fluid is water. Analyze the case and evaluate the component of force that must be provided by the adjacent pipes to keep the elbow from moving. Select appropriate control volume and apply Reynolds transport equation to evaluate the parameters.	**[10]**	3,4	3,4
6.	**A.** Explain the concept of buoyancy with help of hydrostatic principle. Answer following in this context: a. Archimedes statement, b. Centre of buoyancy, c. Meta centre, and d. Condition of floatation.	**[10]**	1,3	1,2
	B. A long, square wooden block is pivoted along one edge. The block is in equilibrium when immersed in water to the depth shown. Evaluate the specific gravity of the wood, if friction in the pivot is negligible. (Refer fig Q. 6(B))	**[10]**	3,4	3
7.	**A.** The clutch system as shown in the figure Q. 7(A), is used to transmit torque through a 3-mm-thick oil film with, μ=0.38 N.s/m^2, between two identical 30-cm-diameter disks. When the driving shaft rotates at a speed of 1450 rpm, the driven shaft is observed to rotate at 1398 rpm. Assuming a linear velocity profile for the oil film, determine the transmitted torque.	**[10]**	2,3	3,4
	B. Cast iron or steel molds are used in a horizontal spindle machine to make tubular castings such as liners and tubes. A charge of molten metal is poured into the spinning mold. The radial acceleration permits nearly uniformly thick wall sections to form. A steel liner, of length (L)=180 cm, outer radius (r_o)=140 cm., and inner radius (r_i)=136 cm., is to be formed by this process. To attain nearly uniform thickness, the angular velocity should be at least 300 rpm. Determine (a) the resulting radial acceleration on the inside surface of the liner and (b) the maximum and minimum pressures on the surface of the mold.	**[10]**	4	4,5

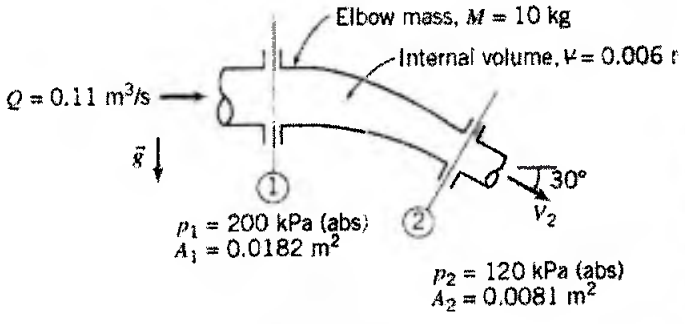


Fig. Q.5(B)

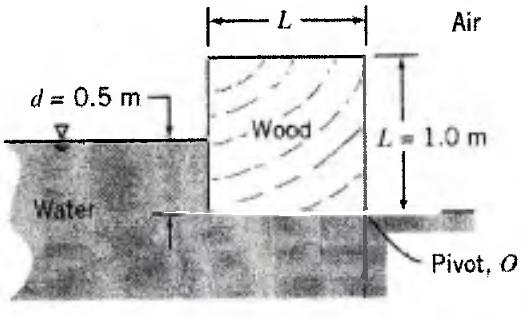


Fig. Q. 6B

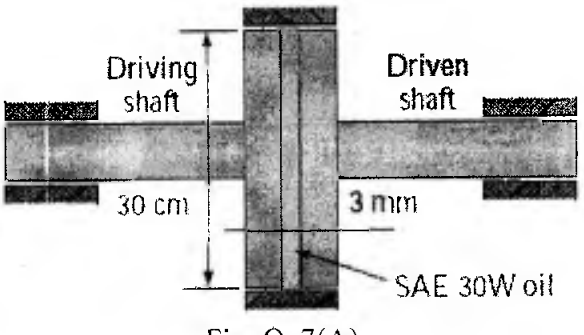


Fig. Q. 7(A)

Lab

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SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER - May 2019 Examinations

Program: S.Y.B. Tech. (Mechanical Engineering) **Duration: 03 Hrs**

Course Code: PCC-BTM404 **Maximum Points: 100**

Course Name: Mechanical Engineering Measurement **Semester: IV**

Notes:

1. Question number 1 is compulsory

2. Solve any 4 questions from question number 2 to 7

2. If necessary assume suitable data with justification

3. Draw neat labeled sketches wherever required.

Q.No.	Questions	Points	CO	BL	PI
1	Following table list the measuring instruments (left hand side column of the table) for measuring mechanical properties (right hand side column of the table) of the system. Students shall match the measuring instrument with the corresponding mechanical property. **Measuring Instruments** – **Properties** Radiation pyrometer – Temperature Pirani gauge – Liquid Level Rotameter – Pressure Float Gauges – Flow rate Thermistor – Acceleration Further student shall explain only the working principle of the measurement instrument listed on left hand side column of the table with neat sketch. (Note: Credits will be given only if match is perfect)	05 15	3	2	1.2.3
2 (a)	A system is given by differential equation $\frac{d^2y}{d^2t}+4\frac{dy}{dt}+8y=8x$ where y=output and x=input. Determine transfer function, undamped natural frequency, damped frequency, damping ratio, peak time, setteling time, rise time, maximum peak overshoot for unit step input.	10	2	3	2.1.2
2 (b)	Explain generalized measurement system with neat schematic diagram. Further map the different constituents of generalized measurement system with the physical elements of Laser Doppler Anemometer.	10	1	2	1.2.2
3 (a)	Following are the different applications wherein the fluid flow and force measurement is essential; (i) Flow of hot flue gases in chimney (ii) Force on free end of structure (cantilever beam). Students shall select the appropriate flow and force measurement system respectively for the above applications with justification and also explain their working principle with neat labelled sketches. (Note: Points will be assigned to explanation only if selection of system is appropriate).	10	4	5	1.2.3
3 (b)	The discharge coefficient C_d of an orifice can be found by collecting the water that flows through during a time interval when it is under a constant	10	2	3	2.1.3

	head h. The formula is $C_d = \frac{W}{t\rho A\sqrt{2gh}}$ Find C_d and its possible error if: W=390±0.25 kg, t=600±2 s, d=12±0.03 mm, ρ=1050±0.1% kg/m^3; A= πd^2/4, h=3.6±0.03 m, g=9.81±0.1% m/s^2				
4 (a)	A bubbler or purge method is used to measure the water level. Air compressor having pressure range of 0-5 bar is used for the measurement of the water level. Air tube with opening at the bottom of the tank is used to purge the air in the water tank. Operator initially purge the 3 bar pressure in the air tube and no air bubbles are observed. The pressure is varied to maximum rating of 5 bar although no air bubble is observed. In fact at the setting of 5 bar pressure the water rises into the air tube up to 5 meters measured from bottom of the tank. Estimate the water level in the tank from the different observations provided.	**05**	**1**	**2**	2.1.2
4 (b)	A Mcleod gauge has volume of bulb and measuring capillary equal to 110x10^{-6} m^3 and measuring capillary diameter of 1.1 mm. (i) Calculate the pressure indicated when the reading of measuring capillary is 28 mm in case approximate formula is used. (ii) What is the error if the exact formula is used for pressure measurement?	**05**	**3**	**2**	3.1.1
4 (c)	Following is the calibration data of a pressure transducer: **q_i(Mpa) | q_o (increasing) (Mpa) | q_o (decreasing) (Mpa)** 0 | 0.25 | 0.2 10 | 10.56 | 10.6 20 | 21.65 | 21.75 30 | 32.21 | 32.65 40 | 43.75 | 43.98 50 | 52.3 | 52.73 Find out: (i) The equation for the best-linear fit. (ii) The standard deviation of input q_i, output q_0, slope and intercept. (ii) q_i if the instrument reads q_0=25.35 after calibration.	**10**	**2**	**3**	2.1.2
5 (a)	A small cantilever beam is constructed for measurement of force F. It is made of spring steel having modulus of elasticity E=200X10^9 N/m^2. The beam is 4.75 mm wide and 0.9 mm thick, with a length of 25±0.025 mm. An LVDT is used for displacement sensing. It is estimated that the limiting error in displacement measurement is ±0.025 mm. Calculate the value of force and the limiting error in force, if the displacement of LVDT is 2.5 mm. The limiting error in bar dimensions (in width and thickness) is ±0.0075 mm. Given force $F = F_i + \frac{3EIx}{L^3}$ where I= Moment of inertia of beam, m^4; L=Length of beam, m; x=	**10**	**2**	**4**	3.1.1

	displacement of LVDT, m, and F_I is residual force error = 0.5±0.3N.				
5 (b)	Determine the maximum discharge of water that can be carried without cavitation by a horizontal 100 mm X 50 mm (inlet diameter 100 mm and throat diameter 50 mm) venturimeter, which has a coefficient of discharge of 0.95. The inlet pressure is 10 kPa (gauge), the vapour pressure of water is 4 kPa (abs) and the local atmospheric pressure is 96 kPa (abs).	**10**	**1**	**4**	3.2.1
6 (a)	A temperature probe is transferred from air at 25^{0}C to air at 35^{0}C, then to water at 70^{0}C, and back to air at 35^{0}C. Assume that in each case the transfer is "instantaneous". The effective time constants and the timing sequence are as follows: In air, probe dry, τ =30 s; In water, τ =5 s; In air, probe wet, τ =20 s; For t < 0, T=25^{0}C (initial temperature) 0 < t < 7, T=35^{0}C (dry probe in air) 7 < t < 15, T=70^{0}C (probe in water), 15 < t < 30, T=35^{0}C (wet probe in air). Calculate the indicated temperature at the end of each time interval and sketch the appropriate indicated temperature (time relationship between t=0 and t=30 s).	**10**	**2**	**4**	4.1.1.
6 (b)	A diaphragm pressure gauge is constructed of 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 is 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	**5**	**3**	**2**	1.1.1
6 (c)	With neat labeled diagram explain working of optical encoder	**5**	**1**	**2**	1.1.2
7 (a)	In a rotating cylinder viscometer, the radii of the cylinders are 32 mm and 30 mm and the outer cylinder is rotated steadily at 200 rpm. For a certain liquid filled in the annular space to a depth of 80 mm, the torque produced on the inner cylinder is 0.9x10^{-4} Nm (considering viscous friction at the bottom plane also). Bottom plane of the inner cylinder is separated with plane of outer cylinder by distance1mm and filled with same liquid. Calculate the viscosity of the liquid. Assume the velocity distribution to be linear.	**10**	**2**	**5**	4.1.2
7 (b)	What are "Desired", "Modifying", and "Interfering" inputs for an instrumentation system? Draw block diagram for showing their influence on the output.	**10**	**2**	**2**	**4.6.2**

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER - July 2019 Re-examinations

Program: S.Y.B. Tech. (Mechanical Engineering) **Duration: 03 Hrs**

Course Code: PCC-BTM404 **Maximum Points: 100**

Course Name: Mechanical Engineering Measurement **Semester: IV**

Notes:

1. Question number 1 is compulsory

2. Solve any 4 questions from question number 2 to 7

2. If necessary assume suitable data with justification

3. Draw neat labeled sketches wherever required.

Q. No.	Questions	Points	CO	BL	PI
1	Explain followings with neat labelled sketches (i) Radiation Pyrometer (ii) Pirani Gauge (iii) Rotameter (iv) Float Gauges for liquid level measurements	20	3	2	1.2.3
2 (a)	The open loop transfer function of a unity feedback measurement system is given by $G(s) = \frac{K}{s(Ts+1)}$ where K is amplifier gain and T is positive constant. By what factor should the amplifier gain be reduced so that the peak overshoot of unit step response of the system is reduced from 80% to 20%.	10	2	3	2.1.2
2 (b)	Explain generalized measurement system with neat schematic diagram. Further map the different constituents of generalized measurement system with the physical elements of Bourdon tube pressure gauge (draw neat labeled sketches). Further, explain how characteristics of each of the physical elements of Bourdon tube pressure gauge plays vital role in sensitivity, range, hysteresis, drift, linearity, dead zone and threshold.	10	1	2	1.2.2
3 (a)	Following are the different applications wherein the fluid flow and force measurement is essential; (i) Flow of hot flue gases in chimney (ii) Force on free end of structure (cantilever beam). Students shall select the appropriate flow and force measurement system respectively for the above applications with justification and also explain their working principle with neat labelled sketches. (Note: Points will be assigned to explanation only if selection of system is appropriate).	10	4	5	1.2.3
3 (b)	The discharge coefficient C_d of an orifice can be found by collecting the water that flows through during a time interval when it is under a constant head h. The formula is $C_d = \frac{W}{t\rho A\sqrt{2gh}}$ Find C_d and its possible error if: W=390±0.25 kg, t=600±2 s, d=12±0.03 mm, ρ=1050±0.1% kg/m^3; A= πd^2/4, h=3.6±0.03 m, g=9.81±0.1% m/s^2	10	2	3	2.1.3
4	With neat labelled sketches explain working of (i) Mechanical Tachometer (ii) Nozzle meter (iii) Inductive Tachometer (iv) Piezoelectric accelerometer (v) Mcleod Gauge (Note neat labelled sketches shall depict	20	4	3	2.1.2

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER - July 2019 Re-examinations

	working principle)				
5 (a)	What is first order system? Starting from conservation of energy derive equation of first order for determination of instantaneous temperature Ttf recorded by mercury in glass thermometer at time t. Thermometer is dipped in liquid system of temperature Ts. Derive final form of equation in terms of time constant. Discuss on options for designer to change the time constant of device.	**10**	**3**	**2**	3.1.1
5 (b)	Determine the maximum discharge of water that can be carried without cavitation by a horizontal 100 mm X 50 mm (inlet diameter 100 mm and throat diameter 50 mm) venturimeter, which has a coefficient of discharge of 0.95. The inlet pressure is 10 kPa (gauge), the vapour pressure of water is 4 kPa (abs) and the local atmospheric pressure is 96 kPa (abs).	**10**	**1**	**4**	[redacted]
6 (a)	A small cantilever beam is constructed for measurement of force F. It is made of spring steel having modulus of elasticity E=200X10^9 N/m^2. The beam is 4.75 mm wide and 0.9 mm thick, with a length of 25±0.025 mm. An LVDT is used for displacement sensing. It is estimated that the limiting error in displacement measurement is ±0.025 mm. Calculate the value of force and the limiting error in force, if the displacement of LVDT is 2.5 mm. The limiting error in bar dimensions (in width and thickness) is ±0.0075 mm. Given force $F = F_1 + \frac{3EIx}{L^3}$ where I= Moment of inertia of beam, m^4; L=Length of beam, m; x= displacement of LVDT, m, and F_1 is residual force error = 0.5±0.3N.	**10**	**2**	**4**	3.1.1
6 (b)	A temperature probe is transferred from air at 25^{0}C to air at 35^{0}C, then to water at 70^{0}C, and back to air at 35^{0}C. Assume that in each case the transfer is "instantaneous". The effective time constants and the timing sequence are as follows: In air, probe dry, τ =30 s; In water, τ =5 s; In air, probe wet, τ =20 s; For t < 0, T=25^{0}C (initial temperature) 0 < t < 7, T=35^{0}C (dry probe in air) 7 < t < 15, T=70^{0}C (probe in water), 15 < t < 30, T=35^{0}C (wet probe in air). Calculate the indicated temperature at the end of each time interval and sketch the appropriate indicated temperature (time relationship between t=0 and t=30 s).	**10**	**2**	**4**	[redacted]
7 (a)	With neat labeled diagram explain working of (i) optical encoder (ii) LVDT	**10**	**2**	**5**	4.1.2
7 (b)	What are "Desired", "Modifying", and "Interfering" inputs for an instrumentation system? Draw block diagram for showing their influence on the output.	**10**	**2**	**2**	**4.6.2**

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

Re-Examination - July 2019

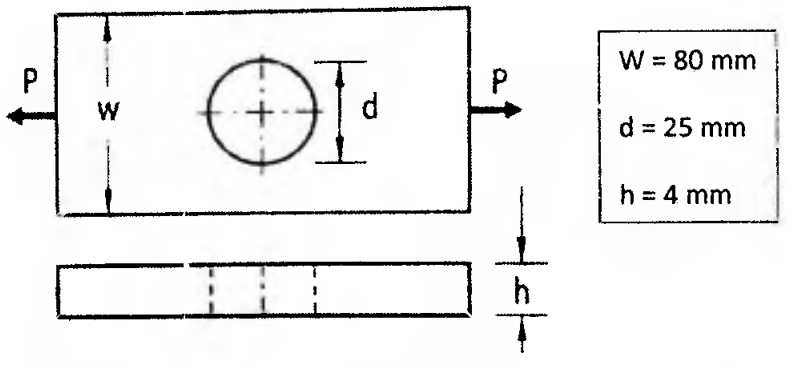
Program: B.Tech. in Mechanical Engineering | **Duration: 3 Hours**

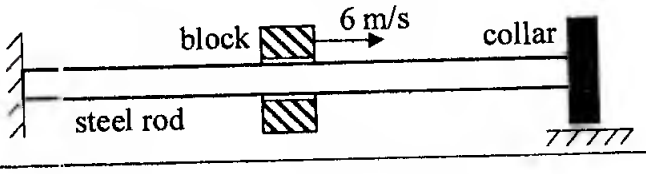
Course Code: PCC-BTM405 | **Maximum Points: 100**

Course Name: Solid Mechanics | **Semester: IV**

Notes:

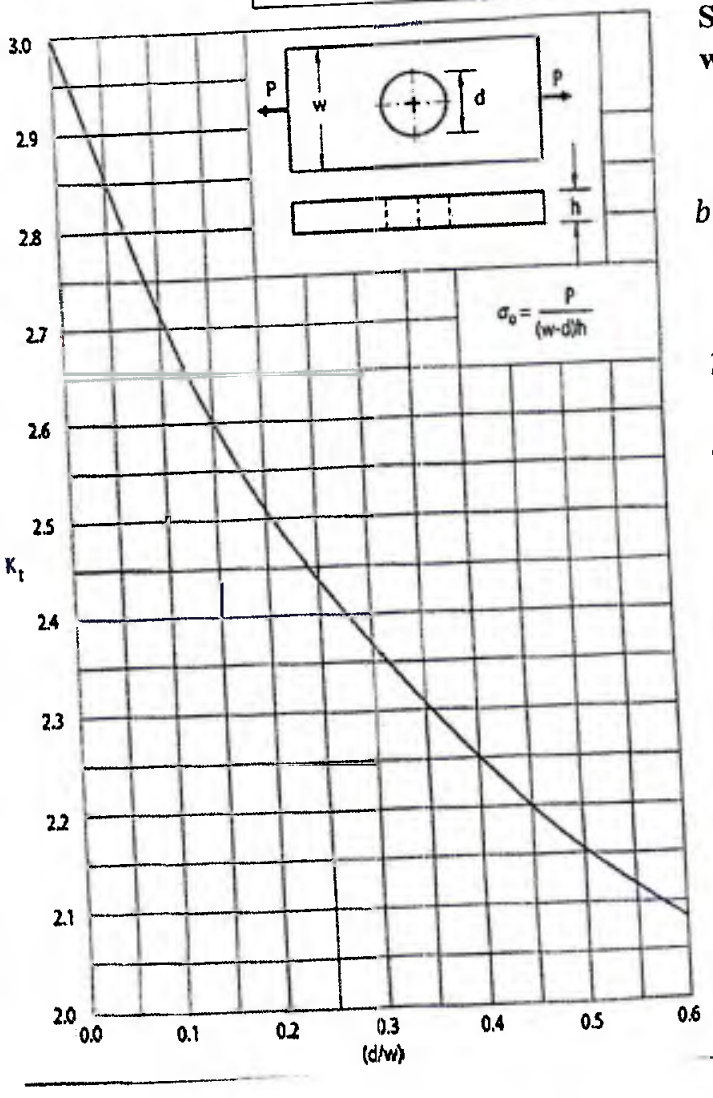
1. Solve any 5 questions.
2. Assume suitable data if necessary

Q. No.	Questions	Points	CO	BL	PI
Q1	A) The state of stress τ_{ij} at a point is as shown. Calculate the principal stresses and find the principal directions associated with the maximum and minimum principal stresses. $\tau_{ij} = \begin{bmatrix} 2 & -2 & 2 \\ -2 & -1 & -1 \\ 2 & -1 & 4 \end{bmatrix}$	(10)	1	3	2.4.1
	B) A flat plate with hole as shown is subjected to axial load P. Calculate safe load if material for plate has ultimate tensile strength of 800 MPa and factor of safety is 5.  Define the term 'stress concentration factor' and give practical examples where the factor plays important role in design calculation.	(10)	2	3	2.2.3
Q2	A) Describe the concept of plane stress and plane strain conditions used to solve elasticity problem. Give two examples of each type. Explain the advantage of these concepts. Establish the relationship between stress and strain components for plane stress and plane strain problems.	(10)	1	2	2.1.2

	B) Two rocket motor case materials are as follows. Consider plane stress case. Low alloy steel: σ_Y =1000 MPa, G_c=28 kJ/m^2 Maraging steel: σ_Y=1600 MPa, G_c=95 kJ/m^2 Design stress = σ_Y/1.5, E = 200 GPa Determine the defect size permissible in each case under plane stress conditions. *Note:* G_c is critical strain energy release rate. For plane stress case $G_c = \frac{K_{Ic}^2}{E}$ For plane strain case $G_c = (1-\nu^2)\frac{K_{Ic}^2}{E}$	**(10)**	*2*	*3*	*2.4.1*
Q3	A) Describe the generalized statement of Hooke's law used for describing behavior of a material. State number of unique material property terms in the law for isotropic and anisotropic materials. Provide significance of Lame's coefficients for isotropic materials.	**(10)**	*2*	*2*	*2.1.2*
	B) Explain the terms: (i) Strain Energy, (ii) Resilience, (iii) Proof resilience. Derive the following expression for strain energy stored in a hollow cylinder (outside diameter *D*, inside diameter *d*) subjected to torsional moment. $U = \frac{\tau^2}{4G}\frac{D^2+d^2}{D^2}V$	**(10)**	*3*	*3*	*2.3.2*
Q4	A) A thick pipe has internal radius of 120 mm. It is subjected to internal pressure of 2.0 MPa and external pressure of 0.75 MPa. If E = 200 GPa and ν = 0.3, determine the thickness as per Maximum Principal stress theory of failure. Consider tensile strength as 300 MPa and factor of safety as 2.5. Also determine the changes in internal and external radii.	**(10)**	*2*	*3*	*2.2.3*
	B) Explain metal plasticity and give examples where plasticity effect will play an important role. Describe the Bauschinger effect with the help of load vs displacement plot. Illustrate the effect using a simple model of 3 bars.	**(10)**	*3*	*3*	*2.1.2*
Q5	A) A sliding block weighing 100 N slides over a 25 mm diameter 1000 mm long horizontal steel rod at a velocity of 6 m/s as shown in the figure. The block is stopped by its impact with a rigid collar provided at the end of rod. Ignoring friction and bending of bar, find instantaneous stress and elongation induced in the rod. Consider E = 210 GPa.  	**(10)**	*4*	*3*	*2.3.1*

	B) Derive Cauchy's relations for stress component. Using these relations, for the stress matrix τ_{ij}, determine magnitude of the normal and shear stress on a plane equally inclined to x, y and z planes. $\tau_{ij} = \begin{bmatrix} -1 & 2 & 3 \\ 2 & 1 & -2 \\ 3 & -2 & -1 \end{bmatrix}$	**(10)**	*1*	*3*	*2.4.1*
Q6	A) Describe the nature of axisymmetric problems in solid mechanics with three examples from real life. A steel disk of 900 mm diameter is shrunk on a steel shaft of 100 mm diameter. The interference *on diameter* is 0.025 mm. Find the rotation speed at which contact pressure is zero. Also calculate the maximum tangential stress at above speed. Consider E = 200 GPa, ν = 0.3 and density = 7850 kg/m^3. B) Explain following terms highlighting their significance for analyzing real life problems: (i) Yield surface and yield locus, (ii) Fracture toughness of material, (iii) Shear Flow, (iv) Stress tensor, (v) Contact stresses	**(10)** **(10)**	*2* *2*	*3* *2*	*2.2.3* *2.1.2*
Q7	A) Explain the principle of superposition and obtain its proof along with necessary conditions for its applicability. Based on the principle of superposition, prove the principle of uniqueness. B) Explain the Fracture Mechanics based approach to evaluate engineering components. Include following points in your explanation: (i) Difference between classical mechanics and fracture mechanics, (ii) different approaches of fracture mechanics, (iii) stress intensity factor and its significance, (iv) three modes of fracture and (v) examples from real life illustrating failures involving brittle fractures.	**(10)** **(10)**	*3* *2*	*4* *3*	*2.3.2* *2.1.2*

ANNEXURE: USEFUL FORMULAE



Stresses for two cylinders in contact with each other

$$b = \sqrt{\frac{2F}{\pi l}\left[\frac{\frac{(1-\nu_1^2)}{E_1} + \frac{(1-\nu_2^2)}{E_2}}{\frac{1}{d_1} + \frac{1}{d_2}}\right]}$$

$$p_{max} = \frac{2}{\pi}\frac{F}{bl}$$

$$\sigma_x = -2\nu p_{max}\left[\sqrt{\left(1+\frac{z^2}{b^2}\right)} - \frac{z}{b}\right]$$

$$\sigma_y = -p_{max}\left[\left(2 - \frac{1}{1+z^2/b^2}\right)\sqrt{1+z^2/b^2} - 2\frac{z}{b}\right]$$

$$\sigma_z = -p_{max}\left[\frac{1}{\sqrt{1+z^2/b^2}}\right]$$

Stresses in thick pressurized cylinders

$$\sigma_r = \frac{p_a a^2 - p_b b^2}{b^2 - a^2} - \frac{a^2 b^2}{r^2} \times \frac{p_a - p_b}{b^2 - a^2}$$

$$\sigma_\theta = \frac{p_a a^2 - p_b b^2}{b^2 - a^2} + \frac{a^2 b^2}{r^2} \times \frac{p_a - p_b}{b^2 - a^2}$$

$\sigma_z = 0$ with both ends open

$\sigma_z = \nu(\sigma_r + \sigma_\theta)$ with both ends closed

Stresses in rotating solid disks

$$\sigma_r = \frac{3+\nu}{8}\rho\omega^2(b^2 - r^2)$$

$$\sigma_\theta = \frac{3+\nu}{8}\rho\omega^2 b^2 - \frac{1+3\nu}{8}\rho\omega^2 r^2$$

Stresses in rotating disks with central hole

$$\sigma_r = \frac{3+\nu}{8}\rho\omega^2\left(b^2 + a^2 - \frac{a^2 b^2}{r^2} - r^2\right)$$

$$\sigma_\theta = \frac{3+\nu}{8}\rho\omega^2\left(b^2 + a^2 + \frac{a^2 b^2}{r^2} - \frac{1+3\nu}{3+\nu}r^2\right)$$

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

RE-Exam _JULY2019

BTM402 – Theory of Machines-I

Class/sem: Second year B.Tech. (Mechanical-Engg)/ IV

Duration: 3 hours **Marks: 100**

Note:

- **Question no. 1 is compulsory, solve any four question out of remaining six.**
- Assume suitable data if required and state it clearly.
- Answers to all sub-questions should be grouped together.

MM= Max. Marks, CO= course outcome, PI= performance Indices

Q no		MM	CO	PI
1	**Answer in brief the following:** a) Compare the cycloidal and involute tooth gear. (at least 4 points) b) State and explain Kennedy's theorem regarding IC's of rotation. c) List the advantages of Ackermann steering gear mechanism over Devis steering gear mechanism used in automobiles. (at least 4 points) d) Draw the neat sketch of Hart mechanism and show the link proportions. e) Summarize the analysis of epi-cyclic gear train procedure in tabular form.	4x5	1,2,3	
2	Draw the displacement, velocity and acceleration w.r.t. time or angle diagram for follower motion of SHM during ascent and CYCLOIDAL during descent for the data given below: Lift = 88 mm, angle of ascent= 120^0, angle of dwell= 30^0, angle of descent = 160^0, speed of cam= 150 rpm. What will be the maximum velocity and acceleration of the follower during lift and the return?	20	3	
3	a) Derive the expression for path of contact when two gears are in mesh, draw a sketch to assist the expression. Define the contact ratio. b) A standard 20^0 pressure angle full-depth 25mm module, 20-teeth pinion drives a 48-teeth gear. The speed of the pinion is 500rev/min. Using the position of the point of contact along the line of action as abscissa, plot a curve showing the sliding velocity at all point of contact. (sliding velocity will change the sign at pitch point), also calculate the contact ratio.	10 10	2	
4	a) A crank rocker mechanism has 30-10-30-20 units as frame-crank-coupler-rocker. Draw the mechanism and determine the maximum and minimum transmission angle. Locate the two toggle positions and find corresponding crank angle and transmission angle. b) Find the frame reactions and torque M_{12} necessary to maintain equilibrium of the four bar linkage as shown in **fig.1.** Data: O_2A= 88mm, BA= O_4B= 150mm, O_2O_4= 50mm, O_4C = 100mm.	08 12		
5	For the given mechanism determine linear velocity and acceleration of the slider B. **(Fig. 2)**	20	1	

6	a)	A tangent cam with a base circle diameter of 120 mm operates a roller follower 48 mm in diameter. The line of stroke of the roller follower passes through the axis of the cam. The angle between the tangential faces of the cam is 90^0, speed of the cam shaft is 180 rpm and nose circle radius of the cam is 12 mm. Calculate: i) Angle of lift, ii) Angle turned by cam during straight flank, iii) distance between cam center and nose circle center, iv) acceleration of follower at beginning of lift.	10	2	
	b)	Explain how Paucellier Mechanism generates exact straight line?	10		
7	a)	An epicyclic gear train with 80 teeth sun wheel and 200 teeth annulus; calculate number of teeth on planet wheel, also determine the speed of the arm : i) if sun wheel rotates at 100 rpm cw and annulus rotates 50 rpm ccw, ii) if sun wheel rotates at 100 rpm cw and annulus is stationary.	12	2,4	
	b)	The center distance of two 24-tooth, 20°pressure angle, full-depth involute spur gears with module of 12 mm/tooth is increased by 3 mm over the standard distance. At what pressure angle do the gears operate?	8		

Fig. 1

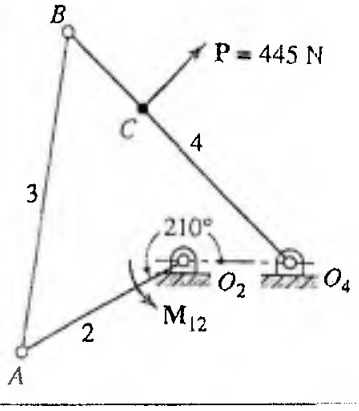
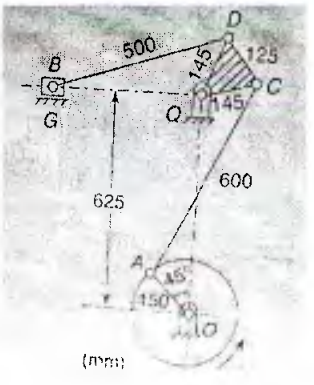


Fig . 2



BharatiyaVidyaBhavan's

Sardar Patel College of Engineering

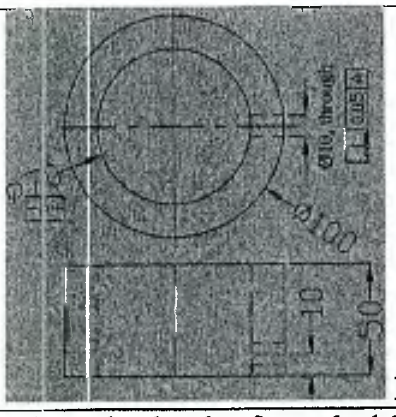
(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
ReExamination Semester Exam
July 2019

Max. Marks: 100 marks Duration: 3 hours
Class:S.Y.B.Tech. Semester: Fourth (4^{th}) Program:**Manufacturing Science II**
Name of the Course: Mechanical EngineeringCourse Code : **BTM 405**

Instructions:
1.**Question No 1 is compulsory.**
2.Attempt any four questions out of remaining six questions.
3.Draw neat schematic diagrams wherever is necessary, **highlight** important points of answer.
4.Assume suitable data if necessary and mention it.

Q. No		Max. Mark	CO No.	Module No.
Q1 A)	Explain "Flat rolling process of metal" with the help of neat schematic sketch? Give significance of draft phenomenon in flat rolling process?	5 M	4	6
B)	i) In a single point turning operation with a Ceramic tool and steel combination having a Taylor exponent of 0.25, if the cutting speed is reduced to 0.33 times previous speed, then new tool life will become...(show calculations) a) 16 b) 125 c) 81 d) 625 ii) Write in brief different type of clearance provided on drill tool? (2M)	5 M	3	4
c)	A hole of diameter 110 mm is to be punched in steel plate of 4 mm thickness with normal clearance on tool as 8% of thickness of sheet. Cutting is completed at 40 % of penetration of punch. Give suitable dimensions of punch and die. Ultimate shear stress for sheet metal is 3600 kg/cm^2. Determine shear angle of punch for double shear in order to bring work within the capacity of 10 tones.	10 M		7
Q2. A)	Explain working principle of *Drilling dynamometer* with the help of neat schematic sketch?	5 M		3
B)	With the help of neat schematic sketch explain in brief *spring back, spring back estimation.* Draw and explain in brief graph of "spring back factor versus fraction of radius of bend to the thickness of blank"?	5 M		7
C)	A cylindrical rod (material 1020 steel) having outer diameter *(O.D.) 120 mm* is turned orthogonally on lathe with single point cutting tool having *rake angle of* 15^0. *Cutting speed is 6 meter/min, feed 0.3 mm/rev, depth of cut 0.35mm, length of continuous chip in one revolution is 100, cutting force* (F_C) *250 kg, feed force* (F_T) *65 kg.* Draw neat sketch showing force components and chip feature.	10 M		2

	Calculate- Coefficient of friction, Shear plane angle, and velocity of chip along tool face, chip thickness, shear strain, shear stress, and shear energy?			
Q3. A)	What are different primary, secondary functions and process effects of cutting fluid?	5 M	3	3
B)	Explain any five important points related to design principles common to jigs & fixtures?	5 M	1	1
C)	An '***70-30 Brass annealed'*** strip 185 mm wide & 30 mm thick is rolled to 13.720 mm thickness in one pass. Roller radius is 150 mm and roller rotates at 80 rpm. Calculate the roll forces and power required to run individual roller and roll mill? Draw necessary sketch of rolling operation and show the different parameters like forces and dimensions on it. Neglect the spreading phenomenon of sheet?(Refer **Figure 1** last page)**	10 M		6
Q4. A)	Sketch and explain working of "O" ring strain gauge type dynamometers? Why Extended "C" ring strain gauge type dynamometers are used for specific application? Give its application?	5 M	3	3
B)	Write short note on Indexable jig with neat schematic sketch and their specific application?	5 M	1	1
C)	A shell having 40 mm diameter and 140 mm length with 1.2 mm is to be manufactured from 1.5 mm thick blank. Calculate-i) Blank diameter, ii) Drawing force (Assume yield strength of material as 3000 kg/cm^2, K is 0.54) iii) Punch and Die opening size?	10 M		5
Q5. A)	Explain the different design requirement of tool force dynamometer?	5 M		3
B)	Explain the relationship between plowing force and size effect? Draw well labeled schematic sketch of contact regions on tool face and related forces acting on them?	5 M	2	2
C)	Give significance of orthogonal **rake** angle 'γ' (larger and smaller magnitude/value) with respect to its advantages and disadvantages during machining operation?	5 M	4	4
D)	Write short note on following terms i) Rate sensitivity, ii) Planar anisotropy in a sheet-metal specimen with necessary sketch?	5 M		7
Q6. A)	Explain in brief Box Jig with schematic sketch? Component having a drilled hole shown in figure, Justify- what should be the locating surface (of workpiece), & type of Jig system can be used to drill hole in workpiece component?	5 M	1	1

	 Figure No-01			
B)	Draw detailed schematic sketch of punched hole and slug showing their characteristic feature? Explain how punch speed affects the burr formation in case of shearing operation?	5 M	4	5
C)	Explain flat rolling process (mechanics) with the help of neat schematic sketch? Give significance of "Draft"?	5 M		6
Q7. A)	Derive expression, to estimate value of back rake, side rake angle of cutting tool (in ASA system) as a function of orthogonal rake, inclination, principal cutting edge angle (in ORS system). With the help of master line principle and related schematic diagram?	10 M	4	4
B)	Write short note on Ceramics and Cermets?	5 M		2
C)	Explain following sheet metal shearing operation along with one combined sketch?a)Notching, b) Trimming, c) Nibbling operations	5 M		5

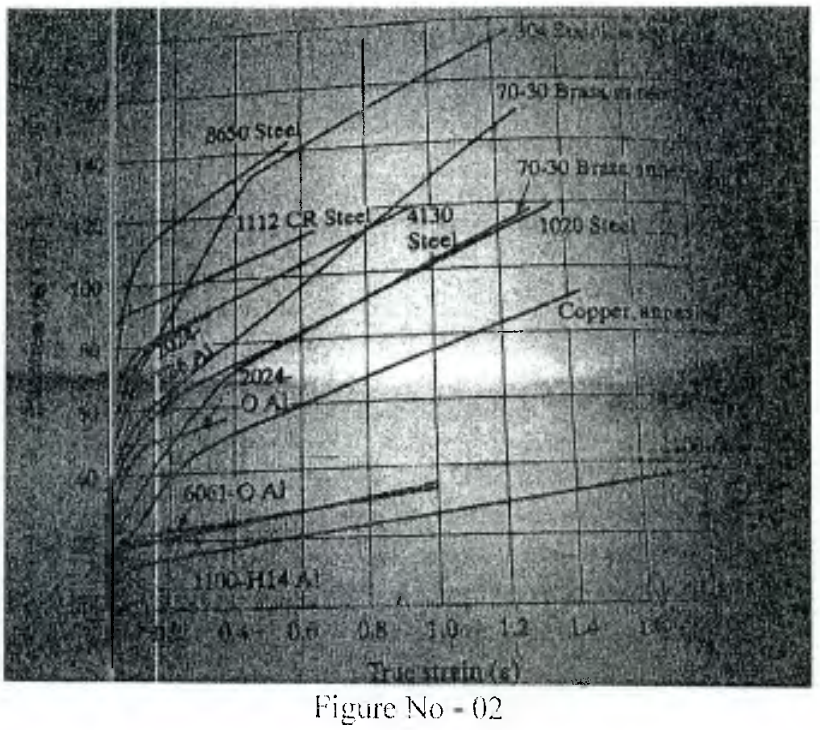


Figure No - 02