Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

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

End Semester Examination

May 2018

Maximum Marks: **100** Duration: **3 hours**

Class: **S.Y.B.Tech** Semester: **IV** Program: **Mechanical Engineering**

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

Instructions:

1. **Question No.1 is compulsory.** Attempt any four from remaining six questions.
2. Attempt Questions serially and answers to all sub questions should be grouped together.
3. Write complete answers with formulas and statement of theorems used.
4. If you attempt more questions, specify which five (Including Q.1) should be graded. Otherwise, by default, only the first five will be graded.

Q		Marks	CO	Module
1(a)	Find Mean and Variance of the random variable with probability density function $g(y)=\begin{cases}4\left(y+\frac{4}{5}\right)^3, & -\frac{4}{5}\le y\le\frac{1}{5}\\ 0, & \text{otherwise}\end{cases}$	6	1	3
(b)	Evaluate $\oint_C \sqrt{1+x^3}\,dx+2xy\,dy$, where C is the triangle with vertices (0,0), (1,0) and (1,3) oriented clockwise.	6	2	1
(c)	A rectangular plate with insulated surface is 20 cm. wide and so long compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature of the short edge $x=0$ is given by $u=\begin{cases}y, & 0\le y\le 10\\ (20-y) & 10\le y\le 20\end{cases}$ and the long edges $y=0, y=20$ as well as the other short edge are kept at zero temperature. Find the temperature u at any point (x,y)	8	3	7

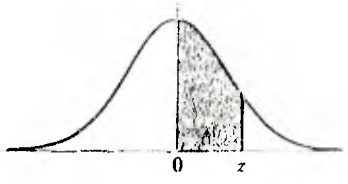
2 (a)	The following table shows the amount of diesel required by a train to travel certain distances. Distance (X km): 90, 150, 230, 310, 390 Diesel used (Y litres): 19.2, 33.9, 49.0, 79.5, 89.9 This data can be modelled by the regression line with equation $y = ax + b$ (i) Find the values of a and b (ii) Use the model to estimate the amount of diesel the train would use if it is driven 270 km.	6	1	2
(b)	The finish times for marathon runners during a race are normally distributed with a mean of 195 minutes and a standard deviation of 25 minutes. a) What is the probability that a runner will complete the marathon within 3 hours? b) Calculate to the nearest minute, the time by which the first 8% runners have completed the marathon.	6	1	4
(c)	Verify Green's Theorem for $\oint_C x^2y^2\,dx + (yx^3 + y^2)\,dy$ where C is the boundary of the triangle having vertices at (0,0) , (4,2) and (4,-8)	8	2	1
3 (a)	Solve the heat equation $\frac{\partial^2 u}{\partial x^2} = \frac{1}{2}\frac{\partial u}{\partial t}$ over $0 < x < 3, \quad t > 0$ for the boundary conditions $u(0,t) = u(3,t) = 0$ and the initial condition $u(x,0) = 5\sin(4\pi x)$	6	3	7
(b)	A machinist is expected to make engine parts with axel diameter of 1.75 cm. A random sample of 10 parts shows a mean diameter 1.85 cm with standard deviation 0.1 cm. On the basis of this sample, would you say that the work of the machinist is inferior?	6	1	5
(c)	Evaluate $\iint_S (\nabla \times \overline{F}) \cdot \overline{ds}$ where $\overline{F} = yz\hat{i} + x^2z\hat{j} + xy\hat{k}$ and S is the surface of the paraboloid $z = 9 - x^2 - y^2$ that lies above the plane $z = 5$	8	2	1
4 (a)	Test the significance of the difference between the means of two normal population with the same standard deviation from the data Sample 1: Size 20, Mean 64, S.D 6 Sample 2: Size 24, Mean 67, S.D 8	6	3	5

(b)	If the light bulbs in a house fail according to a Poisson law, and over the last 15 weeks there have been 5 failures, find the probability that there will not be more than one failure next week.	6	1	3
(c)	If θ is the acute angle between the two regression lines, then prove that $\tan\theta = \frac{1-r^2}{r} \cdot \frac{\sigma_x \sigma_y}{\sigma_x^2 + \sigma_y^2}$,	8	1	2
5 (a)	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 level of significance $\alpha = 0.01$?	6	1	5
(b)	A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially at rest in its equilibrium position. If it is set vibrating to each of its points a velocity $\lambda x(l-x)$, find the displacement of the string at any distance x from one end at any time t.	6	3	6
(c)	The download time of a resource web page is normally distributed with a mean of 6.5 seconds and a standard deviation of 2.3 seconds. (i) What proportion of page downloads take less than 5 seconds? (ii) What is the probability that the download time will be between 4 and 10 seconds? (iii) How many seconds will it take for 35% of the downloads to be completed?	8	1	4
6(a)	Two random sample gave the following data Sample No | Size | Mean | Variance 1 | 1000 | 67.42 | 2.58 2 | 1200 | 67.25 | 2.5 Is the difference between standard deviation significant?	6	1	4
(b)	In a restaurant an average of 3 out of every 5 customers ask for water with their meal. A random sample of 10 customer is selected. Find the probability that (i) Exactly 6 customers ask for water with their meal, (ii) Less than 9 customers ask for water with their meal.	6	1	3

(c)	Given that $u = x - y$ and $v = x + y$. If x & y are uncorrelated, then prove that $r(u,v) = r_{uv} = \frac{\sigma_x^2 - \sigma_y^2}{\sigma_x^2 + \sigma_y^2}$	8	1	2
7(a)	Use Gauss Divergence Theorem to evaluate $\iint_S \bar{F} \cdot \hat{n} ds$, where S is the surface of the cuboid with vertices $(\pm 1, \pm 2, \pm 3)$ and $\bar{F} = x^2 z^3 \hat{i} + 2xyz^3 \hat{j} + z^5 \hat{k}$	6	2	1
(b)	The probability that a match will not strike is 0.009. Calculate the probability that in a box of 100 matches: (a) they all strike satisfactorily (b) at least 2 do not strike	6	1	3
(c)	The points of trisection of a string are pulled aside through the same distance on opposite sides of the position of equilibrium and the string is released from rest. Derive an expression for the displacement of the string at subsequent time and show that the mid-point of the string remains at rest.	8	3	6

Appendix C

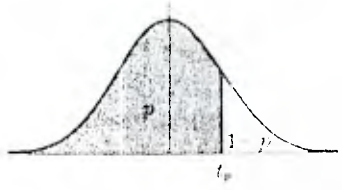
Areas under the Standard Normal Curve from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0764
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	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.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
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

Appendix D

Percentile Values (t_p)
for
Student's t Distribution
with ν Degrees of Freedom



ν	$t_{.55}$	$t_{.60}$	$t_{.70}$	$t_{.75}$	$t_{.80}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$
1	.158	.325	.727	1.000	1.376	3.08	6.31	12.71	31.82	63.66
2	.142	.289	.617	.816	1.061	1.89	2.92	4.30	6.96	9.92
3	.137	.277	.584	.765	.978	1.64	2.35	3.18	4.54	5.84
4	.134	.271	.569	.741	.941	1.53	2.13	2.78	3.75	4.60
5	.132	.267	.559	.727	.920	1.48	2.02	2.57	3.36	4.03
6	.131	.265	.553	.718	.906	1.44	1.94	2.45	3.14	3.71
7	.130	.263	.549	.711	.896	1.42	1.90	2.36	3.00	3.50
8	.130	.262	.546	.706	.889	1.40	1.86	2.31	2.90	3.36
9	.129	.261	.543	.703	.883	1.38	1.83	2.26	2.82	3.25
10	.129	.260	.542	.700	.879	1.37	1.81	2.23	2.76	3.17
11	.129	.260	.540	.697	.876	1.36	1.80	2.20	2.72	3.11
12	.128	.259	.539	.695	.873	1.36	1.78	2.18	2.68	3.06
13	.128	.259	.538	.694	.870	1.35	1.77	2.16	2.65	3.01
14	.128	.258	.537	.692	.868	1.34	1.76	2.14	2.62	2.98
15	.128	.258	.536	.691	.866	1.34	1.75	2.13	2.60	2.95
16	.128	.258	.535	.690	.865	1.34	1.75	2.12	2.58	2.92
17	.128	.257	.534	.689	.863	1.33	1.74	2.11	2.57	2.90
18	.127	.257	.534	.688	.862	1.33	1.73	2.10	2.55	2.88
19	.127	.257	.533	.688	.861	1.33	1.73	2.09	2.54	2.86
20	.127	.257	.533	.687	.860	1.32	1.72	2.09	2.53	2.84
21	.127	.257	.532	.686	.859	1.32	1.72	2.08	2.52	2.83
22	.127	.256	.532	.686	.858	1.32	1.72	2.07	2.51	2.82
23	.127	.256	.532	.685	.858	1.32	1.71	2.07	2.50	2.81
24	.127	.256	.531	.685	.857	1.32	1.71	2.06	2.49	2.80
25	.127	.256	.531	.684	.856	1.32	1.71	2.06	2.48	2.79
26	.127	.256	.531	.684	.856	1.32	1.71	2.06	2.48	2.78
27	.127	.256	.531	.684	.855	1.31	1.70	2.05	2.47	2.77
28	.127	.256	.530	.683	.855	1.31	1.70	2.05	2.47	2.76
29	.127	.256	.530	.683	.854	1.31	1.70	2.04	2.46	2.76
30	.127	.256	.530	.683	.854	1.31	1.70	2.04	2.46	2.75
40	.126	.255	.529	.681	.851	1.30	1.68	2.02	2.42	2.70
60	.126	.254	.527	.679	.848	1.30	1.67	2.00	2.39	2.66
120	.126	.254	.526	.677	.845	1.29	1.66	1.98	2.36	2.62
∞	.126	.253	.524	.674	.842	1.28	1.645	1.96	2.33	2.58

Source: R. A. Fisher and F. Yates, *Statistical Tables for Biological, Agricultural and Medical Research*, published by Longman Group Ltd., London (previously published by Oliver and Boyd, Edinburgh), and by permission of the authors and publishers.

28/5/18

Bhartiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)

(Value Added)

Course Code:-BTM426
Total Marks : 100
CLASS / SEM : S.Y. B.Tech. (Mech.)

May 2018
Duration : 3 hr
SUBJECT: Internet of Things (IOT)

- Q.1 Compulsory
- Solve any 5 out of seven questions
- All questions are compulsory, assume suitable data wherever necessary.
- If there are sub questions, answers to sub questions should be grouped together
- Figures to the right indicate full marks

Q.No.	Question	Marks	Course Outcome	Course Module
Q.1 (a)	Explain the following • Architecture of IOT • Security & Advantages	[10]	[01]	[01]
Q.1 (b)	Write a short note on Selection of IOT Platforms?	[10]	[03]	[06]
Q.2(a)	Explain the various enabling technologies used in IOT?	[10]	[01]	[02]
Q.2(b)	Explain any one application of IOT in Mechanical Engineering?	[10]	[01]	[01]
Q.3(a)	Explain the various criteria used for selection of sensors?	[10]	[01]	[04]
Q.3(b)	Explain the Following with neat sketches • Temperature Sensor • Pressure Sensor • Vibration Sensor	[10]	[03]	[04]
Q.4(a)	Explain the Considerations for Mounting	[10]	[03]	[04]

	Sensors for Right Results			
Q.4(b)	Write a short note on • Rasberry Pi • MQTT	**[10]**	**[01]**	**[05]**
Q.5(a)	Explain the Following • IOT Protocols • Types of Network	**[10]**	**[03]**	**[05]**
Q.5(b)	Explain the various criteria for selection of IOT Platforms	**[10]**	**[01]**	**[06]**
Q.6(a)	Explain the following • Connecting Microcontroller with Mobile devices • Cloud Computing & IOT	**[10]**	**[01]**	**[03]**
Q.6(b)	Write a Short on Model based development on IOT platforms	**[10]**	**[01]**	**[06]**
Q.7	Write short notes on (any three)			
	• Technological Challenges faced by IOT Devices • IOT Platforms Architecture • IOT Design Opportunities • Smart Vehicles • Smart City	**[20]**	**[01]**	[05] [01] [06]

BharatiyaVidyaBhavan's

SARDAR PATELCOLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Re-Exam _Jun2018

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, MN= Module No., CO= course outcome

<table>
<tr><th>Q. no</th><th></th><th>MM</th><th>MN</th><th>CO</th></tr>
<tr><td>1</td><td>a) Define the kinematic pair; elaborate the various types of kinematic pairs based on their classification criterion.
b) Compare the gear drive over the other drive like belt/chain.
c) What do you mean by cam-follower; discuss types of follower.</td><td>8
4
8</td><td>1
7,6
5</td><td>1
1,3
1,2</td></tr>
<tr><td>2</td><td>The dimensions (in mm) for a four bar chain is as given in the table below. The angular velocity ω_2 is constant for each configuration and a negative sign is used to indicate clockwise direction.
<table>
<tr><th>Configuration no.</th><th>Frame-1</th><th>Crank-2</th><th>Coupler-3</th><th>Follower-4</th><th>Θ_2 deg.</th><th>ω_2 rad/s</th></tr>
<tr><td>1</td><td>250</td><td>100</td><td>500</td><td>400</td><td>55</td><td>-10</td></tr>
<tr><td>2</td><td>400</td><td>125</td><td>300</td><td>300</td><td>155</td><td>-15</td></tr>
</table>
Determine: Θ_3, Θ_4, ω_3, ω_4, α_3, α_4, for each configuration. (use relative velocity and acceleration method)</td><td>10+10</td><td>3</td><td>1</td></tr>
<tr><td>3</td><td>a) Find the maximum and minimum transmission angles and corresponding crank angle for the configurations given in Q.no.2. (use graphical method).
b) A chain drive is used for speed reduction from 240 rpm to 110 rpm. The number of teeth on driving sprocket is 22. The centre to centre distance between two sprocket is 540 mm and the pitch circle diameter of the driven sprocket is 480 mm. Determine number of teeth on driven sprocket, pitch and length of the chain.</td><td>10
10</td><td>1
6</td><td>1
1,3</td></tr>
<tr><td>4</td><td>a) Calculate the contact ratio of 17-tooth pinion that drives the 73-tooth gear. The gears are 4 mm module and cut with 20^0 full-depth involute system.
b) Explain law of gearing.</td><td>07
06</td><td>7</td><td>1,3</td></tr>
</table>

	c) Two parallel shafts separated by a distance of 84 mm, are to be connected by a set of involute spur gears, so that output shaft rotates at 40% of the speed of the input shaft. Design a gear set to fit the situation. (use module as 2 mm per tooth).	07	7 7	1,3 1,3
5	a) Deduce an expression for the friction tensions in a v-belt passing round a pulley rim. Draw suitable sketch showing force equilibrium. b) An open belt drive connects two parallel shafts 1.2 meters aparts. The driving and driven shafts rotates 350 rpm and 140 rpm respectively. The driven pulley is 400 mm in diameter. The belt is 5 mm thick and 80 mm wide. The maximum permissible tension in the belting is 1.4 MN/m^2. Take μ= 0.3. Determine: i) diameter of the driving pulley. ii) maximum power that may be transmitted. iii) initial belt tension.	8 12	6	1,3 1,3
6	a) The following particulars relate to tangent cam with roller follower: minimum radius of the cam=40mm; lift 20mm; roller diameter=20mm; speed=360 rpm; angle of ascent = 60 deg.; Calculate the acceleration of a follower at the beginning of the lift, also find its values when the roller just touches the nose and is at the apex of the circular nose. b) Draw the displacement, velocity and acceleration w.r.t. time or angle diagram for follower motion during ascent for the data given below: Lift = 60mm, angle of ascent= 60^0, angle of dwell= 40^0, angle of descent = 90^0, speed of cam= 200 rpm, motion of follower is Cycloidal during ascent.	10 10	5	1,2 1,2
7	a) Give the diagramatic sketches of three mechanisms which are inversion of double slider crank chain, also state the purpose for which each mechanism is used. b) Sketch the Hart's straight-line generating mechanism and prove that the tracing point describes a straight-line path. c) Discuss the static equilibrium for two force, three force and four force members	8 6 6	1 2 4	2,1 2 4

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

(A Government Aided Autonomous Institute)

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

Re-examinations, June 2018

Maximum Points: 100 **Duration: 3 Hrs**

Class: **S.Y. B. Tech. (Mechanical)** Semester: **IV**

Program: **B. Tech. (Mechanical Engineering)**

Name of the Course: **Mechanical Engineering Measurements**

Course Code: **BTM404**

Instructions:

1. **Question number 1 is compulsory; attempt any four questions from remaining questions.**
2. **Draw neat diagrams wherever necessary.**
3. **Assume suitable data if necessary.**

Q. No.		Max. Points	CO No.	M. No.
1	With neat labeled sketches explain working principle of (i) Rotameter (ii) Potentiometer (iii) LVDT (iv) Brideman Gauge	20	3	5,3,7
2 (a)	A thermometer, idealized as a first-order system with a time constant of 2.2 seconds, is suddenly given an input of 160^{0}C from 0^{0}C. What will be the reading of the thermometer after 1.2 seconds?	05	2	1
(b)	List the types of sources of error and methods to avoid the same in measurement using strain gauges	05	2	3
(c)	Select the appropriate instrument for measurement of flue gases from chimney. Explain working principle of proposed measurement system with neat labeled diagram.	10	4	7
3 (a)	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	1,3	1
(b)	Explain with neat labeled diagram four different techniques for liquid level measurement. Suggest suitable technique for determining (i) water level in overhead tank of residential building (ii) depth of an ocean	10	3, 4	7
4(a)	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 working principle)	20	4	6
5 (a)	In laboratory mercury in capillary tube temperature measurement system is available. It was proposed to measure humidity present in the laboratory. Explain step-by-step way to measure humidity.	5	3,4	7
(b)	With neat labelled sketch explain working principle of ionization gauge	5	3	5

(c)	The transfer function of a system is given as $\frac{361}{\left(S^2+16S+361\right)}$ Find the following for a unit step input: undamped natural frequency, damping ratio, damped natural frequency, settling time, peak time, rise time, percentage overshoot.	**10**	**2**	**1**
6. **(a)**	What is first order system? Starting from conservation of energy derive equation of first order for determination of instantaneous temperature T_{tf} 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.	**8**	**3**	**1**
(b)	With neat sketches explain the following terms with respect to the measurement system: (i) Accuracy (ii) Hysteresis (iii) Resolution (iv) Span and Range (v) Drift (vi) Dead zone (vii) Precision	**7**	**1**	**1**
(c)	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 of 0.333 of thickness. Also calculate the natural frequency of diaphragm. Given: Youngs modulus=200 GN/m^2, Poissons ratio=0.28 and density of steel=7800 kg/m^3	**05**	**1,2**	**5**
7. **(a)**	A single strain gauge having resistance of 130 Ω is mounted on a steel cantilever beam at a distance 0.12 m from the free end. The beam dimensions are 25 cm (length) x 2.0 cm (width) x 0.3 cm (depth). An unknown force F applied at the free end produces a deflection of 11.8 mm of the free end. If the changes in gauge resistance is found to be 0.145 Ω, calculate the gauge factor. Deflection of the free end $\delta = FL^3/3EI$, where F= Force, L=Length, E= Youngs modulus, I=Moment of Inertia, Take Young's modulus for steel as 200×10^9 N/m^2	**10**	**2, 3**	**2, 3**
(b)	Explain with neat sketches the working principle of (i) optical pyrometer (ii) Bimetallic thermometer	**10**		**6**

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai - 400058.
End Semester Exam
May 2018

Max. Marks: 100 marks — Duration: 3 hours
Class: S.Y.B.Tech. Semester: Fourth (4th) Program: **Manufacturing Science II**
Name of the Course: Mechanical Engineering — Course 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.

<table>
<tr><th>Q. No</th><th></th><th>Max. Mark</th><th>CO No.</th><th>Module No.</th></tr>
<tr><td>Q1 A)</td><td>Explain in brief need of Jigs and fixture system pointwise?</td><td>5 M</td><td>1</td><td>1</td></tr>
<tr><td>B)</td><td>i) If the position of single point cutting tool in O.D. cylindrical turning is above the work-piece centre; (Working rake angle(γ_x), original rake angle (γ), working clearance angle (α_x), original clearance angle (α), Give justification with sketch.
a) $\gamma_x > \gamma$, $\alpha_x > \alpha$ b) $\gamma_x > \gamma$, $\alpha_x < \alpha$
c) $\gamma_x < \gamma$, $\alpha_x < \alpha$ d) $\gamma_x < \gamma$, $\alpha_x > \alpha$
ii) Write in brief different type of clearance provided on drill tool? (2M)</td><td>5 M</td><td>3</td><td>4</td></tr>
<tr><td>C)</td><td>A shell has height (h) of 56 mm and diameter (d) 56 mm, corner radius is 4 mm, thickness is 1 mm, work piece material is medium carbon steel (having yield strength of 3600kg/cm^2). Assume clearance is 1.09 times thickness of stock, value of constant 'k' for drawing pressure of material is 0.61, force of friction and blank holder force required is one fourth of drawing force.
Calculate- Blank diameter (with trimming allowance), number of draw passes required and percentage reduction during each pass, Punch and die diameter for each stage, drawing force , blank holder and frictional force, Press capacity required? (Refer table 1)
Table 1
<table>
<tr><th>Draw ratio e= (h/d)</th><th>No. of reduction passes</th><th colspan="4">% reduction</th></tr>
<tr><th></th><th></th><th>1st Draw</th><th>2nd Draw</th><th>3rd draw</th><th>4th Draw</th></tr>
<tr><td>0.75</td><td>1</td><td>40</td><td></td><td></td><td></td></tr>
<tr><td>0.75-1.5</td><td>2</td><td>40</td><td>25</td><td></td><td></td></tr>
<tr><td>1.5-3</td><td>3</td><td>40</td><td>25</td><td>15</td><td></td></tr>
</table></td><td>10 M</td><td>4</td><td>7</td></tr>
</table>

Q2. A)	Explain working principle of *strain gauge type 2D turning lathe dynamometer* with the help of neat schematic sketch?	5 M	2	3
B)	Write short note on compound dies along with sketch of its process setup?	5 M	4	5
C)	A solid cylindrical slug of Copper annealed material is 210 mm diameter & 100 mm height. It is processed in open die forging with flat dies, so that its height is reduced by 50% at room temperature. Assume coefficient of friction is 0.3. Calculate the forging force at the end of stroke? (Refer **Figure 1**) Explain the different tests are used to check forgeablity of the material?	10 M	4	6
Q3. A)	Draw well labelled neat sketch of any two lever type clamps and state their applications?	5 M	1	1
B)	With the help of neat schematic sketch explain in brief the following; i) *Feed engagement*, ii) *Back engagement*, iii) *undeformed chip thickness*, iv) relationship between uncut chip thickness and feed engagement?	5 M	3	2
C)	During machining of die steel material using single point cutting tool whose geometry defined in ASA system as: 2° , 12° , 4°, 6° , 12° , 75° , 1mm. Calculate orthogonal rake γ_0 , Inclination rake λ, orthogonal clearance α_0, maximum rake angle γ_M of tool. Draw tool geometry in ASA system and ORS system.	10 M	3	4
Q4. A)	Match the following pairs for Cutting fluid with certain additive content will not be applicable for machining of certain workpiece material? What are the cutting fluid selection criteria based on process performance?	5 M	2	3

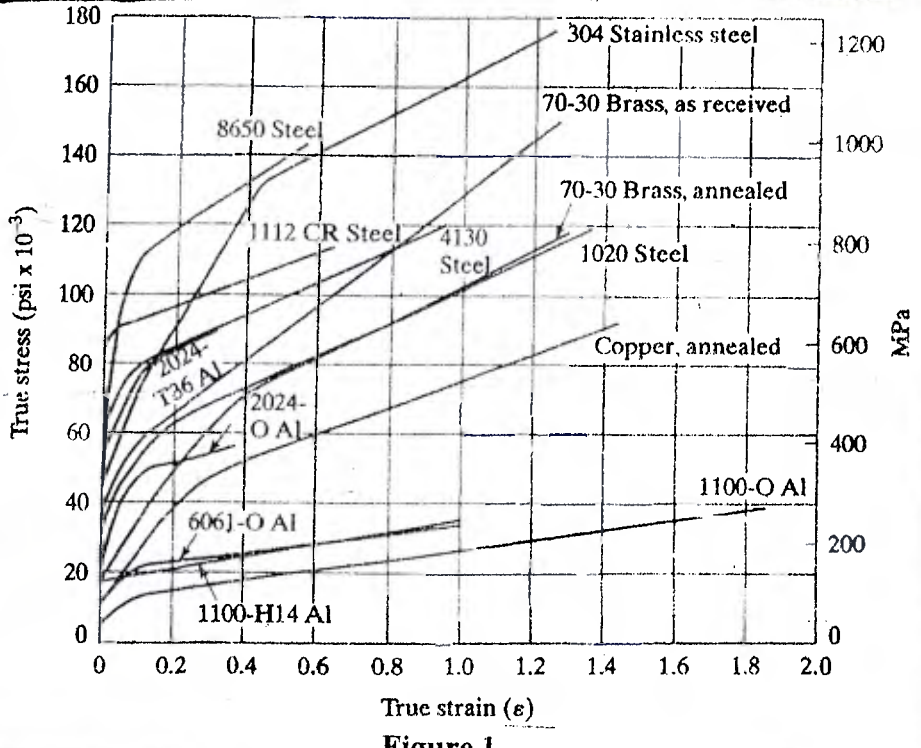
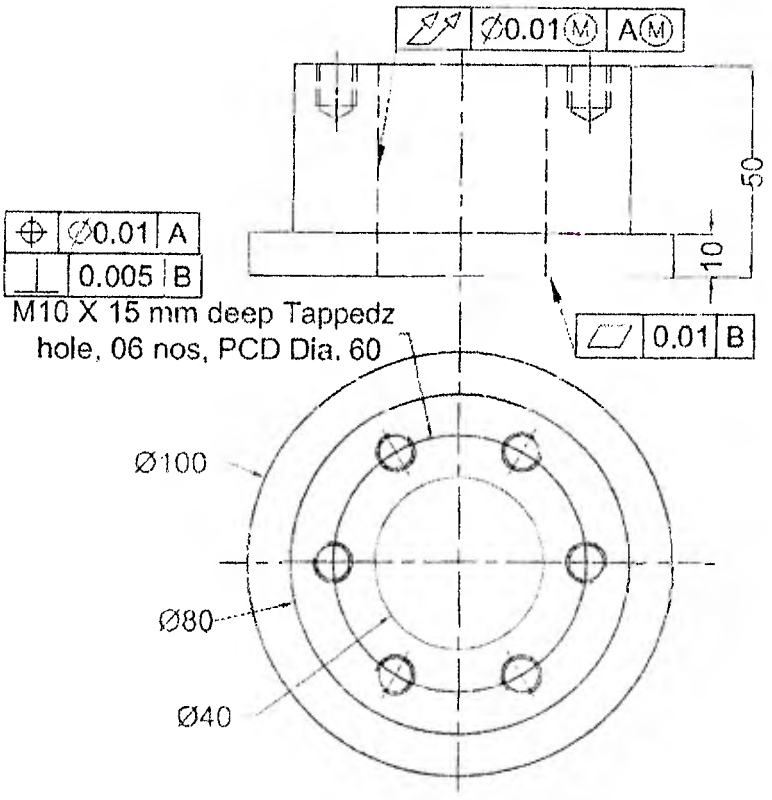
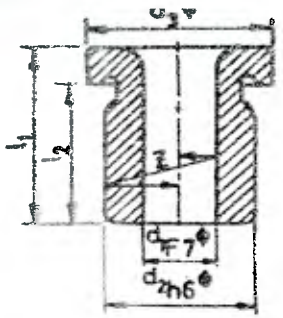


Figure 1

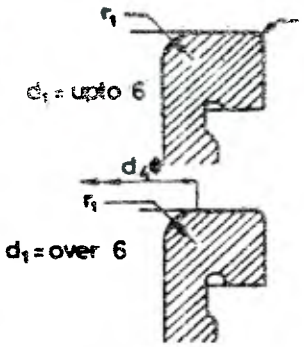
Cutting fluid (CF) with additives	Workpiece material
a)C.F. with sulfur content	i)High carbon steel
b)C.F. with chlorine content	ii)Nickel based alloys
	iii)Electrolytic grade Copper
	iv)Titanium

B)	Explain characteristics of rolled metals with reference to their residual stresses and surface roughness?	5 M	4	6
C)	What are different criteria's to choose optimum cutting speed for particular machining operation? For manufacturing of 'N_b' batch of components with the help of 'M' number of machines and 'N_t' number of tools, obtain the expression for optimum cutting speed (V_c), which should be kept during machining operation so that overall production cost will be minimum(by considering non-productive cost, machining cost and tool cost)?	10 M	3	2
Q5. A)	Draw neat schematic sketch of different types of electrical transducers working based on deflection measurement?	5 M	3	3
B)	Write short note on carbide tool material with reference to their basic group, general characteristic, modes of failure and their limitation?	5 M	2	2
C)	An integral obstruction type chip breaker height of 0.75 mm, its distance is 5mm. It is found during the process that chip is broken satisfactorily when chip thickness is 0.9 mm. Determine chip breaker distance provided for an attached obstruction type chip breaker to give the same performance as that of integral type, if the chip breaker height is 1.8 mm, chip breaker wedge angle is 40^0. Assume chip tool contact length is equal to chip thickness?	5 M	3	4
D)	Write short note on following terms i) Minimum bend radius and bendability ii) Wrinkling in a sheet-metal specimen with necessary sketch?	5 M	4	7
Q6. A)	Write short note on *Cryogenic* machining along with their specific application?	5 M	2	3
B)	Suggest a rolling process for manufacturing Large rings for rockets & turbines and explain its characteristics, advantages with the help of neat schematic sketch?	5 M	4	6
C)	i) Calculate and sketch punch and die size for blanking and punching operation, ii) punch length and die block size iii) Suggest material selection criteria for punch based on its compressive strength, iv) press capacity? for manufacturing of medium carbon steel washer having outer diameter 20 mm, inner diameter 12 mm, thickness 3.2 mm. Ultimate shear strength of material is 32 kg/mm^2. Assume efficiency of press 51%, shrinkage and expansion allowance 0.075 mm, and clearance for medium carbon steel washer material is 5% of stock thickness. **Table 2** Die block thickness (in mm) / Total perimeter of washer to be sheared off (in mm) 15 / 75 mm 25 / 75-250 mm 30 / For larger perimeter values 'E' Young modulus of elasticity for punch material = 2.1 X 10^3 ton/cm^2.	10 M	4	5
Q7. A)	What are different types of burnishing and sizing dies? Draw their well labelled setup schematic sketch?	5 M	4	5
B)	Suggest sheet metal forming process for manufacturing of Aircraft wing	5 M	4	7

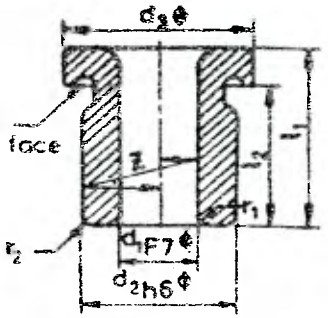
	skin panel and Boat hulls. Draw well labelled neat sketch of setup and explain this process?			
C)	Design and sketch jig plate, jig bush system and other miscellaneous elements for manufacturing of component shown in figure 2. Draw the assembly view of jig plate, jig bush and workpiece component for performing final drilling operation. State probable accuracy of jig plate surfaces and jig bush surfaces to be maintained (geometric tolerance). Also state sequence of machining process (machine tool used, cutting tool used and accuracy maintained in brief)? Raw material (phosphor bronze I) size ϕ102 mm X 52 mm, batch size required is 75 nos.  **Figure 2.**	10 M	1	1



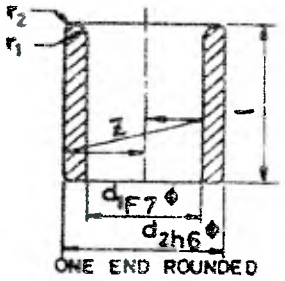
Bore rounded on top only



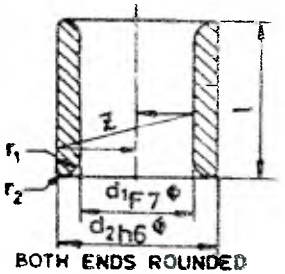
Detail of rounding



Bore rounded on both ends



ONE END ROUNDED



BOTH ENDS ROUNDED

FIXED BUSH

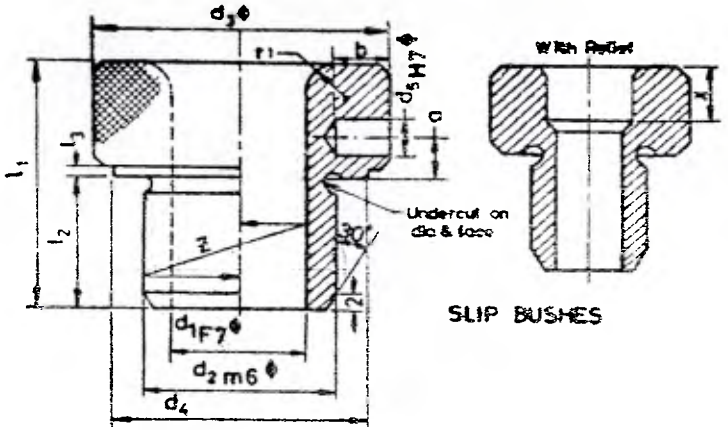
d_1	Short		Long		d_2	d_3	d_4	r_1	r_2	z
	l_1	l_2	l_1	l_2						
Upto 1	6	4	9	7	3	6	—	1.2	0.2	0.005
1.0—1.8	6	4	9	7	4	7	—	1.2	0.2	0.005
1.8—2.6	6	4	9	7	5	8	—	1.2	0.3	0.005
2.6—3.3	8	6	12	9	6	10	—	1.6	0.3	0.005
3.3—4.0	8	6	12	9	7	11	—	1.6	0.4	0.005
4.0—5.0	8	6	12	9	8	12	—	2.0	0.4	0.005
5.0—6.0	10	7	16	13	10	14	—	2.0	0.4	0.01
6.0—8.0	10	7	16	13	12	16	10	2.0	0.6	0.01
8.0—10	12	8	20	16	16	20	13	2.5	0.8	0.01
10—12	12	8	20	16	18	22	16	2.5	0.8	0.01
12—15	16	12	28	24	25	26	20	4.0	0.8	0.01
15—18	16	12	28	24	25	30	24	4.0	0.8	0.01
18—22	20	15	36	31	30	35	28	6.0	1.0	0.01
22—26	20	15	36	31	36	41	33	6.0	1.0	0.02
26—30	20	15	36	31	42	47	40	6.0	1.0	0.02
30—35	25	20	45	40	48	55	46	8.0	1.0	0.02
35—42	25	20	45	40	56	63	52	8.0	1.0	0.02
42—48	32	25	56	50	63	70	59	8.0	1.6	0.02
48—55	32	25	56	50	70	77	67	8.0	1.6	0.02
55—63	36	30	72	66	80	87	75	8.0	1.6	0.02

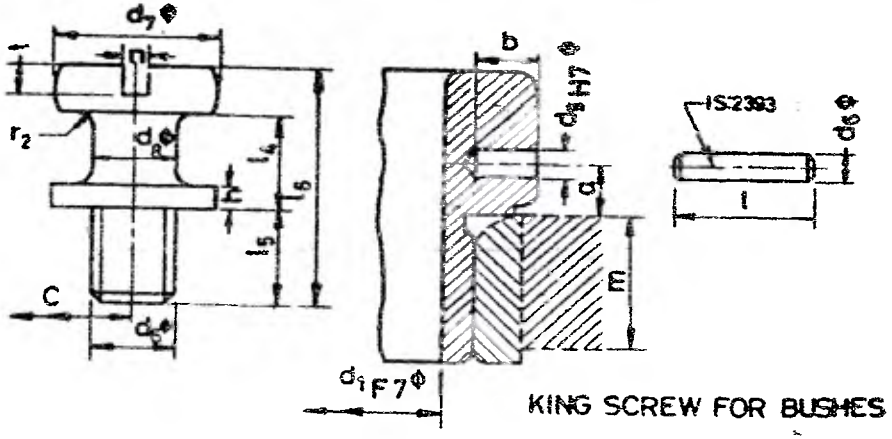
LINER BUSH

63 to 65 HRC

d_1	Short	Long	d_2	r_1	r_2	z
Upto 1	6	9	3	1.2	0.2	0.005
1.0—1.8	6	9	4	1.2	0.2	0.005
1.8—2.6	6	9	5	1.2	0.3	0.005
2.6—3.3	8	12	6	1.6	0.3	0.005
3.3—4.0	8	12	7	1.6	0.4	0.005
4.0—5.0	8	12	8	2.0	0.4	0.005
5.0—6.0	10	16	10	2.0	0.4	0.01
6.0—8.0	10	16	12	2.0	0.6	0.01
8.0—10	12	20	16	2.5	0.8	0.01
10—12	12	20	18	2.5	0.8	0.01
12—15	16	28	22	4.0	0.8	0.01
15—18	16	28	25	4.0	0.8	0.01
18—22	20	36	30	6.0	0.8	0.01
22—26	20	36	36	6.0	1.0	0.02
26—30	20	36	42	6.0	1.0	0.02
30—35	25	45	48	8.0	1.0	0.02
35—42	25	45	56	8.0	1.0	0.02
42—48	30	56	63	8.0	1.6	0.02
48—55	30	56	70	8.0	1.6	0.02
55—63	36	70	80	8.0	1.6	0.02

All dimensions in millimetres





SLIP BUSHES AND LOCKING SCREWS

All dimensions in millimetres.

d_1	d_2	d_3	d_4	d_5	l_1	l_2	l_3	a	b	r_1	z	x
Upto 4	8	16	11	2.5	20	10	1	3	4	3	0.01	14
4— 6	10	19	14	2.5	22	12	1	3	4	3	0.01	12
6— 8	12	22	17	2.5	25	12	1	3	4	4	0.01	10
8— 10	16	26	21	3.0	28	16	1	4	5	5	0.01	12
10—12	18	30	24	3.0	28	16	1	4	5	5	0.01	10
12—15	22	35	29	5.0	36	20	1	5	7	5	0.01	12
15—18	25	40	35	5.0	36	20	1	5	7	5	0.01	8
18—22	30	47	41	5.0	36	20	1	5	7	6	0.01	0
22—26	36	56	47	6.0	45	25	2	6	8	6	0.02	0
26—30	42	62	54	6.0	45	25	2	6	8	6	0.02	0
30—35	48	69	61	6.0	50	32	2	6	11	8	0.02	0
35—42	56	78	69	6.0	50	32	2	6	11	8	0.02	0
42—48	63	85	78	6.0	56	36	2	6	14	8	0.02	0

chamfer $1 \times 45°$
Material C 45; Hardness HRC 50

d_6	d_7	d_8	l_4	l_5	l_6	h	d_6 m6$^{\phi} \times l$	m	n	t	r_2	c
M 5							2.5×14	10				15
M 5							2.5×14	12				16
M 5	10	5	6	6	15	2	2.5×14	12	1.6	2.0	0.6	18
M 5							3.0×14	16				20
M 5							3.0×14	16				22
M 6							5 ×20	20				26
M 6	13	6	8	8	20	2	5 ×20	20	2.0	2.5	1.0	29
M 6							5 ×20	20				33
M 8							6 ×24	25				38
M 8							6 ×24	25				41
M 8	16	8	10	10	25	2.5	6 ×24	30	2.5	3.0	1.6	45
M 8							6 ×24	30				48
M 8							6 ×28	35				55

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RE-Examination, June 2018

S.Y.B.Tech., Sem-IV — **B.Tech. in Mechanical Engineering**

Course: **FLUID MECHANICS (BTM 403)**

Max. Marks: 100 — **Duration: 3 Hours**

Instructions:

- Answer any FIVE (05) questions,
- Answers to all sub questions must be grouped together,
- Make suitable assumption if needed with proper reasoning,
- Figures on right in square bracket shows maximum marks for a particular sub-question,

1. A. What is Reynolds Transport Equation? Explain physical meaning of each terms involved in it. [8]
   B. Difference between Lagrangian and Eularian methods of study of fluid flow. [6]
   C. Basic laws used in the analysis of fluid flow and their mathematical representation. [6]

2. A. Distinguish between - [10]
      i. Path line and streak line
      ii. Compressible and incompressible flow
      iii. Euler and Stocks flow
      iv. Newtonian and non-Newtonian fluid

   B. Newton's law of viscosity? How does viscosity of liquid and gas vary with temperature? Give reasons. [10]

   The velocity of the fluid filling a hollow cylinder of radius 0.1 m varies as $u = 10\left(1 - \left(\frac{r}{0.1}\right)^2\right)$ m/s along the radius r. The viscosity of the fluid is 0.018 Ns/m^2. For 2 m length of the cylinder, determine the shear stress and shear force over cylindrical layers of fluid at r = 0 (centre line), 0.02, 0.04, 0.06 0.08 and 0.1 m (wall surface.)

3. A. What is the difference between a barometer and a manometer. [10]
   Derive an expression for the force on a thin plate of given arbitrary shape immersed in a liquid at an angle θ to the free surface.

   B. Explain how liquid surface behaves by itself and when it is in contact with other surfaces. Also show that the capillary rise in an annulus is given by $\frac{2\sigma\cos\beta}{\gamma(r_o - r_i)}$, where r_o and r_i are the radii and σ is the surface tension, γ is the specific weight and β is the contact angle. [10]

4. A. Consider a flow with velocity components $u = 0, v = -y^2$, and $w = 3y^2z$. Answer following with sufficient explanation. [10]
      i. Is this a one-, two- or three-dimensional flow?
      ii. Is this a steady or unsteady flow?
      iii. Demonstrate whether this is an incompressible or compressible flow.
      iv. Develop an expression for total acceleration.
      State overall nature of the flow.

09/10.

B. Derive an expression to calculate displacement and momentum boundary layer thickness assuming parabolic variation of velocity in the boundary layer. [10]

5. A. Define and explain Couette flow? Simplify N-S equation to obtain a mathematical model for it and derive an expression for velocity profile. [10]

B. What is buoyancy? State and explain the conditions for the stability of floating bodies with proper illustration. [10]
Two spheres, one heavier and weighing 12000 N and of diameter 1.2 m and the other lighter and weighing 4000 N, are tied with a rope and placed in water. It was found that the spheres floated vertically with the lighter sphere just submerging.

6. A. (a) What is flow separation? Discuss its mechanism and consequence. How it can be controlled? [10]
(b) Derive Bernoulli's equation along a streamline and state the assumption made in derivation.

B. A pipe inclined at 45° to the horizontal converges from 0.2 m dia to 0.1 m at the top over a length of 2 m. At the lower end the average velocity is 2m/s. Oil of specific gravity 0.84 flows through the pipe. Determine the pressure difference between the ends, neglecting losses. If a mercury manometer (specific gravity 13.6) is used to measure the pressure, determine the reading of the manometer difference in m of mercury. Oil fills the limbs over mercury in the manometer. [10]

7. A. Discuss following: [10]
(i) Moody Chart
(ii) Features of Von Karmon approach to solve boundary layer problem

B. Show that the velocity profile in laminar flow through a circular pipe is parabolic. [10]
Oil with specific gravity of 0.85 flows in a pipe of 100 mm dia., the flow rate being 0.5 lps. The kinematic viscosity at this condition is 1.8×10^{-5} m^2/s. Determine whether flow is laminar or turbulent.
determine
(i) centre line and average velocity,
(ii) velocity at r = 2 cm,
(iii) friction factor,
(iv) wall shear and

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End Semester Exam

May- 2018

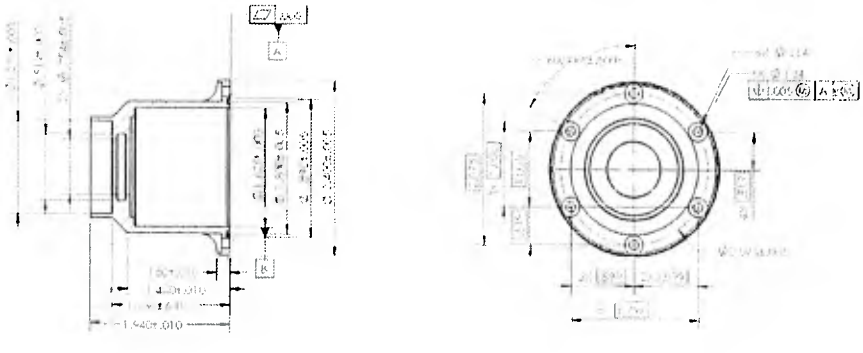
Q. P. Code:
Duration: 2Hour
Semester: IV

Max. Marks: 50
Class: **S.Y. B.Tech.**
Program: **Computer numerical control programming**
Name of the Course: **(Mechanical Engineering)**
Course Code : **BTM427**

Instructions:

i) **All questions are compulsory**

ii) **Wherever necessary assume suitable data and draw well labeled diagram/graph.**

Q. No		Max Mark	CO#	Module #
Q1	Write the CNC program according to SEMENS control to turn following component as shown in below figure, on CNC lathe machine? Do selection of cutting tool insert also and specify sequence of operations?  Write the procedure to test this program in test mode?	30 M	CO2 ,4	5
Q2	Write short note on following codes; M03, M06,M13,G75, G33	10M	CO2	3,4
Q3	Write short note on CNC machine drives and feedback control system?	10 M	CO3	2,3