Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

RE-EXAMINATION, JUNE 2015

Total Marks: 100   Duration: 3 Hours

S.Y.BTech, (Mechanical), SEM IV   **FLUID MECHANICS**

Master

- Attempt any **FIVE** questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Make suitable assumption if needed with proper reasoning

1   a)   Distinguish between -   8
      i. Compressible and incompressible flow
      ii. Steady and uniform flow
      iii. Two dimensional and Axi-symmetric flow
      iv. Laminar and turbulent flow
      v. Newtonian and non-Newtonian fluid

   b)   What is dynamic viscosity? How does viscosity of liquid and gas vary with   12
temperature? Give reasons.
The velocity of the fluid filling a hollow cylinder of radius 0.1 m varies as $u = 10\,[1 - (r/0.1)^2]$ 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.)

2.   a)   The pressures in chambers A, B, C and D   8
as shown in Fig. 1 are 3.4, 2.6, 1.8 and
2.1   bar   respectively.   Determine   the
readings of gauges 1 to 6.
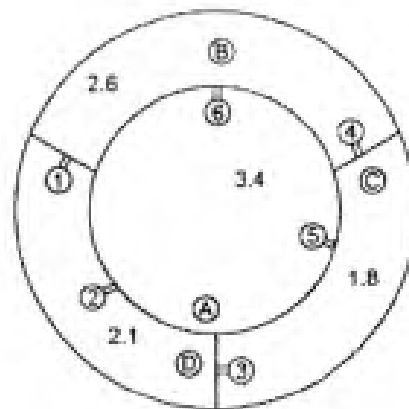
Pressure in bar

   b)   Explain how liquid surface behaves by itself and when it is in contact with other   12
surfaces. Also show that the capillary rise in an annulus is given by $\dfrac{2\sigma\cos\beta}{\gamma(r_o - r_i)}$, 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.

3   a)   Assuming linear variation of velocity in the boundary layer, develop an equation for   8
it and obtain expression for displacement and momentum boundary layer thickness.

b) Explain the importance of the study of fluid forces on surfaces and submerged bodies. **12**
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.

4 a) What is Couette flow? Develop an exact solution for velocity using N-S equation and explain it. **8**

b) What is buoyancy? State and explain the conditions for the stability of floating bodies with proper illustration. **12**
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.

5 a) In a two dimensional flow the x and y directional velocities u and v are given by **8**

$$u = -\frac{x}{x^2 + y^2}, \quad v = -\frac{y}{x^2 + y^2}$$

i. Show that the flow is steady
ii. Find velocity vector, local and convective acceleration at (2,5)
iii. Check whether the flow is irrotational

b) Derive Bernoulli's equation along a streamline and state the assumption made in derivation. **12**
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.

6 a) What is flow separation? Discuss its mechanism and consequence. How it can be controlled? **8**

b) Show that the velocity profile in laminar flow through a circular pipe is parabolic. **12**
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} m²/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

7 (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**

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.

master

Q1.a) Obtain the Fourier Series for $f(x) = x^2$ in $(0, 2\pi)$ **06**

Q1.b) To verify whether a course in accounting improved performance, a similar test was given to **06** 12 participants both before and after the course. The original marks recorded in alphabetical order of the participants were 44, 40, 61, 52, 32, 44, 70, 41, 67, 72, 53 and 72. After the course, the marks were in the same order 53, 38, 69, 57, 46, 39, 73, 48, 73, 74, 60 & 78. Was the course useful?

Q1.c) Obtain complex form of the Fourier series for $f(x) = e^{-x}$ $0 \le x \le 2\pi$ **08**

Q2.a) If the mean of a binomial distribution is 3 and the variance is $\frac{3}{2}$, find the probability of **06** obtaining atleast 4 success.

Q2.b) Solve the equation **06**

$$\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$$

by the method of separation of variables.

Q2.c) Show that the functions $\varphi_1(x) = 1$ $\varphi_2(x) = x \ \& \ \varphi_3 = \frac{1}{2}(3x^2 - 1)$ are orthogonal over **08**

$(-1, 1)$

Q3.a) In usual notations solve the one dimensional wave equation. **06**

Q3.b) The probability that a smoker aged 25 years will die before reaching the age of 30 years may **06** be taken a 0.018. Out of a group of 400 smokers, now aged 25 years, what is the probability that 2 smokers will die within the next 5 years?

Q3.c) If $f(x) = x$ $0 \le x \le 2$ **08**

Find half range cosine series using Parseval's identity deduce

$$\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + - - - - - -$$

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Q4.a) A drawer contains 50 bolts and 150 nuts. Half of the bolts and half of the nuts are rusted. If one item is chosen at random, what is the probability that it is rusted or is a bolt? 06

Q4.b) Obtain the Fourier Series for 06

$$f(x) = |\sin x| \qquad -\pi \le x \le \pi$$

Q4.c) In a distribution exactly 7% of items are under 35 and 89% are under 63. What are the mean and standard deviation? 08

Q5.a) Compute spearman's rank coorelation coefficient for the following data 06

X	18	20	34	52	12
Y	39	23	35	18	46

Q5.b) Derive the one dimensional heat equation. 06

Q5.c) 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 08

Q6.a) For a random sample of 10 pigs fed diet A, the increases in weight in pounds in a certain period were 10, 6, 16, 17, 13, 12, 8, 14, 15, 9. 06
For another random sample of 12 pigs, fed on diet B, the increase in the same period were 7, 13, 22, 15, 12, 14, 18, 8, 21, 23, 10, 17. Test whether the diets A & B differ significantly as regards their effect on increase in weight

Q6.b) A string is stretched and fastened to two point's l apart. Motion is started by displacing the string in the form $y = a \sin \dfrac{\pi x}{l}$ from which it is released at time $t = 0$, show that the displacement of any point at a distance x from one end at time t is given by $y(x, t) =$ 06

$$y = a \sin \frac{\pi x}{l} \cos \frac{\pi c t}{l}.$$

Q6.c) Calculate the correlation coefficient for the following data: 08

X	9	8	7	6	5	4	3	2	1
Y	15	16	14	13	11	12	10	8	9

Q7.a) Fit a binomial distribution for the following data and compare the theoretical frequencies with the actual ones: 06

X	0	1	2	3	4	5
f(x)	2	14	20	34	22	8

Q7.b) The following data gives the heights in inches(X) and weights in lbs(Y) of a random sample of 10 students 06

X	61	68	68	64	65	70	63	62	64	67
Y	112	123	130	115	110	125	100	113	116	126

Estimate the weight of a student with height 59 inches

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Q7.c) The theory predicts the proportions of bean in the four groups A, B, C & D should be 9:3:3:1. 08
In an experiment among 1600 beans, the number in the four group are 882, 313, 287 & 118.
Does the experimental result support the theory?

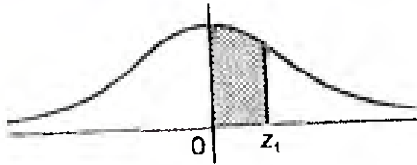Page - 8

Percentage Points of *t* - distribution

Example

For $\Phi = 10$ 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	1.383	1.833	2.262	2.821	3.250
10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.287
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.325	2.576

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	.8832	.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

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Applied Mathematics - IV
(Civil / Const. / Prod.) (III) Statistical Tables
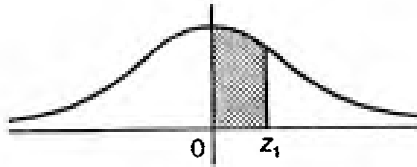
Percentage Points of χ^2 - Distribution

Example

For $\Phi = 10$ 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	22.618	24.725
12	3 571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	27.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.349	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.198	36.415	40.270	42 980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.953	18 493	29.336	40.256	43.773	47.962	50.892

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Applied Mathematics - IV
(Civil / Const. / Prod.)

(1)

Statistical Tables
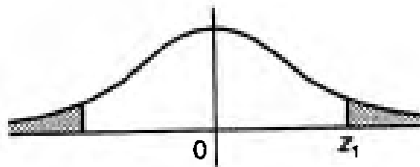
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2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4560	.4961	.4962	.4963	.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

Applied Mathematics - IV
(Civil / Const. / Prod.)

(II)

Statistical Tables

Percentage Points of *t*- distribution

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10	1.372	1.812	2.228	2.764	3.169
11	1.363	1.796	2.201	2.718	3.106
12	1.356	1.782	2.179	2.681	3.055
13	1.350	1.771	2.160	2.650	3.012
14	1.345	1.761	2.145	2.624	2.977
15	1.341	1.753	2.131	2.602	2.947
16	1.337	1.746	2.120	2.583	2.921
17	1.333	1.740	2.110	2.567	2.898
18	1.330	1.734	2.101	2.552	2.878
19	1.328	1.729	2.093	2.539	2.861
20	1.325	1.725	2.086	2.528	2.845
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797
25	1.316	1.708	2.060	2.485	2.287
26	1.315	1.706	2.056	2.479	2.779
27	1.314	1.703	2.052	2.473	2.771
28	1.313	1.701	2.048	2.467	2.763
29	1.311	1.699	2.045	2.462	2.756
30	1.310	1.697	2.042	2.457	2.750
40	1.303	1.684	2.021	2.423	2.704
60	1.296	1.671	2.000	2.390	2.660
120	1.289	1.658	1.980	2.358	2.617
∞	1.282	1.645	1.960	2.325	2.576

b) A belt drive transmits 8 kW of power from a shaft rotating at 240 rpm to another shaft rotating at 160 rpm. The belt is 5mm thick. The diameter of the smaller pulley is 600 mm and the two shaft are 5 m apart. The coefficient of friction is 0.25. If the maximum stress in the belt is limited to 3 N/mm², find width and length of the belt for i)open belt drive, ii) cross belt drive   **5+5**

c) A chain drive is used for speed reduction from 240 rpm to 110 rpm. The number of teeth on the driving sprocket is 22. The center distance between the sprockets is 540 mm and the pitch circle diameter of the driven sprocket is 480 mm. Determine the number of teeth on the driven sprocket, pitch and the length of the chain.   **5**

Q.5 a) State the conditions for generating exact straight line by any mechanism. Explain how Peaucellier mechanism generates straight line.   **3+5**
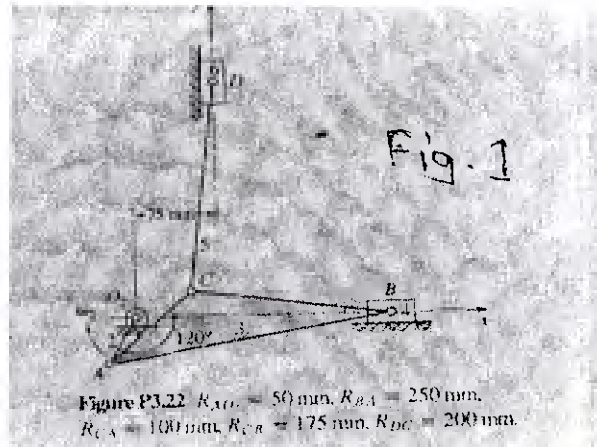
b) Derive an expression for the ratio of angular vel. of the shafts of a Hook's joint.   **8**

c) Four bar kinematic chain is the basic mechanism. Explain.   **4**

Q.6 a) Find the velocity of points B,C and D of the double slider crank mechanism (fig.1), if crank 2 rotates at 42 rad/s cw uniformly. (Use relative velocity method.)   **6**
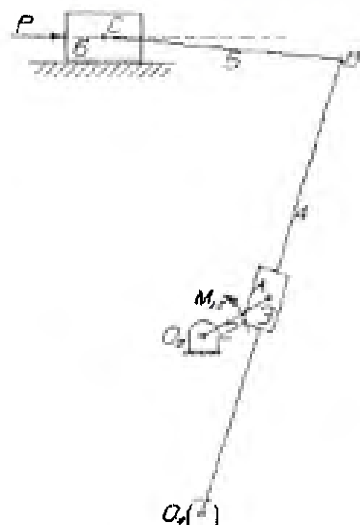
b) Find angular velocity of link 3 and 5, also linear velocity of link 4 and 6. (Use IC method, locate all IC's). fig.1.   **8**

Figure P3.22 R_{AO} = 50 mm, R_{BA} = 250 mm. R_{CA} = 100 mm, R_{CB} = 175 mm, R_{DC} = 200 mm.

Fig. 1

c) Find acceleration of point B and D in fig.1. (use relative acceleration method)   **6**

Q.7 a) Sketch a complete free-body diagram of each link of the linkage shown. Determine the torque required to drive the slider 6 against a load P= 445 N   **10**

b) Find the angular velocity and angular acceleration of link 4; if crank O₂A is moving with uniform angular velocity of 1 rad/s. ccw (use complex algebra method).   **10**

R_{AO_2} = 63 mm∠30° = 54.125$\hat{i}$ + 31.25$\hat{j}$ mm R_{AO_4} = 186.65 mm∠73.37° = 53.4$\hat{i}$ + 178.85$\hat{j}$ mm

R_{BO_4} = 400 mm∠73.37° = 114.45$\hat{i}$ + 383.275$\hat{j}$ mm R_{CB} = 200 mm∠175.20° = -199.3$\hat{i}$ + 16.725$\hat{j}$ mm

page ②

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

End sem examination Apr-May 2015

Total Marks: 100   Duration: 4 Hours

CLASS: S.E.(Mech), Sem: **IV**   SUBJECT: **Theory of machines-I (ME352)**

- **Q. no. 1 is compulsory.**
- Attempt any **Four** questions out of remaining **SIX** questions.
- Figures to the right indicate full marks.
- Make any suitable assumption if needed with proper reasoning.
- Answer to the sub-questions should be grouped together.

Q.1	Answer any five from the following	
a)	State and derive the law of gearing.	2+3
b)	Define mobility of mechanism and explain Kutzback's equation	2+3
c)	State advantages and dis-advantages of belt drive over gear drive.	5
d)	State and prove Kennedy's theorem as applicable to instantaneous center of rotation of three bodies. How it is helpful in locating IC's of a mechanism?	2+2+1
e)	State and prove law of correct steering. Sketch Davis steering gear mechanism	3+2
Q.2 a)	Deduce an expression for velocity of sliding in gear drive.	4
b)	Two 20^0 involute spur gears having velocity ratio 2.5 mesh externally. The module is 4mm and the addendum is equal to 1.23 module. The pinion rotates at 150 rpm. Find the minimum number of teeth on each wheel to avoid interference, contact ratio and what will be the sliding velocity at the moment the tip of the tooth of the pinion has contact with the gear flank	3+5+3
c)	A pair of spur gears has 16 and 18 teeth, a module 12.5 mm, and an addendum of 1 module and pressure angle of 14.5^0. Prove that gears have interference. Determine the min. number of teeth to avoid interference and to maintain exact velocity ratio.	3+2
Q.3 a)	Draw the displacement, velocity and acceleration w.r.t. time or angle diagram for follower motion for the data given: Lift = 40mm, angle of ascent= 75^0, angle of dwell= 40^0, angle of descent = 75^0, speed of cam= 300 rpm, motion of follower during rise is **cycloidal** and during return is **SHM** Locate the peak values of all.	5+5+6
b)	Classify different types of follower with suitable sketches according to its motion.	4
Q.4 a)	For a V- belt prove that—	5

$T_1/ T_2 = e^{\mu\alpha/\sin\theta}$, where

T_1 = tension in the tight side, T_2 = tension in the slack side, μ = coefficient of friction between the belt and pulley, α = angle of contact between belt and pulley, θ= semi-cone angle of pulley.

between the belt and pulley, α = angle of contact between belt and pulley.

b) A counter shaft is to be driven at 240 rpm from a driving shaft running at 100 rpm by belt drive. The diameter of the driving pulley is 480 mm. The center distance is 2 m. If belt has to transmit 3 kW of power and safe permissible tension stress is 15 N/mm width of the belt. Find the width and length of belt in open belt and cross belt drive.   4+4

c) A chain drive is used for speed reduction from 240 rpm to 110 rpm. The number of teeth on the driving sprocket is 22. The center distance between the sprockets is 540 mm and the pitch circle diameter of the driven sprocket is 480 mm. Determine the number of teeth on the driven sprocket, pitch and the length of the chain.   6

Q.5 a) State and explain various inversions of a simple four bar kinematic chain with 3R-1P.   8

b) Discuss Paucellier straight line generating mechanism.   5

c) Discuss Davis steering gear mechanism.   7

Q.6 a) Length of the various links of the mechanism are as shown in fig. If crank OA rotates 60 rpm in ccw direction, find linear velocity of slider and angular velocity of link BD.(use relative velocity method and IC method)   6+6
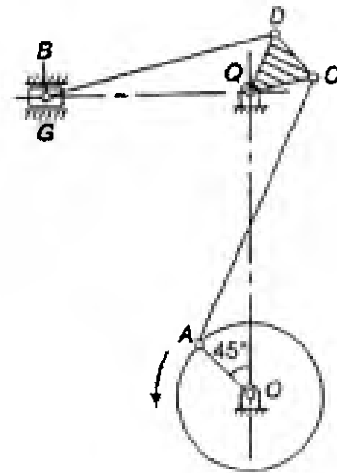
b) Determine angular acceleration of link BD and linear acceleration of slider B.   08

OA = 150 mm	CD = 125 mm
AC = 600 mm	BD = 500 mm
CQ = QD = 145 mm	OQ = 625 mm

Q.7 a) In a slider crank mechanism, crank O_2A=100mm, connecting rod AB=450mm has an external load P=2000N acting horizontally at slider link 4. Determine the torque M_{12} that must be applied to crank link 2 to hold the mechanism in static equilibrium, if crank makes 120^0 with horizontal in ccw direction and rotating in cw direction.   5

b) If the slider crank mechanism as mentioned in Q.7 a) rotates at uniform angular velocity of 120 rpm in ccw, find velocity and acceleration of slider using analytical method (complex algebra)   10

c) What is static equilibrium? Discuss equilibrium of two force member and three force member.   5

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Re - examination May-JUNE 2015

Total Marks: 100   Duration: 4 Hours

CLASS: S.E .(Mech), Sem: IV   SUBJECT: **Theory of machines-I (ME352)**

- **Q. no. 1 is compulsory.**
- Attempt any **Four** questions out of remaining **SIX** questions.
- Figures to the right indicate full marks.
- Make any suitable assumption if needed with proper reasoning.
- Answer to the sub-questions should be grouped together.

Master

Q.1   Answer any **four** from the following:

   a)   Sketch the pantograph and explain its use with suitable derivation.   2+3

   b)   What are the different types of constrained motion in kinematic pair? Explain with   2+3
        suitable sketches.

   c)   Define and elaborate the law of belting and crowning of pulley.   2+3

   d)   Define: kinematics, kinematic link, kinematic pair, kinematic chain and kinematic   5
        mechanism

   e)   Derive an expression for the ratio of angular velocities of the shafts of a hooks joint.   5

Q.2 a) The number of teeth on the gear and the pinion of two spur gears in mesh are 30 and 18   4+3+3
        respectively. The gears have module of 6mm and pressure angle of $20°$. If the pinion
        rotates at 400 rpm, what will be the sliding velocity at the moment the tip of the tooth of
        the pinion has contact with the gear flank? Take addendum as one module. Also find the
        maximum velocity of sliding and contact ratio.

   b) State and explain law of gearing.   5

   c) Deduce an expression for minimum no. teeth on gear wheel to avoid interference.   5

3   a) Draw the displacement, velocity and acceleration w.r.t. time or angle diagram for follower   6+5+5
        motion for the data given below:

            Lift   = 50mm, angle of ascent= $90°$, angle of dwell= $40°$, angle of descent = $90°$, speed
        of cam= 260 rpm, motion of follower during rise is **SHM** and during return is **cycloidal**
        Locate the peak values of all.

   b) What are the advantages and disadvantages of Cam-Follower mechanism over the other   4
        type of mechanism?

Q.4 a) For a flat- belt prove that—   6

        $T_1/ T_2 = e^{\mu a}$, where

            T_1 = tension in the tight side, T_2 = tension in the slack side, μ = coefficient of friction

Q.4.A. As an effective Manager what strategies will you adopt to conduct an effective meeting. -05-

Q.4. B. Read the case below and answer the questions:- -10-

Dr. Ahmed Khan was the public management department chair person for ten years at Hindu University. His leadership style was explained as "autocratic". However, he had, "personal qualities necessary to command respect and loyalty". Additionally, Dr. Ahmed Khan made and enforced all rules, regulations and policies in extreme detail. His autocratic style of leadership left very little to the individual faculty member in terms of experimentation, freedom in teaching and handling of students. His style of leadership caused the faculty to be "passive, subservient, dependent and ambivalent". However, faculty morale was generally high and faculty turnover was modest. Many faculty members trusted Dr. Ahmed Khan and felt that they were not restricted.

When Dr. Ahmed Khan suddenly died he was replaced by Dr. R. R. Rangaswamy case study holds that Dr. Rangaswamy came from a neighbouring university where he held a position as a faculty member and assistant department chairperson. Dr. Rangaswamy's leadership style was in sharp contrast to Dr. Ahmed Khan. Dr. Rangaswamy believed strongly in the concept of "democratic administration". In other words, he believed in delegating tasks to his subordinates. For example, at the first department meeting of the semester, he articulated that he wanted to share the budgeting, scheduling and the allocation of supplies responsibilities with the members of the faculty. He believed that this would allow the faculty to have a greater role in the decision making process. Unfortunately, this led to to decreased morale and a feeling that Dr. Rangaswamy was assigning chair person work to faculty members.

Furthermore, Dr. Rangaswamy did not assign the faculty any non-instructional duties, assuming that the faculty would participate in committee and department meetings, advice student groups with no interference from him. However, this did not happen and was eventually noticed by the dean, and Dr. Rangaswamy was invited for a "chat". During this "chat" the dean and the provost stated that they "no longer know what's going on in the 'public Management Department' and were concerned that perhaps Dr. Rangaswamy was not up to the job of department chair".

    a. Explain the leadership traits of both Dr. Ahmed Khan and Dr. Rangaswamy? -04-
    b. How a change in leadership has caused a successful Public Management Department to be deemed unsatisfactory by the Dean? And why? -04-
    c. Write recommendations as Dean to improve the situation. -02-

Q.5. Fill in the blanks:- -05-
    a. The informal channel of communication is also called_____.
    b. _____ is the Redressal forum in an organization.
    c. _____ for a meeting should be circulated in advance.
    d. A presentation with _____ distracts the audience than captures the attention of an audience.
    e. The capacity for recognizing our own feelings and those of others for motivating and for managing emotions is called as _____.
    f. _____ types of reports analyze problems and present a conclusion and also give recommendations.

All the Best

SE(mem), Sem-IV, 29/4/15
Presentation & Communication Techniques.

16.
Exam
29.4.15

BHARTIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING

[An Autonomous Institution Affiliated to University of Mumbai]

SUBJECT: Presentation and Communication Techniques (2014-2015)

Total Marks: 50   CLASS/SEM: IV (mem)SE   Duration: 2 Hour

1) All Questions are compulsory.
2) Figures to the right indicate marks.

master

Q.1. A company is considering a proposal to establish a new factory in your town. The managing Director has asked you to write a report on the suitability of the place for the establishment of this factory. For this report, an outline is provided below. Study it carefully and rewrite it in accordance with the principles of coordination, subordination, phrasing, numbering, ordering, etc. Write the Complete report in letter form.   **-10-**

Establishment of a New Factory

Outline

1. Introduction
2. Fire fighting and Communication facilities
   i. Telephone
   ii. Fax
   iii. Films
   iv. Games
3. Education and Entertainment facilities
4. How is the market
   a. Potential
   b. General
5. Labor from Local and other Plants
   5.1 Raw Materials
   5.2 Cost
6. Transport Facilities
   6.1 Rail, Road, Air
   6.2 Raw Materials
   a. Building
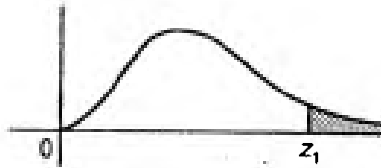   b. Infrastructural
7. Recommendations
8. Conclusions

Q.2.A. What factors will you bear in mind while giving an oral presentation before a large group? Write 15 most important steps.   **-05-**

Q.2.B. Define Leadership and explain the functions of a leader.   **-05-**

Q.3.A. List ten top Time-wasters. List five effective time management tips.   **-05-**

Q.3. B. What is Group dynamics? Explain 5 characteristics of an effective group .   **-05-**

Applied Mathematics - IV
(Civil / Const. / Prod.)

(III)

Statistical Tables

Percentage Points of χ^2 - Distribution

Example

For $\Phi = 10$ 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	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	27.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	16.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.349	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36.415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.652	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	44.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.953	18.493	29.336	40.256	43.773	47.962	50.892

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SARDAR PATEL COLLEGE OF ENGINEERING

Andheri (west), Mumbai -58

END SEMESTER EXAM – April 2015

Total Marks: 50

Subject: **Presentation & Communication Techniques**   Duration: 2 hrs
Class: IV Semester Electrical, Mechanical, Civil (SE)(C/M/E)   Date: _Master_

Instruction: All Questions are compulsory.

Q.1. Fill in the blanks.   (2marks)

    i) _____ represents the unofficial channels of communication which are created and controlled by people themselves rather than the management.

    ii) _____ communication is used to explain to the subordinates the rationale of their jobs so that they understand the significance of their work in relation to organizational goals.

    iii) _____ is a formal gathering of persons for the purpose of discussing and deciding matters of common interests of all of them.

    iv) The official records of the proceedings of a meeting is known as the _____.

Q.2. Prepare a minute of narration based on the following notice and agenda for a meeting.   (8 marks)

NOTICE

25 April 2015

It is hereby informed that the fifth meeting of Board of Directors of the ABC Company will take place in the Board Room, Corporate Mansion, on 28 April 2015, at 10.00 am.

Following are the agendas for meeting:
1. Confirmation of minute of previous meeting
2. Consideration of Report of the expert Committee for proposed setting up of a new plant
3. Consideration of issue of new employee health benefits
4. Consideration of the proposal for new employee training program
5. Any other matter with the permission of the Chairman
5. Date of next meeting

S.K. Arora
Secretary

Q.3. You are an employee of sales department of Tesco International Pvt. Ltd. From past few months employees in the department have been suffering from physical and mental health issues. An effect of which is visible in the productivity and efficiency of the department. Your boss, the Sales Manager has asked you to look into the matter, and submit an analytical report based on your investigation and observation, with recommendations for physical as well as mental health issues. Write in memo report format.   (10 marks)

Q.3. Discuss any one behavioral theory of leadership in detail.   (5marks)

Q.4. Discuss any five disadvantages of group decision making in brief.   (5 marks)

Q.5. List any 10 tips for making effective Powerpoint Presentation.   (5 marks)

Q.6. What is 80:20 rule of time management and how to you develop 80:20 thinking.   (7 marks)

Q.7. State whether following is true or false. Give reasons to your answer.   (8 marks)
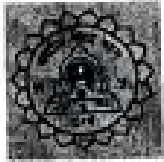
    i) Your communication will be very effective if you use impressive vocabulary and correct grammar.

    ii) The message sent is not always the same as the message received.

    iii) A successful leadership does not depend on appropriate behavior, skills, actions and personal traits. Because leaders are born and not made.

    iv) In a group, more the number, more knowledge and information can flow in.

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Bhartiya Vidya Bhavan's

Sardar Patel College of Engineering

An Autonomous Institution Affiliated to Mumbai University

Re-Exam
June 2015

Class: S.E. Mechanical (Semester: IV)

Subject: Mechanical Engineering Measurements

Total Marks: 100
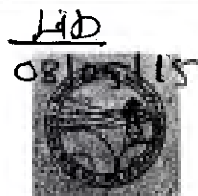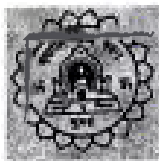
Duration: 3 hrs

Master

- Question no.1 is compulsory.
- Attempt **any four** questions out of remaining six.
- Figures to right indicate full marks.
- Assume suitable data if necessary.
- Answers to sub questions should be grouped together.

Q. 1   Write short notes on **(any four):**   20
      (a) Drift & Static Sensitivity of a measuring instrument.
      (b) Comparison between Null type and Deflection Type of Instruments.
      (c) Working of Strain Gauge Accelerometer.
      (d) Working of Capacitive transducers using change in area of plates.
      (e) Working of Diaphragms for pressure measurement.
      (f) Sight Glass Method for liquid level measurement.

Q. 2 (a)   The following ten observations were recorded when measuring a   06
      Temperature in °C: 61.7, 62.0, 61.8, 62.0, 62.1, 61.9, 62.0, 61.9, 62.5 and 61.8.
         Find (i) Arithmetic Mean,
             (ii) Average Deviation,
             (iii) Standard deviation treating data as finite.

Q.2 (b)   Draw a generalised measurement system for a Bourdon's Tube for pressure   04
      measurement?

Q.2 (c)   Explain various types of digital encoders for displacement measurement?   10

Q.3 (a)   Explain construction and working of Toothed Rotor variable reluctance type   10
      tachometer? Give advantages?

Q.3 (b)   Define Gauge Factor of a strain gauge?   10
      Explain temperature compensation with dummy strain gauge method?

Q.4 (a)   Describe construction and working of Bridgman High Pressure Gauge.   10

Q.4 (b)   Describe construction and working of Mcleod Gauge for vacuum   10
      measurement? Give advantages and disadvantages?

Q.5 (a)   Explain construction and working of any one type of Pyrometer for   10
      temperature measurement?

Q.5 (b)   Explain construction and working of RTDs? Give advantages and   10
      disadvantages.

Q.6 (a)   Explain the construction and working of a Rotameter? State its advantages and   10
disadvantages?

Q.6 (b)   Explain construction and working of a Laser Doppler anemometer? State its   10
advantages and disadvantages?

Q.7 (a)   Explain working of any one type of hydrometer for density measurement?   10

Q.7 (b)   Explain the working of resistive hygrometer for humidity measurement?   10

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Bhartiya Vidya Bhavan's

Sardar Patel College of Engineering

An Autonomous Institution Affiliated to Mumbai University

End Semester

May 2015

Class: S.E. Mechanical (Semester: IV)   **Total Marks: 100**

Subject: Mechanical Engineering Measurements   **Duration: 3 hrs**

- Question no.1 is compulsory.
- Attempt **any four** questions out of remaining six.   MASTER FILE.
- Figures to right indicate full marks.
- Assume suitable data if necessary.
- Answers to sub questions should be grouped together.

Q. 1   Write short notes on **(any four):**   20
    (a) Accuracy & Precision of an instrument.
    (b) Causes and preventative measures for Gross Error & Environmental Error.
    (c) Need of temperature compensation required for strain gauge.
    (d) Working of D.C. tachogenerators.
    (e) C-Type Bourdons Tube for pressure measurement.
    (f) Gamma Rays Method for liquid level measurement.

Q. 2 (a) The following 10 values were recorded from the measurements of a resistor: 08
    147.2, 147.4, 147.9, 148.1, 147.1, 147.5, 147.6, 147.4, 147.6 & 147.5.
    Calculate: (a) Arithmetic Mean (b) Average deviation (c) standard deviation
    treating data as finite   (d) standard deviation treating data as population.

Q.2 (b)   Give the input output configuration of measurement systems. (Diagram only)   03

Q.2 (c)   Classify and explain different types of inputs with an example for each?   09

Q.3 (a)   Describe the construction and working of the any one displacement transducer   10
    with advantages and disadvantages?

Q.3 (b)   Define Gauge Factor of a strain gauge?   10
    Explain any two methods for temperature compensation with active strain
    gauges?

Q.4 (a)   Describe construction and working of Bridgman High Pressure Gauge.   10

Q.4 (b)   Describe construction and working of Pirani Gauge? Give advantages and   10
    disadvantages?

Q.5 (a)   Give the characteristics of the material required for RTDs?   04

Q.5 (b)   State three laws on which the thermocouple works?   06

Q.5 (c)   Explain construction and working of Infra red pyrometer?   10

Q.6 (a) Explain the construction and working of a Venturimeter? State their advantages and disadvantages? **10**

Q.6 (b) Explain construction and working of a Laser Doppler anemometer? State their advantages and disadvantages? **10**

Q.7 (a) Explain the working of Piezo electric accelerometer and state salient features of it. **10**

Q.7 (b) Explain the working of resistive hygrometer for humidity measurement? **10**

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DEPARTMENT OF MECHANICAL ENGINEERING, SPCE

SE (Mechanical), SEM-IV, End Semester Examination, MAY 2015

[MANUFACTURING SCIENCE- II]

- **Question no 1 is compulsory**
- Attempt **any four out of remaining six** questions.
- Figures to the right (in bold) indicate full marks.
- Assume suitable data if necessary

Time : 3 Hour
Marks: 100

Master

Q1	**a)**	Explain diamond pin location with neat sketches	**05**
	b)	Explain the construction and working of a drilling tool force dynamometer	**05**
	c)	Discuss the influence of side cutting edge angle and end cutting edge angle on tool design	**05**
	d)	What are chip breakers? Sketch its various types (*any four*)	**05**

Q2 **a)** Why are work pieces clamped? *(1 mark)*   **10**
State any 5 principles for clamping purposes. *(5 marks)*
Explain bridge clamps and swinging strap clamps with neat sketches(*4 marks*)

b) Discuss machinability in brief *(3 marks)*   **10**
How is it quantified using the tool forces and power consumption method? *(1 mark)*
Comment on the machinability of steels, thermoplastics, and rubber; and suggest techniques to improve their machinability *(6 mark)*

Q3 **a)** In an orthogonal cutting operation, the following data has been observed: **10**
Uncut chip thickness t = 0.14mm, width of cut b = 6.35mm, cutting speed V= 2m/s, rake angle α = 10°, cutting force F_c = 520N, thrust force F_t = 250N, chip thickness t_c = 0.28mm. Determine:
The shear angle, the friction angle, shear stress along the shear plane, power required for the cutting operation, chip velocity, shear strain in the chip and the shear plane length

b) Explain the process of rotary swaging with neat sketches *(5 mark)*   **10**
Discuss briefly the tumbling process and the pickling process employed to clean forgings *(5 mark)*

Q4 **a)** What are the different types of tool wear? *(1 mark)*   **10**
Suggest two possible reasons for each of their occurrence *(6 mark)*

The equation for tool life for a turning operation is given by. $VT^{0.13} f^{0.77} d^{0.37}$ = C.
A 60 minute tool life was obtained while cutting at V = 30m/min, f = 0.3mm/rev and d =2.5mm. Determine the new tool life if the cutting speed is increased by 20% while the feed and depth of cut is kept unchanged. *(3 mark)*

b) A symmetrical cup work piece with a total shell height of 2inch and an external   **05**

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diameter of 2 inch is to be manufactured. The corner radius of the punch is 1/16 inch. The workpiece material is cold rolled steel and is 0.032 inch thick. Determine the required diameter of the blank

c) Explain the need for punch shredders. Discuss its types with neat sketches(any two)   **05**

Q5 a) Calculate the bending force in tons for a $45°$ bend in 24ST3 Aluminum, 0.06 inch   **05** thick, 24inch long, with a die opening 8 times the metal thickness. The bend is made by air- bending method. Ultimate tensile strength $S = 32.5 \text{tons/inch}^2$

The constant K   = 1.33 (die opening 8 times t)
= 1.20 (die opening nearing 16 t)
= 0.333 (single wiping bend)

b) Compare mechanical presses and hydraulic presses based on the following   **05** characteristics : *Stroke length, slide speed, capacity, control, application*

c) Explain line standards and end standards with examples *(4 marks)*   **• 10** Three 100mm end bars are measured on a level comparator by first wringing them• together and comparing with a calibrated 300mm bar which has a known error of $+30\mu m$. The three end bars together measure $40\mu m$ less than the $300\mu m$ bar. Bar A is $15\mu m$ longer than bar B and $10\mu m$ longer than bar C. Find the actual length of each bar. *(6 marks)*

Q6 a) With neat sketches explain the following terms associated with a milling cutter: **10** diameter, land, primary relief angle, secondary relief angle, flute*(5 mark)*

The feed of a 10-tooth face mill cutter is 0.03cm per tooth at 200rev/min. The material cut is 300BHN steel. The width and the depth of cut are 15cm and 0.32cm respectively. The machinability factor K can be assumed to be $8.2 \text{ cm}^3/\text{min/hp}_c$. Calculate
(a) the horsepower at the cutter,
(b)horsepower at the motor if the efficiency of the power transmission between the cutter and the motor is 70% *(5 mark)*

b) What is a sine bar? *(1 mark)*   **10** Explain its principle of operation with neat sketch. *(2 mark)* In setting a sine bar of 125 mm length to an angle of $30°$ what would be the actual angle set if: *(7 mark)*
(i) The assumed 125 mm roller separation is actually 125 +0.005 mm?
(ii) Gauging face of the bar is out of parallel from rollers by + 0.002 mm.
(iii) The slip gauges used have a total unsuspected error of -0.005 mm.

Q7 a) Explain Parkinson's gear tester with neat sketches*(6 marks).*   **10** If a spur gear with 32 teeth has a module of 4mm, calculate the chordal tooth thickness and the chordal addendum *(4 marks).*

b) Explain the following processes/components/terms briefly with sketches   **10**
    i.   Jack pins
    ii. Lancing
    iii. Ironing
    iv. International prototype meter
    v.   Fullering

DEPARTMENT OF MECHANICAL ENGINEERING, SPCE

SE (Mechanical), SEM-IV, Re- Examination, June 2015

[MANUFACTURING SCIENCE- II]

- **Question no 1 is compulsory**
- Answer **any four out of remaining six** questions.
- Figures to the right (in bold) indicates full marks.
- Assume suitable data if necessary

Time : 3 Hour

Marks: 100

Master

Q1	**a)**	Explain renewable drill bushes and press fit drill bushings with neat sketches	**05**
	b)	Explain the construction and working of a turning tool force dynamometer	**05**
	c)	Explain with sketches the different types of rolling mills.	**05**
	d)	Explain impression die forging with neat sketches. What is the difference between impression die forging and closed die forging?	**05**

Q2 a) Design a jig to drill a through hole in pre-machined mild steel pin at a given distance   **10**
from one end face as indicated
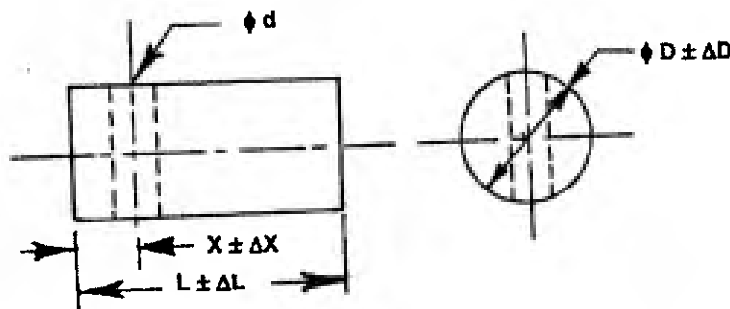
Explain the construction and working of the jig

b) What are the purposes for employing cutting fluids while machining?   **10**
List four essential properties that a cutting fluid should possess.
Explain any four types of cutting fluids

Q3 a) How are single point cutting tools classified based on the direction of feed?   **10**
With neat sketches explain the various tool angles of a single point cutting tool as
designated by the ASA system.

b) Explain with neat sketches the structural defects observed in rolled components.   **10**

Q4 a) A circular component with 25mm internal diameter and 50mm external diameter is   **10**
to be made from a 5mm thick sheet of metal. The shear strength of the material is
200N/mm². Compute (a) the required punching pressure, (b) the required blanking
pressure, (c) the pressure required when the punches are staggered, (d) the pressure

required when the punches are not staggered, (e)the press capacity if the shear on tools reduces the force required up to 80%.

b) With neat sketches explain the following terms associated with a drilling tool **10**
(a)Back taper, (b)land, (c)margin, (d)chisel edge, (e)chisel angle

The feed of a 10-tooth face mill cutter is 0.03cm per tooth at 200rev/min. The material cut is 300BHN steel. The width and the depth of cut are 15cm and 0.32cm respectively. The machinability factor K can be assumed to be 8.2 cm^3/min/hp_c. Calculate the horsepower at the cutter and the horsepower at the motor if the efficiency of the power transmission between the cutter and the motor is 70%

Q5 a) Define metrology and state it's any 5 objectives **10**
Explain primary, secondary, tertiary and working standards

b) With a neat sketch, explain the construction and working of a compound die **10**

Q6 a) Discuss the importance of strip layout during punching and blanking operation. **10**
A steel component 20mm x 60mm is to be made from 2mm thick sheet. Sketch the strip layout and determine
i. The values for back scrap and front scrap
ii. The value for scrap bridge
iii. The width of strip
iv. The length of one piece of stock needed to produce 1 blank
v. The number of parts which can be produced from a 2.4m long strip
vi. The scrap remaining at the end of the strip
vii. The percentage utilization

b) Discuss the influence of process variables, tool material, tool geometry, work piece material, surface condition of the work piece and cutting fluid on tool life **10**

If the useful tool life of a HSS tool machining mild steel at 18m/min is 3 hours, calculate the tool life when the tool operates at 24m/min. Constant n = 0.125.

Q7 a) Explain briefly any 5 systems of displacement amplifications used in mechanical comparators, with sketches **10**

b) A washer with a 10 mm internal hole and an outside diameter of 20mm is to be **10** made from 1.5mm thick strip. The shear strength of the metal strip material is 300N/mm^2. The total elastic recovery for the material is 0.05mm and the clearance on each side is 5% of t. Considering elastic recovery of the material find (a)The clearance (b) Blanking die-opening size, (c)Blanking punch size, (d)The piercing punch size (e)The piercing die-opening size

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

SE (mech), Sem - IV,
Applied Mathematics - IV.

APRIL/MAY 2015

Duration: **3 Hours**

Total Marks: 100

CLASS/SEM: **S.E (MECHANICAL)/IV**   SUBJECT: **APPLIED MATHEMATICS IV**

Master

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.

Q.1 (a) Find the Fourier series expansion of the periodic function of period

$$f(x) = \frac{1}{2} + x, \quad -\frac{1}{2} < x \le 0$$

$$= \frac{1}{2} - x, \quad 0 < x < \frac{1}{2}$$

6

(b) A drug is given to 10 patients and increments in their blood pressure were recorded to be 3, 6, -2, 4, -3, 4, 0, 0, 2,6. Is it reasonable to believe that the drug has no effect on change of blood pressure?

6

(c) Fit a poisson distribution for the following data and also test the goodness of fit

X	0	1	2	3	4	5
f(x)	142	156	69	27	5	1

8

Q.2 (a) The probability of a man hitting the target is ¼.(i)If he fires 7 times what is the probability of his hitting the target atleast twice ?(ii)How many times must he fire so that the probability of his hitting the targets atleast once is greater than 2/3?

6

(b) Solve the equation

$$\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$$

by the method of separation of variables.

6

(c) In an examination it is laid down that a student passes if he secures 30% or more marks. He is placed in Ist,IInd or IIIrd division according as he secures 60% or more marks, between 45% & 60% and between 30% & 45% respectively. He gets distinction in case he secures 80% or more marks. It is noticed from the result that 10% of the students failed in the examination where as 5% of them obtained distinction. Calculate the percentage of students placed in the second division

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Q.3 (a) In usual notations solve the one dimensional heat equation. **6**

(b) The number of arrivals of customers during any day follows Poisson distribution with a mean of **6** 5 What is the Probability that the total number of customers on two days Selected at random is less than 2?

(c) Obtain the Fourier series expansion of $f(x) = x^2$ $-\pi < x < \pi$, hence deduce

i) $1 + \dfrac{1}{2^2} + \dfrac{1}{3^2} + \dfrac{1}{4^2} + \text{---------} = \dfrac{\pi^2}{6}$

8

ii) $1 - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + \text{---------} = \dfrac{\pi^2}{12}$

iii) $1 + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \text{------} = \dfrac{\pi^2}{8}$

Q.4 (a) Ten contestants in a beauty contest are judged by three judges in the following order. **6**

Ranks by Ist judge	6	10	2	9	8	1	5	3	4	7
IInd judge	5	4	10	1	9	3	8	7	2	6
IIIrd judge	4	8	2	10	7	5	9	1	3	6

Using rank coorelation coeeficient find which pair of judges has the nearest approach to common tastes in beauty

(b) Obtain the Fourier Series for $f(x) = \sqrt{1 - \cos x}$ $0 \le x \le 2\pi$ & hence show that

$$\sum_{n=1}^{\infty} \dfrac{1}{n^2 - 1} = \dfrac{1}{2}$$

(c) Obtain the half range cosine series

$$f(x) = x(\pi - x) \qquad 0 < x < \pi$$

Hence show that $\displaystyle\sum_{n=1}^{\infty} \dfrac{1}{n^4} = \dfrac{\pi^4}{90}$

Q.5 (a) Derive the one dimensional wave equation.

2

(b) Find the Fourier series of the function $f(x) = \begin{cases} -1 & \text{for} & -\pi < x < -\dfrac{\pi}{2} \\ 0 & \text{for} & -\dfrac{\pi}{2} < x < \dfrac{\pi}{2} \\ +1 & \text{for} & \dfrac{\pi}{2} < x < \pi \end{cases}$ **6**

(c) 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   **8**

6(a) The heights of six randomly chosen sailors are in inches;63,65,68,69,71 & 72.The heights of ten randomly chosen soldiers are;61,62,65,66,69,69,70,71,72&73.Discuss in the light of this data that the soldiers on an average are as tall as the sailors.   **6**

(b) Obtain the complex form of the Fourier series of the function $f(x) = \begin{cases} 0 & -\pi \le x \le 0 \\ 1 & 0 \le x \le \pi \end{cases}$ **6**

(c) If X & Y are random variables with the same standard deviation σ and zero correlation then show that $U = X\cos\alpha + Y\sin\alpha$ & $V = X\sin\alpha - Y\cos\alpha$ have zero covariace.   **8**

7(a) Seven coins are tossed and number of heads obtained is noted.The experiment is repeated 128 times and following distribution is obtained.   **6**

No.of heads	0	1	2	3	4	5	6	7	Total
Frequency	7	6	19	35	30	23	7	1	128

Fit a Binomial distribution if the nature of coins is unknown.

(b) 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).

(c) From adult male population of four metros, random samples of sizes given below were taken and the no. of married and single men recorded. Does the data indicate significant variations among

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the cities in the tendency of men to marry?

City	Delhi	Mumbai	Chennai	Kolkatta	Total
Married	137	164	152	147	600
Single	32	57	56	35	180
Total	169	221	208	182	780

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