College of Engineering, Pune
Department of Mathematics
MA 227 Engineering Mathematics IV (For Mechanical)
End Semester Examination

Date:28/04/2011 Max. Marks 50 Max. Time 3 Hours

Use Separate answer sheet for Section A and B

(SECTION A)

Instructions: Solve all questions. Figures on the right indicate max. marks.

1. Six independent space missions to the moon are planned. The estimated probability of success on each mission is 0.95. What is the probability that atleast five of the six missions will be successful? **[2]**

2. (a) If $P(\chi^2_n \leq 4.594) = 0.2$ then find n, the degrees of freedom of Chi-square r.v. **[1]**

   (b) A soft drink dispensing machine is said to be out of control if the variance of the contents exceeds 1.15 deciliters. If a random sample of 25 drinks from this machine has a variance of 2.03 deciliters, does this indicate at 0.05 level of significance that the machine is out of control? Assume that the contents are approximately normally distributed. Mention all the steps including figure. **[3]**

   OR

   The following data was collected to determine the relationship between pressure and the corresponding scale reading for the purpose of calibration.

$Pressure, x(lb/sq.in.)$	10	10	10	10	10	50	50	50	50	50
$Scalereading, y$	13	18	16	15	20	86	90	88	88	92

   Find the equation of regression line and hence find the pressure for a scale reading of 54. **[4]**

3. It is claimed that an automobile is driven on the average more than 20000 k.ms per year. To test this claim, a random sample of 100 automobile owners are asked to keep a record of the kilometers they travel. Would you agree with this claim if the sample showed an average of 23500 k.m. and a standard deviation of 3900 k.m.? Use 4 percent level of significance.

   OR

   Compute the correlation coefficient for the following grades of 6 students selected at random:

$MathsGrade$	70	92	80	74	65	83
$EnglishGrade$	74	84	63	87	78	90

   Interpret your result. **[4]**

4. Let D^2 denote the sum of the squares of the deviations from the mean of a random sample consisting of n observations. Assume that the random sample is taken from a population X with mean μ and variance σ^2. Give an unbiased and a biased estimator of σ^2. [2]

5. (a) If Z is a standard normal r.v. with $P(Z \geq k) = 0.057$ then find k. [2]

   (b) The average time taken by Mr. X to travel from home to office is 24 minutes with a standard deviation of 3.8 minutes. Assume the distribution of trip times to be normally distributed. If he leaves the house at 8.30 A.M and coffee is served at the office from 8.50 A.M. until 9 A.M. what is the probability that he misses the coffee? [2]

6. Find (i) k (ii) mean (iii) median and (iv) variance of a r.v. X with pdf

$$f(x) = \begin{cases} kx; & 0 < x < 3 \\ 0 \ ; & \text{otherwise} \end{cases}$$

OR

The s.d. of a random sample of size 20 taken from a normal population with mean 10 is 1.23. If $P(0 < \frac{\overline{X}-\mu}{s/\sqrt{n}} < t) = 0.3$, find the value of $\overline{X}$ [4]

College of Engineering Pune

(An Autonomous Institute of Govt. of Maharashtra)

END SEMESTER EXAMINATION

(PE-208) Metrology and Mechanical Measurements

Programme: S.Y.B.Tech. (Mechanical Engineering) Year: 2010-2011

Duration: 03 hr Max. Marks: 50

Instructions:

1. All questions are compulsory
2. Solve Section-A & B separately
3. Draw neat figures wherever required.
4. Assume suitable data if necessary.

SECTION-A

Q.1	A) What is Legal Metrology? What are the applications of Legal Metrology?	2
	B) Explain briefly with neat sketch " Constant deviation prism"	3
Q.2	A) What is comparators? Classify the comparator according to the principles used for obtaining magnification.	3
	B) Name the various methods for measuring effective diameter. Derive an expression for finding out constant value which is added to the diameter under wire to find out effective diameter.	5
	C) List out any two optical angular measuring instruments	2
Q.3	A) Determine the Arithmetical mean deviation (Ra) value for a given surface if, sampling length is 120mm, sum of areas above centre line is 533mm^2 and below center line is 447mm^2 The optical magnification is 50X & mechanical magnification is 100X	2
	B) Define the term "Primary texture" and secondary texture of surface. Describe in detail, one type of instrument used for obtaining a graphical record of primary texture	5
	C) What do you understand by Monochromatic light? Explain the principle of interference of monochromatic light	3

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SECTION-B

Q.1	A) For which type of pressure measurement Mcleod Gauge is used? Explain in detail.	4
	B) What are the different types of strain gauge transducer Explain it.	2
	C) Why the temperature compensation is required in case of strain gauge transducer? Explain it.	2
	D).Write an operating principle of Electrical method of force measurement.	2
Q.2	A) How to measure the height of a liquid column using a radioactive material? Explain in detail with diagram.	3
	B) Write a short note on Electromagnetic Flow Meter	3
	C) State the Law of Intermediate Temperature and Law of Intermediate Metals.	2
	D) For a certain thermister, β=3000K and the resistance at 27°C is known to be 1050Ω.The thermister is used for temperature measurement and the resistance measured is as 2330Ω.Find the measured temperature.	2
Q.3	A) Describe first order system and its response to a ramp input.	3
	B) What are the desirable characteristics of a transducer element?	2

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(Section B Numerical Methods)

Marks : 30

Assume suitable data.

Q1 a Find the positive root of the equation $xe^x = 1$ which lies between 0 and 1 correct to 5 places of decimals, using any of the methods studied. 4

b S is the specific heat of a body at temperature 0°C. Find the total heat required to raise the temperature of the body of weight 1 gram form 0°C to 12°C using the following data of values and Simpson's $3/8^{th}$ rule. 4

θ	0	2	4	6	8	10	12
S	1.00664	1.00543	1.00435	1.00331	1.00233	1.00149	1.00078

Q2 Write a flow chart for fitting a second degree curve through data points defined by user. 2

Q3 Using Lagrange's interpolation formula, find the value of x corresponding to y = 12. 4

x	1.2	2.1	2.8	4.1	4.9	6.2
y	4.2	6.8	9.8	13.4	15.5	19.6

OR

Q3 Find the value of $y_{12.2}$ from the following table $y_x = 1 + \log_{10} \sin x$ using Stirling's interpolation method. 4

x	10	11	12	13	14
y	0.23967	0.28060	0.31788	0.35209	0.38368

Q4 Find best values of a_0, a_1, a_2 so that the parabola $y = a_0 + a_1x + a_2x^2$ fits the data. 4

x	0	2	4	6	8	12	20
y	10	12	18	22	20	30	30

OR

Q4 Relation between x & y is given by y(ax+b) = 1. Find the values of a & b. 4

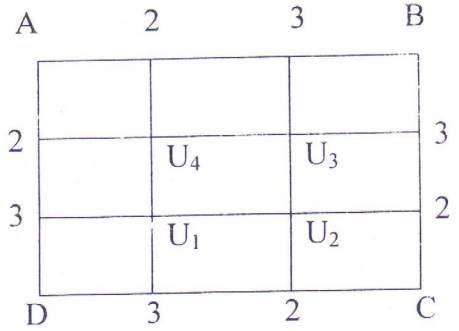
x	0.4	0.6	0.8	1.1	1.4	2.0	2.5
y	0.3571	0.2777	0.2273	0.1786	0.1471	0.1087	0.0893

Q5 Solve the equation $\frac{dy}{dx} = (1 + y^2)$; Given y(0.6) =0.6841, y(0.4) = 0.4228, y(0.2) = 0.2027 and y(0) = 0, Evaluate y(-0.2) using Milen's Predictor Corrector method. 6

OR

Q5 Use fourth order Runge Kutta method to solve $\frac{dy}{dx} = x + yz$; $\frac{dz}{dx} = x^2 - y^2$ y(0) = 1, z(0) = 0.5, find y and z at x=0.2, take h=0.2 6

Q6 Solve the equation $U_{xx}+U_{yy}= 0$ for the following square mesh with boundary values as shown. 6



OR

Q6 Solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$, correct to two places of decimal, at the nodal points of square grid using the boundary values indicated.

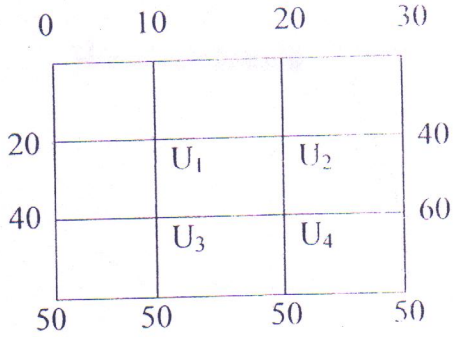
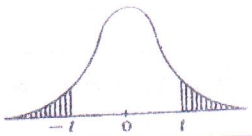


Table 9

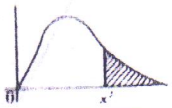
TABLE OF t



n	P = .9	.8	.7	.6	.5	.4	.3	.2	.1	.05	.02	.01
1	.158	.325	.510	.727	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657
2	.142	.289	.445	.617	.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925
3	.137	.277	.424	.584	.765	.978	1.250	1.638	2.353	3.182	4.541	5.841
4	.134	.271	.414	.569	.741	.941	1.190	1.533	2.132	2.776	3.747	4.604
5	.132	.267	.408	.559	.727	.920	1.156	1.476	2.015	2.571	3.365	4.032
6	.131	.265	.404	.553	.718	.906	1.134	1.440	1.943	2.447	3.143	3.707
7	.130	.263	.402	.549	.711	.896	1.119	1.415	1.895	2.365	2.998	3.499
8	.130	.262	.399	.546	.706	.889	1.108	1.397	1.860	2.306	2.896	3.355
9	.129	.261	.398	.543	.703	.883	1.100	1.383	1.833	2.262	2.821	3.250
10	.129	.260	.397	.542	.700	.879	1.093	1.372	1.812	2.228	2.764	3.169
11	.129	.260	.396	.540	.697	.876	1.088	1.363	1.796	2.201	2.718	3.106
12	.128	.259	.395	.539	.695	.873	1.083	1.356	1.782	2.179	2.681	3.055
13	.128	.259	.394	.538	.694	.870	1.079	1.350	1.771	2.160	2.650	3.012
14	.128	.258	.393	.537	.692	.868	1.076	1.345	1.761	2.145	2.624	2.977
15	.128	.258	.393	.536	.691	.866	1.074	1.341	1.753	2.131	2.602	2.947
16	.128	.258	.392	.535	.690	.865	1.071	1.337	1.746	2.120	2.583	2.921
17	.128	.257	.392	.534	.689	.863	1.069	1.333	1.740	2.110	2.567	2.898
18	.127	.257	.392	.534	.688	.862	1.067	1.330	1.734	2.101	2.552	2.878
19	.127	.257	.391	.533	.688	.861	1.066	1.328	1.729	2.093	2.539	2.861
20	.127	.257	.391	.533	.687	.860	1.064	1.325	1.725	2.086	2.528	2.845
21	.127	.257	.391	.532	.686	.859	1.063	1.323	1.721	2.080	2.518	2.831
22	.127	.256	.390	.532	.686	.858	1.061	1.321	1.717	2.074	2.508	2.819
23	.127	.256	.390	.532	.685	.858	1.060	1.319	1.714	2.069	2.500	2.807
24	.127	.256	.390	.531	.685	.857	1.059	1.318	1.711	2.064	2.492	2.797
25	.127	.256	.390	.531	.684	.856	1.058	1.316	1.708	2.060	2.485	2.787
26	.127	.256	.390	.531	.684	.856	1.058	1.315	1.706	2.056	2.479	2.779
27	.127	.256	.389	.531	.684	.855	1.057	1.314	1.703	2.052	2.473	2.771
28	.127	.256	.389	.530	.683	.855	1.056	1.313	1.701	2.048	2.467	2.763
29	.127	.256	.389	.530	.683	.854	1.055	1.311	1.699	2.045	2.462	2.756
30	.127	.256	.389	.530	.683	.854	1.055	1.310	1.697	2.042	2.457	2.750
∞	.12566	.25335	.38532	.52440	.67449	.84162	1.03643	1.28155	1.64485	1.95996	2.32634	2.57582

Table 8

TABLE OF χ^2



$$P = \int_{\chi^2}^{\infty} \frac{e^{-\frac{1}{2}\chi}\,\chi^{(n-2)/2}}{2^{n/2}\,\Gamma\left(\frac{n}{2}\right)}\,d\chi$$

D.F. n	P = .99	.98	.95	.90	.80	.70	.50	.30	.20	.10	.05	.02	.01
1	.000157	.000628	.00393	.0158	.0642	.148	.455	1.074	1.642	2.706	3.841	5.412	6.635
2	.0201	.0404	.103	.211	.446	.713	1.386	2.408	3.219	4.605	5.991	7.824	9.210
3	.115	.185	.352	.584	1.005	1.424	2.366	3.665	4.642	6.251	7.815	9.837	11.345
4	.297	.429	.721	1.064	1.649	2.195	3.357	4.878	5.989	7.779	9.488	11.668	13.277
5	.554	.752	1.145	1.610	2.343	3.000	4.351	6.064	7.289	9.236	11.070	13.388	15.086
6	.872	1.134	1.635	2.204	3.070	3.828	5.348	7.231	8.558	10.645	12.592	15.033	16.812
7	1.239	1.564	2.167	2.833	3.822	4.671	6.346	8.383	9.803	12.017	14.067	16.622	18.476
8	1.646	2.032	2.733	3.490	4.594	5.527	7.344	9.524	11.030	13.362	15.507	18.168	20.090
9	2.088	2.532	3.325	4.168	5.380	6.393	8.343	10.656	12.242	14.684	16.919	19.679	21.666
10	2.558	3.059	3.940	4.865	6.179	7.267	9.342	11.781	13.442	15.987	18.307	21.161	23.209
11	3.053	3.609	4.575	5.578	6.989	8.148	10.341	12.899	14.631	17.275	19.675	22.618	24.725
12	3.571	4.178	5.226	6.304	7.807	9.034	11.340	14.011	15.812	18.549	21.026	24.054	26.217
13	4.107	4.765	5.892	7.042	8.634	9.926	12.340	15.119	16.985	19.812	22.362	25.472	27.688
14	4.660	5.368	6.571	7.790	9.467	10.821	13.339	16.222	18.151	21.064	23.685	26.873	29.141
15	5.229	5.985	7.261	8.547	10.307	11.721	14.339	17.322	19.311	22.307	24.996	28.259	30.578
16	5.812	6.614	7.962	9.312	11.152	12.624	15.338	18.418	20.465	23.542	26.296	29.633	32.000
17	6.408	7.255	8.672	10.085	12.002	13.531	16.338	19.511	21.615	24.769	27.587	30.995	33.409
18	7.015	7.906	9.390	10.865	12.857	14.440	17.338	20.601	22.760	25.989	28.869	32.346	34.805
19	7.633	8.567	10.117	11.651	13.716	15.352	18.338	21.689	23.900	27.204	30.144	33.687	36.191
20	8.260	9.237	10.851	12.443	14.578	16.266	19.337	22.775	25.038	28.412	31.410	35.020	37.566
21	8.897	9.915	11.591	13.240	15.445	17.182	20.337	23.858	26.171	29.615	32.671	36.343	38.932
22	9.542	10.600	12.338	14.041	16.314	18.101	21.337	24.939	27.301	30.813	33.924	37.659	40.289
23	10.196	11.293	13.091	14.848	17.187	19.021	22.337	26.018	28.429	32.007	35.172	38.968	41.638
24	10.856	11.992	13.848	15.659	18.062	19.943	23.337	27.096	29.553	33.196	36.415	40.270	42.980
25	11.524	12.697	14.611	16.473	18.940	20.867	24.337	28.172	30.675	34.382	37.652	41.566	44.314
26	12.198	13.409	15.379	17.292	19.820	21.792	25.336	29.246	31.795	35.563	38.885	42.856	45.642
27	12.879	14.125	16.151	18.114	20.703	22.719	26.336	30.319	32.912	36.741	40.113	44.140	46.963
28	13.565	14.847	16.928	18.939	21.588	23.647	27.336	31.391	34.027	37.916	41.337	45.419	48.278
29	14.256	15.574	17.708	19.768	22.475	24.577	28.336	32.461	35.139	39.087	42.557	46.693	49.588
30	14.953	16.306	18.493	20.599	23.364	25.508	29.336	33.530	36.250	40.256	43.773	47.962	50.892

Table 7 NORMAL AREAS (A) AND ORDINATES (y)

$$y = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$$

$$A = \int_0^x y\,dx$$

x	y	A	x	y	A	x	y	A
.00	.39894	.00000	.45	.36053	.17364	.90	.26609	.31594
.01	.39892	.00399	.46	.35889	.17724	.91	.26369	.31859
.02	.39886	.00798	.47	.35723	.18082	.92	.26129	.32121
.03	.39876	.01197	.48	.35553	.18439	.93	.25888	.32381
.04	.39862	.01595	.49	.35381	.18793	.94	.25647	.32639
.05	.39844	.01994	.50	.35207	.19146	.95	.25406	.32894
.06	.39822	.02392	.51	.35029	.19497	.96	.25164	.33147
.07	.39797	.02790	.52	.34849	.19847	.97	.24923	.33398
.08	.39767	.03188	.53	.34667	.20194	.98	.24681	.33646
.09	.39733	.03586	.54	.34482	.20540	.99	.24439	.33891
.10	.39695	.03983	.55	.34294	.20884	1.00	.24197	.34134
.11	.39654	.04380	.56	.34105	.21226	1.01	.23955	.34375
.12	.39608	.04776	.57	.33912	.21566	1.02	.23713	.34614
.13	.39559	.05172	.58	.33718	.21904	1.03	.23471	.34850
.14	.39505	.05567	.59	.33521	.22240	1.04	.23230	.35083
.15	.39448	.05962	.60	.33322	.22575	1.05	.22988	.35314
.16	.39387	.06356	.61	.33121	.22907	1.06	.22747	.35543
.17	.39322	.06749	.62	.32918	.23237	1.07	.22506	.35769
.18	.39253	.07142	.63	.32713	.23565	1.08	.22265	.35993
.19	.39181	.07535	.64	.32506	.23891	1.09	.22025	.36214
.20	.39104	.07926	.65	.32297	.24215	1.10	.21785	.36433
.21	.39024	.08317	.66	.32086	.24537	1.11	.21546	.36650
.22	.38940	.08706	.67	.31874	.24857	1.12	.21307	.36864
.23	.38853	.09095	.68	.31659	.25175	1.13	.21069	.37076
.24	.38762	.09483	.69	.31443	.25490	1.14	.20831	.37286
.25	.38667	.09871	.70	.31225	.25804	1.15	.20594	.37493
.26	.38568	.10257	.71	.31006	.26115	1.16	.20357	.37698
.27	.38466	.10642	.72	.30785	.26424	1.17	.20121	.37900
.28	.38361	.11026	.73	.30563	.26730	1.18	.19886	.38100
.29	.38251	.11409	.74	.30339	.27035	1.19	.19652	.38298
.30	.38139	.11791	.75	.30514	.27337	1.20	.19419	.38493
.31	.38023	.12172	.76	.29887	.27637	1.21	.19186	.38686
.32	.37903	.12552	.77	.29659	.27935	1.22	.18954	.38877
.33	.37780	.12930	.78	.29431	.28230	1.23	.18724	.39065
.34	.37654	.13307	.79	.29200	.28524	1.24	.18494	.39251
.35	.37524	.13683	.80	.28969	.28814	1.25	.18265	.39435
.36	.37391	.14058	.81	.28737	.29103	1.26	.18037	.39617
.37	.37255	.14431	.82	.28504	.29389	1.27	.17810	.39796
.38	.37115	.14803	.83	.28269	.29673	1.28	.17585	.39973
.39	.36973	.15173	.84	.28034	.29955	1.29	.17360	.40147
.40	.36827	.15542	.85	.27798	.30234	1.30	.17137	.40320
.41	.36678	.15910	.86	.27562	.30511	1.31	.16915	.40490
.42	.36526	.16276	.87	.27324	.30785	1.32	.16694	.40658
.43	.36371	.16640	.88	.27086	.31057	1.33	.16474	.40824
.44	.36213	.17003	.89	.26848	.31327	1.34	.16256	.40988

$$y = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}x^2}$$

$$A = \int_0^x y\,dx$$

x	y	A	x	y	A	x	y	A
1.35	.16038	.41149	1.80	.07895	.46407	2.25	.03174	.48778
1.36	.15822	.41309	1.81	.07754	.46485	2.26	.03103	.48809
1.37	.15608	.41466	1.82	.07614	.46562	2.27	.03034	.48840
1.38	.15395	.41621	1.83	.07477	.46638	2.28	.02965	.48870
1.39	.15183	.41774	1.84	.07341	.46712	2.29	.02898	.48899
1.40	.14973	.41924	1.85	.07206	.46784	2.30	.02833	.48928
1.41	.14764	.42073	1.86	.07074	.46856	2.31	.02768	.48956
1.42	.14556	.42220	1.87	.06943	.46926	2.32	.02705	.48983
1.43	.14350	.42364	1.88	.06814	.46995	2.33	.02643	.49010
1.44	.14146	.42507	1.89	.06687	.47062	2.34	.02582	.49036
1.45	.13943	.42647	1.90	.06562	.47128	2.35	.02522	.49061
1.46	.13742	.42786	1.91	.06439	.47193	2.36	.02463	.49086
1.47	.13542	.42922	1.92	.06316	.47257	2.37	.02406	.49111
1.48	.13344	.43056	1.93	.06195	.47320	2.38	.02349	.49134
1.49	.13147	.43189	1.94	.06077	.47381	2.39	.02294	.49158
1.50	.12952	.43319	1.95	.05959	.47441	2.40	.02239	.49180
1.51	.12758	.43448	1.96	.05844	.47500	2.41	.02186	.49202
1.52	.12566	.43574	1.97	.05730	.47558	2.42	.02134	.49224
1.53	.12376	.43699	1.98	.05618	.47615	2.43	.02083	.49245
1.54	.12188	.43822	1.99	.05508	.47670	2.44	.02033	.49266
1.55	.12001	.43943	2.00	.05399	.47725	2.45	.01984	.49286
1.56	.11816	.44062	2.01	.05292	.47778	2.46	.01936	.49305
1.57	.11632	.44179	2.02	.05186	.47831	2.47	.01889	.49324
1.58	.11450	.44295	2.03	.05082	.47882	2.48	.01842	.49343
1.59	.11270	.44408	2.04	.04980	.47932	2.49	.01797	.49391
1.60	.11092	.44520	2.05	.04879	.47982	2.50	.01753	.49379
1.61	.10915	.44630	2.06	.04780	.48030	2.51	.01709	.49396
1.62	.10741	.44738	2.07	.04682	.48077	2.52	.01667	.49413
1.63	.10567	.44845	2.08	.04586	.48124	2.53	.01625	.49430
1.64	.10396	.44950	2.09	.04491	.48169	2.54	.01585	.49446
1.65	.10226	.45053	2.10	.04398	.48214	2.55	.01545	.49461
1.66	.10059	.45154	2.11	.04307	.48257	2.56	.01506	.49477
1.67	.09893	.45254	2.12	.04217	.48300	2.57	.01468	.49492
1.68	.09728	.45352	2.13	.04128	.48341	2.58	.01431	.49506
1.69	.09566	.45449	2.14	.04041	.48382	2.59	.01394	.49520
1.70	.09405	.45543	2.15	.03955	.48422	2.60	.01358	.49534
1.71	.09246	.45637	2.16	.03871	.48461	2.61	.01323	.49547
1.72	.09089	.45728	2.17	.03788	.48500	2.62	.01289	.49560
1.73	.08933	.45818	2.18	.03706	.48537	2.63	.01256	.49573
1.74	.08780	.45907	2.19	.03626	.48574	2.64	.01223	.49585
1.75	.08628	.45994	2.20	.03547	.48610	2.65	.01191	.49598
1.76	.08478	.46080	2.21	.03470	.48645	2.66	.01160	.49609
1.77	.08329	.46164	2.22	.03394	.48679	2.67	.01130	.49621
1.78	.08183	.46246	2.23	.03319	.48713	2.68	.01100	.49632
1.79	.08038	.46327	2.24	.03246	.48745	2.69	.01071	.49642

College of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra, Pune-411005).

End Semester Examination

MT-213 : Material Science and Technology

Year: S.Y.B.Tech. **Branch:** Mechanical Engineering
Academic Year: 2010-11 **Date:** 26/04/2011
Duration: 3 Hours. **Out of** 50 Marks

Instructions to candidates:

1. **Neat Diagrams must be drawn wherever necessary.**
2. **Figures to the right indicate full marks.**

Put your **MIS** number here, before you start.

All Questions are Compulsory

Question No.1

A. Answer the following in short **12**

I. Give classification of composites based on the matrix material and reinforcements used. 3

II. After **Nitriding,** fast cooling (/quenching) is **not** required, but after carburizing it is **necessary**, explain why? 3

III. Explain the term **Ductile-Brittle Transition Temperature**, and enlist the factors affecting it. 2

IV. High carbon steel cannot be used for manufacturing of sheet metals. 2

V. Explain with specific example, how Flame hardening technique is useful? 2

Question No.2 **20**

B. Draw and label the CCT Curve for Eutectoid steel. Indicate cooling rates for the formation of
i) Martensite, **ii)** Fine Pearlite, **iii)** Coarse Pearlite **iv)** Cooling Rate indicating CCR. **3+2**

C. Brief the steps involved in manufacturing of a **gear** by powder metallurgy route.
- Write any six advantages of PM Technique. **4+3**

D. With respect to given points, write short notes on following **4+4**
(Points – Types, Alloying Elements, Microstructure and Properties, Heat Treatments, Applications/ Use)

a. Stainless Steels

b. Tool Steels

Question No.3 — 18

Differentiate between following **with reference to specified points.**

(**Note:** Don't Draw Microstructures). **(Answer in Tabular format only)**

(i) **Gray Cast Iron** and **White Cast Iron** — 3

Hardness & Wear Resistance, Microstructural Features, Cooling Rate, Damping Capacity & Weldability.

(ii) **Alloy Steels** and **Plain Carbon Steel** — 4

Hardness at elevated Temperatures, Hardenability-CCR, Strength, Corrosion Resistance,

(iii) **Induction Hardening** and **Case Carburizing** Heat Treatments — 4

Process & Heat Source, Microstructure, Compositional Change - Amount of Carbon, Typical Applications.

(iv) **Thermosetting** and **Thermoplastic** Polymers. — 3

Definition, Properties, Advantage/Disadvantage & Examples.

(v) **Fine Grain Structure** and **Coarse Grain Structure** — 2

Effect on Strength, Hardness, Cooling Rate (with Justification).

(vi) **Destructive** and **Non-destructive** methods of Testing (Any **Three Strong** Points) — 2

——MST——

College of Engineering, Pune
S.Y.Btech - Mechanical

Subject: TOM I

Timing: 3 hrs
Max. Marks: 50

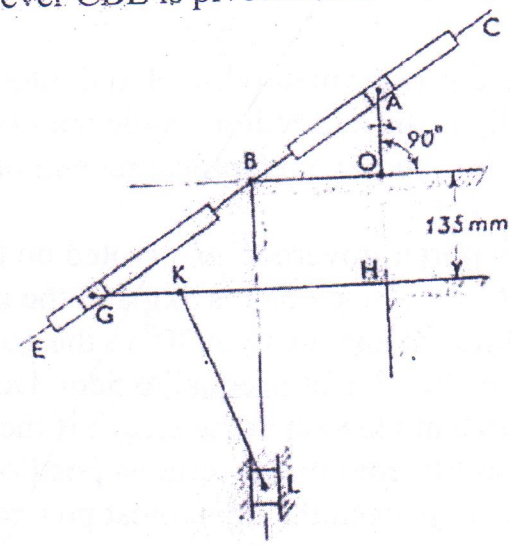
Academic Year: 2010- 11

Spring Semester

Important Instructions:

1. All questions are compulsory.
2. Figures to right indicate full marks
3. **Answer should be precise and to the point.**
4. **Draw neat sketch/figures wherever necessary to support the answer.**

Q. 1 A. If, in the mechanism shown in figure, the link OA rotates at 3.183 rev/sec, determine the velocity and acceleration of the slider L for the position shown. Link length are, OA = 90 mm, OB = 150mm, HG = 375mm, HK = 240mm, KL = 300mm.Slotted lever CBE is pivoted at B 08



B. Derive expression for correct steering for Davis steering gear. comment on the Davis gear mechanism 04

Q. 2 A. A single cylinder horizontal steam engine has a stroke of 0.75m and connecting rod of 1.8m long. The mass of reciprocating parts is 520kg and that of connecting rod is 230kg. The C.G of the rod is 0.8m from the crank pin and the moment of inertia about an axis through the center of gravity perpendicular to the plane of motion is 100kgm^2 .for an engine speed of 90rpm and the crank position of 45^0 to the inner dead center, determine the torque on the crank shaft and the force on the crankshaft bearings due to the inertia of the parts. 06

Q. 3 A. Show that the condition for minimum sliding velocity of spiral gears is 06

$$\tan\varphi_1 = \frac{\sin\theta}{G + \cos\theta}$$

If the angle between two shafts is 70^0, center distance is 125mm, normal pitch is 12mm, and has 2 to 1 velocity ratio when the rotation of pinion is 240 rpm,

determine the minimum sliding velocity between the teeth.

B. A worm gear of speed ratio 5 connects two shafts at right angles. The worm has 4 teeth of normal module 20mm. The pitch diameter of the worm is 40mm. Calculate the tooth angles of worm and wheel and the distance between the centers of the shafts. 04
If the efficiency of the gear is 90%, the worm being the driver, find approximately the coefficient of friction between the tooth surfaces.

Q. 4 a A pair of spur gear with Involute teeth is to give a gear ratio 4:1. The arc of approach is not to be less than the circular pitch and the smallest wheel is the driver. The pressure angle is 14.5^0, Determine: 04
i) The least number of teeth that can be used on each wheel.
ii) The addendum of wheel in terms of circular pitch.

b Two gears are in mesh have 9 teeth and 39 teeth respectively. They are full depth and pressure angle is 20^0. The module pitch is 8.5mm. Determine: 04
1) The reduction in the addendum of gear to avoid interference.
2) The contact ratio.

OR

b What are the various methods to avoid interference of gears? Discuss them. 04

c When and why is the correction couple applied while considering the inertia of the connecting rod of a reciprocating engine. 02

Q. 5

a The arms of a porter governor are pivoted on the governor axis and are each 25 cm long. Mass of each ball is 5kg and the mass of sleeve is 40 kg. The arms are inclined at and angle of 30^0 to the governor axis in lowermost position of the sleeve. Lift is equal to 5cm. Determine the force of friction as equivalent force in Newton at the sleeve if the speeds at the moment the sleeve starts to lift from the lowermost position, is the same as the speed at the moment it falls from the uppermost position. Determine also the range of the governor. 08

b Explain effort and power for governor. Derive an expression for the same for porter governor 04

OR

b Explain and discuss the terms : 04
1) Sensitivity of governor.
2) Hunting of governor.

College of Engineering, Pune

(S.Y. B. Tech)- (Mechanical)

(ME 206)- (Fluid Mechanics)

Date- May 2010 Timing: 3 hrs

Academic Year: 2010- 11 Max. Marks: 50

Spring Semester (End semester Examination)

Instructions:

1. Solve any **five** questions
2. Figures to the right indicate full marks
3. Use of non-programmable calculator is permitted
4. Make suitable assumptions if necessary

Q. 1	A.	Define a centre of pressure and prove that for a plane in the water inclined to horizontal plane by an angle θ it is given by $h_c = h_g + \frac{I_{gg}}{h_g A}\sin^2\theta$ The notations carry the usual meaning.	5
	B.	A cone made up of wood whose density is 820 kg/m^3 is floating in a liquid whose density is 1200 kg/m^3. The height of the cone is 50 cm. Find out the limiting diameter of the cone if it has to float with stability. The apex of the cone is down.	5
Q. 2	A.	What do you understand by dimensional analysis? Explain its use in fluid mechanics with one practical example.	3
	B.	State Buckingham π theorem and explain how it is used for reducing the controlling parameters.	2
	C.	Using Buckingham π theorem show that the velocity (U) through a circular orifice is given by $U = C\left(\sqrt{2gH}\right) f\left(\frac{D}{H}, \frac{\rho DU}{\mu}\right)$ Where H is the head causing the flow, D is the diameter of orifice and ρ and μ are the density and viscosity of the fluid, respectively. C is a constant.	5
Q. 3	A.	Define and distinguish between streamline, path line and streak line.	3
	B.	Calculate the unknown velocity components in the following so that the continuity equation is satisfied. (a) $u = 2x^2;\ v = xyz;\ w = ?$ (b) $u = (2x^2 + 2xy);\ w = (z^3 - 4xz - 2yz);\ v = ?$	2
	B.	For two-dimensional incompressible flow, show that the flow rate per unit width between two streamlines is equal to the difference between the values of stream function corresponding to these streamlines.	5
Q. 4	A.	Derive Bernoulli's equation from Euler's equation of motion.	5
	B.	The pressure leads from a Pitot-tube mounted on an air craft are connected to a pressure gage in the cockpit. The dial of the	5

		pressure gage is calibrated to read the speed in m/s. The calibration is done on the ground by applying a known pressure across the gage and calculating the equivalent velocity using incompressible Bernoulli's equation and assuming that the density is 1.224 kg/m^3 The gage having been calibrated in this way the air craft is flown at 9200 m, where the density is 0.454 kg/m^3 and ambient pressure is 30000 N/m^2. The gage indicates the velocity of 152 m/s. What is the true speed of the air craft?	
Q. 5	A.	Explain the terms hydraulic gradient and total energy lines.	2
	B.	Derive an expression for loss of head due to sudden expansion.	4
	C	A pipe 0.15 m diameter taking off from a reservoir suddenly expands to 0.3 m diameter at the end of 16 m and continues for another 15 m. If the head above the inlet of the pipe is 4.88 m, determine the actual velocity at the exit, taking into consideration all the losses. Assume $f = 0.04$ for the complete pipe line.	4
Q. 6	A	Show that in a steady uniform laminar flow the pressure gradient in the direction of flow is equal to the shear stress gradient in the normal direction.	4
	B	Lubricating oil of specific 0.82 and dynamic viscosity 12.066×10^{-2} $N.s/m^2$ is pumped at a rate of 0.02 m^3/s through a 0.15 m diameter 300 m long pipe. Calculate the pressure drop, average shear stress at the wall of the pipe and the power required to maintain the flow if the pipe is horizontal.	4
	C	What do you understand by displacement thickness and momentum thickness?	2