

College of Engineering, Pune – 5
(An autonomous Institute of Government of Maharashtra)

End Semester Examination Nov. 2011

Year : F.Y.M.Tech

Subject : Digital signal Processing & Machine
Vision

Specialization: Mechatronics

Date:

Max.Marks : 50

Duration : 3 Hrs

Instructions:

1. Assume suitable data wherever necessary

Figures to the right indicate full marks

Q.1) Prove that poles of Butterworth approximation function lie on the circle with radius Ω_c and sketch them for $N=3$. [10]

OR

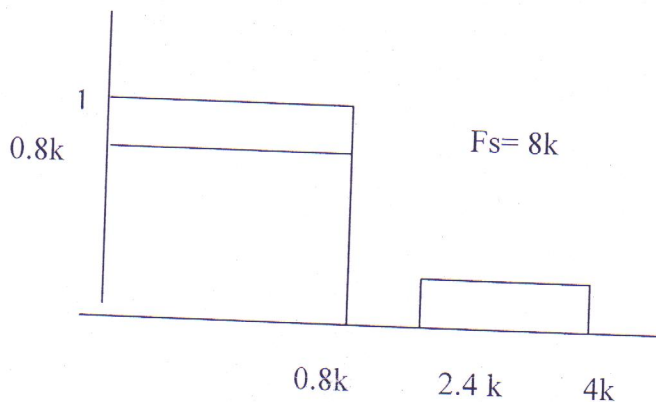
Q.1) $x[n] = \{1, 2, 3, 4, 5, 6, 7, 8\}$. calculate 8 point DFT using DIT algorithm. Sketch butterfly structure and also mention number of additions and multiplications for the same example. [10]

Q.2) A) Prove that type II FIR filter can not be used for design of HPF. [5]

OR

Q.2) A) $H(z) = (3 - 4z^{-1}) / (1 - 3.5z^{-1} + 1.5z^{-2})$. This is a transfer function given. Sketch pole zero plot for the same. [5]

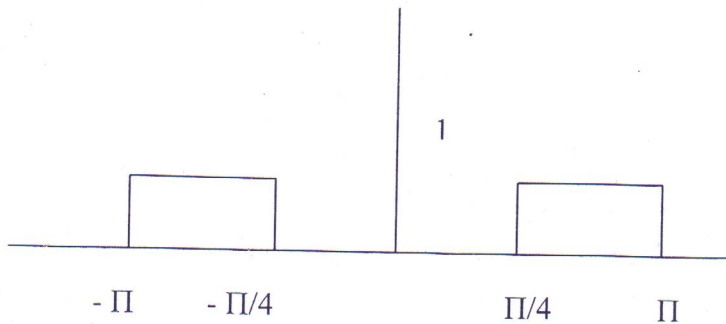
Q.3) A) [10]



Design a digital LPF with the specifications shown in above fig using bi linear transformation.

OR

Q.3) Design High pass FIR filter for the following specs using hanning window [10]
 For $N = 11$ (hanning window $w[n] = 0.5 + 0.5 \cos (2*\Pi n/N-1)$)



Q.3 b) A common measure of transmission for digital data is the baud rate, defined as the number of bits transmitted per second. Generally, transmission is accomplished in packets consisting of a start bit, a byte (8 bits) of information, and a stop bit. Using these facts, answer the following:

- How many minutes would it take to transmit a 1024 X 1024 image with 256 gray levels using a 56K baud modem?
- What would the time be at 750 K baud, a representative speed of a phone DSL (digital subscriber line) connection?

(5)

OR

Define Illumination and reflectance? How the image function $f(x,y)$ is related to this? What is simultaneous contrast? Explain?

(5)

Q.4) a) Explain the types of gray level transformations used in image enhancement? What is mask processing? How averaging filter is implemented using mask?

(5)

- Explain the properties of 2D Fourier transform?

OR

- Explain image enhancement (filtering) in Frequency domain.

(5)

Q.5) a) What is segmentation? What are the applications of segmentation? What are the basic approaches for image segmentation? Explain?

(5)

- What is edge? Explain edge detection techniques in detail?

(5)

OR

- Discuss about region based image segmentation techniques. Compare it with thresholding techniques?

(5)

PIETS' College of Engineering, Pune [CoEP]
(An Autonomous Institute of Government of Maharashtra)

END SEMESTER EXAMINATION

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[PE-5203] PRINCIPLES OF DESIGN OF MACHINE ELEMENTS

Programme :- F. Y. M. Tech. (Mechatronics)
Duration :- 3 Hrs.
Max. Marks :- 50

Date :- / / 2011
Year :- 2011 - 2012
Semester :- I (Autumn)

Instructions:-

1. **Attempt all questions.**
 2. Figures to the right indicate full marks.
 3. Draw neat sketches wherever required.
 4. Use of pocket calculators is allowed.
 5. Assume suitable data wherever necessary.
- =====

- Q.1. (A)** The pitch circle diameters of the spur pinion and gear are 100 mm and 300 mm respectively. The pinion is made of plain carbon steel 40C8 ($S_{ut} = 600 \text{ N/mm}^2$) while gear is made of Grey Cast Iron FG300. The gear pair is generated by hobbing. The pinion receives 5 kW power at 500 r.p.m. through its shaft. The service factor and factor of safety can be taken as 1.5 each. The face width of the gear can be taken as ten times the module. If the velocity factor accounts for the dynamic load, calculate the module and number of teeth on pinion and gear. (5)
- Specify the surface hardness for a gear pair.
 $C_v = 6/(6+V)$, $Y = 0.484 - 2.87/Z$, $K = 0.18 (\text{BHN}/100)^2$
- (B)** It is required to design a helical compression spring subjected to a maximum force of 7.5 kN. The mean coil diameter should be 150 mm from space consideration. The spring rate is 75 N/mm. The spring is made of oil hardened and tempered steel wire with ultimate tensile strength of 1250 N/mm². The permissible shear stress for the spring wire is 30% of the ultimate tensile strength ($G = 81370 \text{ N/mm}^2$). Calculate (5)
- (i) Wire diameter and
 - (ii) Number of active coils
- Q.2. (A)** A 21 teeth straight bevel pinion rotating at 720 rpm transmits 10 kW power to a 40 teeth bevel gear. The module is 6 mm and the pressure angle is 20°. The face width is 45 mm. If the shaft angle is 90°, determine (5)
- (i) The pitch circle diameters of the pinion and gear
 - (ii) The pitch cone distance
 - (iii) The pitch cone angles of the pinion and gear
 - (iv) The mean radii of the pinion and gear
 - (v) The back cone radii of the pinion and gear and
 - (vi) The components of force acting on meshing teeth.
- (B)** Write a short note on any one absorption type dynamometer. (5)
- Q.3. (A)** A worm gear pair is used to transmit 3 kW power from an electric motor running at 1500 r.p.m. to the machine running at 60 r.p.m. The axial pitch of the worm is 18.85 mm while the diametral quotient is 10. If the centre distance is to be fixed at 180 mm, designate the gear pair and determine the components of force acting on meshing teeth. (5)
- Assume coefficient of friction to be 0.1 and wheel to have a normal pressure angle of 20°.

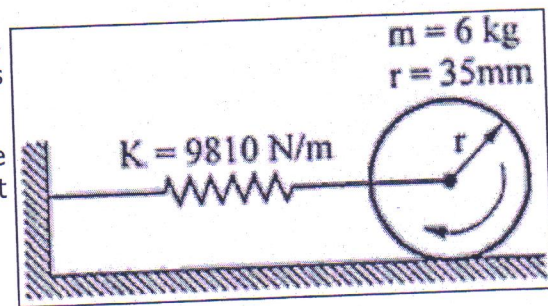
- (B) A single row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust force of 3 kN. The shaft rotates at 1200 rpm. The expected life of the bearing is 20,000 hr. The minimum acceptable diameter of the shaft is 75 mm. Select a suitable ball bearing for this application. (5)

Bearing Number	Dynamic load carrying capacity, C (N)	Static load carrying capacity, C ₀ (N)
6015	39700	26000
6215	66300	40500
6315	112000	72000
6415	153000	114000

(F _a /C ₀)	(F _a /F _r) ≤ e		(F _a /F _r) > e		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

- Q.4. (A) Find the frequency of oscillations for the roller, if it rolls without slipping for the system as shown in the figure. (5)

If the roller radius was doubled keeping the mass same, by using a lighter material, what would be the new frequency?

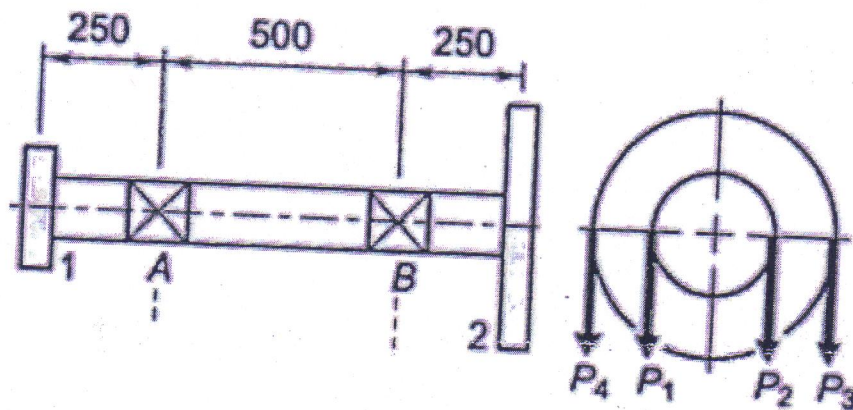


- (B) Compare involute and cycloidal gear tooth forms. Two 20° involute spur gears mesh externally and give a velocity ratio, $(N_2/N_1) = 1/3$. Module is 3 mm and addendum is equal to 1.1 module. If the pinion rotates at 120 r.p.m. determine: (5)

- The minimum number of teeth on each wheel to avoid interference
- The number of pairs of teeth in contact

- Q.5. (A) Four masses $m_1, m_2, m_3,$ and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. (5)

- (B) The layout of a shaft carrying two pulleys 1 and 2, and supported on two bearings A and B is shown in figure. The shaft transmits 7.5 kW power at 360 r.p.m. from the pulley 1 to the pulley 2. The diameters of pulleys 1 and 2 are 250 mm and 500 mm respectively. The masses of pulleys 1 and 2 are 10 kg and 30 kg respectively. The belt tensions act vertically downward and the ratio of belt tensions on the tight side to slack side for each pulley is 2.5:1. The shaft is made of Plain Carbon Steel 40C8 ($S_{yt} = 380 \text{ N/mm}^2$) and the factor of safety is 3. Estimate suitable diameter of shaft. If the permissible angle of twist is 0.5° per meter length, calculate the shaft diameter on the basis of torsional rigidity. Assume $G = 79300 \text{ N/mm}^2$. (5)



END-SEMESTER EXAM [CIM]

Programme: F.Y.M.Tech. (Mechatronics)

Year: 2011 –12; Semester:

Duration: 3 Hrs.

Max. Marks: 50

Instructions:

1. Figures to the right indicate full marks.
2. Draw neat sketches wherever required.
3. Use of pocket calculators is allowed.

Q.1	a.	What are the seven steps of finite element analysis?	5
	b.	Write short notes on: 1) Euler's equation to validate a solid with suitable example. 2) Concept of CSG tree with suitable example.	5
		OR	
	c.	Why 3D modelling is important? Explain the limitations of wire frame modelling over solid modelling.	5
Q.2	a.	Following transformations are to be carried out on an object in the given sequence. 1. Translation through 5 and 2 units in X and Y direction. 2. Change of scale in X and Y direction by 4 and 3 units respectively with respect to origin. 3. Rotation through 30° in anticlockwise direction about point P(4,3) about Z axis. Develop the concatenated matrix for above operations.	5
	b.	What will be the effect of above concatenated transformation on a circle having its center located at (0,0), and radius 1 unit. Find the new coordinates of center of circle and any other 4 points on circle. Draw a neat sketch.	5
Q.3	a.	The coordinates of two end points on a Cubic Spline are P0 = [4 8 12] and P1 = [20 40 60] and Tangent Vector at P0 = [1 2 1], Tangent Vector at P1 = [4 5 6]. Estimate x,y,z coordinates of points on curve for u = 0.25, u = 0.5 and u = 0.75 Given:	5
		$P(u) = \begin{bmatrix} u^3 & u^2 & u & 1 \end{bmatrix} \times \begin{bmatrix} 2 & -2 & 1 & 1 \\ -3 & 3 & -2 & -1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} p_0 \\ p_1 \\ p'_0 \\ p'_1 \end{bmatrix}$	
	b.	Explain the blending procedure of two bezier segments to have tangential continuity.	5
		OR	
	c.	Explain with the help of diagrams the different types of surfaces used for surface modelling.	5
Q.4	a.	Describe the procedure of Generative Process Planning.	5
	b.	Explain the working functions of shop floor control.	5
		OR	
	c.	Explain the concept of CIM. How CIM helps the industries to enhance their performance?	5
Q.5		Write a short note on: Any Three 1. CIPMS 2. B Spline 3. Factory data collection 4. Development of CAD Software	10

END-SEMESTER EXAM [CIM]

Programme: F.Y.M.Tech. (Mechatronics)

Year: 2011 –12; Semester: I

Duration: 3 Hrs.

Max. Marks: 50

Instructions:

1. Figures to the right indicate full marks.
2. Draw neat sketches wherever required.
3. Use of pocket calculators is allowed.

- Q.1 a. What are the seven steps of finite element analysis?
b. Write short notes on:
1) Euler's equation to validate a solid with suitable example.
2) Concept of CSG tree with suitable example.
OR
c. Why 3D modelling is important? Explain the limitations of wire frame modelling over solid modelling.

- Q.2 a. Following transformations are to be carried out on an object in the given sequence.
1. Translation through 5 and 2 units in X and Y direction.
2. Change of scale in X and Y direction by 4 and 3 units respectively with respect to origin.
3. Rotation through 30° in anticlockwise direction about point P(4,3) about Z axis.
Develop the concatenated matrix for above operations.
b. What will be the effect of above concatenated transformation on a circle having its center located at (0,0), and radius 1 unit.
Find the new coordinates of center of circle and any other 4 points on circle. Draw a neat sketch.

- Q.3 a. The coordinates of two end points on a Cubic Spline are $P_0 = [4 \ 8 \ 12]$ and $P_1 = [20 \ 40 \ 60]$ and Tangent Vector at $P_0 = [1 \ 2 \ 1]$, Tangent Vector at $P_1 = [4 \ 5 \ 6]$. Estimate x,y,z coordinates of points on curve for $u = 0.25$, $u = 0.5$ and $u = 0.75$
Given:

$$P(u) = \begin{bmatrix} u^3 & u^2 & u & 1 \end{bmatrix} \times \begin{bmatrix} 2 & -2 & 1 & 1 \\ -3 & 3 & -2 & -1 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \times \begin{bmatrix} p_0 \\ p_1 \\ p'_0 \\ p'_1 \end{bmatrix}$$

- b. Explain the blending procedure of two bezier segments to have tangential continuity.
OR
c. Explain with the help of diagrams the different types of surfaces used for surface modelling.
- Q.4 a. Describe the procedure of Generative Process Planning.
b. Explain the working functions of shop floor control.
OR
c. Explain the concept of CIM. How CIM helps the industries to enhance their performance?

- Q.5 Write a short note on: Any Three
1. CIPMS
 2. B Spline
 3. Factory data collection
 4. Development of CAD Software

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END SEM EXAM
 Mathematical Modelling and Simulation (PE5201)

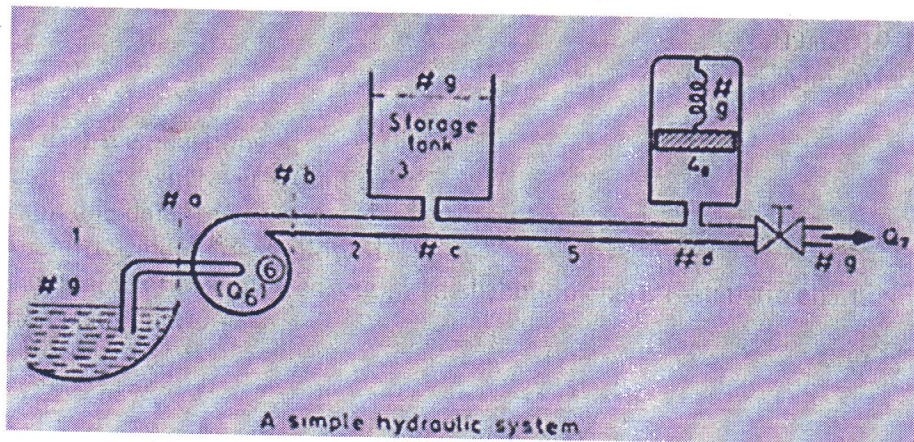
Programme: F.Y.M.Tech. **Mechatronics** (Production Engineering)
 Duration: 3 Hr.

Year: 2011-2012
 Date: 19-11-2011
 Max. Marks: 50

Instructions:

1. Answer **Any Five** questions.
2. Draw neat figures wherever required.
3. Assume suitable data if necessary.
4. Use of scientific calculator is allowed.
5. Use of standard charts is allowed. e.g., χ^2 distribution chart, F-statistic chart, Normal distribution chart etc.,

- Q.1 a) The city water system is shown in fig. below. State the assumptions. Write system dynamics when exit valve is suddenly closed. (Using Chord Formulation Technique) 8



- b) Define Random Numbers and Pseudo-random Numbers. 2
- Q.2 a) Use Lagged product test for checking independence of the following sequence of pseudo random numbers. Use lag 2. 5
- 0.477, 0.678, 0.8692, 0.980, 0.626, 0.6398, 0.581, 0.260, 0.001, 0.334.
- b) Explain the elements of the flight simulator model with the help of block diagram. 5

- Q.8 a) A contractor undertakes to supply diesel engines to truck manufacturer at the rate of 25 per day. He finds that the cost of holding a completed engine in stock is ₹ 16 per month. Production of engines is in batches and each time a new batch is started, there are set-up costs of ₹ 10,000. How frequently should the batches be started and what will be the minimum average inventory cost and production time if production rate is 40 engines / day.
Assume 300 working days in year. 5

- b) Consider the friction clutch system. Draw the network analog and corresponding electrical analog of this system. Obtain mathematical model by applying Kirchoff's current law. State Kirchoff's current law and Kirchoff's voltage law 5

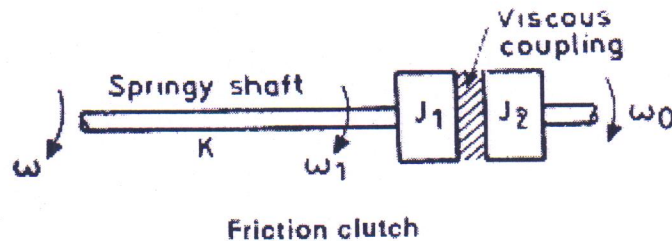
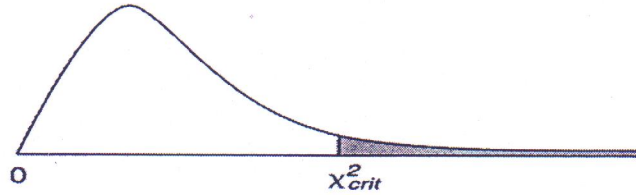


Table D^a
CRITICAL VALUES OF χ^2



LEVEL OF SIGNIFICANCE
 (p-value in color)

<i>df</i>	<i>p</i> > .10	<i>p</i> < .10	<i>p</i> < .05	<i>p</i> < .01	<i>p</i> < .001
1	.10	.05	.01	.001	
2	2.71	3.84	6.64	10.83	
3	4.60	5.99	9.21	13.82	
4	6.25	7.81	11.34	16.27	
5	7.78	9.49	13.28	18.47	
6	9.24	11.07	15.09	20.52	
7	10.64	12.59	16.81	22.46	
8	12.02	14.07	18.48	24.32	
9	13.36	15.51	20.09	26.12	
10	14.68	16.92	21.67	27.88	
11	15.99	18.31	23.21	29.59	
12	17.28	19.68	24.72	31.26	
13	18.55	21.03	26.22	32.91	
14	19.81	22.36	27.69	34.53	
15	21.06	23.68	29.14	36.12	
16	22.31	25.00	30.58	37.70	
17	23.54	26.30	32.00	39.25	
18	24.77	27.59	33.41	40.79	
19	25.99	28.87	34.80	42.31	
20	27.20	30.14	36.19	43.82	
21	28.41	31.41	37.57	45.32	
22	29.62	32.67	38.93	46.80	
23	30.81	33.92	40.29	48.27	
24	32.01	35.17	41.64	49.73	
25	33.20	36.42	42.98	51.18	
26	34.38	37.65	44.31	52.62	
27	35.56	38.88	45.64	54.05	
28	36.74	40.11	46.96	55.48	
29	37.92	41.34	48.28	56.89	
30	39.09	42.56	49.59	58.30	
40	40.26	43.77	50.89	59.70	
50	51.80	55.76	63.69	73.40	
60	63.17	67.50	76.15	86.66	
70	74.40	79.08	88.38	99.61	
	85.53	90.53	100.42	112.32	

F - Distribution

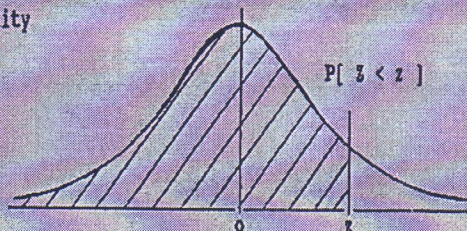
SAMPLE SIZE (N)	LEVEL OF SIGNIFICANCE FOR $D = \text{MAXIMUM} [F_2(X) - S_2(X)]$				
	.20	.15	.10	.05	.01
1	.900	.925	.950	.975	.995
2	.684	.726	.776	.842	.929
3	.565	.597	.642	.708	.828
4	.494	.525	.564	.624	.733
5	.446	.474	.510	.565	.669
6	.410	.436	.470	.521	.618
7	.381	.405	.438	.486	.577
8	.358	.381	.411	.457	.543
9	.339	.360	.388	.432	.514
10	.322	.342	.368	.410	.490
11	.307	.326	.352	.391	.468
12	.295	.313	.338	.375	.450
13	.284	.302	.325	.361	.433
14	.274	.292	.314	.349	.418
15	.266	.283	.304	.338	.404
16	.258	.274	.295	.328	.392
17	.250	.266	.286	.318	.381
18	.244	.259	.278	.309	.371
19	.237	.252	.272	.301	.363
20	.231	.246	.264	.294	.356
25	.210	.220	.240	.270	.320
30	.190	.200	.220	.240	.290
35	.180	.190	.210	.230	.270
OVER 35	$\frac{1.07}{\sqrt{N}}$	$\frac{1.14}{\sqrt{N}}$	$\frac{1.22}{\sqrt{N}}$	$\frac{1.36}{\sqrt{N}}$	$\frac{1.63}{\sqrt{N}}$

STANDARD STATISTICAL TABLES

1. Areas under the Normal Distribution

The table gives the cumulative probability up to the standardised normal value z i.e.

$$P[Z < z] = \int_{-\infty}^z \frac{1}{\sqrt{2\pi}} \exp(-\frac{1}{2}z^2) dz$$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5159	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7854
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8804	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9773	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9865	0.9868	0.9871	0.9874	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9924	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9980	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
z	3.00	3.10	3.20	3.30	3.40	3.50	3.60	3.70	3.80	3.90
P	0.9986	0.9990	0.9993	0.9995	0.9997	0.9998	0.9998	0.9999	0.9999	1.0000

College of Engineering, Pune (COEP)
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END SEMESTER EXAMINATION

Subject: (PE 5207) Mechatronics System Design
Class: FY M.Tech. Mechatronics
Time: 3.00 hrs

Sem: 1
Year: 2011-12
Max. Marks 50

Instructions for Section A

1. Attempt any two questions out of Q.1, Q.2 & Q.3.
 2. Q.4 is compulsory.
 3. Numbers to right shows marks assigned to questions.
 4. Non-programmable calculator is allowed.
 5. Assume suitable data if required.
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Section A

Q.1	a)	Explain the types of design to be considered for any mechatronics product.	4
	b)	Explain the role of operator in Man- machine interface. Discuss the steps to be followed to measure the quality of interface design.	4
Q.2	a)	Explain the brushless DC motors with suitable sketch.	4
	b)	A mechatronics system having three mechanical links and three electrical motors operating these links independently. The links are arranged in a way that any one link working successfully will give the required output. The links are identical having reliability 0.98 and the electric motor operating the link is having failure rate 0.0005 & mission time is 100 hrs. Find the system reliability	4
Q.3	a)	Explain the discrete control and indicator units used in human machine interface.	4
	b)	Explain the Robot system for pick & place application with suitable figure	4
Q.4	a)	What are the considerations to be made while designing & analyzing the hydraulic circuits? Draw & explain a cylinder synchronizing circuit using hydraulic source.	5
	b)	Explain the elements of pneumatic system used for pneumatic application circuit building.	4

Instructions for Section B

1. Solve all questions
 2. Numbers to right shows marks assigned to questions.
 3. Non-programmable calculator is allowed.
 4. Assume suitable data if required.
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Section B

Q.1	a)	Discuss and explain in detail a mechatronics based engine management system	5
	b)	Derive the equations for an inverted pendulum on cart. Suggest a control strategy to keep the pendulum in vertical position.	5
		OR	
	b)	What are the typical components required for data acquisition and control of a pH control system? Explain in detail.	5
Q.2	a)	Define transfer function. Also state its properties.	3
	b)	List down physical components of hydraulic system.	2
Q.3	a)	Discuss the functions of signal conditioner. Also draw the typical diagrams for the following: i. Inverting amplifier ii. non inverting amplifier	2
	b)	Explain the working principle of LVDT.	3
	c)	What are the typical features of PID controller? In a liquid level system, a PID controller has the following specifications: i. Proportional band=50% ii. Integral time=3 min iii. Derivative time=3min iv. Set point=40% v. Measurement=30% How long will it take for the output to change by 5% if the measurement remains constant?	5

COLLEGE OF ENGINEERING, PUNE
(An Autonomous institute of Government of Maharashtra)
End Semester Examination
(EE 5301) (Power Electronics and Drives)

Programme: M.Tech. (Mechatronics)

Year: 2011-12

Duration: 3 Hrs

Date: 23/11/2011

Max. Marks: 50

- Instructions:**
- 1 All questions compulsory.**
 - 2 Assume suitable data if necessary.**
 - 3 Figures to the right indicates full marks.**

Q.1) A: Draw the circuit diagram of a single phase ac control and explain its principle of operation. Also draw the output voltage and output current waveforms for resistive load.

---- (5)

Q.1) B: Draw the circuit schematic of three phase bridge inverter and mention the six different modes of operation for 180° conduction.

---- (5)

[OR]

Q.1) B: Draw the waveforms for all gate signals, line to line output voltages, phase voltages and any one line current for a three phase bridge inverter for 180° conduction

---- (5)

Q.2) A: Draw the circuit schematic of a cycloconverters and explain its principle of operation. Draw the output voltage waveforms.

---- (5)

Q.2) B: Draw the circuit schematic of single phase full bridge inverter and explain its principle of operation.

---- (5)

[OR]

Q.2) B: Among two types of ac voltage controllers which one is preferred and why? Give merits and demerits of ac voltage controllers.

---- (5)

Q.3) A: What are the different methods of speed control of induction motors? Describe the thyristorized method for stator voltage control of a squirrel cage induction motor.

---- (5)

Q.3) B: What is meant by single pulse width modulation? Discuss how SPWM works

---- (5)

[OR]

Q.3) B: Prove that total harmonic distortion of the input current for a single phase diode bridge inverter is 48.4%

---- (5)

Q.4) A: Draw a neat diagram of a PWM switching converter drive for dc motor and explain it. Draw the typical acceleration-deceleration cycle of such a drive under the action of the control loops. ----- (5)

Q.4) B: Describe the different modes of operation of a thyristor with the help of its V-I characteristics. ----- (5)

[OR]

Q.4) B: Draw the schematic of bidirectional speed and position control system with PWM transistor bridge drive for dc motor. ----- (5)

Q.5) Write short notes (any two)

- 1) Uninterruptible power supply.
- 2) DSTATCOM
- 3) Electronic ballasts

----- (10)

Bet of Luck