

College of Engineering, Pune
Department of Mathematics
MA 224 Engineering Mathematics IV (For Instrumentation and Control)
End Semester Examination

Date: 28/04/2011 Max. Marks 50

Max. Time 3 Hours

SECTION A

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

1. Fill in the blanks: [5]
 - (a) The cardinality of the set of outcomes when a coin is tossed until a head or 3 tails appear is
 - (b) If X is a continuous random variable with CDF $F(x)$ then $F(x) = \dots\dots$
 - (c) The r.v. X whose probability distribution is $f(x) = \frac{e^{-6}6^x}{x!}$; $x = 0, 1, 2, \dots$ is called a random variable and its mean is and variance is
2. 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]
3. (a) If $P(\chi_n^2 \leq 4.594) = 0.2$ 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.

<i>Pressure, x(lb/sq.in.)</i>	10	10	10	10	10	50	50	50	50	50
<i>Scale reading, y</i>	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]

4. 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:

<i>MathsGrade</i>	70	92	80	74	65	83
<i>EnglishGrade</i>	74	84	63	87	78	90

Interpret your result.

[4]

5. 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]
6. (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]
7. 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 $P(0 < \frac{\bar{X} - \mu}{s/\sqrt{n}} < t) = 0.3$, find the value of \bar{X} [4]

College of Engineering, Pune-5

End Semester Exam - May 2011

(IE 209) Automatic Control System

S.Y.B.Tech. (Instrumentation and Control)

Duration : 3 Hours

Max. Marks: 50

Instructions to candidates:

1. All questions are compulsory.
2. Assume suitable data, if necessary.

- Q. 1 (a) Find the Laplace transform of the differential equation given below and hence evaluate the time solution of same. Given that $y(0+) = 0$ and $y'(0+) = 6$ (5)

$$\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = 12e^t$$

- (b) Derive mathematical model for DC servomotor. (5)

- Q. 2 (a) Derive closed loop TF for the figure given in 1 using block reduction technique. (5)

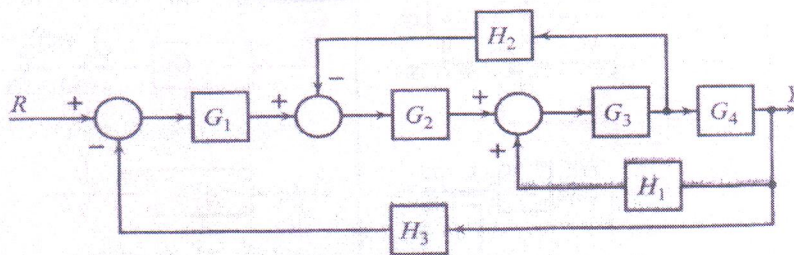


Figure 1: Q.2 a

- (b) For the figure given in part (a) find TF using Mason's gain formula (5)

- Q. 3 (a) The control system with unity feedback whose OLTf is given as $G_1(s) = \frac{(1+sK_e)}{(s+2)}$ connected in cascade with error rate control $G_2(s) = \frac{10}{s}$ (5)
Determine

- i. Determine the value of settling time and maximum peak overshoot. Find the steady state error if the input is a unit-ramp.
- ii. What will those values without error control.

- (b) For a unity feedback system whose OLTF is (5)

$$G(s) = \frac{64}{(s^2 + 3.2s + 64)}$$

Find rise time, peak overshoot, peak time, settling time and delay time.

- Q. 4 (a) Sketch root locus for a unity feedback system whose OLTF $G(s)$ is given by (7)

$$G(s) = \frac{K}{s(s+2)(s^2+6s+25)}$$

- (b) Using Routh-Harwitz criterion determine stability of the system whose characteristic equation is given by (3)

$$s^6 + 3s^5 + 5s^4 + 9s^3 + 8^2 + 6s + 4 = 0$$

- Q. 5 (a) Sketch Bode plot and find frequency response indices for the system

$$G(s) = \frac{64(2+s)}{s(s+0.5)(s^2+3.2s+64)}$$

(5)

- (b) Sketch Nyquist plot for

(5)

$$G(s) = \frac{2}{s(s^2+s+2)}$$

College of Engineering, Pune.
End Semester Examination
(PE-210) - Production Processes and Metrology

Programme : S. Y. B. Tech.

Semester : II

Duration : 03 Hrs.

Branch : Instrumentation & Control

Year : 2010-11

Max. Marks : 50

Date : 20/04/2011

Instructions:-

1. Question no. 1 compulsory.
2. Attempt any four questions from remaining six questions.
3. Draw neat sketches wherever required.
4. Assume necessary data if required.
5. Use of non programmable calculator is allowed.

- Q.1 a What are industrial applications of robots? 2
- b What are different bonds used for grinding wheel? 2
- c What are slitting and lancing operations? 2
- d Enlist linear and angular measuring instruments used in Metrology. 2
- e Set the dividing head to mill 25 teeth on spur gear blank by simple indexing method. Plate 1 has index holes 15,16,17,18,19,20. Plate 2 has index holes: 21,23,27,29,31,33 Plate 3 has index holes: 37,39,41,43,47,49. 2
- Q.2 a Sketch and explain pawl mechanism used in shaper machine. 5
- b Discuss the working, applications, advantages and limitations of electrochemical machining. 5
- Q.3 a With the help of sketch, explain column and knee type milling machine. 5
- b Explain the principle of resistance welding? Explain upset & flash butt welding with neat sketch. 5
- Q.4 a Classify different grinding processes? Explain internal centerless grinding operation. 5
- b i) Derive the relation for combined sine and cosine error. 2
- ii) Sketch half nut mechanism & explain its use. 3

- Q.5 a Enlist different elements of NC system. Classify NC system according to any two criterions. 5
- b Explain different configurations of Robot. Sketch work volume for each configuration. 5
- Q.6 a Calculate the force required to cut a square blank of 50 mm side from a 5 mm thick metal plate. Ultimate shear stress of the material is 350 N/mm^2 . Also find the work done if percentage penetration is 20 % of material thickness. If a shear of 1.2 mm is provided on die blank, what will be its effect on cutting force requirement? 5
- b Explain Thermit welding with a sketch. Explain its working and operations. 5
- Q.7 a Write short notes on: 5
1. Line Standard
 2. End Standard
 3. Wavelength Standard
- b Sketch twist drill geometry showing different angles. 5

College of Engineering, Pune
(An Autonomous Institute of Government of Maharashtra)

End Semester Examination

**(IE 213) Digital Techniques
Semester - II**

Academic Year: 2010 ~ 11

Branch: Instrumentation & Control

Class: Second Year B. Tech

Duration: 3 hrs

Max. Marks: 50

Instructions:

1. Solve all questions.
2. Figures to right indicate full marks.
3. Draw neat figures wherever required.
4. Assume suitable data if necessary.
5. Use of non-programmable calculator is allowed.

Q. 1		
A.	a) Identify the law of Boolean algebra upon which the following quantities are based i) $AB' + CD + AC'D + B = B + AB' + AC'D + CD$ ii) $AB(CD + EF' + GH) = ABCD + AB EF' + ABGH$	[2]
	b) Using Boolean algebra simplify the following expressions and implement using gates i) $BD + B(D + E) + D'(D + F)$ ii) $AB + (A' + B')C + AB$	[3]
B.	Minimize each expression with Karnaugh map and implement with gates i) $AB + AB'C + ABC$ ii) $AB'C'D + ACD' + BC'D + A'BCD'$	[5]
Q. 2		
A.	Write down the truth table for 4 bit binary to gray code converter and implement using gates	[5]
B.	A clocked synchronous sequential circuit using positive edge triggered D flip flop has an input 'X' and output 'Y'. The excitation equations are $D1 = Q_1X' + Q_1'Q_0X + Q_1Q_0'X$ $D2 = Q_0X' + Q_0'X$ and the output equation is $Y = Q_1Q_0X$ i) Draw a circuit diagram ii) Obtain its state table iii) Redesign the circuit using T FFs	[5]
Q. 3		
A.	Design and implement a mod 10 synchronous counter using D F/F.	[5]
B.	i) What are the various ways for triggering F/Fs ii) What is race around condition in F/Fs	[3] [2]
Q. 4		
A.	Design a counter to produce following binary sequence. Use J-K F/F 1, 4, 3, 5, 7, 6, 2, 1....	[5]
B.	Implement a full subtractor with a decoder and NAND gates. The subtractor inputs are A, B and C. The subtractor produces output D and Bo	[5]

Q. 5		
A.	Draw Internal structure of PAL and explain it briefly	[5]
B.	i) Compare TTL and CMOS logic families ii) Compare CPLD and FPGA	[2] [3]

COLLEGE OF ENGINEERING, PUNE-5
(An Autonomous Institute of Govt. of Maharashtra)

(IE 212) Electronic Instrumentation
Programme: S. Y. B. Tech Instrumentation

Year: 2010-11

Semester II

Duration: 3 hrs

Max. Marks: 50

End Semester Exam

Instructions:

1. Figures to right indicate full marks.
2. Draw neat diagrams wherever required.
3. All questions are compulsory.
4. Use of Non Programmable calculators is allowed.

Q1.	A)	Discuss the need for input attenuation and amplification with a digital frequency meter. Draw waveforms to illustrate the errors that can be produced by noisy waveforms, and the method of dealing with them.	6
	B)	Explain Rejection Amplifier circuit. Where it is used?	4
Q2.	A)	Explain in detail Swept Superhetrodyne Spectrum Analyzer. List the various controls and specifications of spectrum analyzer.	6
	B)	Explain the generator which produced sine and symmetrical square wave at frequencies between 20Hz to 20kHz.	4
Q3.	A)	Explain the thermal method of RMS conversion. and Prove the relation $V_{rms}=0.707V_p$	6
	B)	Explain the FFT Analyser.	4
Q4.	A	What are the different types of softwares used in virtual instrumentation system? Describe it with suitable examples.	6
	B)	Describe Network Analysis System Elements.	4
Q.5	A)	Short note on Telemetry systems.	6
	C)	Explain the term Partitioning related to virtual Instrumentation	4