College of Engineering, Pune

(An Autonomous Institute of Government of Maharashtra)
End Semester Examination
(IE 314) Instrument and System Design
Semester - II

Academic Year: 2012 ~ 13   Branch: Instrumentation & Control
Class: Third Year B. Tech
Duration: 3 hours   Max. Marks: 75

Instructions:
1. All questions from section one and two are compulsory.
2. Draw neat figures wherever required.
3. Assume suitable data if necessary.

Enrollment No:

Section – I

Each question carries one mark. Negative marks will apply to this section. One mark will be deducted for every three wrong answers.

Q.1   Electrolytic capacitors are ----------- capacitors
a.   Low b. High c. Very High d. Medium

Q.2   Above audio frequency, a conductor normally has ------- inductive reactance than resistance?
a. Less b. More

Q.3   When a conductor becomes longer than --------- of wave length, it should be treated as transmission line?
a. 1/20 b. 1/5 c. 1/10 d. 1/100

Q. 4   Reflection loss is function of the -------- divided by --------
a. Permeability, Conductivity
b. frequency, permeability
c. Conductivity, frequency
d. Conductivity, Permeability

Q. 5 The maximum ------------ dimension, not the -------- of an aperture determines the amount of leakage.

Q. 6 Use a ----------- material to shield against electric field, plane waves, and high frequency magnetic fields.
a. High conductive b. Low conductive c. Magnetic

Q. 7 Electric fields are harder to shield than magnetic fields (T/F)

Q. 8 To prevent the glow discharge keep the contact voltage below ------ volts?

Q. 9 Contact noise is the problem at -------- frequency (Low/High)

Q.10 The crest factor of for thermal noise is normally assume to be ------
a. One b. Two c. Three d. Four

Q. 11 Increasing the source resistance may ----- the noise factor while ----- the total noise in the circuit (Increase (ing) / Decrease (ing))

1

Q. 12 The primary way of to control the differential mode radiation is to reduce the loop area (T/F)

Q. 13 Digital circuits are usually not susceptible to radiated rf energy unless the field strength is above 10 V/m (T / F)

Q. 14 Materials with surface resistivity of 10^9 Ω per square or less can be discharged rapidly by grounding. (T / F)

Q.15 Noise having equal power in each unit of bandwidth is referred to as -------------
a. Thermal noise b. Shot Noise c. Popcorn noise d. White Noise

Q.16 The purpose of balancing is to make the noise pickup equal in both the conductors. Balancing in many cases is a cost effective noise reduction technique. Answer the following.
a. In a balanced system, both resistive and reactive balance must be maintained.(T/F)
b. When source impedance is low and load impedance is high multi-element filter must be used to improve filtering. (T/F)
c. To minimize noise, the bandwidth of a system should be no more than that necessary to transmit the desired signal.(T/F)
d. The higher the characteristics impedance of a dc power distribution circuit, the less the noise coupling over it.(T/F)
e. From noise point of view dissipative filter is preferred over a reactive filter.(T/F)
Q.17 IEC and NEMA are two widely prevalent standards followed while choosing industrial equipments. Identify statements from below as True or False:
a. IEC definitions are more comprehensive and specific
b. IEC sizes per the application requirements and hence preferred over NEC
c. Ingress Protection (IP) protection code first digit represents protection against liquid
d. Ingress Protection (IP) protection code second digit represent protection against solid
e. Need to derate motor output if operational altitude is higher, as the air density of the air surrounding the motor diminishes as altitude increases, reducing the ability of the surrounding air to cool the motor.

Answers:

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16a	16b	16c	16d	16e
17a	17b	17c	17d	17e

Section – II

Q. 1		
a.	How is the inductance and of the conductor is related to its diameter?	[2]
b.	How do the inductive reactance and ac resistance of the conductor vary with frequency?	[2]
c.	What is the most important consideration in choosing a type of capacitor?	[1]
Q. 2		
a.	There are two parallel conductors a grounding shield is placed around conductor 2. The capacitance from conductor 2 to the shield is 100 pf. The capacitance between conductor 2 and 1is 2 pF and capacitance between conductor 2 and ground is 5 pF. Conductor 1 has 10 V ac signal at the frequency of 100KHz on it. For this configuration what is the noise voltage pick up by the conductor 2 if it terminates R_T is an infinity resistance, a 1000 Ω resistance and a 50 Ω resistance?	[3]
b.	When popcorn noise is produce in semiconductor devices and how we can eliminate it.	[2]
Q. 3		
a.	Calculate the shielding effectiveness of 0.015 inch thick copper shield located 1 inch from the source of 10 KHz magnetic field? Also if the shield is located in far field what will be the shielding effectiveness?	[3]
b.	A shield that contents 10 identical holes in a linear array is required to have 30 dB of shielding effectiveness at 100 MHz. What is the maximum linear dimension of one hole?	[2]
Q. 4		
a.	What is the shielding effectiveness of a 0.032 in thick soft aluminum shield is located 1 ft away from the source of 10 KHz electric field?	[3]
b.	What are the three different items on which the amount of leakage from the aperture depends?	[2]
Q. 5		
a.	Which type of breakdown is hardest to prevent, glow discharge or arc discharge, and why? Justify your answer	[3]
b.	A 150 Ω, 0.2 H relay coil is operated from 12 V dc power source through a silver switch contact. Design contact protection network use across the relay?	[2]
Q. 6		
a.	Why contact protection networks are required for inductive load? Justify the selection of various networks for various condition of load.	[3]
b.	Draw the probability density function for thermal noise and explain characteristics of thermal noise.	[2]
Q. 7		
a.	Calculate the noise voltage produced by 5000 Ω resistor in a system with 10KHz bandwidth at a temperature of 300 K and 373 K	[3]
b.	For a purely reactive source is used, noise factor is meaningless? T/F Justify	[2]
Q. 8		
a.	Why ESD is important while considering the overall EMC of a system? Draw a human body model and typical waveform produced by human body model discharge and explain briefly.	[3]
b.	List the three pronged approach for effective ESD immunity design and justify the importance of each approach.	[2]
Q. 9		
a.	Compare standards and functional specification of an equipment? How standards are beneficial to manufacturer justify your answers with examples.	[3]
b.	Draw bathtub curve of probability? Explain how it is correlated to electronics components and equipment?	[2]
Q. 10		
a.	List and briefly explain the three techniques for reducing the differential mode radiations from a product other than reducing the loop area, frequency and current?	[3]
b.	How Differential mode radiations and common mode radiation can be modeled?	[2]

3