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4E2941

Roll No. : _____ Total Printed Pages : 4

4E2941

B. Tech. (Sem. IV) (Main / Back) Examination, June/July - 2013
Electronics Instrumentation & Control
4EI1 Control System - I

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

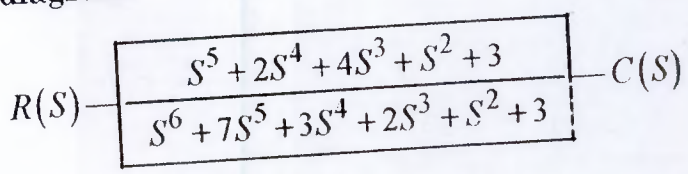
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Semi-log Graph Paper 2. Graph Paper

UNIT - I

1 (a) Write the differential equation for the system given in block diagram.



assume that $r(t) = 3t^3$. 8

(b) A system is described by the following differential equation

$$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 3x = 1$$

with the initial conditions

$x(0) = 1,\ \dot{x}(0) = -1$

show a block diagram of the system, giving its transfer function and all pertinent input and outputs. 8

OR

[Contd...

1 Draw the signal flow graphs for the following differential equations

(i) $y_2 = a\frac{dy_1}{dt}$

(ii) $y_3 = \frac{d^2y_2}{dt^2} + \frac{dy_1}{dt} - y_1$

(iii) $\frac{d^3y}{dt^3} + 2\frac{dy}{dx} + \frac{11}{2}y = x$

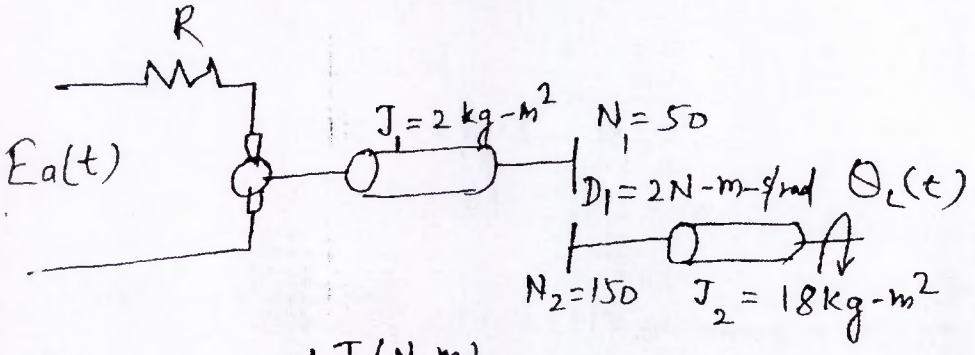
Develop the block diagram of all above the equation and find the transfer function by both methods ?

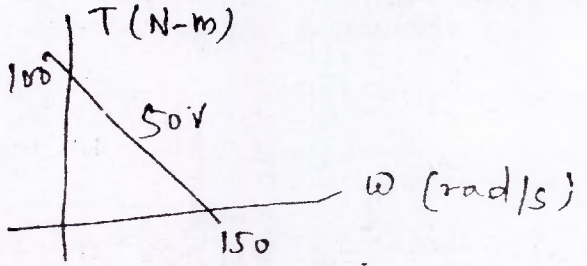
16

UNIT - II

2 (a) Derive the transfer function of the DC motor that relates output torque to input armature voltage.

(b) For the motor, load and torque speed curve shown in figure 1, find the transfer function $G(S) = \theta_L(S)/Ea(S)$





OR

UNIT - IV

4 (a) Explain the correlation between time and frequency specifications.

(b) Using Nyquist criteria, find out whether the system given below is stable.

$$G(s)H(s)=\frac{K}{(T_1s+1)(T_2s+1)} \quad K, T_1 \text{ and } T_2>0.$$

16

OR

4 Given the unity feedback system, make a accurate plot of the root locus for the following

(a) $$G(s)=\frac{K^2(s^2-2s+2)}{(s+1)(s+2)}$$

(b) $$G(s)=\frac{K(s-1)(s-2)}{(s+1)(s+2)}$$

Calibrate the gain for at least four points for each case. Also find the breakaway points, the jw-axis crossing and the range of gain for stability. Find the angle of arrival for part (a).

16

UNIT - V

5 A feedback system described by $G(s)=\frac{10}{s(1+0.25)(1+0.015)}H(s)=1$

construct a Bode plot and find :

(a) Gain crossover and phase crossover frequency

(b) Gain margin and phase margin.

(c) Stability of closed-loop system.

16

OR

5 Write short notes on :

(a) Frequency plots of a system with time delay.

(b) Percent overshoot for system with time delay.

8×2=16

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Calibrate the gain for at least four points for each case. Also find the breakaway points, the jw-axis crossing and the range of gain for stability. Find the angle of arrival for part (a).

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8×2=16

4E2089

Roll No. : _____ Total Printed Pages : 4

4E2089

B. Tech. (Sem. IV) (Back) Examination, June/July - 2013
Electronics & Comm. (Old Scheme)
4EC5 Random Variables & Stochastic Processes

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

*Attempt any **five questions**. Selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls from the box at random. Find the probability that among the balls drawn there is at least one ball of each colour. 8

(b) P is the probability that a man aged x year will die in a year. Find the probability that out of n men $A_1, A_2, \ldots\ldots, A_n$ each aged x, A_1 will die in a year and will be the first to die. 8

OR

2 (a) In a bolt factory machines A, B and C manufacture respectively 25%, 35% and 40% of the total of their output 5, 4, 2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machine A, B and C ? 8

(b) A card is drawn from a well-shuffled pack of playing cards. What is the probability that it is either a spade or an ace? 8

UNIT - II

3 (a) Probability that a man aged 60 would be alive till the 70 years of age is 0.65. Find the probability that at least 7 out of 10 such men would be alive till 70 years of age. 8

(b) The mileage which car owner gets with a certain kind of radial tyre is a random variable having an exponential distribution with mean 40,000 km. Find the probabilities that one of these tyres will last :

(i) at least 20,000 km

(ii) at most 30,000 km 8

OR

4 (a) Find the mean and variance of normal distribution. 8

(b) A manufacturer of cotter pins knows that 5% of his product is defective. If he sells cotter pins in boxes of 100 and guarantees that not more than 10 pins will be defective. What is the approximate probability that a box will fail to meet the guaranteed equality ? 8

UNIT - III

5 (a) Joint distribution of x and y is given by

$$F(x,y)=4xy\,e^{-\left(x^2+y^2\right)};\ x\geq 0,\ y\geq 0$$

(i) Are they independent ?

(ii) Find the conditional density of x given $Y=y$.

(b) A gan is aimed at a certain point (origin of the coordinate system). Because of the random factors, the actual hit point can be any point (x, y) in a circle of radius R about the origin. Assume that the joint density of x and y is constant in this circle given by 8

$$f_{xy}(x,y)=k,\ \text{for}\ x^2+y^2\leq R^2$$

$$=0,\ \text{otherwise}$$

(i) Compute-K

(ii) Show that $f_x(x)=\frac{2}{\pi R}\left\{1-\left(\frac{x}{R}\right)^2\right\}^{1/2}$

$$=0,\ \text{otherwise}$$

OR 8

6 (a) Two discrete random variables x and y have the joint probability density function

$$p(x,y)=\frac{\lambda^x e^{-\lambda} p^y (1-p)^{x-y}}{y!(x-y)!},\ y=0,1,2,.....x$$

$$x=0,1,2,.....$$

where λ, p are constants with $\lambda>0$ and $0<p<1$.

Find

(i) The marginal probability density function of x and y.

(ii) The conditional distribution of y for a given x and of x for a given y.

8

(b) If x and y are two random variables having joint density function

$$f(x,y)=\begin{cases}\frac{1}{8}(6-x-y); 0<x<2, 2<y<4\\ 0, otherwise\end{cases}$$

Find

(i) $P(X<1\cap Y<3)$

(ii) $P(X+Y<3)$

(iii) $P(X<1|Y<3)$

8

UNIT - IV

7 (a) Use Chebychev's inequality to determine how many time a fair coin must be tossed in order that the probability will be at least 0.90 that the ratio of the observed number of heads to the number of tosses will die between 0.4 and 0.6.

8

(b) If $\mu'r$ is the r^{th} moment about origin, prove that

$$\mu'_r=\sum_{j=1}^{r}\binom{r-1}{j-1}\mu'_{r-j}\,k_j$$

where k_j is the j^{th} cumulant.

8

OR

8 (a) Calculation the coefficient of correlation from the following data -

x	64	65	66	67	68	69	70
y	66	67	55	68	70	68	72

8

(b) In a certain distribution, the first four moments about the point 4 are –1.5, 17, –30, and 108.

Calculate β_1 and β_2 and state whether the distribution is Reptokuritic or Platykurtic.

8

UNIT - V

9 (a) The auto correlation function of a random process is $R_x(\tau)=e^{-\tau/2\sigma^2}$. Fiind the power spectral density and the normalized average power content.

8

(b) Define the Gaussian process. If $\{x(t)\}$ is a Gaussian process with $\mu(t)=10$ and $k_x(t_1,t_2)=16e^{-|t_1-t_2|}$. Find the probability that

(i) $x(10)\le 8$

(ii) $|x(10)-x(6)|\le 4$

8

OR

10 (a) Define the wide sense stationary process. Show that the random process $x(t)=A\cos(w_0t+\theta)$ is wide sense stationary (wss). If A and w_0 are constants and θ is a uniformly distributed random variables in $(0,2\pi)$.

8

(b) If $x(t)$ with $x(0)=0$ and $\mu=0$ is a Wiener process, show that $y(t)=\sigma x\left(t/\sigma^2\right)$ is also a Wiener process, find its covariance function.

8

4E2946

Roll No. : _____ Total Printed Pages : 3

4E2946

B. Tech. (Sem. IV) (Main & Back) Examination, June/July - 2013
Biomedical Engg.
4BM5 Analog Communication (Common with 4EI5)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) What is noise figure. Describe the noise figure and noise factor. 8

(b) For an nonideal amplifier the following parameters, determine
(i) Input S/N ratio (dB)
(ii) Output S/N ratio (dB)
(iii) Noise factor and noise figure
given input signal power = 2×10^{-10} w
input noise power = 2×10^{-18} w
Power gain = 1,000,000
Internal noise = 6×10^{-12} w 8

OR

1 (a) Compare between analog and digital communication and draw the signal to noise power ratio. 8

(b) Determine :
(i) Noise figure for an equivalent noise temperature of 75K.
(ii) Equivalent noise temperature for a noise figure of 6dB. (use 290K for the reference temperature) 8

42

UNIT - II

2 (a) What is angle modulation. Give the mathematical representation of FM. 8

(b) Describe the derivation sensitivity and give mathematical expression also. 8

OR

2 (a) Compare AM, FM and PM and what are the Bandwidth requirements of Angle-Modulated waves. 8

(b) For an FM modulator with a peak frequency deviation $\Delta f = 10\,KHz$, a modulating frequency $f_m = 10\,KHz$ $V_c = 10\,V$ and a 500 *KHz* carrier determine

(i) Actual minimum between from the Bessel function table

(ii) Plot the output frequency spectrum for the Bessel approximation. 8

UNIT - III

3 (a) What is Am receiver. Give short notes on T.R.F. with the help of block diagram. 8

(b) For an Am commercial broad cast-band receiver 1535 KHz to 1605 KHz) with an input filter Q-factor of 54, determine the between at the low and high ends of the RF spectrum. 8

OR

3 (a) Describe superheterodyne receiver and give the expression for equivalent noise temperature. 8

(b) Give the expression for image frequency and double spatting. 8

UNIT - IV

4 (a) What is metallic transmission lines gives the expression for frequency wavelength on this. 8

(b) Why we use co-axial transmission lines in communication system. Write the advantage of transmission line. 8

OR

4 (a) Determine the characteristics impedance for an RG-59A coaxial cable with the following specification d=0.025 inches, D=0.15 inches and $\varepsilon_r = 2.23$.

8

(b) What is loss less in transmission line and gives the expression for standing wave ration for transmission line.

8

UNIT - V

5 (a) What is optical fiber gives short notes on it. Explain total internal deflection.

8

(b) Why we use Radar in communication system and gives the satellite orbital parameter in communication system.

8

OR

5 (a) What the basic concept of satellite communication also draw the block diagram of satellite communication.

8

(b) What is numerical aperture in reference to optical fiber. Derive the expression for maximum acceptance angle of an optical fiber.

8

4E2989

Roll No. : _____ Total Printed Pages : 4

4E2989

B. Tech. (Sem. IV) (Main / Back) Examination, June/July - 2013
Electronics & Comm.
4EC5 Random Variables & Stochastic Processes

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) Consider "a" apples are distributed randomly among "b" children. Determine the probability that a particular child receives "c" apples; where c < a. **6**

(b) Suppose urn 1 contains "p" white balls and "q" black balls, and urn 2 contains "r" white balls and "s" black balls. One ball of unknown color is transferred from the first urn into the second urn and then a ball is drawn from the latter. Determine the probability that it will be a white ball. **10**

OR

1 Prove following :

(a) If $P(A/B)$ is the conditional probability of A given B, then show that

(i) $P(A/B) \geq 0$ **4**

(ii) $P(S/B) = 1$ **4**

(iii) $P(A_1 \cup A_2 / B) = P(A_1/B) + P(A_2/B)$ if $A_1 \cap A_2 = \phi$ **4**

(b) If $P(A/B) > P(A)$, then prove that $P(B/A) > P(B)$. **4**

Note : In (ii) of (a), S denotes the universal sample space.

50

UNIT - II

2 (a) Determine the mean and variance of the uniform distribution $\cup(a,b)$.

6

(b) Consider the sequence of bernoulli trials with probability p of success. This sequence is observed until the first success occurs. Let the random variable X represent the trial number on which the first success occurs. Then the pmf is given by

$$p_X(x) = P(X = x) = (1-p)^{x-1} p;\ x = 0,1,2,..... \rightarrow (i)$$

because there must be x–1 failures before the first success occurs on trial x. The random variable X defined in this problem is called as "geometric random variable" with probability p.

(i) Show that $p_X(x)$ given in above equation

(a) Satisfies the expression

$$\sum_k p_X(x_k) = 1$$

5

(ii) Determine the cdf $F_X(x)$ of X.

5

OR

2 (a) If the density function of a continuous random variable is $f(x) = C\,e^{-b(x-a)};\ a \le x$.

where a,b,c are real constant. Show that $b = c = \frac{1}{\sigma_X}$ and $a = \mu_X - \sigma_X$. Where $\mu_X = E[X]$ and $\sigma_X^2 = \text{var}[X]$.

8

(b) State and explain the "memory less property" of exponential distribution.

8

UNIT - III

3 (a) The joint pdf of a bivariate random variable (X,Y) is given by

$$f_{XY}(x,y)=\begin{cases}\frac{kx}{y}; 1<x<2; 1<y<2\\ 0; \text{ otherwise}\end{cases}$$

where k is the constant.

(i) Determine K. **5**

(ii) are X and Y independent **5**

(b) Varify the property :

$$P(x_1<X\le x_2, Y\le y)=F_{XY}(x_2,y)-F_{XY}(x_1,y)$$

6

OR

3 (a) Varify the property :

$$P(X\le x, y,<Y\le y_2)=F_{XY}(x,y_2)-F_{XY}(x,y_1)$$

6

(b) A joint pdf of a bivariate random variable (X,Y) is given by

$$f_{XY}(x,y)=\begin{cases}\frac{1}{y}e^{-x/y}e^{-y} & ; x>0, y>0\\ 0 & ; \text{otherwise}\end{cases}$$

(i) Show that $f_{XY}(x,y)$ satisfies the equation

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f_{XY}(x,y)dxdy=1$$

5

(ii) determine $P(X>1/Y=y)$ **5**

UNIT - IV

4 (a) Consider a continuous random variable X, prove that

$$E(X)=\int_0^{\infty}[1-F_X(x)]dx-\int_{-\infty}^{0}F_X(x)dx$$

where $E(X)$ denotes the expectation of random variable X. **8**

(b) For the correlation - coefficient of X and Y (defined as ρ_{XY}), prove that

$|\rho_{XY}| \leq 1$

4

(c) Consider the random variable X, which takes the values $x_1 = -2$ and $x_2 = 2$ with pmf's $p_X(x_1) = p_X(x_2) = \frac{1}{2}$. Find the characteristic function of X.

4

OR

4. State and explain the "central limit theorem in detail with appropriate mathematical equations.

16

UNIT - V

5 (a) The psd of white noise $(N_0/2)$ is 6×10^{-6} watts/Hz, is applied to an ideal low pass filter with power transfer function 1 and bandwidth = W rad/sec. Find the W so that output average noise power is 15 watts.

8

(b) The psd of a zero mean WSS process $X(t)$ is given by

$$S_{XX}(\omega) = \begin{cases} 1 \; ; \; |\omega| \leq \omega_0 \\ 0 \; ; \; \text{anywhere} \end{cases}$$

Determine whether $X(t)$ and $X\left(t + \frac{\pi}{\omega_0}\right)$ are uncorrelated.

8

OR

5 (a) The power spectrum of Noise $N(t)$ is defined as

$$S_{NN}(\omega) = \begin{cases} \frac{N_0}{2} \; ; \; -W \leq \omega \leq W \\ 0 \quad ; \quad \text{elsewhere} \end{cases}$$

Determine the auto correlation function of $N(t)$ and draw the plot of $R_{NN}(\tau)$ versus τ.

8

(b) Explain the "Narrow Banel Gaussian Processes" with appropriate mathematical expressions.

8

4E2903

Roll No. : _____ Total Printed Pages : 3

4E2903

B. Tech. (Sem. IV) (Main / Back) Examination, June/July - 2013
Electronics Instrumentation & Control
4EI4 Transducers in Instrumentation (Common for 4EI4, 4AI4 & BM4)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) Explain the method of displacement measurement by LVDT with the relevant expressions. 8

(b) Briefly describe how transducers are classified. 8

OR

1 (a) For a transducer, describe the following :

(i) i/p characteristics

(ii) transfer characteristics. 4+4

(b) Briefly explain the construction of various types of strain gauges.

54

UNIT - II

2 (a) Explain the following with reference to force measurements
(i) Bellows
(ii) Bourdon tubes

5+5

(b) Briefly describe the characteristics of transducers for measurement of pressure.

6

OR

2 (a) Describe the method used for measurement of low pressure using pirani gauge.

8

(b) Explain how strain gauge can be used for measurement of pressure.

8

UNIT - III

3 (a) Describe the construction and working of bimetallic therometers.

8

(b) Explain the theory of radiation pyrometers.

OR

3 (a) Explain the method to measure the p-H value of a solution.

8

(b) What are the different methods to measure humidity. Explain in brief.

8

UNIT - IV

4 (a) Describe the working and theory of an ultrasonic flow meters.

8

(b) Explain the electromagnetic flow meters to measure flow. Also give the advantages of the method.

8

OR

4 Describe in detail the various methods to measure liquid level with necessary diagrams.

16

UNIT - V

5 Explain the theory and warking of LCD for display. Describe the difference between light scattering and field effect type of LCD's. Also explain the advantages of LCD's. **16**

OR

5 (a) Explain the construction and operating principle of feat panel CRT for displays. 8

(b) Explain the 5×7 LED matrix used to display alphabet and decimal digit with necessary diagrams. 8

4E2086

Roll No. : _____ Total Printed Pages : 3

4E2086

B. Tech. (Sem. IV) (Main / Back) Examination, June/July - 2013
Electronics Instrumentation & Control
4IC2 Analog Electronics (Old Back) (Common for 4IC2, 4EC2)

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) What are the four possible topologies of a feedback amplifier ? Identify the output signal X_o and Feedback signal X_f for each topologies (either as current or voltage) 8

(b) List the five characteristics of an amplifier which are modified by negative feedback. Explain them in brief. 8

OR

1 (a) Draw and explain the circuit of a current - series feedback amplifier. 8

(b) List the steps required to carry out the analysis of a feedback amplifier. Explain in brief. 8

UNIT - II

2 (a) Sketch and explain the circuit of Schemitt trigger using a bi-polar function transistor.

8

(b) Give the two Barkhausen conditions required in order for sinusoidal oscillations to be sustained. Also draw neat diagrams.

8

OR

2 (a) Sketch the circuit for a Wein briedge Oscillator. What determines the frequency of Oscillation ? Will Oscillations take place if the bridge is balanced ?

8

(b) Sketch the topology for a generalized resonant - circuit Oscillator, using impedance Z_1, Z_2, Z_3. At what frequency will the circuit Oscillate ?

8

UNIT - III

3 (a) Draw the small signal high frequency CE model of a transistor. Explain the same.

8

(b) What is the physical origin of the two capacitors in the hybrid - model ? What is the order of magnitude of each capacitance ?

8

OR

3 (a) Derive the expression for the CE short circuit current gain Ai as a function of frequency.

8

(b) Define f_b, f_T. What is the relationship between f_b and f_T.

8

UNIT - IV

4 Write short note on any two :

(a) Band Pass Amplifier

(b) Double Tuned Transforme Coupled Amplifier

(c) Stagger Tuned Amplifier

(d) Parallel resonant circuits.

8+8

UNIT - V

5 (a) Explain quasi complementary symmetry amplifiers.

8

(b) Draw the diagram of a transformer coupled single - transistor output stage, and explain the need for impedance matching.

8

OR

5 (a) Explain why even harmonics are not present in a push-pull amplifier. Give two additional advantages of this circuit over that of a single transistor amplifier.

8

(b) Show that the maximum conversion efficiency of the idealized class B push pull circuit is 78.5%.

8

4E2091

Roll No. : _____ Total Printed Pages : 3

4E2091

B. Tech. (Sem. IV) (Main / Back) Examination, June/July - 2013
Electronics & Comm. (Common for 4EC6.2 & 4AI6.3)
4EC6.2 Data Base Management System

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.
Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT - I

1 (a) Define and Explain different levels of data abstraction. 8

(b) Explain the difference between physical and logical data independence. 8

OR

1 (a) Explain the concept of specialization and generalization with an example. 8

(b) Explain following operations in Relational Algebra with example :
(a) Project
(b) Union
(c) Cartesian Product
(d) Set Intersection 4×2

60

UNIT - II

2 Define functional dependencies in detail and explain Armstrong's axioms.

16

OR

2 (a) Explain the concept of Denormalization.

8

(b) State the difference between tuple and domain relational calculus.

8

UNIT - III

3 (a) What is a 'cursor' ? How it is created and what are its Advantages.

8

(b) With the help of a suitable diagram discuss SQL Query processing.

8

OR

3 Write and explain sample SQL queries for :

(a) Table creation

(b) Updation of table schema

(c) Insertion of records into a table

(d) Updation of records in a table

(e) Deletion of records

(f) Deletion of table

(g) Creating views

(h) Updating views

8×2

UNIT - IV

4 Define following terms w.r.t. physical data organization.

(a) Indexing field

(b) Clustering field

(c) Secondary key field

(d) Block anchor

(e) Dense index

(f) Sparse index

also state the difference among primary, secondary and clustering indexes.

16

OR

4 (a) What is a grid file. State its advantages and disadvantages

8

(b) Explain how hashing can be used to construct an index.

8

UNIT - V

5 Write short notes on following :

(a) Type of locks used in concurrency control

(b) Two phase locking protocol.

8×2

OR

5 (a) Granularity levels for locking.

(b) Latches

(c) Time stamp

(d) Dirty bit

4×4

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4E2088

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4E2088

B. Tech. (Sem. IV) (Main / Back) Examination, June/July - 2013
Electronics & Comm. (Common for 4EC4, 4EI62 & 4BM6.2)
4EC4 Electromagnetic Field Theory

Time : 3 Hours] [Total Marks : 80
[Min. Passing Marks : 24

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.
(Mentioned in form No. 205)

1. Calculator 2. NIL

UNIT - I

1 (a) Express the vector field $\vec{A} = xy^2z\,\vec{a}_x + x^2yz\,\vec{a}_y + xyz^2\,\vec{a}_z$ in cylindrical and spherical coordinates at (3, –4, 5). 10

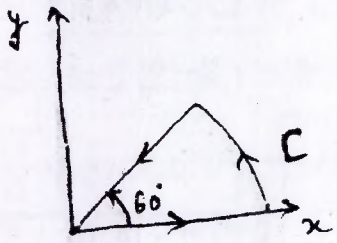
(b) Determine the divergence and curl of vector $\vec{A} = \rho z \sin\phi\,\vec{a}_\rho + 3\rho z^2 \cos\phi\,\vec{a}_\phi$ at $\left(5, \pi/2, 1\right)$ 3×2

OR

1 (a) Verify the divergence theorem for vector $\vec{A} = \rho^2 \cos^2\phi\,\vec{a}_\rho + z\sin\phi\,\vec{a}_\phi$ over closed surface of the cylinder $0 \le z \le 1,\ \rho = 4$. 8

(b) Give physical interpretation of gradient of a scalar. 4

(c) Calculate the circulation of vaector $\vec{A} = \rho\cos\phi\,\vec{a}_\rho + z\sin\phi\,\vec{a}_z$ around the edge C of the wedge defined by $0 \le \rho \le 2, 0 \le \phi \le 60^\circ$ and $z = 0$.



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UNIT - II

2 (a) Find the flux density at a point $P(6,4,-5)$ cased by
(i) a point charge of 20mC at the origin
(ii) a uniform line charge $\rho_L = 20\,\mu C/m$ on the z-axis and
(iii) a uniform charge density $\rho_S = 60\,\mu C/m^2$ at a plane $x = 8$.

6

(b) Given the potential $V = \dfrac{10\sin\theta\cos\phi}{r^2}$, calculate the work done in moving a $10\mu C$ charge from point A $\left(1, 30^\circ, 120^\circ\right)$ to point $B\left(4, 90^\circ, 60^\circ\right)$.

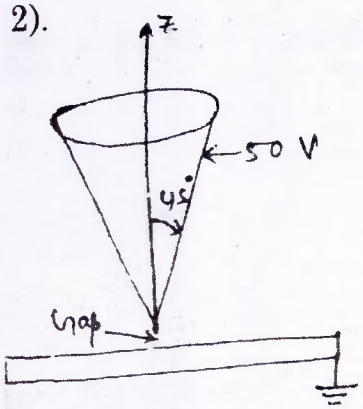
2

(c) Derive the expression of energy density in electrostatic fields.

8

OR

2 (a) A large conducting cone $\left(\theta = 45^\circ\right)$ is placed on a conducting plane with a tiny gap separating it from the plane as shown in figure. If the cone is connected to a 50 volt source, find V and $\vec{E}$ at (–3, 4, 2).



8

(b) Explain the field determination by method of images.

8

UNIT - III

3 (a) Derive Bio-Savart's law and Ampere's law using vector magnetic potential. Why it should be a vector, whereas the analogous quantity in electric field is voltage, that is scaler quantity.

4+2

(b) The positive y-axis (semi-infinite line with respect of the origin) carries a filamentary current of 2A in the $-\vec{a}y$ direction. Assume it is part of a large circuit. Find $\vec{H}$ at (2, 3, 0).

6

(c) The radii of the inner and outer conductors of a coxial cable are 2mm and 6mm respectively. $\mu = \mu_0$, find the inductance of a 10m long cable.

4

OR

3 (a) A current distribution gives rise to the vector magnetic potential $\vec{A} = x^2 y \vec{a}_x + y^2 x \vec{a}_y - 4xyz \vec{a}_z$ Wb/m. Calculate $\vec{B}$ at (–1, 2, 5) and the flux through the surface defined by $z = 1,\ 0 \le x \le 1,\ -1 \le y \le 4$.

6

(b) Two homogeneous, linear and isotropic media have an interface at $x = 0$, $x < 0$ describes medium 1 and $x > 0$ describes medium 2. $\mu_{r1} = 2$ and $\mu_{r2} = 5$. The magnetic field in medium 1 is $\vec{H}_1 = 150 \vec{a}_x - 400 \vec{a}_y + 250 \vec{a}_z$ A/m.

Determine :

(i) Magnetic field in medium 2.

(ii) Magnetic flux density in medium 1.

(iii) Magnetic flux density in medium 2.

6

(c) The core of a toroid is $12cm^2$ and is made of material with $\mu_r = 200$. If the mean radius of the toroid is 50 cm, calculate the number of turns needed to obtain an inductance of 2.5 H.

4

UNIT - IV

4 (a) Solve the wave equation for a uniform plane wave in an isotropic homogeneous lossy dielectric medium with no sources. Calculate the propagation constant, attenuation constant and phase constant.

8

(b) A uniform plane wave in a medium having $\sigma = 10^{-3}\ s/m$, $\varepsilon = 80\,\varepsilon_0$ and $\mu = \mu_0$ is having a frequency of 10 kHz. Explain the nature of given media. Calculate

(i) Attenuation constant
(ii) Phase constant
(iii) Intrinsic impedance
(iv) Wavelength
(v) Velocity of wave. 8

OR

4 (a) Derive expression for reflection coefficient and transmission coefficient for $\vec{E}$ and $\vec{H}$ fields when an electromagnetic wave is incident normally on the boundary separating two different media

(i) conducting
(ii) perfectly dielectric. 8

(b) In a nonmagnetic medium $(\mu = \mu_0)$

$\vec{E} = 4\sin\left(2\pi \times 10^7 t - 0.8x\right)\vec{a}_z\ V/m$ find

(i) ε_r, η
(ii) The time average power carried by the wave and
(iii) The total power crossing $100cm^2$ of plane $2x + y = 5$. 8

UNIT - V

5 (a) Discuss radiation from a small current element (Hertzain dipole) and hence calculate value of radiated power and radiation resistance. 10

(b) Explain the retarded potentials. 6

OR

5 (a) What do you understand by EMI and EMC ? Discuss different methods to eliminate EMI. 10

(b) Calculate the power radiated and radiation resistance by a hertzian dipole of length $\frac{l}{40}$ in free space if it carries a uniform current of $I = 0.5$ Amp. 6

6E3093

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6E3093

B. Tech IV Sem. (Main & Back) Exam., May/June 2013

Electronics & Comm. Engg.

6EC6.3 Elective Optimization Techniques

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question from each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1._____ 2._____

UNIT – I

Q.1. (a) Discuss the various phase in solving an operation research problem. [8]

(b) A toy company manufactures two types of doll, a basic version-doll A and a deluxe version doll B. Each doll of type B takes twice time as long to produce as one of the type A, and the company would have time to make a maximum of 2000 per day. The supply of plastic is sufficient to produce 1500 dolls per day (both A and B combined). The deluxe version requires a fancy dress of which there are only 600 per day available. If the company makes a profit of Rs. 3 and Rs. 5 per doll, respectively on doll A and B, then how many of each dolls should be produced per day in order to maximize the total profit. Formulate this problem. [8]

OR

Q.1. (a) What is optimization technique? Write engineering application of optimization. [8]

(b) Consider the following problem faced by a production planner of a soft drink plant. He has two bottling machines A and B. A is designed for 8-ounce bottles and B for 16-ounce bottles. However each can also be used for both types of bottles with some loss of efficiency. The following data is available.

Machine	8-ounce Bottles	16-ounce Bottles
A	100/minutes	40/minutes
B	60/minutes	75/minutes

The machine can be run for 8 hours per day, 5 days per week. The profit on an 8-ounce bottle is 15 paise and on a 16-ounce bottle is 25 paise. Weekly production of the drink cannot exceed 3,00,000 bottles and the market can absorb 25,000 eight ounce bottles and 7,000 sixteen ounce bottles per week. The planner wishes to maximize his profit, of course, to all the production and marketing restrictions. Formulate this as liner programming problem. [8]

UNIT – II

Q.2. (a) Consider the L.P.P.

Maximize $z = 2x_1 + x_2 + 4x_3 - x_4$

s.t. $x_1+2x_2+x_3-3x_4 \leq 8$, $-x_2+x_3+2x_4 \leq 0$, $2x_1+7x_2-5x_3-10x_4 \leq 21$

and $x_1, x_2, x_3, x_4 \geq 0$

The optimum solution to this problem is contained in the following simplex table:

C_B	y_B	x_B	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
2	y_1	8	1	0	3	1	1	2	0
1	y_2	0	0	1	-1	-2	0	-1	0
0	y_3	5	0	0	-4	2	-2	3	1
		$Z_j - C_j$	0	0	1	1	2	3	0

If b_2 becomes 11 then make the necessary corrections in the optimum table and solve the resulting problem. [8]

(b) Using the dual, solve the following L.P.P.

Maximize $z = 3x_1 - 2x_2$

s.t. $x_1 \leq 4$, $x_2 \leq 6$, $x_1 + x_2 \leq 5$, $-x_2 \leq -1$

and $x_1, x_2, \geq 0$ [8]

OR

Q.2. (a) Solve the following LP problem using simple method

Maximize $z = 16x_1 + 17x_2 + 10x_3$

s.t. $x_1 + x_2 + 4x_3 \leq 2000$

$2x_1 + x_2 + x_3 \leq 3600$

$x_1 + 2x_2 + 2x_3 \leq 2400$

$x_1 \leq 30$

and $x_1 + x_2 + x_3 \geq 0$ [8]

(b) Solve the following LPP using revised simplex method

Maximize $z = x_1 + x_2 + x_3$

s.t. $x_1 - x_4 - 2x_6 = 5$

$x_2 + 2x_4 - 3x_5 + x_6 = 3$

$x_3 + 2x_4 - 5x_5 + 6x_6 = 5$

and $x_j \geq 0, j = 1, 2, \ldots\ldots, 6$ [8]

UNIT – III

Q.3. (a) A Salesman has to visit five cities, C_i, $i = 1, 2 \ldots\ldots, 5$. He should start from C_1, his headquarter, visit each city once and only once, and return to C_1. The cost of going C_i to C_i is given in the following table (blank indicates that the journey is not possible). Find how he should travel to minimize the cost. [8]

Cities	C_1	C_2	C_3	C_4	C5
C_1	-	20	4	15	-
C_2	6	-	5	-	10
C_3	7	4	-	6	8
C_4	11	5	8	-	12
C_5	-	13	9	6	-

(b) Solve the following transportation problem. [8]

		To			Supply
		1	2	3	
From	1	2	7	4	5
	2	3	3	1	8
	3	5	4	7	7
	4	1	6	2	14
Demand		7	9	18	34

OR

om C_1, his
ng C_i to C_i
Find how
[8]

(a) A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix.

Employees

Jobs	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man hours? [8]

(b) In the modification of a plant layout of a factory four new machines M_1, M_2, M_3, M_4 are to be installed in a machine shop. There are five vacant places A, B, C, D and E available. Because of limited spaces, machine M_2 cannot be placed at C and M_3 cannot be placed at A. The cost of locating a machine at a place (in hundred rupees) is a follows

Location

Machine	A	B	C	D	E
M_1	9	11	15	10	11
M_2	12	9	-	10	9
M_3	-	11	14	11	7
M_4	14	8	12	7	8

Find the optimal assignment schedule. [8]

UNIT – IV

Q.4. (a) Perform two iteration of method of steepest decent to find the point of minima of function $f(x) = x_1^2 + 3x_2^2 - 2x_1x_2 - 4x_2 + 5$. Take starting point X_1 as (4.2, -1), $\in = 0.01$ and $M = 100$.

(b) Use four iteration of Fibonacci search method to find the point of minima of the function $f(x) = x^2 + 2.6x + 2$, in the interval $-2 \le x \le 3$.

OR

Q.4. Solve the following problem up to three iteration using Zoutendijk's method.

Maximize $2x_1^2 + 2x_2^2 - 2x_1x_2 - 4x_1 - 6x_2$

s.t. $x_1 - 5x_2 \le 5$

$2x_1^2 - x_2 \le 0$

$-x_1 \le 0$

$-x_2 \le 0$ [16

UNIT – V

Q.5. Solve the following LP problem using dynamic programming approach

Maximize $10x_1 + 8x_2$

s.t. $2x_1 + x_2 \le 25$

$3x_1 + 2x_2 \le 45$

$x_2 \le 10$

and $x_1, x_2 \ge 0$

Verify your solution by solving it graphically. [16]

OR

Determine

Maximize $x_1^2 + x_2^2 + x_3^2$

s.t. $x_1 x_2 x_3 \leq 6$

Where x_1, x_2, x_3 are positive integers [16]
