Roll no.: 13483

National Institute of Technology, Hamirpur (HP)

End Semester Exam – B.Tech

Branch: ECE **Semester: 6th**

Course Name: Wireless Communication **Code: ECD- 322**

Time: 3 Hours **Marks: 60**

Note: *1. Attempt all questions*
2. Attempt all the parts of the question at one place

Q1

a) Frequency Reuse factor, N=2 is invalid. Justify this statement with proper diagram. (2)

b) Given an indoor path loss model of form

$$PL(d)\ dB = 40 + 20\log d + \Sigma FAF \qquad d \geq 1m$$

Find the mean receiver power between three floors of a building if Floor Attenuation factor (FAF) is 15dB per floor. Assume the transmitter radiates 20dBm and unity gain antennas are used at both the transmitter and receiver and the straight line path between the transmitter and receiver is 15m through the floors. (3)

c) In US AMPS cellular operator is allocated 12.5MHz for each simplex band and if B_t is 12.5MHz, B_{guard} = 10KHz and channel bandwidth is 30KHz; find the number of channels available in an FDMA system. (2)

d) Explain the training of a Generic Adaptive Equalizer. (5)

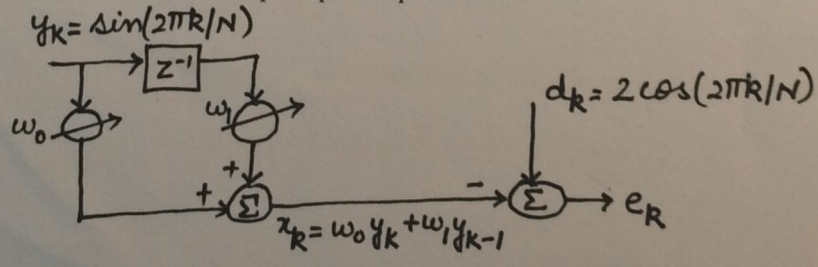
Q2

a) Explain the capture effect in Packet Radio. (3)

b) Find the Median path loss using HATA Model for d=31.068 miles, h_{te} = 100m, h_{re} = 10m in (i) small sized city (ii) Large sized city (iii) Sub-urban area

If Base station transmitter radiates an EIRP of 1KW at a carrier frequency of 850 MHz, find received power at receiver [assume unity gain Receiver antenna] (6)

c) Consider the two-tap adaptive equalizer as shown



Roll no.:.....

	Find the cross correlation Matrix for Input y_k.	(3)
Q3	a) Based on Multipath Time delay spread, Explain various types of small scale fading.	(4)
	b) Explain in detail about Non-Linear equalizers.	(8)
Q4	a) What is the need for Diversity? Explain in detail various types of Diversity.	(6)
	b) Design an encoder for a (7, 4) cyclic code if $g(x) = 1+ x+ x^3$. Find the systematic codeword for message m = [0101] and verify the authenticity of the codeword.	(6)
Q5	a) Explain with necessary diagram, the operation of Orthogonal Frequency Divison Multiple Access Technique.	(4)
	b) What are the major differences between TDMA, FDMA, and SDMA. Explain in detail about each Multiple access technique	(8)

Roll no.:.....

National Institute of Technology, Hamirpur (HP)

End Semester Exam May, 2016 – B. Tech.

Branch: Electronics and Communication Engineering | **Semester : 6th**
Course Name: Digital Signal Processing | **Course Code: ECD-323**
Time: 3 Hours | **Maximum Marks: 60**

Note: All questions are compulsory.
Assume suitable data if required.
Attempt all parts of the question at one place only.

1. Determine whether the following signals are power signals, energy signals, or neither.
   (a) $x(n) = (\frac{1}{2})^n u(n)$
   (b) $x(n) = e^{j(\frac{\pi}{2}n+\frac{\pi}{8})}$
   (c) $x(n) = \cos(\frac{\pi}{4}n)$
   (d) $x(n) = \delta(n)$
   (e) $x(n) = n \; ; \; 0 \leq n \leq 5$ (5)

2. For each of the following input output relationships determine whether the corresponding system is :
   (i) linear/non-linear
   (a) $y(n) - 3n\, y(n-1) = x(n)$
   (b) $y(n) + 2^n\, y(n-1) = x(n)$

   (ii) causal/non-causal
   (a) $y(n) = x(-n)$
   (b) $y(n) = x(n)\cos(n+1)$

   (iii) time variant/time invariant
   (a) $y(n) = nx(n)$
   (b) $y(n) = \sin[x(n)]$

   (iv) stable/unstable
   (a) $y(n) = e^{x(n)}$
   (b) $y(n) = r^n\, x(n)$, where r >1

   (v) static/dynamic
   (a) $y(n) = log_e[x(n)]$
   (b) $y(n) = x(n^2)$ (10)

3. Determine the fourier series coefficients of the signal x(n) and plot its magnitude and phase spectra.
   $x(n) = 1 + \sin\left(\frac{2\pi}{N}n\right) + 3\cos\left(\frac{2\pi}{N}n\right) + \cos\left(\frac{4\pi}{N}n + \frac{\pi}{2}\right)$ (5)

4. Suppose that a system has the response $(1/4)^n u(n)$ to the input $(n+2)\left(\frac{1}{2}\right)^n u(n)$. If the output of this system is $\delta(n) - (-1/2)^n u(n)$, what is the input? (5)

5. The impulse response of a linear time-invariant system is

$$h(n) = \{1, 2, 2, -1\}$$
$$\uparrow$$

Determine the response of the system to the input signal

$$x(n) = \{1, 2, 3, 1\}$$
$$\uparrow$$

(5)

6. Find the inverse z-transform of

$$X(z) = \frac{1 - z^{-1} + z^{-2}}{\left(1 - \frac{1}{2}z^{-1}\right)(1 - 2z^{-1})(1 - z^{-1})} \text{ with ROC } 1 < |z| < 2$$

(5)

7. Determine the z-transform of the following signals:
   (a) $x(n) = a^n \sin(\omega n)\, u(n)$
   (b) $x(n) = a^n \cos(\omega n)\, u(n)$

(5)

8. Let x(n) = (n+1) , $0 \leq n \leq 9$, and h(n) $\{1, 0, -1\}$. Implement the overlap add method
$$\uparrow$$
to compute y(n) = x(n) * h(n). (5)

9. Given x(n) $=\{1,2,1,2,1,2,1,2\}$, find 8-point DFT X(k) using the DIF-FFT algorithm. Show all Intermediate results. (5)

10. Obtain the cascade and parallel form realization of the given LTI system governed by the difference equation :

$$y(n) = \frac{5}{8}y(n-1) - \frac{1}{16}y(n-2) + x(n) - 3x(n-1) + 3x(n-2) - x(n-3)$$

(5)

11. Give the first order system function H(z) for simple High Pass FIR filter design. Find out the 3dB frequency and frequency response. Also draw the pole-zero plot, magnitude response and phase response. (5)

Roll No.: 13183

National Institute of Technology, Hamirpur (H.P.)

Name of the Examination: B. Tech. (Mid Term Examination)

Branch : Electrical & Electronics Engineering **Semester** : 6th

Course Name : Optimization Techniques **Course Code** : EEO-325

Time: 1H 30 Min **Maximum Marks: 20**

Q.1. What is the Optimization Techniques? Write down the definition and importance of Optimization Techniques. (3)

Q.2. Write the short notes on the Classification of Optimization Problems based on the number of objective functions and based on the structure of the problem. (3)

Q.3. State the various methods available for solving a multivariable optimization problem with equality constraints. (3)

Q.4. Find the co-ordinates of the points lie in the ellipse as given below using Lagrange multiplier method (4)

$$\frac{x^2}{4}+\frac{y^2}{5}+\frac{z^2}{25}=1,\quad x-y-z=0$$

Which are such that square of their distance from the origin is maximum.

Q.5. Find the extreme points of the function (3)

$$f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$$

Q.6. What is the real valued function? Also define the local and global extrema of a single variable function. (4)

Roll No.:.....

National Institute of Technology, Hamirpur (HP)

Name of Examination: B.Tech. MID Semester **Session**: March 2016

Branch : Electronics & Communication Engg. **Semester** : 6th

Course Name: Analog & Digital VLSI Design **Course Code** : ECD-324

Time: 1.5 Hours **Maximum Marks: 20**

Note: ***All questions are compulsory and carry equal marks.***

1. Draw schematics of different feasible MOS inverter circuit configurations. Specify design pros and cons in each case. Hence justify of these which circuits are preferred in VLSI design and why?

2. Given the threshold voltage of NMOS and PMOS is 1V and -1V, $K_n'=30\mu A/V^2$, $K_p'=10\mu A/V^2$respectively, load capacitance is 1pF and supply voltage is 5V for 0.5μm technology node.
   (i) What is the delay of the inverter circuit for minimum transistor dimensions?
   (ii) Redesign the circuit so that delay is less than 20ns.

3. Draw a CMOS inverter driving a capacitive load. Showing both the equivalent circuits, determine its total input and output load capacitances. Assume interconnect capacitance to be C_{int} and fan-out capacitance as C_g.

4. (i) Derive the propagation delay τ_{pLH} for a CMOS inverter circuit.
   (ii) Mention the main factors affecting CMOS Power and Delay
   (iii) Suggest strategies for optimal design of VLSI circuits.
   (iv) Hence design a 2-input CMOS NOR gate with zero short-circuit power.

Data: V_T=26mV, $\varepsilon_o = 8.854\times10^{-12} F/m, \varepsilon_{ox} = 4, \varepsilon_{Si} = 12, n_i = 1.5\times10^{16} m^{-3}, k = 1.38\times10^{-23} J/K$

Electronics and Comm Engg Deptt, NIT Hamirpur, HP
ECD 321 – Microcontroller & Embedded System

Max Marks = 20 Test I - Feb 2016 Time: 90mins

Answer all the following

1. Discuss any 4 pros and cons of a majorly hardware based embedded system and a majorly software based embedded system. (2)

2. Contrast Harvard and von Neumann architectures with suitable diagrams. Discuss the advantages and disadvantages of each. (2)

3. Explain "Fault tolerance" in regards to an embedded system. Give an example. (2)

4. Assume Task-1 is at ORG 0050H and Task-2 at ORG 00A0H. Write program sections to prepare the context for Task-1 and to switch context for Task-2 and then switch context back to Task-1 in a round robin fashion. Both the tasks use different R0, R1 and SP. (4)

5. Explain relative addressing mode and indexed addressing modes. Give an example each and show how the absolute address is computed. (2)

6. Write a program to swap Accumulator nibbles every 210 machine cycles and output at P2; also read P0 and write to P1 at every external interrupt. Show calculations. (4)

7. Write the final value in accumulator after each piece of code executes. Assume that each code is executed after reset. Show how you arrive at the value. (4)

A)	B)	C)	D)

mov a, #55h
mov R7, #8
LP1: rrc a
xch a, 0f0h
rlc a
xch a, 0f0h
djnz R7, LP1
xch a, 0F0h
	clr c
	mov a, 81h
	orl c, ACC.0
	mov a, #0
	rlc a
		mov 15h, #0EEh
		orl psw,#08h
		mov a,R6
			mov R4, #0ABh
			mov R1, #4
			mov a, @R1

Roll no:.....

National Institute of Technology, Hamirpur (HP)

Mid Semester Exam – B.Tech (ECE)

Branch: ECE | **Semester: 6th**
Course Name: Wireless Communication | **Code: ECD-322**
Time: 1.5 Hours | **Marks: 20**

Note: *1. Assume data as required.*
2. Attempt all the parts of the question at one place.

Q1	How call is made from Mobile to Wireline (PSTN)?	(4)
Q2	How cell splitting and Cell sectoring improves the coverage and capacity in cellular system? Compare these two in terms of Trunking efficiency and Signal to interference ration (S/I).	(4)
Q3	Derive a relationship between Received power (P_r) and distance (d) between transmitter and receiver in Ground Reflection (Two Ray) Model and Show that the received power falls off with distance at the rate of 40dB/decade.	(4)
Q4	a) Find the median path loss for d=50K.m, h_{te} =100m, h_{re} = 10m in a small city. If Base station radiates EIRP of 1K.W at carrier frequency of 900MHz. Find the power at receiver P_r(dBm) (Assume unity gain receiving antenna). b) If P_t = 10W, G_t = 0dB, G_r = 0dB and f_c =900MHz.Find P_r in watts at a free space distance of 1km.	(4) (2)
Q5	Explain the following terms: (i) Dwell Time (ii) Cell Dragging	(2)

Roll No.:.....

National Institute of Technology, Hamirpur (HP)

Name of Examination: B.Tech. END Semester **Session:** May 2016

Branch : Electronics & Communication Engg. **Semester** : 6th

Course Name: Analog & Digital VLSI Design **Course Code** : ECD-324

Time: 3 Hours **Maximum Marks: 60**

Note: ***All questions are compulsory and carry equal marks.***

1. For a CMOS inverter, pictorially identify the regions for which NMOS, PMOS or both transistors operate in saturation for an input varying from V_{tp} to $V_{DD}+V_{tn}$. In tabular form enlist the non-ideal effects encountered in static and dynamic logics? Give a design method by which the problem of erroneous results in cascaded PE dynamic logic is overcome? (5+5)

2. What are Euler's and Elmore's design rules and where are these used? Justify with suitable examples. (5+5)

3. Design a NOR based 4x4 ROM Memory. Compare and contrast MOS DRAMs. Hence explain the working of a 3Transistor DRAM for read and write operations. (5+5)

4. Draw the circuit diagrams for static and dynamic CMOS logic for the function F, where $F = \overline{(pq+r).(s+t)}$. Hence design an equivalent static CMOS inverter if all MOS transistors have five times the minimum and same dimensions. Assume PMOS dimensions are three times those of NMOS for 90nm technology node. Hence draw a permissible suitable stick diagram for function F. (5+5)

5. i) Design a BiCMOS inverter circuit. ii) Design a NAND gate using complementary pass transistor logic and iii) an XOR gate using CMOS transmission gates. (4+3+3)

6. Analyze a single stage common source MOS amplifier design with drain resistance R_D and source resistance R_S. Draw equivalent circuit. Explain the importance of g_m, g_{mb}, and r_o. Give the advantages of a differential amplifier over a single stage amplifier? (4+3+3)

Data: V_T=26mV, $\varepsilon_o = 8.854\times10^{-12}\,F/m, \varepsilon_{ox} = 4, \varepsilon_{Si} = 12, n_i = 1.5\times10^{16}\,m^{-3}, k = 1.38\times10^{-23}\,J/K$

Electronics and Comm Engg Deptt, NIT Hamirpur, HP
ECD - 321 Microcontroller & Embedded Systems

6 X 10 = 60 (Max)

1. Draw the possible scheduling using Earliest-Deadline First algorithm for the following process. Give the CPU utilization factor. Discuss the pros and cons for the same.

Process	Execution Time	Period
P1	2	6
P2	1	4
P3	1	3

2. Write an assembly program using look-up table to find the square root of a number at port0. If the square root is not an integer, then find the square of the number. Give the output at port1.

3. Show the interface diagram for 8051 with 16KB of program space, 16KB of data ROM starting at 0000, and 16K of RAM starting at 8000H. Use absolute address decoding. Show the address range for each.

4. Interface 8051 with a PC using UART. When the character 'A' is received by 8051, send the message "I know what to do" back to PC. When the character 'B' is received by 8051, send the message "I do not know what to do" back to PC. Use 9600 baud rate. Show calculations.

5. Connect an 8-step (Half-stepping) stepper motor interface with 8051. Configure two external edge triggered interrupts. Whenever interrupt-1 arrives, turn the stepper motor by one step in the clock-wise direction. Whenever interrupt-2 arrives, turn the stepper motor by one step in the anti-clock-wise direction.

6. Write short notes on any one of the ARM Cortex processor architecture. Give any 6 differences between 8051 and Cortex processors.

7. Show a diagram with two masters and two slaves. How does synchronization and arbitration take place among them? Show the communication frame format for read data with 7-bit address and write data with 10-bit address after a restart signal. (I^2C)

8. Write short notes on "Data frame" in CAN based communication.

9. Discuss in detail the characteristics of a real-time embedded system. Describe the merits and demerits of designing using various hardware platforms.

10. What are the characteristics of a task? Why is an RTOS required? Draw the FSM a task goes through and discuss with an example.

Id No.:

National Institute of Technology, Hamirpur (HP)

Mid Term Examination/ March 2016

Communication Skills (ECH-123)

B. Tech., 1st Year, 2nd Semester

Max. Marks: 20 **Time Allotted: 1:30 hrs.**

Note: Be specific in answering questions. Attempt all.

PART-1 (Objective Type) **(1*5=5)**

Q.1. 1. Define jargons.

2. Explain consideration as convention of communication.

3. State the objectives of reflective and probing questions during the interview.

4. Differentiate between verbal and non verbal medium.

5. Explicate transmission as an ingredient of communication process.

PART –II (Short Answer Type) **(4*2.5=10)**

Q.2. What are the dos and don'ts of group discussion?

Q.3. Give a brief account of linguistic barriers.

Q.4. Discuss the problems of second language.

Q. 5.Write a note on oral communication.

PART –III (Comprehensive Type) **(1*5=5)**

Q.6. Draft a cover letter for the position of Chief Engineer in an MNC by inventing all the necessary details.

Roll. No. . . 15408

National Institute of Technology Hamirpur (HP)
Name of Examination: B.Tech End-Semester Examination May-2016

Branch : Electronics & Communication Engineering.
Course Name : Electromagnetic Field Theory
Semester : 2nd
Course Code : ECD-125

Time : 3 Hours Full Marks : 60

Note: 1.The question paper comprises of 4 questions.
2. Each question consists of 3 parts (A,B,C).
3. All questions are compulsory.
4. The question paper consists of 3 pages and a smith chart
5. Symbols are having usual meanings.
6. Assume necessary data if necessary.

1 A Consider a 50 cm length of coaxial cable having an inner radius of 1mm and an outer radius of 4 mm. The spacing between conductors is assumed to be filled with air. The total charge on the inner conductor is 30 nC. Find the surface charge density on each conductor along with E and D field in each conductor. (7 marks)

B. Three point charges -1 nC,4 nC,and 3 nC are located at (0,0,0) ,(0,0,1)and (1,0,0) respectively. Find the energy in the system. (5 marks)

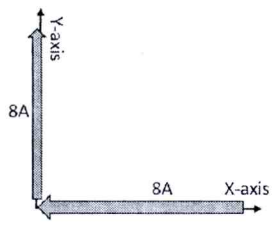
C. A point charge 5nC is located (-3,4,0) while line formed by the intersection of plane y=1,z=1 carries a uniform charge 2 nC/m. If V=100 V at (1,2,1). Find the potential V at (-2,5,3). (3 marks)

2 A. State the Maxwell's equation for static and for a harmonic varying field in differential form along with its interpretation. (5 marks)

B. A sheet current K=6 a_x A/m lies in the z=0 plane and a current filament is located at the intersection of plane y=0 and z=4m. Determine I (current) and its direction if H = 0 at (0,0,1.5m) (5 marks)

C. (i) A radial field H= $\frac{2.39\,x10^6}{\rho}$ cos ϕ a_ρ A/m exist in free space . Find the magnetic flux φ crossing the surface defined by $\frac{-\pi}{4} \leq \emptyset \leq \frac{\pi}{4}$, $0 \leq z \leq 1\ m$. (2 marks)

(ii) Determine H at (0.4,0.3,0) in the field of an 8 A. A filamentary current directed inward from infinity to the origin on the positive x axis, and the outward to infinity along the y axis as shown in diagram. (3 marks)



3 A (i) If E= $(a_x + j\,a_y)e^{jkz-jwt}$ and H = $\left(\frac{k}{\omega\mu}\right)(a_y + j\,a_x)e^{jkz-jwt}$. Calculate the time averaged pointing vector P(x,y,z). (2 marks)

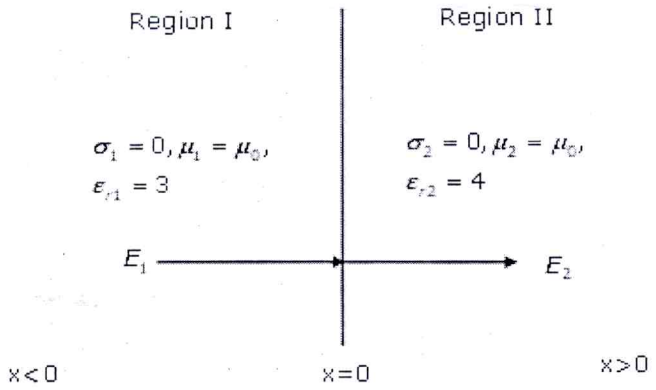
(ii) Medium 1 has the electrical permittivity $\varepsilon_1 = 1.5\,\varepsilon_0\ F/m$ and occupies the region to the left of x=0 plane . Medium 2 has the electrical permittivity $\varepsilon_2 = 2.5\,\varepsilon_0\ F/m$ and occupies the region to the right of x=0 plane .If E_1 in medium 1 is $E_1 = (2a_x - 3a_y + a_z)V/m$, find E_2 in medium 2. (3 marks)

B. (i) A material has conductivity of 10^{-2} mho/m and the relative permittivity of 4.Find the frequency at which the conduction current in the medium is equal to the displacement current. (2 marks)

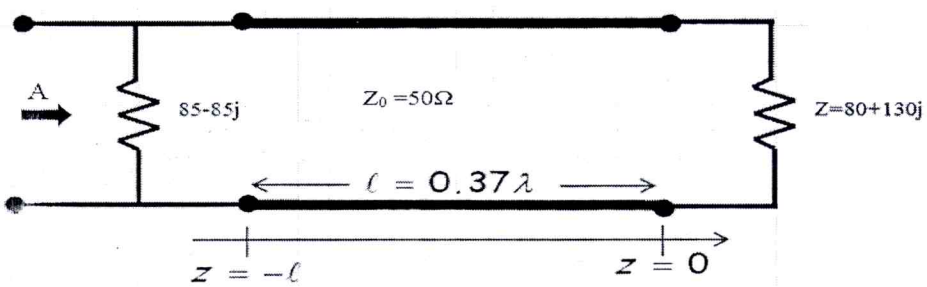
(ii) A plane wave having the electric field component E_1 =24 cos (3x 10^8t -βy)a_z V/m and travelling in free space is incident normally on a lossless medium with μ =μ_0 and ε =9 ε_0 which occupies the region y≥0. Find the reflected magnetic field component. (3 marks)

C. (i) The depth of penetration of electromagnetic wave in a medium having conductivity σ at a frequency of 1 MHz is 25 cm. Find the depth of penetration at a frequency of 4 MHz. (2 marks)

(ii) A medium is divided into region I and II about x=0 as show below. An electromagnetic wave with electric field $E_1 = 4a_x + 3\,a_y + 5\,a_z$ is incident normally on the interface from region I. Find the electric field in region II. (3 marks)



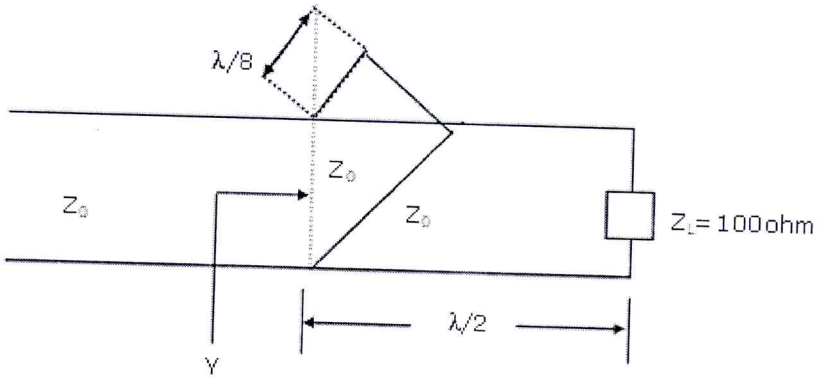
4 A Using smith chart attain the value of input impedance A in ohms. Then find the minimum distance from A towards the generator side that will give 50Ω. (5 marks)



B A 600 Ω transmission line is 150 m long ,operates at 400 KHz with α =2.4 x 10^{-3} Np/m and β = 0.0212 rad/m and supplies a load impedance Z_L= 300 + 300j Ω. Find the wavelength, Γ_L, , Γ_{in} and Z_{in} for a received voltage V(z=0) =50 V. Find the total voltage at input V(z=-150 m). (5 marks)

C (i) In air the lossless transmission line of length 50 cm with L=10 μH/m, C=40 pF/m is operated at 25 MHz. Find the electrical path length. (2 marks)

(ii)A short-circuited stub is shunt connected to a transmission line as in figure below. If Z_0 =50 Ω. Find the admittance Y seen at the junction of the stub and the transmission line. (3 marks)



National Institute of Technology, Hamirpur (H.P.)

Semester End Examination, B. Tech. Sem. II, May 2016

Chemistry for Electronics & Communication Engineering, ECS-122

Duration: 3 Hr. Total Marks: 60

Name: Garima Sood Roll No.: 15408

- *Attempt all of the given questions.*
- *Use of non-programmable scientific calculator is allowed.*
- *Write your name and roll no. on top of this question paper.*

Q1. a) Predict the high resolution proton NMR spectra of the following compounds: (4)

(*Take appropriate shielding/deshielding effects and splitting patterns into account*)

i) $ClCH_2–CHCl_2$ ii) $OHC–N(CH_3)_2$

b) With the help of Jablonski diagram, differentiate between the phenomenon of fluoroescence and phosphorescence. (3)

c) Arrange the chromophores present in CH_3OH, CH_3Br, $CH_2=CH_2$ and $CH\equiv CH$ in increasing order of their λ_{max} values. Provide reasoning for the order as well. (3)

Q2. a) Explain the process of Electric Arc Discharge technique for the synthesis of carbon nanotubes. (3)

b) Large scale production of graphene can be done by using colloidal solutions of graphite intercalation compounds. Elaborate this synthetic process. (3)

c) ^{14}C is radioactive whereas ^{12}C is not. Why ? (2)

Q3. a) With the help of a neat block diagram, explain the functioning and components of a heavy water nuclear reactor. (4)

b) Explain the working principle of a Polymer electrolyte fuel cell along-with the involved electrochemical reactions. What are the advantages of employing such fuel cells ? (3)

c) Write a short note on 'Injection Molding' technique for making plastics. (3)

Q4. a) The molar absorption coefficient of a solute at 540 nm is 286 $dm^3mol^{-1}cm^{-1}$. When light of that wavelength passes through a 6.5 mm cell containing a solution of the solute, 46.5 percent of the light is absorbed. What is the concentration of the solution ? (3)

b) What is the use of employing magnetic field in a mass spectrometer ? (2)

c) How is Differential Scanning Calorimetry (DSC) different from Differential Thermal Analysis (DTA) ? (3)

Q5. a) Taking an example, write the mechanism of coordination polymerization. How does it leads to polymers of desired stereochemistry ? (2)

b) How is tinning different from galvanization ? (2)

c) Quality of greases is predicted by the magnitude of their _____point. (1)

d) Plywood is an example of _____composite. (1)

Q6. a) Give an example of each of the following: (5)

(i) Cathodic Corrosion Inhibitor

(ii) Synthetic lubricant

(iii) P-doped conducting polymer

(iv) Hypsochromic shifts in UV-Vis Spectra

(v) A superconducting fullerene

b) Alloys are fairly prone to undergo intergranular corrosion. How does it occur ? (3)

c) What are different failure modes of Fibre-Reinforced composites ? Explain any one of such modes. (2)

Q7. a) Explain the principle of Extreme Pressure lubrication. (2)

b) What is 'Impressed Current Cathodic Protection method' of preventing corrosion ? (3)

c) The wavenumber of the fundamental vibration of CO molecule is 2140 cm^{-1}. Calculate the force constant of CO bond. (At. mass of C = 1.99×10^{-26} kg and O = 2.66×10^{-26} kg) (3)

National Institute of Technology, Hamirpur (HP)-177005

End-Term Examination, May 2016

ECS 121—Engineering Mathematics II

Dated: 02th May, 2016 **Roll No. .....**

Time: 3 Hours **Max Marks: 60**

Q. No. 1 (a) State and Prove Parseval's Identity.

(b) Find the Fourier series of the function $f(x) = |x|$. Using Fourier series of $|x|$, find without calculation Fourier series of

$$f(x) = \begin{cases} x + \pi/2, & -\pi \le x < 0 \\ -x + \pi/2, & 0 \le x \le \pi \end{cases} \qquad (3+4)$$

Q. No. 2 (a) Solve the initial value problem

$y'' + 4y' + 4y = 12t^2e^{-2t}$, $y(0) = 2, y'(0) = 1$, by using the method of Laplace transforms. **(4)**

(b) Evaluate (i) $\int_0^\infty t^3 e^{-t} \sin t \; dt$ (ii) $L\left\{e^{-3t}\int_0^t \frac{\sin^2 t}{t} dt\right\}$ (iii) $L^{-1}\left\{\frac{1}{(s-a)^4}\right\}$ **(3 + 3 + 2)**

Q. No. 3 (a) Write Laurent series of $f(z) = \frac{z^2-2z+3}{z-2}$ about the singularity point and discuss the nature of singularity point.

(b) State Cauchy's integral formula and use it to evaluate $\int_C \frac{1}{(z^3-z^4)} dz$, $C: |z| = \frac{1}{2}$.

(c) Show that the function $u = xy^3 - x^3y$ is harmonic. Find the harmonic conjugate and construct the analytic function. **(3 + 3 + 4)**

Q. No. 4 (a) Find the bilinear transformation which maps the points $z = \infty, i, 0$ into points $w = 0, i, \infty$ respectively.

(b) Find whether the function

$$f(z) = \begin{cases} \frac{x^2y^5(x+iy)}{x^4+y^{10}}, & z \neq 0 \\ 0, & z = 0 \end{cases}$$ is analytical at origin. **(3 + 4)**

Q. No. 5 (a) Under what circumstances will the equation $M(x,y)dx + N(x,y)dy = 0$ have an integrating factor that is a function of the $z = x + y$. **(4)**

P.T.O.

(b) Solve the following differential equation

(a) $x\dfrac{dy}{dx}+\cot y=0,\ \ if\ \ y=\dfrac{\pi}{4}\ \ when\ \ x=\sqrt{2}$

(b) $2xy\dfrac{dy}{dx}=3y^2+x^2$ **(3 + 2)**

Q. No. 6 Find the general solution of the following equations

a) $\dfrac{dy}{dx}+y\tan x=y^3\sec x$

b) $(y')^2-2xy'+y=0$

c) Using variation of parameters $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}+y=e^x\log x$

d) $x^3\dfrac{d^3y}{dx^3}+2x^2\dfrac{d^2y}{dx^2}+2y=10\left(x+\dfrac{1}{x}\right)$ **(3 + 4 + 4 + 4)**

1448T

National Institute of Technology, Hamirpur (HP)

End Sem Exam – B. Tech.

Branch: Electronics & Communication **Semester: 5th**
Course Name: Antenna &wave propagation **Code : ECD-313**
Time: 3 Hours **Marks: 60**

Note: *1. Attempt all questions*
2. Attempt all the parts of the question at one place
3. Assume suitable data if required

Q.1	a. Explain the importance and disadvantages of impedance matching in the antenna system	(4)
	b. Describe ideal dipole and short dipole antennas.	(4)
Q.2	a. The electric field intensity of wave radiated by an antenna is defined by $E = \sin\theta \sin\phi$, where θ is the angle measured from the z axis and ϕ is the angle measured from the x axis. E has value only for $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$ and zero elsewhere(the pattern is unidirectional with maximum in y direction). Find the exact and approximates directivities and decibel difference.	(5)
	b. An elliptically polarized wave travelling in positive z direction in a medium of relative permittivity 4.5. Find the average power per unit area covered by the waves. $E_x = 3\sin(\omega t - \beta z)$ and $E_y = 7\sin(\omega t - \beta z - 60^0)$	(3)
	c. Describe the difference between directivity and gain. Are they same in any case?	(2)
Q.3	a. Show the directivity for a broadside array of two identical isotropic in phase point sources separated at distance d is given by $D(\theta,\phi) = \frac{2}{1+\frac{\sin\beta d}{\beta d}}$	(6)
	b. Find the FNBW of 18 λ long antenna arrays in broad side as well as end fire arrays	(4)
Q.4	a. Explain the principle of operation of folded dipole antenna with its application and how it is different from conventional dipole antenna?	(6)
	b. Describe the small and large loop antenna design parameters with its working. Mention the disadvantages of the loop antenna.	(6)

Q.5	Find the distance at which electric field intensity is 5 square times the field intensity at field intensity at unit distance from a T_X antenna. Assume propagation is taking place over a ground path with $\sigma = 4.0$ mS/m and f=8.5 MHz and attenuation factor is about 0.2 . Also find the value of E_o and E_g.	(5)
Q.6	**a.** Explain the structure of ionosphere regions and ionospheric abnormalities	(8)
	b. Determine the frequency of wave propagating through an ionosphere layer with refractive index of 0.6 and electron density 3.25×10^5 electrons/cc. Also, determine the corresponding change in frequency, if the refractive index increases by 35%.	(4)
	c. Find the maximum range of communication between the antennas of heights 120 ft and 60 ft. what will be the optical horizon and radio horizon in this case?	(3)

Roll no.:.....

National Institute of Technology, Hamirpur (HP)

Mid Semester Exam– B. Tech.

Branch: Electronics & comm. **Semester: 5th**
Course Name: Antenna & wave Propagation **Code: ECD-313**
Time: 1.5 Hours **MM: 20**

Note: *1. Attempt all questions*
2. Attempt all the parts of the question at one place
3. Assume suitable data if required

Q.1	Discuss the electric and magnetic field distribution on antenna. How the radiation mechanism starts on dipole antenna? (4)
Q.2	The power radiated by a lossless antenna is 10 watts. The directional characteristics of the antenna are represented by the radiation intensity of $U = B_o \cos^3\theta$ *W*/unit solid angle $0 \le \theta \le \pi/2, \quad 0 \le \phi \le 2\pi$ Find the (a) Maximum power density (in watts per square meter) at a distance of 1000 m. Specify the angle where this occurs. (b) Directivity of the antenna (dimensionless and in dB) (c) Gain of the antenna (dimensionless and in dB) (4)
Q.3	Define the terms (i) Antenna aperture (ii) cross and co-polarization of antenna (iii) free space loss factor. (6)
Q.4	A resonant lossless (e_{cd}=1) half wavelength dipole antenna, having a directivity of 2.156 dB, has an input impedance of 73 ohms and is connected to a lossless, 50 ohms transmission line. A wave, having the same polarization as the antenna, is incident upon the antenna with a power density of 5 W/m^2 at a frequency of 10 MHz. Find the received power available at the end of the transmission line. (3)
Q.5	Explain the field regions of an antenna (3)

Roll no.:.....

National Institute of Technology, Hamirpur (HP)

Mid Semester Exam 2015 – B. Tech.

Branch: Electronics & Communication | **Semester : Fifth**
Course Name : Antenna & Wave Propagation | **Code : ECD-313**
Time: 1.5 Hours | **Marks: 20**

Note: *1. Attempt all questions*
2. Attempt all the parts of the question at one place

Q. 1 (a) How radiation are created and detached from a dipole antenna? (3)

(b) Derive the electric and magnetic field components for small circular loop of radius ***r*** carrying a uniform current $I_o \cos \omega t$ in the x-y plane. (4)

Q. 2 The E Field pattern of an antenna, independent of ϕ, varies as follows: (3)

$$E = \begin{cases} 1 & 0^0 \le \theta \le 45^0 \\ 0 & 45^0 < \theta \le 90^0 \\ \frac{1}{2} & 90^0 < \theta \le 180^0 \end{cases}$$

What is the directivity of this antenna?

Q.3 Prove that maximum power transfer theorem under conjugate matching for radiation, and dissipation of transmitting and receiving antennas. (3)

Q.4 A 30-dB, right circularly polarized antenna whose $\mathbf{E} = (a_x - ja_y)\, E_1\, e^{-jyz}$ in a radio link radiates 5 W of power at 2 GHz. The receiving antenna has an impedance mismatch at its terminals, which leads to a VSWR of 2. The receiving antenna is about 95% efficient and has a field pattern near the beam maximum given by $\mathbf{E_R} = (2a_x + ja_y)\, E_1\, e^{jyz}$ the distance between two antenna is 4,000 Km and the receiving antenna is required to deliver 10^{-14} W to the receiver. Determine the maximum effective aperture of the receiving antenna. (4)

Q.5 Draw the total E field amplitude pattern if the two isotropic point sources of same amplitude but opposite phase. (3)

Roll No.:.....

National Institute of Technology, Hamirpur (HP)

Name of Examination: B.Tech. E&CE, MID-SEM Examination Sep 2015

Branch : Electronics & Communication Engg. **Semester** : 5th

Course Name: Electronic Device Modelling **Course Code** : ECD-314

Time: 1.5 Hours **Maximum Marks: 20**

Note: ***All questions are compulsory and carry equal marks. Assume any missing data.***

1.	i)	Give the circuit diagram of a CMOS inverter. Thereafter, write a SPICE program to find its dc and transient responses. Given pulse input with final voltage of 1V, rise and fall time 2ns and pulse width of 20ns. The dc supply voltage is 1V. Consider minimum size transistors for 180nm technology.	**2**
	ii)	Give electrical equivalent circuit model of a pn junction diode. Give significance of each component.	**1**
	iii)	Derive the maximum depletion width in a zero body biased NMOS.	**2**
2.	(a)	Give recombination current model for a pn junction diode.	**3**
	(b)	Show typical variation of C_s and C_j with applied bias characteristics. If C_j is double the value of zero bias junction capacitance for a p^+n step diode, determine the applied bias in terms of built in potential.	**2**
3.		Sketch energy band diagrams to show onset of depletion, onset of inversion, weak inversion and strong inversion conditions for a MOSFET. Hence give condition for MOSFET threshold voltage on the basis of these figures.	**5**
4.		Consider p^+n junction diode at 300K. For the p^+ region $N_A=10^{19}$ cm^{-3}, $D_n=20$ cm^2s^{-1} and $\tau_n=1$ns. For the n-type base region $N_D=10^{16}cm^{-3}$, $\mu_p=0.058m^2/Vs$, and $\tau_p=1$ns. Given the base width of the bulk on n-side is 0.25µm. Determine the diffusion length of holes and electrons and the nature of diode?	**5**

$DATA: \varepsilon_o = 8.854\times10^{-12} F/m, \varepsilon_{ox} = 4, \varepsilon_{Si} = 12, n_i = 1.5\times10^{16} m^{-3}, k = 1.38\times10^{-23} J/K,$

$R = (np - n_i^2)/[\tau_n\{p + n_i \exp((-(E_t - E_i))/kT)\} + \tau_p\{n + n_i \exp((E_t - E_i)/kT)\}]$

Name: ..... Roll No.: .....

National Institute of Technology, Hamirpur (HP)

Name of Examination: B. Tech.

(December-2016)

Branch	:	ECE	Semester	:	5th
Course Name	:	Electronic Device Modeling	Course Code	:	ECD-314

Time: 3 Hours **Maximum Marks: 60**

Note: **1)** Attempt all the questions.
2) Assume suitable data if required

Q(1) : (a) Under what condition velocity will saturate in MOSFET. **(2)**

(b) What is the condition under which MOSFET behaves as short channel device? **(2)**

(c) What does it mean "the channel is pinched off"? **(2)**

(d) We generally use the enhancement type MOSFET, so what is the utility/application of depletion type MOSFET. **(2)**

(e) Why, in general is the mobility of carriers in the inversion layer not a constant with applied voltage? **(2)**

Q(2): Drive the equation for recombination rate R, and also explain how it is used in determining of forward & reverse current of a p-n junction structure. **(10)**

Q(3): A) Draw the energy band diagram of a MOS structure in accumulation, depletion and inversion mode of operation. **(8)**

B) Why is the intrinsic carrier concentration in a semiconductor a constant and not an increasing function of time, inspite of EHPs being continuously generated at room temperature? **(2)**

Q(4): Derive the model equation for Schechman-Hodge MOSFET model (Level-0 model) and us e the same to solve the following problem:

"An N-channel MOSFET is operated with its source and body terminals grounded, and 1V applied to the gate terminal. Determine the drain current for applied drain potential=0.2V and 5V. Also, determine the bias to be applied to the body terminal which would make the drain current = 0. V_{TNO}= 0.7 V, K_N'= 40 $\mu A/V^2$, Υ = 0.4 $V^{0.5}$, $2\varphi_F$ = 0.6 V, W=10 μm, L=1μm". **(10)**

(5) : Explain the Sub-threshold Slope for a MOSFET and determine formula for the same. Also derive the equation for minimum sub-threshold slope. **(10)**

(6) : What is base width modulation and high level injection in the light of pnp transistor. And hence derive the model equation that includes the base width modulation and high level injection. **(10)**

n+p+n

Student Roll No. ..... and Name.....

Department of Electronics and communication Engineering
National Institute of Technology,
Hamirpur (H.P.)-177005

ECD-314 Electronic Device Modeling

Max. Marks = 20 Max. Time = 1½ Hrs

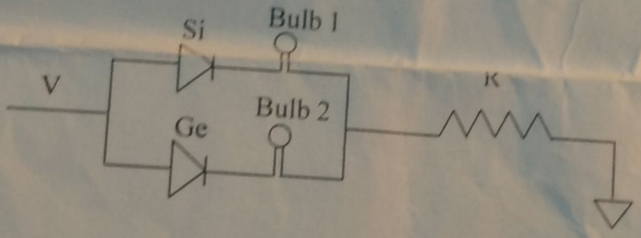
Note: -

1. **Attempt all questions**
2. **Assume suitable data if required**
3. **Use of calculator is allowed while the use of mobile phone is prohibited.**

Q (1): Answer the following precisely

a) Why built-in potential can not be measured? (1)

b) If voltage is increased from 0 to 5 V. Which bulb would glow? Justify. (1)



Q (2): An intrinsic silicon sample is doped with donors from one side such that $N_D = N_0 \exp(-ax)$. Find an expression for the built-in field E(x) at equilibrium over the range for which $N_D >> n_i$ (3)

Q (3): Determine the n-type doping concentration to meet the following specifications for a Si p-n junction: $N_A = 5.0 \times 10^{17} cm^{-3}$, $E_{max} = 8 \times 10^5$ V /cm, Reverse bias voltage $V_R = 28V$, and T = 300K.. (5)

Q (4): The doping distribution in a sample is given by $(N_D - N_A) = Gxn$ (for $-d \le x \le d$) and o (otherwise. Assume that the electric field vanishes at $x = \pm d$. Derive the expression for the electric field for $-d \le x \le d$ and sketch it. What is the expression for the maximum electric field in term of G and d? Determine the expression for built in potential across the junction in term of G and d and sketch it. Also find the expression for junction capacitance (10)

Solid state Device

Karmalkar

Good Luck

Roll No.: .....

National Institute of Technology, Hamirpur (HP)
B.Tech., Regular, End Semester Examination, Dec 2016

Branch: E&CE
Subject: Digital Communication And Systems
Time: 3 Hours

Semester: 5th
Subject Code: ECD-312
Maximum Marks: 60

Note: *1. Attempt all questions*
2. Presume data if required
3. Each question carries equal marks.
3. Sub-marks allotted to every sub-question are given along with the question.

1. (a) Define companding. Explain natural sampling & flat top sampling with suitable diagrams **(6)**

(b) What is delta modulation? What is its importance? Also explain limitations of it & how we can avoid those limitations. **(6)**

2. (a) In a digital communication system, the bit rate for a NRZ data stream is 1 Mbps (megabits per second) & carrier of transmission is 100 MHz. Find symbol rate for transmission & bandwidth requirements in **(4)**

i) BPSK System
ii) QPSK System
iii) 16-ary PSK System

(b) What do you mean by QPSK? Discuss QPSK transmitter & receiver with neat & clean diagram. **(8)**

3. (a) Discuss working of Integrate & Dump filter. Also derive mathematical expression for Signal to Noise ratio for it. **(6)**

(b) Define Matched Filter. Find out Probability of Error for BFSK technique with the help of Matched Filter **(6)**

4.(a) A DMS X has five symbols X_1, X_2, X_3, X_4 & X_5 with respective probabilities P_1=0.4, P_2=0.19, P_3=0.16, P_4=0.15 & P_5=0.10 Construct a Shanon-Fanno Code & Huffman Code. Compare the efficiency of the code with both the techniques **(6)**

(b) For a (6,3) Systematic Linear Block Code, the three parity check bits C_4, C_5 & C_6 are formed from the following equations:-

$C_4 = d_1 \oplus d_3$

$C_5 = d_1 \oplus d_2 \oplus d_3$

$C_6 = d_1 \oplus d_2$

Here d_1, d_2 & d_3 are the data bits. **(6)**

i) Write down the generator matrix G.

ii) Construct all possible code words.

iii) Suppose that received code word is 010110. Decode this received word by finding the location of the error with the help of syndrome vector.

5. (a) Differentiate quantization noise & thermal noise. Find out output Signal to Noise ratio for PCM by considering the effect of quantization noise & Thermal noise. **(8)**

(b) For same bit rate & fixed bandwidth the PCM technique is better than DM technique. Justify the statement. If true, prove it otherwise give your reasons. **(4)**

Roll No.: .....

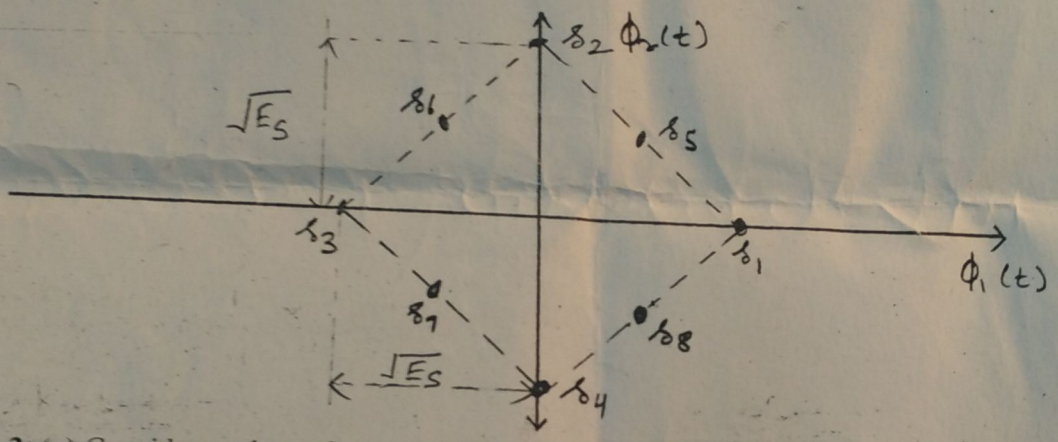
National Institute of Technology, Hamirpur (HP)
B.Tech. Mid-Semester Exam (20-September-2016)

Branch: E&CE
Subject: DCS
Time: 1.5 Hours

Semester: 5th
Subject Code: EC3312
Maximum Marks: 20

Note: *1. Attempt all questions*
2. Presume data if required
3. Each question carries 5 marks.
3. Sub-marks allotted to every sub-question are given along with the question.

1. (a) Differentiate discrete signals & digital signals with suitable example. **(1)**
(b) Explain bit rate & baud rate with suitable example. **(1)**
(c) Given an 8 level PSK signal having 2 different amplitudes as shown in figure. Calculate the distance between nearest neighbors in terms of signal energy. Compare it with standard 8 level PSK & determine which technique would give smallest probability of error?**(3)**



2. (a) Consider a telegraph source having 2 symbols dot & dash. The dot duration is 0.2 seconds. The dash duration is 3 times the dot duration. The probability of dot`s occurring is twice as that of probability of dash and time between symbols is 0.2 seconds. Find the average information rate.**(2.5)**
(b) Construct a Shannon-Fano code for a DMS source having six symbols $\{x_1, x_2, x_3, x_4, x_5, x_6\}$ having probabilities{0.30, 0.25, 0.20, 0.12, 0.08, 0.05}. Find efficiency & redundancy of the code.**(2.5)**
3.(a) Explain concept of quantization in digital communication systems.**(2)**

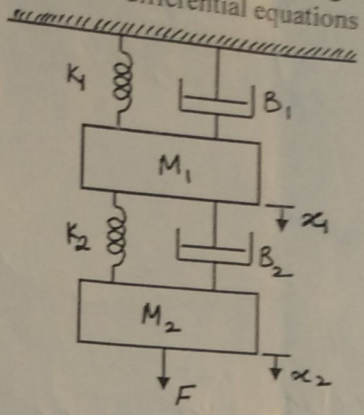
(b) Explain working of PCM generator with neat & clean diagram**(3)**

4.(a) Differentiate delta modulation & adaptive delta modulation**(2).**
(b) Explain working of BFSK transmitter with neat & clean diagram.**(3)**

Department of Electrical Engineering
National Institute of Technology, Hamirpur

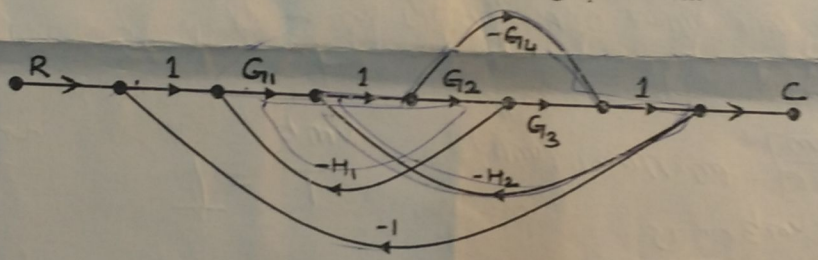
Periodical Examination **Control System (ECD-315)**
MM: 20 **Time: 1hr: 30mins**

1. For the mechanical system shown, draw an analogous electric circuit in which force is analogous to current. Find the differential equations representing the system. (4)

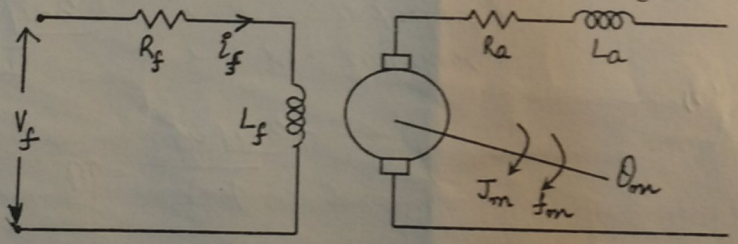


2. A closed loop control system is represented as $\frac{d^2c}{dt^2} + 4\frac{dc}{dt} = 16e$, where $e = r - c$ is the error signal. Determine the undamped natural frequency, damping ratio, percentage maximum overshoot for a unit step input. (4)

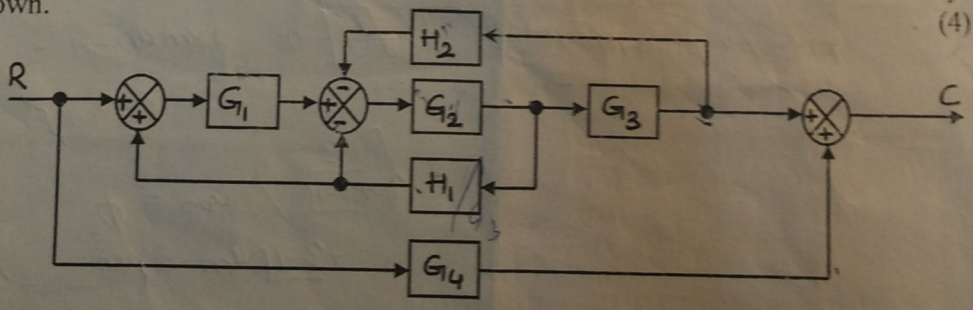
3. Obtain the transfer function C/R from the signal flow graph shown. (4)



4. Find the transfer function of the separately excited field controlled DC motor as shown. Draw the block diagram. The symbols have their usual meaning. (4)



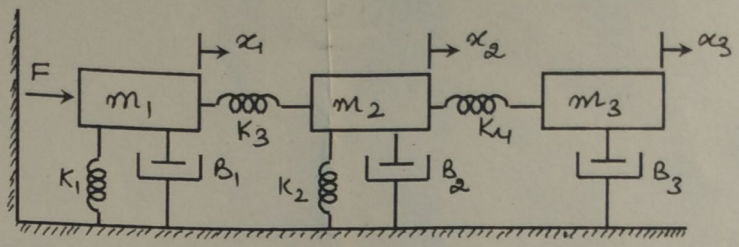
5. Using block diagram reduction technique find closed loop transfer function of the system shown. (4)



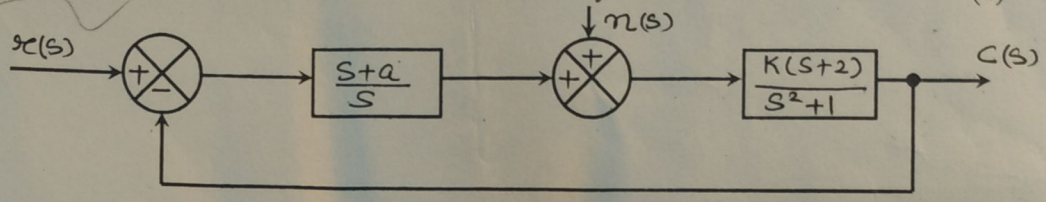
Department of Electrical Engineering
National Institute of Technology, Hamirpur

Periodical Examination — **Control System (ECD-315)**
MM: 20 — **Time: 1hr: 30mins**

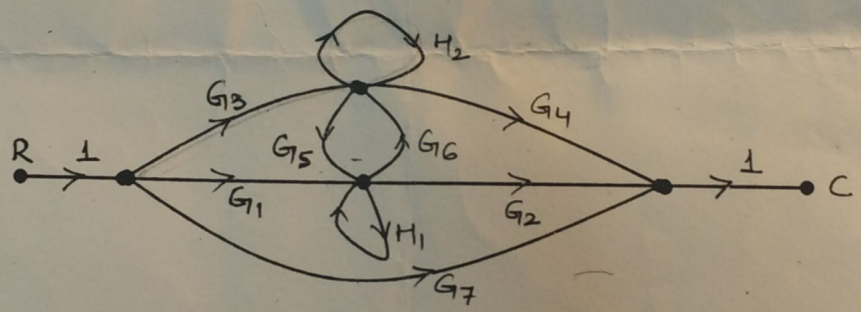
1. For the mechanical system shown, draw an analogous electric circuit in which force is analogous to current. Find the differential equations representing the system. (4)



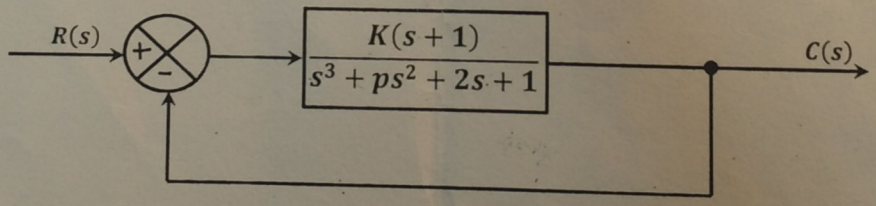
2. For the system shown, find steady state output when $r(t) = 0$ & $n(t) =$ *unit step*.find the relation between k & a for the system to be stable. (4)



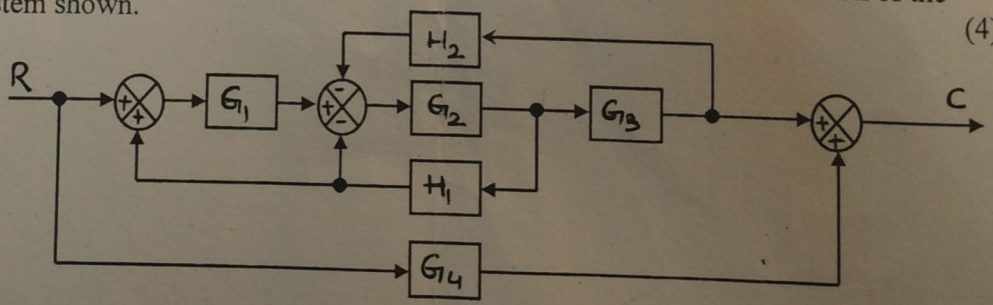
3. Obtain the transfer function C/R from the signal flow graph shown. (4)



4. The system shown in the block diagram oscillates with a frequency of 2 rad/sec. find the value of K_{max} and p. (4)



5. Using block diagram reduction technique find closed loop transfer function of the system shown. (4)



Roll no - 14404

Electronics and Comm Engg Deptt, NIT Hamirpur, HP
ECD - 311 Microprocessor Theory & Applications

Time: 3hours

6 X 10 = 60 (Max)

Instructions:
1. Give importance to specifics and details.
2. Assume any info required to solve the problem.
3. Marks for each sub-section are given within ().
4. Attempt every section of each question and do not split them across pages.

1. Draw the timing diagram of PUSH H instruction present at the program memory address 1234H. [10]

2. (a) Write an 8085 program to setup 8155 and generate a square wave of 1KHz for about 100ms and then terminate the wave. Assume that timer clock frequency is 100KHz. (6)

(b) Draw the 8155 architecture diagram and explain the timer modes. (4) [10]

3. (a) Draw the internal block diagram of 8259 and explain the purpose of each block. (6)

(b) Write an 8085 program to setup 8259 in single, level triggered interrupt, automatic end of interrupt mode with call address interval of 8-bytes. (4) [10]

4. Explain DMA controller's interface with 8085 (2), registers (2), modes (2) with suitable diagrams. Write a program to setup DMA controller to copy data from single memory address F000H to fill 16 bytes of another memory with starting address 0050H. (4) [10]

5. Whenever a RST 6.5 interrupt arrives, read a packed BCD from port 88H, unpack it and cumulatively perform 16-bit addition (4). Whenever a RST 5.5 interrupt arrives send the lower byte of the current cumulative sum to port 89H (1). Whenever a RST 7.5 arrives generate a packed BCD value from the current cumulative sum and send it to output port 8AH. Ignore error in conversion if any (3). Setup 8085 to perform the above tasks forever (2). [10]

6. (a) Draw a simple architecture diagram of 8086. (2)

(b) Explain the format of MOV instruction in 8086 processor with the relevant tables. (4)

(c) Show how the following instructions execute. (4)

MOV CL, [BX]

MOV [43H+SI], DH

MOV CX, [437AH]

MOV CS:[BX], DL

[10]

30 9/

Electronics and Comm Engg Deptt, NIT Hamirpur, HP

EC– 311 Microprocessor theory and applications

Max Marks = 20 **Test I – Sept 2015** **Max Time: 90 mins**

Answer all the following

1. Draw the timing diagram for PUSH B instruction. (7marks)

2. Interface two memory chips and one input device with 8085 using full address decoding logic. The details of the chips are given below. Draw one diagram interfacing all the 3 chips and write the address ranges for each.
a. Memory1 is a RAM of size 6K Bytes and its starting address is 6F00H.
b. Memory2 is a ROM of size 512 Bytes and its starting address is 0060H.
c. Input device is a set of 8 switches whose address is FFH.

(6marks)

3. a. List the addressing modes of 8085. Describe each addressing mode in two sentences. Give two examples for each.
b. Write an assembly program to add two bytes of data using each of the addressing modes. (5marks)

4. Write in two sentences the purpose/function performed by the following program. (2marks)

```
      LXI D,C300H
      LXI H,C200H
      LXI B,C400H
      STC
      CMC
REP:  LDAX D
      SBB M
      STAX B
      INX H
      INX D
      LDA C100H
      DCR A
      STA C100H
      JNZ REP
      HLT
```

Electronics and Comm Engg Deptt, NIT Hamirpur, HP
ECD - 311 Microprocessor Theory & its Applications

Attempt all the questions. Give importance to specifics and details. ☺

1. Write an assembly program for 8085 to rearrange the contents of the internal 16-bit registers in the following manner.

`Acc_Flags -> BC; BC -> DE; DE -> HL; HL -> Acc_Flags`

The program should only use PUSH/POP instructions to complete this. Initialize stack pointer ahead of rearranging.

In words, the contents of Accumulator and Flags are put in BC register pair, the contents of BC register pair is put in DE, the contents of DE in HL and the contents of HL in Accumulator and Flags. [2]

2. Write an assembly program for 8085 to check if the given 8-bits in accumulator is a palindrome or not. If it is a palindrome, write FFH in B-register else write 00H in B-register. Your method should at least use four right-shifts and four left-shifts. [5]

3. Draw a detailed Memory and I/O interface diagram with 8085 for the following conditions:

a. Data RAM starts from 1000H and is of 4K bytes

b. Program ROM starts from 4000H and is of 2K bytes

c. A seven segment display with an address 40H

Give the memory range for each of the memories.

Note: Connect the ICs with one decoder in a single diagram. Use only full address decoding logic. Clarity, neatness, labels also carry marks. [8]

4. Write the contents of the internal register used and the status of each of the flags after the following instruction sequence is executed. Show your result and reason in steps. [2]

```
LXI H,2070H
MVI M,64H
MVI A,8FH
CMP M
```

5. Read through the program and answer the following questions.

a. Identify and write the function performed by the program in one sentence.

b. What determines the number of additions performed?

c. When will the final result be wrong? [3]

```
      MVI B,00H
      MVI C,06H
      LXI H,FF60H
ABC:  MOV A,M
      RAL
      JC DEF
      RAR
      ADD B
      MOV B,A
DEF:  INX H
      DCR C
      JNZ ABC
      STA FF70H
      HLT
```

Department of Mathematics
National Institute of Technology Hamirpur HP 177005 INDIA

End-Semester Examination – December, 2016
Electronics and Communication Engineering
ECS-211: Engineering Mathematics III

Note: Attempt all questions. Each question in section B carries 4 marks

Time: 3 hours **Marks 60**

Section A

1. a) Find series solution of $(1-x^2)y'' - 2xy' + 2y = 0$. 6

b) Prove that $\exp\left(\frac{x}{2}\left(z - \frac{1}{z}\right)\right)$ is generating function of Bessel functions. Hence find series for $\cos(x\sin\theta)$, $\sin(x\sin\theta)$ in terms of Bessel functions. 6

2. a) Solve $p + 3q = 5z + \tan(y - 3x)$ 3

b) Solve $p^2 + q^2 = z^2(x + y)$ 4

c) A tightly stretched string with fixed end points $x = 0$ and $x = L$ is initially in a position given by $y = y_0 \sin^3 \frac{\pi x}{L}$. If from this position, it is released from rest, find the expression for displacement at any point and at any time. 5

3. a) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & if \ |x| < 1 \\ 0 & if \ |x| > 1 \end{cases}$.

Using this evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^2} \cos\left(\frac{x}{2}\right) dx$

b) Using Fourier transform technique, find the expression of $u(x,t)$, given that $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$ for $x \geq 0, t \geq 0$ under the conditions that $u = u_0$ at $x = 0, t > 0$ with initial condition $u(x,0) = 0$, $x \geq 0$.

Section B

4. What do you understand by pairwise independent events. Let A and B be two events associated with an experiment. Suppose that P(A) = 0.4, P(AUB) = 0.7 and P(B) = p, for what values of p, are A and B? *(i)* Mutually Exclusive *(ii)* Independent.

PTO

5. A factory produces a certain type of outputs by three types of machine. The respective daily production figures are:

Machine I : 3,000 Units Machine II : 2,500 Units Machine III : 4,500 Units

Past experience shows that 1 percent of the output produced by Machine I is defective. The corresponding fraction of defectives for the other two machines are 1.2 percent and 2 percent respectively. An item is drawn at random from the day's production run and is found to be defective. What is the probability that it comes from the output of

(i) Machine I, *(ii)* Machine II, *(iii)* Machine III ?

6. A company uses many thousands of electric lamps annually burning continuously day and night. Assume that under such conditions the life of a lamp may be regarded as a variable normally distributed about a mean of 50 days with a standard deviation of (SD) of 19 days. On January 1, 2015 the company put 5000 new lamps into service. How many would you expect to need replacement by (a) February 1, (b) April 1? Given:

Z	2.5	2	-1	2.11
Area	0.9938	0.9772	0.1587	0.9826

7. Assume that the mean duration of a telephone conversation is three minutes, and that no more than a three minute wait for the phone may be tolerated.

iii) What is the largest amount of incoming traffic that can be supported?

iv) Determine the maximum call rate that can be supported.

8. A petrol pump station has 1 pump. The service times follow the exponential distribution with a mean of 4 minutes and cars arrive for service in a Poisson process at the rate of 10 cars per hour. Find the probability that a customer has to wait for service. What proportion of time the pumps remain idle?

9. In a public telephone booth having just one phone, the arrivals are considered to be Poisson with the average of 15 per hour. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes. Find: *(i)* Average number of customers waiting in the system and in the queue *(ii)* Probability that a person arriving at the booth will have to wait in the queue *(iii)* Expected waiting time of a customer in the system and in the queue *(iv)* percentage of time that the telephone booth will be idle

$\lambda = 15 \quad \frac{3}{60} = \frac{1}{20}$

$\frac{1}{\mu} \quad \mu = 20$

Roll No.: 18408

National Institute of Technology, Hamirpur (HP)

Name of Examination: B.Tech. End-Semester Examination (December–2016)

Branch: ECE **Semester:** 3rd

Subject: Analog Electronics **Subject Code:** ECD-212

Time: 3 Hours **Maximum Marks:** 60

Note: *Attempt all questions*

Q. 1	Derive an expression of current gain of two-stage RC coupled amplifier at low, mid and high frequencies. Give a labeled frequency response curve of amplifier clearly indicating cut-off frequencies and determine the bandwidth.	**(10)**
Q. 2	Discuss the effect of cascading of stages on the overall current gain and bandwidth. Four identical FET amplifiers, each having a mid-band voltage gain of 8 and BW of 500 kHz are cascaded. Find the mid-band voltage gain and the bandwidth of the cascaded amplifier.	**(10)**
Q. 3	Draw the CB connection at high frequencies. Why it results in higher gain-bandwidth product than does the connection with emitter common?	**(10)**
Q. 4(a)	The internal gain of a basic amplifier is 1000. A negative feedback of 40 dB is applied to it. Due to the change in supply voltage, if there occurs a 10% change in the internal gain, how much will be the percentage change in the overall gain of the feedback amplifier?	**(5)**
(b)	Explain how the negative feedback applied to an amplifier reduces the harmonic distortion.	**(5)**
Q. 5	Consider a single-ended transformer coupled Class A amplifier with a turn ratio of 1:2. Assume that an input ac signal results in the peak ac base current of 7 mA and the transistor has h_{fe} = 50. (a) Draw the dc and ac load lines. (b) Find the input dc power. (c) Compute the ac output power. (d) Find I_{max}, I_{min}, V_{max}, and V_{min}. (e) Compute the power dissipated by the transistor. (f) Calculate the efficiency of the amplifier. (g) What is the maximum theoretical efficiency of the circuit? Find the required peak base current to produce the maximum efficiency.	**(10)**
Q. 6 (a)	A tank circuit has a capacitor of 100 pF and an inductor of 150 μH. The series resistance is 15 Ω. Find the impedance, Q and bandwidth of the resonant circuit.	**(5)**
(b)	Draw the circuit diagram of Hartley oscillator using BJT. Explain its working.	**(5)**

National Institute of Technology, Hamirpur(HP)
Electronics & Communication Engg. Deptt
Name of Examination: Final (Dec-2016)

Branch : ECE — Semester: 3rd semester
Course Name : Digital Electronics & Logic Design — Course Code: ECD-213
Time: 3Hours — Maximum Marks: 60
Note: All questions are compulsory.

Q.No. 1 (a) The solution to the quadratic equation x^2-11x +22 is x =3 and x = 6. What is the base of the numbers?

(b) (i) Find the sixteen complement of AF3B.

(ii) Convert AF3B to binary.

(iii) Find the 2's complement of the result in (i).

(iv) Convert the answer in (iii) to hexadecimal and compare with the answer in (i).

(c) Perform subtraction on the following binary number using 2's compliments of the subtrahend. Where the result should be negative, 2's compliment it and affix a minus sign.

i) 11011- 11001 (ii)110100-10101

(d) Express the following in sum of min terms and product of max terms:

$F(a,b,c,d)= \bar{b}d + \bar{a}d + b\bar{d}$

Q.No. 2 (a) Simplify $F(a,b,c,d) = \sum m(1,3,5,7,15) + \sum d(4,6,12,13)$ by using Karnaugh-map and implement with minimum number of NAND gates.

(b) A majority circuit is a combinational circuit whose output is equal to 1 if the input variables have more 1's than 0's. The output is 0 otherwise. Design a 3-input majority circuit.

Q.No.3 (a) Design and explain magnitude comparator circuit which can compare two four bit binary numbers.

(b) Find the prime implicants and essential prime implicants using generalized consensus method: $F(a,b,c,d) = \sum m(0,1,2,3,5,7,11,15)$

Q.No.4 (a) Explain the truth table of j-k flip-flop. What is race around condition in j-k flip-flop and how it is eliminated?

(b)Draw and explain the logic circuit of Inverter, NAND and NOR gate using CMOS.

Q.No.5(a)Write short note on Multiplexer and Demultiplexer and hence realize the following function using one 8 : 1 multiplexer while connecting variable a ,b and c to the select lines: $F(a,b,c,d) = \sum m(0,1,3,5,6,7,9,10,11,13,15)$

(b) List the PLA programming table for the following two Boolean functions and implement in PLA:

$F_1(a,b,c,) = \sum m(1,2,4,6)$, $F_2(a,b,c,) = \sum m(0,1,6,7)$

Roll No.: 15408

NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR (HP)

Name of Examination: B.Tech., End Semester Examination (December 2016)

Branch: ECE **Semester:** 3rd

Subject: Communication Theory **Subject Code:** ECD-215

Time: 3 Hours **Maximum Marks:** 60

Note: (i) All questions are compulsory.

(ii) The symbols used have their usual meaning.

1. **(10)**

(a) Draw and explain (5)

I. Unit step signal

II. Signum signal

III. Rectangular pulse

(b) Sketch the following signal (5)

$$x(t) = e^{-a|t|} \text{ for } a>0$$

Also, determine whether the signal is a power signal or energy signal or neither.

2. **(10)**

(a) The CDF for a certain random variable is given as (5)

$$F_X(x) = \begin{cases} 0 & -\infty < x \leq 0 \\ kx^2 & 0 < x \leq 10 \\ 100\,k & 10 < x < \infty \end{cases}$$

(i) Find the value of k;

(ii) Find the value of $P(x \leq 5)$;

(iii) Find the value of $P(5 < x \leq 7)$;

(iv) Find the expression for PDF.

(b) Write the expression for joint PDF and conditional PDF. Write their various properties. (5)

3. **(10)**

A continuous time signal is given below:

$$x(t) = 8\cos 200\pi t$$

Determine

(i) Minimum sampling rate i.e., Nyquist rate required to avoid aliasing.

(ii) If sampling frequency f_s = 400 Hz. What is the discrete-time signal x(n) or $x(nT_s)$ obtained after sampling ?

(iii) If sampling frequency f_s = 400 Hz. What is the discrete-time signal x(n) or $x(nT_s)$ obtained after sampling ?

(iv) What is the frequency $0 < f \leq f_s/2$ of sinusoidal that yields samples identical to those obtained in part (iii)?

4. **(10)**

What do you mean by white noise? Draw its power density spectrum. Derive the expression for noise power using power density spectrum of a noisy resistor.

5. **(10)**

What do you mean by transfer function of a network? How the convolution is useful in obtaining the output signal from the knowledge of the input signal and impulse response of the network?

6. **(10)**

A zero-memory source emits the messages m_1 and m_2 with probabilities 0.8 and 0.2, respectively.

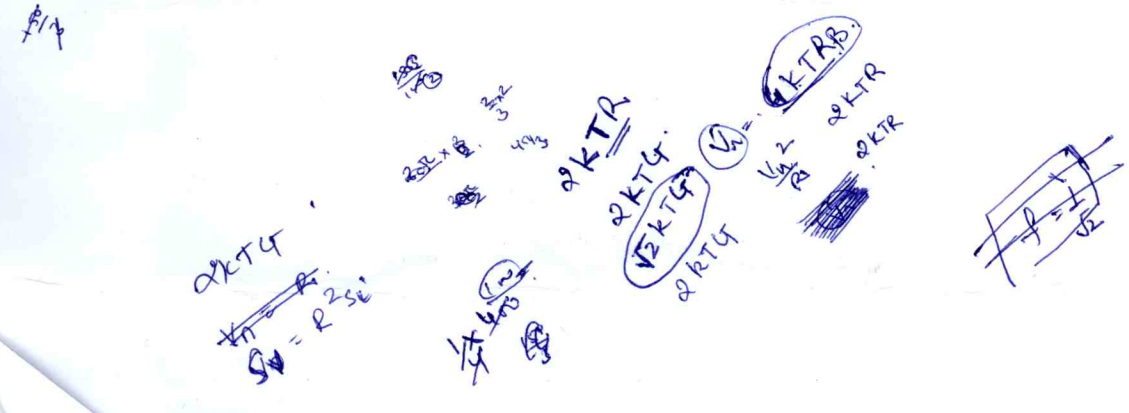
I. Find the optimum (Huffman) binary code for this source as well as for its second order extensions.

II. Find the optimum binary code for this source as well as for its third order extensions.

III. Determine the code efficiency in each case.

IV. Determine the redundancy in each case.

V. How it is decided that which order extension are used for the optimum coding in Huffman coding?



Roll No. 13408

NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR

(B.Tech.End Semester Examination, December 2016)

Course	**: ECE**	**Semester/Year**	**: 3rd/2nd**
Subject	**: Data Structure and Algorithm**	**Subject Code**	**: ECD-216**
Time	**: 3 Hrs.**	**Total Marks**	**: 60**

Instructions for candidates:

1. Mobile phones, Tablets, Programmable Calculators are not allowed in the examination hall.
2. Wherever necessary try to validate your answer with example.
3. Attempt all questions.

Q.1 a) Define linear and non linear data structure with example. What is the main advantage of data structure?
b) Write short note on:
i) Binary Search ii) Sparse matrix iii) Applications of Stack iv) Radix sort **[10]**

Q.2 Consider the following Queue of characters where QUEUE is a circular array which is allocated six memory cells: Front=1, Rear=3, QUEUE: _,A,C,D,_,_
a) Describe the QUEUE while the following operations take place.
i) F is added to the rear of queue ii) Two letters from the front are deleted. iii) K,L and M are added to the rear of the queue. iv) One letter from the front is deleted. v) R and S is added to the rear of the queue.

b) Write an algorithm to perform enqueue and dequeue operations in a circular queue. **[6]**

Q.3 Bubble sort algorithm is inefficient because it continues execution even after\ an array is sorted by performing unnecessary comparisons. Therefore, the number of comparisons in the best and worst cases are the same. Modify the algorithm in such a fashion that it will not make the next pass when the array is already sorted. **[4]**

Q.4 What is a linked list? Write an algorithm to perform the following operations:
a) Insert a node with value y in the sorted singly linked list.
b) Delete the starting node from a circular linked list. **[5]**

Q.5 Given a linked list L,Write a function to create a singly linked list that is reverse of the list L.For example if the list L is 1->2->3->4 then the new list should be 4->3->2->1. **[4]**

Q.6 The preorder traversal of a binary search tree T is 23,12,11,9,6,45,32,67,56.Find the inorder and postorder traversals of tree T and also write a non-recursive algorithm for postorder traversal. **[5]**

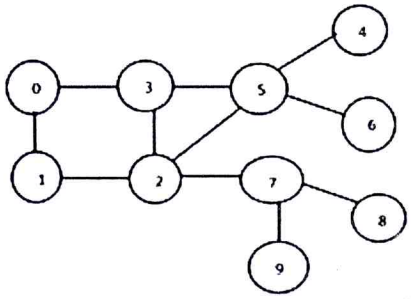
Q.7 Define AVL tree. Construct a AVL tree by inserting the following values sequentially.
21,26,30,9,4,14,28,18,15,10,20
a) Delete 4, 20 successively. **[5]**

Q.8 Construct a B tree of order 5 by inserting the following key values sequentially:
9,37,30,35,20,15,55,28,25,5,60,19,12,38,27,90,45,48 **[5]**
a) Delete 19, 30 successively.

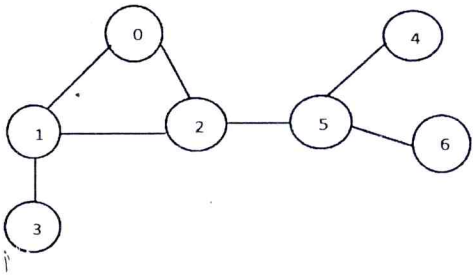
Q.9 Write an algorithm to sort the following list using merge sort 42, 31, 10,55,75,46,66,22,99. Drive the complexity of merge sort. **[4]**

Q.10 Find the articulation points in the following graphs and show the resultant graphs. **[2]**

a)

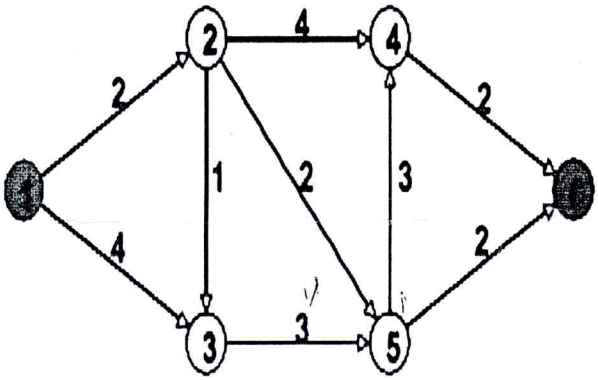


b)

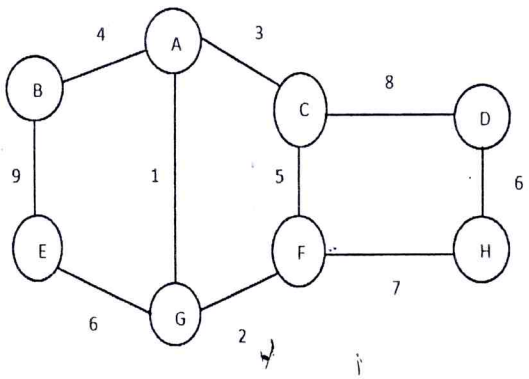


Q.11 Consider the graph given below and find:

a) the shortest paths from vertex 1 to all other vertices using Dijkstra's algorithm. Also find the shortest path from 1 to 6 with its cost.
b) the depth-first traversal of the graph. **[6]**



Q.12 Consider the graph given below and find the minimum spanning tree of the graph using Prim's algorithm with vertex A as starting point. **[4]**



Roll. No. 15416...

National Institute of Technology Hamirpur (HP)
Name of Examination:End-Semester B.Tech (2016-2017)

Branch : Electronics & Communication Engineering.
Course Name : Network Analysis and Synthesis
Semester : 3rd
Course Code : ECD-214
Time : 3 Hours Full Marks : 60

Note: 1.The question paper comprises of 10 questions.
2. The question paper consists of 2 pages.
3. Symbols are having usual meanings.
4. Assume necessary data if necessary.

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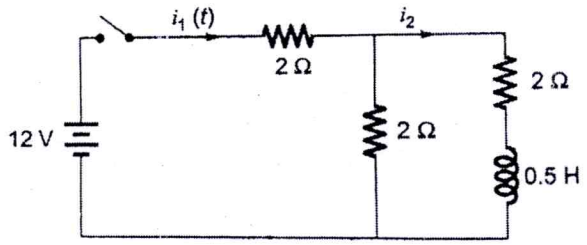
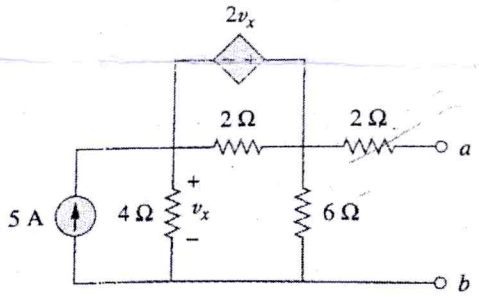
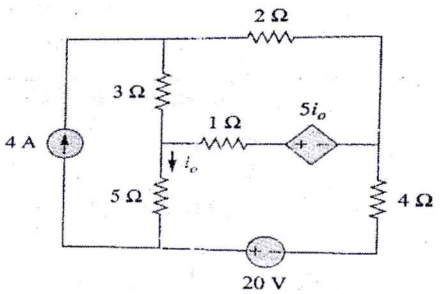
1. Using laplace transform, find the current I_1 (t) when the switch is closed at t=0 with zero initial current in inductor. (5 marks)



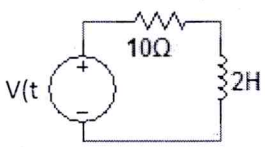
2. Find the thevenin equivalent across the circuit at terminal a-b. (5 marks)



3. Find I_0 using super position theorem (5 marks)

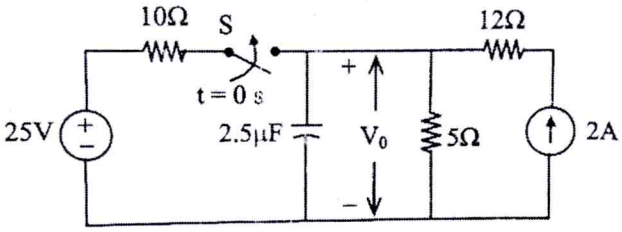


4. For the circuit shown in fig the v(t) =(20 cos (5t) +30 cos (10t))u(t),where u(t) is a unit- step function. Find the current inside the circuit. Assume the circuit is initially relaxed.



(5 marks)

5.



For the figure above

i. Find V_0 for $t \leq 0$ and as $t \to \infty$

ii. Write the expression for V_0 as a function of time for $0 \leq t \leq \infty$

iii. Evaluate V_0 at t= 25 μsec (8 marks)

6. For the system described by the state model

$$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} -2 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} [u]$$

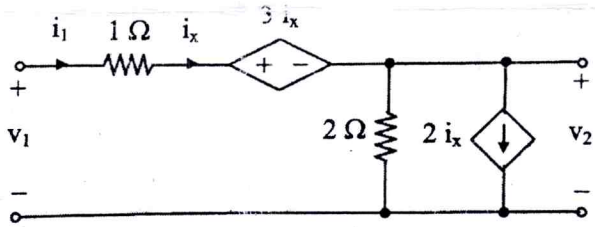
And output $$y = [1 \quad 0] \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}.$$

Find the transfer function $\frac{Y(s)}{U(s)}$ (5 marks)

7. For the two port network shown in figure below

i. Determine the h-parameters.

ii. Calculate the output voltage V_2 (output port), when the output port is terminated in a 3 Ω resistance and a 1 V (DC) is applied at the input port i.e. V_1 =1V. (7 marks)

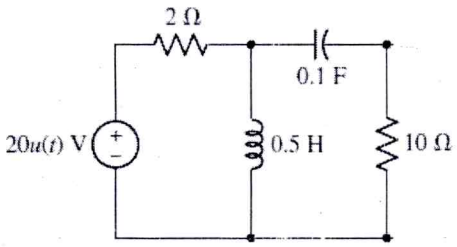


8. Check whether the function is $Z(s) = \frac{s^3+4s^2+7s+3}{s^3+3s^2+5s+6}$ is positive real or not. (5 marks)

9. Synthesize the impedance function Z(s) using Foster form I, Foster form II, Cauer form I and Cauer form II where

$$Z(s) = \frac{(s^2+3)(s^2+5)}{s(s^2+4)(s^2+6)}$$ (10 marks)

10. Find the current through the inductor i.e. $I_L(t)$ and voltage across the capacitor i.e. $V_C(t)$ using state variable method only. (5 marks)



Id No.:

National Institute of Technology, Hamirpur (HP)

Mid Term Examination/ March 2016

Communication Skills (ECH-123)

B. Tech., 1st Year, 2nd Semester

Max. Marks: 20 **Time Allotted: 1:30 hrs.**

Note: Be specific in answering questions. Attempt all.

PART-1 (Objective Type) **(1*5=5)**

Q.1. 1. Define jargons.

2. Explain consideration as convention of communication.

3. State the objectives of reflective and probing questions during the interview.

4. Differentiate between verbal and non verbal medium.

5. Explicate transmission as an ingredient of communication process.

PART –II (Short Answer Type) **(4*2.5=10)**

Q.2. What are the dos and don'ts of group discussion?

Q.3. Give a brief account of linguistic barriers.

Q.4. Discuss the problems of second language.

Q. 5.Write a note on oral communication.

PART –III (Comprehensive Type) **(1*5=5)**

Q.6. Draft a cover letter for the position of Chief Engineer in an MNC by inventing all the necessary details.

Roll. No. . . 15408

National Institute of Technology Hamirpur (HP)
Name of Examination: B.Tech End-Semester Examination May-2016

Branch : Electronics & Communication Engineering.
Course Name : Electromagnetic Field Theory
Semester : 2nd
Course Code : ECD-125

Time : 3 Hours Full Marks : 60

Note: 1.The question paper comprises of 4 questions.
2. Each question consists of 3 parts (A,B,C).
3. All questions are compulsory.
4. The question paper consists of 3 pages and a smith chart
5. Symbols are having usual meanings.
6. Assume necessary data if necessary.

1 A Consider a 50 cm length of coaxial cable having an inner radius of 1mm and an outer radius of 4 mm. The spacing between conductors is assumed to be filled with air. The total charge on the inner conductor is 30 nC. Find the surface charge density on each conductor along with E and D field in each conductor. (7 marks)

B. Three point charges -1 nC,4 nC,and 3 nC are located at (0,0,0) ,(0,0,1)and (1,0,0) respectively. Find the energy in the system. (5 marks)

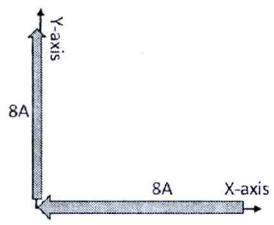
C. A point charge 5nC is located (-3,4,0) while line formed by the intersection of plane y=1,z=1 carries a uniform charge 2 nC/m. If V=100 V at (1,2,1). Find the potential V at (-2,5,3). (3 marks)

2 A. State the Maxwell's equation for static and for a harmonic varying field in differential form along with its interpretation. (5 marks)

B. A sheet current K=6 a_x A/m lies in the z=0 plane and a current filament is located at the intersection of plane y=0 and z=4m. Determine I (current) and its direction if H = 0 at (0,0,1.5m) (5 marks)

C. (i) A radial field H= $\frac{2.39\,x10^6}{\rho}$ cos ϕ a_ρ A/m exist in free space . Find the magnetic flux φ crossing the surface defined by $\frac{-\pi}{4} \leq \emptyset \leq \frac{\pi}{4}$, $0 \leq z \leq 1\ m$. (2 marks)

(ii) Determine H at (0.4,0.3,0) in the field of an 8 A. A filamentary current directed inward from infinity to the origin on the positive x axis, and the outward to infinity along the y axis as shown in diagram. (3 marks)



3 A (i) If E= $(a_x + j\,a_y)e^{jkz-jwt}$ and H = $\left(\frac{k}{\omega\mu}\right)(a_y + j\,a_x)e^{jkz-jwt}$. Calculate the time averaged pointing vector P(x,y,z). (2 marks)

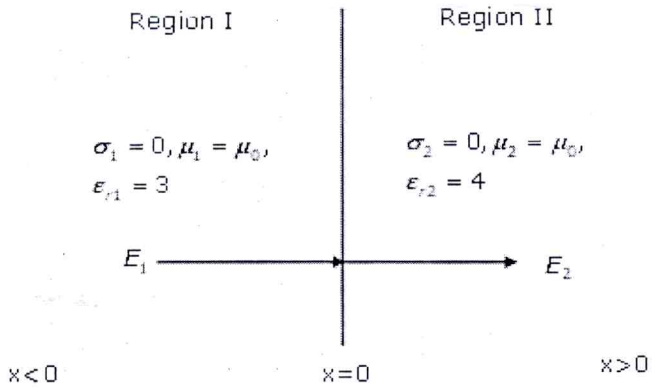
(ii) Medium 1 has the electrical permittivity $\varepsilon_1 = 1.5\,\varepsilon_0\ F/m$ and occupies the region to the left of x=0 plane . Medium 2 has the electrical permittivity $\varepsilon_2 = 2.5\,\varepsilon_0\ F/m$ and occupies the region to the right of x=0 plane .If E_1 in medium 1 is $E_1 = (2a_x - 3a_y + a_z)V/m$, find E_2 in medium 2. (3 marks)

B. (i) A material has conductivity of 10^{-2} mho/m and the relative permittivity of 4.Find the frequency at which the conduction current in the medium is equal to the displacement current. (2 marks)

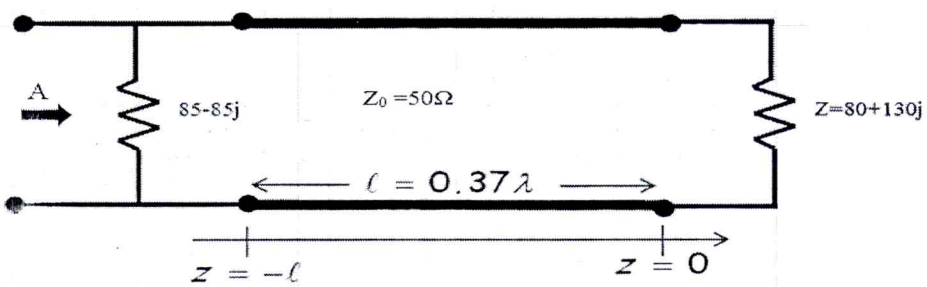
(ii) A plane wave having the electric field component E_1 =24 cos (3x 10^8t -βy)a_z V/m and travelling in free space is incident normally on a lossless medium with μ =μ_0 and ε =9 ε_0 which occupies the region y≥0. Find the reflected magnetic field component. (3 marks)

C. (i) The depth of penetration of electromagnetic wave in a medium having conductivity σ at a frequency of 1 MHz is 25 cm. Find the depth of penetration at a frequency of 4 MHz. (2 marks)

(ii) A medium is divided into region I and II about x=0 as show below. An electromagnetic wave with electric field $E_1 = 4a_x + 3\,a_y + 5\,a_z$ is incident normally on the interface from region I. Find the electric field in region II. (3 marks)



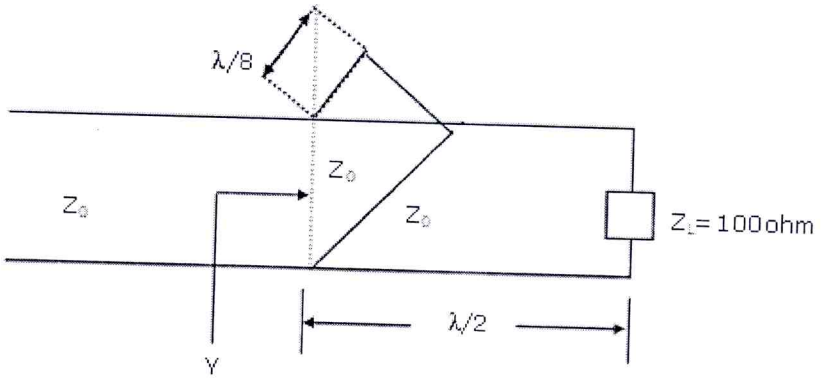
4 A Using smith chart attain the value of input impedance A in ohms. Then find the minimum distance from A towards the generator side that will give 50Ω. (5 marks)



B A 600 Ω transmission line is 150 m long ,operates at 400 KHz with α =2.4 x 10^{-3} Np/m and β = 0.0212 rad/m and supplies a load impedance Z_L= 300 + 300j Ω. Find the wavelength, Γ_L, , Γ_{in} and Z_{in} for a received voltage V(z=0) =50 V. Find the total voltage at input V(z=-150 m). (5 marks)

C (i) In air the lossless transmission line of length 50 cm with L=10 μH/m, C=40 pF/m is operated at 25 MHz. Find the electrical path length. (2 marks)

(ii)A short-circuited stub is shunt connected to a transmission line as in figure below. If Z_0 =50 Ω. Find the admittance Y seen at the junction of the stub and the transmission line. (3 marks)



National Institute of Technology, Hamirpur (H.P.)

Semester End Examination, B. Tech. Sem. II, May 2016

Chemistry for Electronics & Communication Engineering, ECS-122

Duration: 3 Hr. Total Marks: 60

Name: Garima Sood Roll No.: 15408

- *Attempt all of the given questions.*
- *Use of non-programmable scientific calculator is allowed.*
- *Write your name and roll no. on top of this question paper.*

Q1. a) Predict the high resolution proton NMR spectra of the following compounds: (4)

(*Take appropriate shielding/deshielding effects and splitting patterns into account*)

i) $ClCH_2–CHCl_2$ ii) $OHC–N(CH_3)_2$

b) With the help of Jablonski diagram, differentiate between the phenomenon of fluoroescence and phosphorescence. (3)

c) Arrange the chromophores present in CH_3OH, CH_3Br, $CH_2=CH_2$ and $CH\equiv CH$ in increasing order of their λ_{max} values. Provide reasoning for the order as well. (3)

Q2. a) Explain the process of Electric Arc Discharge technique for the synthesis of carbon nanotubes. (3)

b) Large scale production of graphene can be done by using colloidal solutions of graphite intercalation compounds. Elaborate this synthetic process. (3)

c) ^{14}C is radioactive whereas ^{12}C is not. Why ? (2)

Q3. a) With the help of a neat block diagram, explain the functioning and components of a heavy water nuclear reactor. (4)

b) Explain the working principle of a Polymer electrolyte fuel cell along-with the involved electrochemical reactions. What are the advantages of employing such fuel cells ? (3)

c) Write a short note on 'Injection Molding' technique for making plastics. (3)

Q4. a) The molar absorption coefficient of a solute at 540 nm is 286 $dm^3mol^{-1}cm^{-1}$. When light of that wavelength passes through a 6.5 mm cell containing a solution of the solute, 46.5 percent of the light is absorbed. What is the concentration of the solution ? (3)

b) What is the use of employing magnetic field in a mass spectrometer ? (2)

c) How is Differential Scanning Calorimetry (DSC) different from Differential Thermal Analysis (DTA) ? (3)

Q5. a) Taking an example, write the mechanism of coordination polymerization. How does it leads to polymers of desired stereochemistry ? (2)

b) How is tinning different from galvanization ? (2)

c) Quality of greases is predicted by the magnitude of their _____point. (1)

d) Plywood is an example of _____composite. (1)

Q6. a) Give an example of each of the following: (5)

(i) Cathodic Corrosion Inhibitor

(ii) Synthetic lubricant

(iii) P-doped conducting polymer

(iv) Hypsochromic shifts in UV-Vis Spectra

(v) A superconducting fullerene

b) Alloys are fairly prone to undergo intergranular corrosion. How does it occur ? (3)

c) What are different failure modes of Fibre-Reinforced composites ? Explain any one of such modes. (2)

Q7. a) Explain the principle of Extreme Pressure lubrication. (2)

b) What is 'Impressed Current Cathodic Protection method' of preventing corrosion ? (3)

c) The wavenumber of the fundamental vibration of CO molecule is 2140 cm^{-1}. Calculate the force constant of CO bond. (At. mass of C = 1.99×10^{-26} kg and O = 2.66×10^{-26} kg) (3)

National Institute of Technology, Hamirpur (HP)-177005

End-Term Examination, May 2016

ECS 121—Engineering Mathematics II

Dated: 02th May, 2016 **Roll No. .....**

Time: 3 Hours **Max Marks: 60**

Q. No. 1 (a) State and Prove Parseval's Identity.

(b) Find the Fourier series of the function $f(x) = |x|$. Using Fourier series of $|x|$, find without calculation Fourier series of

$$f(x) = \begin{cases} x + \pi/2, & -\pi \le x < 0 \\ -x + \pi/2, & 0 \le x \le \pi \end{cases} \qquad (3+4)$$

Q. No. 2 (a) Solve the initial value problem

$y'' + 4y' + 4y = 12t^2e^{-2t}$, $y(0) = 2, y'(0) = 1$, by using the method of Laplace transforms. **(4)**

(b) Evaluate (i) $\int_0^\infty t^3 e^{-t} \sin t \; dt$ (ii) $L\left\{e^{-3t}\int_0^t \frac{\sin^2 t}{t} dt\right\}$ (iii) $L^{-1}\left\{\frac{1}{(s-a)^4}\right\}$ **(3 + 3 + 2)**

Q. No. 3 (a) Write Laurent series of $f(z) = \frac{z^2-2z+3}{z-2}$ about the singularity point and discuss the nature of singularity point.

(b) State Cauchy's integral formula and use it to evaluate $\int_C \frac{1}{(z^3-z^4)} dz$, $C: |z| = \frac{1}{2}$.

(c) Show that the function $u = xy^3 - x^3y$ is harmonic. Find the harmonic conjugate and construct the analytic function. **(3 + 3 + 4)**

Q. No. 4 (a) Find the bilinear transformation which maps the points $z = \infty, i, 0$ into points $w = 0, i, \infty$ respectively.

(b) Find whether the function

$$f(z) = \begin{cases} \frac{x^2y^5(x+iy)}{x^4+y^{10}}, & z \neq 0 \\ 0, & z = 0 \end{cases}$$ is analytical at origin. **(3 + 4)**

Q. No. 5 (a) Under what circumstances will the equation $M(x,y)dx + N(x,y)dy = 0$ have an integrating factor that is a function of the $z = x + y$. **(4)**

P.T.O.

(b) Solve the following differential equation

(a) $x\dfrac{dy}{dx}+\cot y=0,\ \ if\ \ y=\dfrac{\pi}{4}\ \ when\ \ x=\sqrt{2}$

(b) $2xy\dfrac{dy}{dx}=3y^2+x^2$ **(3 + 2)**

Q. No. 6 Find the general solution of the following equations

a) $\dfrac{dy}{dx}+y\tan x=y^3\sec x$

b) $(y')^2-2xy'+y=0$

c) Using variation of parameters $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}+y=e^x\log x$

d) $x^3\dfrac{d^3y}{dx^3}+2x^2\dfrac{d^2y}{dx^2}+2y=10\left(x+\dfrac{1}{x}\right)$ **(3 + 4 + 4 + 4)**

Roll No.....

National Institute of Technology, Hamirpur (HP)
Name of the Examination: B.Tech (Final

Branch : ECE **Semester : 7th**

Course Name : Control Systems **Course Code : ECD-411**

Time: 3 Hours **Maximum Marks: 60**

Note: Attempt all questions. Do all parts of the questions consecutively.

Q.1 (a) Derive the transfer function for two identical RC circuits connected in cascade.
(b) Explain control of the effect of disturbance signal by use of feedback
(c) Explain with examples linear and nonlinear systems (4+4+4)

Q.2 Using Routh array , determine the values of K and b, so that the unity feedback system whose open loop transfer function is $G(s) = \dfrac{K(s+1)}{s^3 + bs^2 + 3s + 1}$ oscillates at a frequency of oscillations of 2 rad/sec. (8)

Q.3 Derive the expression for time response of under-damped second order system for unit step input. (8)

Q.4 Sketch the root loci for the system whose open loop transfer function is $G(s)H(s) = \dfrac{K(s+2)(s+3)}{s(s+1)}$. The gain K is assumed to be positive. Observe that for small or large values of K the system is over-damped and for medium values of K, it is under-damped. At what values of K, the system is critically damped. (8)

Q.5 Write short notes **on any two** of the following:
(i) AC servomotor
(ii) PID controller
(iii) Synchro as an error detector
(iv) Stepper motor (4+4)

Q.6 Determine the canonical state model of the system, whose transfer function is
$$T(s) = \frac{2(s+5)}{(s+2)(s+3)(s+4)}.$$ (4)

Q.7 A linear time-invariant system is characterized by homogeneous state equation.
$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$; Compute the solution of the homogeneous equation, assuming the initial state vector $x_0 = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$ (4)

Q.8 Explain concept of controllability and observability in control system design. Describe Gilbert s method of testing controllability for SISO and MIMO systems. (8)

Roll. No. .....

राष्ट्रीय प्रौद्योगिकी संस्थान, हमीरपुर (हि.प्र.) भारत

Name of Examination: B.Tech End - Semester (2014-2015)

Branch : Electronics & Comm. & Engg. Semester : 7^{th}

Course Name : Optical Communication Systems Course Code : ECD-412

Time : 3 Hours Maximum Marks : 60

Note:
1. Attempt all questions
2. Draw neat and clean diagrams/waveforms.
3. Symbols are having usual meanings.
4. Assume necessary data if necessary.

1. Explain various types of optical fibers based on refractive index profile and modes. [6]
2. A multimode step index fiber has a relative refractive index difference of 1% and a core refractive index of 1.5. The number of modes operating at wavelength of $1,300\ nm$ is $1,100$. Calculate fiber core diameter. [3]
3. The beat length of 12 cm is observed in a typical single mode fiber when light of wavelength $1,100\ nm$ is launched into it. Calculate the difference between the propagation constant for the two orthogonally polarized modes and the model birefringence. [3]
4. Explain Dispersion phenomenon in optical fiber communication systems. [10]
5. Write a note on Kerr effects. [3]
6. Explain liquid phase technique for the preparation of optical fibers. [4]
7. Explain fusion and mechanical splicing techniques. [4]
8. Drive an expression for number of photons per unit volume in LASER Diodes. [5]
9. Explain the working of *pin* photodetector. A PIN diode generates one electron-hole pair per three incident photons at a wave length of 850 nm. Calculate the quantum efficiency of diode and mean output photocurrent when the incident optical power is 15 μW. [5]
10. Explain the pumping mechanism in EDFAs. [5]
11. What do you mean by external pumping in SOAs. Drive an expression for steady state gain per unit length. An FPA has facet reflectivities of 30 % and a single pass gain of 4.8 dB. The device has an active region with refractive index of 3.75, a peak gain wavelength of 1500 nm with spectral bandwidth of 240 GHz. Determine the length of active region and mode spacing. [7]
12. Explain Optical Cross Connects and Optical Add/Drop Multiplexers. [5]

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Roll No :

National Institute of Technology, Hamirpur (H.P.)

End Semester Examination : B.Tech

Branch : E&CE Semester: 7^{th}

ECD-413 : Digital Signal Processing

Time : 3 Hrs Max. Marks : 60

Note:

All symbols used have their usual meanings.

Assume necessary data, if any.

Attempt all parts of the question at one place only.

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1. Short answer type questions [20 Marks]

   (a) Find if $e^{j[(\pi/3)n+(\pi/2)]}$ signal is energy or power signal. Justify.

   (b) Check whether the system $y(n) = even\{x(n)\}$ is linear, causal and shift in variant.

   (c) Evaluate the unit step response for the LTI system represented by the impulse response $h(n) = (\frac{1}{4})^n u(n)$.

   (d) Find Z-transform of sequence $x(n) = (\frac{1}{4})^n cos(\frac{\pi}{3}n)u(n)$.

   (e) Realize the system $H(z) = \frac{1}{2} + \frac{1}{4}z^{-1} + \frac{1}{4}z^{-2} + \frac{1}{2}z^{-3}$ with minimum components.

   (f) Explain the relationship between Z-transform and Fourier Transform.

   (g) Find the inverse Fourier transform of $X(\omega) = 2 + e^{-j\omega} + 3e^{-j3\omega} + 4e^{-j4\omega}$.

   (h) Using radix-2 DIF FFT algorithm find 4-point DFT of $x(n) = \{2, 1, 4, 3\}$.

   (i) Consider $H(z) = \frac{1}{4}(1 + 2z^{-1} + z^{-2})$ for a digital system. Classify the systems as LPF or HPF, also find the 3dB frequency for the same.

   (j) Why linear phase filter realization is so important? What are the properties of Linear phase filters?

2. [8 Marks]

   (a) Find the 7-point circular convolution of $x_1(n) = \{1, 2, 1, 2\}$ and $x_2(n) = \{4, 3, 2, 1\}$. Validate your result.

   (b) An LTI system is described by the difference equation

$$y(n) - \frac{9}{4}y(n-1) + \frac{1}{2}y(n-2) = x(n) - 3x(n-1)$$

   Specify the ROC of $H(z)$, and determine $h(n)$ for the following conditions:

   i. The system is stable.

   ii. The system is causal.

(c) Compare IIR & FIR systems on the basis of impulse response, phase response, stability and structure realization.

3. [8 Marks]

(a) If the DFT of $x(n)$ is given by $X(k) = \{4, -2j, 0, 2j\}$, using properties of DFT, find

i. DFT of $x(n-2)$

ii. DFT of $x(-n)$

iii. DFT of circular convolution of $x(n)$ with $x(n)$.

iv. Signal energy.

(b) The real and odd signal in time domain will have imaginary and odd spectra. Justify the statement with suitable mathematical expressions.

4. [8 Marks]

(a) A designer is available with a number of four-point FFT chips. Show explicitly how he should interconnect these chips to compute 16-point FFT.

(b) Discuss the different structural realizations for IIR systems. What are the advantages and disadvantages of these structures over each other? Why these different realization structures are required?

5. [8 Marks]

(a) State and prove the time convolution property of Discrete Time Fourier Transform.

(b) Design a second order Bandpass filter with centre frequency $\pi/2$ rad and 3-dB bandwidth $\pi/4$ rad. Give the structural realization of the filter. Draw the magnitude response of the filter.

Best of Luck

Roll No.....

National Institute of Technology, Hamirpur (HP)

Name of Examination: B.Tech. (Dec. 2014)

Branch :E&CE
Course Name : Mobile Communication

Semester :7th
Course Code :EC-414(e)

Time:3Hours

Maximum Marks :60

Note: 1) All questions are compulsory.
2) Assume suitable data where necessary, mention assumed data clearly.

Q.No.1.

a. Describe the concept of frequency reuse channels in cellular mobile system. Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $=\sqrt{3N}$, where $N = i^2 + ij + j^2$ and hence calculate the frequency reuse distance for N= 4, 7, and 12. (6)

b. Consider a GSM system with 395 allocated voice channels. If the traffic is uniform with an average call holding time of 120 seconds and the call blocking during the system busy hour is 2%, calculate (i) the number of calls per cell site per hour and (ii) mean C/I ratio for cell reuse factor of 4 and 7. Assume omnidirectional antenna with path loss slope of 40db/decade. (7)

Q.No.2.

a. Describe various types of data burst used in GSM. (6)

b. Calculate the C/I value for co-channel interference reduction factor of 4.6 for worst case scenario of omnidirectional antenna. Compare the results with worst case of directional antenna having six sector antenna with cluster size of 7. (7)

Q.No.3.

a. Draw and describe in brief the architecture of GSM and GPRS. Show the various interfaces between these two networks. (6)

b. What do you understand by near end far end interference in case of cellular mobile system? Calculate the minimum frequency channel separation between two mobile stations to avoid adjacent channel interference if desired MS is situated at 10 Km from the BS whereas, another undesired MS is situated at distance of 0.25 Km from the BS. Assume that channel filter has 24 dB/oct slope. (7)

Q.No.4.

a. Describe CSMA/CA medium access used in Wi-Fi. Explain how hidden node problem is addressed. (6)

b. Describe in brief broadcast and common control channels used in GSM. Discuss various steps involved in setting up a call when MS is switched on. (7)

Q.No.5.

a. Describe the piconet and scatternet in details (4)

b. Enlist various channel allocation schemes used in cellular system with brief description (4)

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Roll No.....

Table B.1 *(Continued)*

(Offered Load)	A in Erlangs												
n	P_B												
	1.0%	1.2%	1.5%	2%	3%	5%	7%	10%	15%	20%	30%	40%	50%
50	37.9	38.5	39.2	40.3	41.9	44.5	46.7	49.6	54.0	56.5	68.5	81.0	98.1
51	38.8	39.4	40.1	41.2	42.9	45.5	47.7	50.6	55.2	59.7	69.9	82.7	100.1
52	39.7	40.3	41.0	42.1	43.9	46.5	48.8	51.7	56.3	61.0	71.3	84.3	102.1
53	40.6	41.2	42.0	43.1	44.8	47.5	49.8	52.8	57.5	62.2	72.7	86.0	104.1
54	41.5	42.1	42.9	44.0	45.8	48.5	50.8	53.9	58.7	63.5	74.2	87.6	106.1
55	42.4	43.0	43.8	44.9	46.7	49.5	51.9	55.0	59.8	64.7	75.6	89.3	108.1
56	43.3	43.9	44.7	45.9	47.7	50.5	52.9	56.1	61.0	65.9	77.0	91.0	110.1
57	44.2	44.8	45.7	46.8	48.7	51.5	53.9	57.1	62.1	67.2	78.4	92.6	112.1
58	45.1	45.8	46.6	47.8	49.6	52.6	55.0	58.2	63.3	68.4	79.8	94.3	114.1
59	46.0	46.7	47.5	48.7	50.6	53.6	56.0	59.3	64.5	69.7	81.3	96.0	116.1
60	46.9	47.6	48.4	49.6	51.6	54.6	57.1	60.4	65.6	70.9	82.7	97.6	118.1
61	47.9	48.5	49.4	50.6	52.5	55.6	58.1	61.5	66.8	72.1	84.1	99.3	120.1
62	48.8	49.4	50.3	51.5	53.5	56.6	59.1	62.6	68.0	73.4	85.5	101.0	122.1
63	49.7	50.4	51.2	52.5	54.5	57.6	60.2	63.7	69.1	74.6	87.0	102.6	124.1
64	50.6	51.3	52.2	53.4	55.4	58.6	61.2	64.8	70.3	75.9	88.4	104.3	126.1
65	51.5	52.2	53.1	54.4	56.4	59.6	62.3	65.8	71.4	77.1	89.8	106.0	128.1
66	52.4	53.1	54.0	55.3	57.4	60.6	63.3	66.9	72.6	78.3	91.2	107.6	130.1
67	53.4	54.1	55.0	56.3	58.4	61.6	64.4	68.0	73.8	79.6	92.7	109.3	132.1
68	54.3	55.0	55.9	57.2	59.3	62.6	65.4	69.1	74.9	80.8	94.1	111.0	134.1
69	55.2	55.9	56.9	58.2	60.3	63.7	66.4	70.2	76.1	82.1	95.5	112.6	136.1
70	56.1	56.8	57.8	59.1	61.3	64.7	67.5	71.3	77.3	83.3	96.9	114.3	138.1
71	57.0	57.8	58.7	60.1	62.3	65.7	68.5	72.4	78.4	84.6	98.4	115.9	140.1
72	58.0	58.7	59.7	61.0	63.2	66.7	69.6	73.5	79.6	85.8	99.8	117.6	142.1
73	58.9	59.6	60.6	62.0	64.2	67.7	70.6	74.6	80.8	87.0	101.2	119.3	144.1
74	59.8	60.6	61.6	62.9	65.2	68.7	71.7	75.6	81.9	88.3	102.7	120.9	146.1
75	60.7	61.5	62.5	63.9	66.2	69.7	72.7	76.7	83.1	89.5	104.1	122.6	148.0
76	61.7	62.4	63.4	64.9	67.2	70.8	73.8	77.8	84.2	90.8	105.5	124.3	150.0
77	62.6	63.4	64.4	65.8	68.1	71.8	74.8	78.9	85.4	92.0	106.9	125.9	152.0
78	63.5	64.3	65.3	66.8	69.1	72.8	75.9	80.0	86.6	93.3	108.4	127.6	154.0
79	64.4	65.2	66.3	67.7	70.1	73.8	76.9	81.1	87.7	94.5	109.8	129.3	156.0
80	65.4	66.2	67.2	68.7	71.1	74.8	78.0	82.2	88.9	95.7	111.2	130.9	158.0
81	66.3	67.1	68.2	69.6	72.1	75.8	79.0	83.3	90.1	97.0	112.6	132.6	160.0
82	67.2	68.0	69.1	70.6	73.0	76.9	80.1	84.4	91.2	98.2	114.1	134.3	162.0
83	68.2	69.0	70.1	71.6	74.0	77.9	81.1	85.5	92.4	99.5	115.5	135.9	164.0
84	69.1	69.9	71.0	72.5	75.0	78.9	82.2	86.6	93.6	100.7	116.9	137.6	166.0
85	70.0	70.9	71.9	73.5	76.0	79.9	83.2	87.7	94.7	102.0	118.3	139.3	168.0
86	70.9	71.8	72.9	74.5	77.0	80.9	84.3	88.8	95.9	103.2	119.8	140.9	170.0
87	71.9	72.7	73.8	75.4	78.0	82.0	85.3	89.9	97.1	104.5	121.2	142.6	172.0
88	72.8	73.7	74.8	76.4	78.9	83.0	86.4	91.0	98.2	105.7	122.6	144.3	174.0
89	73.7	74.6	75.7	77.3	79.9	84.0	87.4	92.1	99.4	106.9	124.0	145.9	176.0
90	74.7	75.6	76.7	78.3	80.9	85.0	88.5	93.1	100.6	108.2	125.5	147.6	178.0
91	75.6	76.5	77.6	79.3	81.9	86.0	89.5	94.2	101.7	109.4	126.9	149.3	180.0
92	76.6	77.4	78.6	80.2	82.9	87.1	90.6	95.3	102.9	110.7	128.3	150.9	182.0
93	77.5	78.4	79.6	81.2	83.9	88.1	91.6	96.4	104.1	111.9	129.7	152.6	184.0
94	78.4	79.3	80.5	82.2	84.9	89.1	92.7	97.5	105.3	113.2	131.2	154.3	186.0
95	79.4	80.3	81.5	83.1	85.8	90.1	93.7	98.6	106.4	114.4	132.6	155.9	188.0
96	80.3	81.2	82.4	84.1	86.8	91.1	94.8	99.7	107.6	115.7	134.0	157.6	190.0
97	81.2	82.2	83.4	85.1	87.8	92.2	95.8	100.8	108.8	116.9	135.5	159.3	192.0
98	82.2	83.1	84.3	86.0	88.8	93.2	96.9	101.9	109.9	118.2	136.9	160.9	194.0
99	83.1	84.1	85.3	87.0	89.8	94.2	97.9	103.0	111.1	119.4	138.3	162.6	196.0
100	84.1	85.0	86.2	88.0	90.8	95.2	99.0	104.1	112.3	120.6	139.7	164.3	198.0
N	1.0%	1.2%	1.5%	2%	3%	5%	7%	10%	15%	20%	30%	40%	50%
							B						

(End Term Examination, December2014)

Course – MEMS & Sensor Design, ECE-415(a) *Class – B.Tech. 7th Semester*

Time allowed : 180 minutes *Maximum Marks : 60*

Roll No..... *E&CED, NIT Hamirpur*

Note: Symbols have their usual meaning. *Assume suitable data if necessary.*

Q.1 What are various important factors involved in the substrate material selection for MEMS & Sensors? Describe working of a Thermoemf Sensor using suitable diagrams & mathematical expressions. 10

Q.2 Discuss Charge -Voltage cycle of a thermocouple? Explain the principle behind Theromoeletric Technology & Explain the Construction & Operation of a Standard Thermoelectric Module. 10

Q.3 What are various types of Magnetic Sensors? Describe Delay line, Matteucci Effect, Villari Effect & Laminated Core Load Cells Operations. 10

Q.4 Discuss effect of geometry in Hall Effect Sensor Designing. Explain various Parameters involved in Sensors Static & Dynamic Characterization. 10

Q.5 Explain the role of Hooks Law in MEMS & Sensor Designing? prove that $V_m=\sqrt{k/m}.A$ & $T=2\pi\sqrt{I/m.g.d}$ for a small oscillation & Pendulum respectively using SHM. 10

Q.6 Write short notes on the following. 10

a) Radiation Sensors

b) ΔY Effect