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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2017
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Find y(0.1) by using Taylor's series method, given that $y' = \sqrt{x^2 + y}$, $y(0) = 0.8$. Consider upto third order derivative terms. **(06 Marks)**

b. Given : $\frac{dy}{dx} = \frac{1}{1+x^2} - 2y^2$, y(0) = 0. Find y(0.5), by taking h = 0.25, using Euler's modified method. **(07 Marks)**

c. If $y' = \frac{1}{x+y}$, $y(0) = 2.0000$, $y(0.2) = 2.0933$, $y(0.4) = 2.1755$, $y(0.6) = 2.2493$, find y(0.8) by using Adams-Bash forth method. **(07 Marks)**

2 a. Using the Picard's method, obtain the 2nd order approximate solution of the problem at x = 0.2, $\frac{dy}{dx} = x + yz$; $\frac{dz}{dx} = y + zx$, y(0) = 1 and z(0) = -1. **(06 Marks)**

b. Using the R-K method, find the solution at x = 0.1 of an equation; $y'' - x^2y' - 2xy - 1 = 0$ with the conditions y(0) = 1, y'(0) = 0 and step size 0.1. **(07 Marks)**

c. Given that $y'' + xy = 0$, $y(0) = 1$, $y(0.1) = 1.0998$, $y(0.2) = 1.1987$, $y(0.3) = 1.2955$, $y'(0) = 1$, $y'(0.1) = 0.9946$, $y'(0.2) = 0.9773$, $y'(0.3) = 0.946$, find y(0.4), using Milne's method. (Apply corrector formula only once). **(07 Marks)**

3 a. Derive Cauchy-Riemann equations in the polar form. **(06 Marks)**

b. If f(z) = u + iv is an analytic function, then prove that the family of curves; u(x, y) = C_1, v(x, y) = C_2, C_1 and C_2 being constants, interfect orthogonally. Is the converse true? Justify your answer. **(07 Marks)**

c. In a two dimensional fluid flow; if the velocity potential is $e^{-x}\cos y + xy$, find the stream function. **(07 Marks)**

4 a. Find the bilinear transformation which maps the points z = 1, i, -1 onto the points w = i, 0, -i. Also find the invariant points. **(06 Marks)**

b. Discuss the transformation, $w = z + \frac{K^2}{z}$, where $z \neq 0$, $K \neq 0$. **(07 Marks)**

c. State and prove the Cauchy's theorem. **(07 Marks)**

PART – B

5 a. Obtain the series solution of Bessel's differential equation. **(07 Marks)**

b. Derive the Rodrigue's formula. **(07 Marks)**

c. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(06 Marks)**

6 a. 'A' can hit a target 3 times in 5 shots, 'B' 2 times in 5 shots and 'C' 3 times in 4 shots. They fire a volley. Find the probability that (i) 2 shots hit (ii) at least 2 shots hit. **(06 Marks)**

b. If A and B are events with $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{4}$, $P(\overline{B}) = \frac{5}{8}$ find $P(A \cap B)$, $P(\overline{A} \cap \overline{B})$, $P(\overline{A} \cup \overline{B})$ and $P(\overline{A} \cap B)$. **(07 Marks)**

c. State and prove Baye's theorem. **(07 Marks)**

7 a. (i) Is the function defined as follows a density function? $f(x) = e^{-x}, x \geq 0$, $f(x) = 0$, $x < 0$.

(ii) If so, determine the probability that the variate having this density will fall in the interval (1, 2).

(iii) Also find the cumulative probability function F(2). **(06 Marks)**

b. Obtain the mean and standard deviation of the Poisson distribution. **(07 Marks)**

c. The life of an electric bulb is normally distributed with mean life of 200 hours and S.D. of 60 hours. Out of 2500 bulbs, find the number of bulbs which are likely to last between 1900 and 2100 hours. Given that $P(0 < Z < 1.67) = 0.4525$. **(07 Marks)**

8 a. Explain the following terms briefly: (i) Null hypothesis (ii) Type I and Type II errors (iii) Confidence limits. **(06 Marks)**

b. Two types of batteries are tested for their length of life and the following results are obtained:

Battery A : $n_1 = 10$, $\bar{x}_1 = 500$ hrs, $\sigma_1^2 = 100$

Battery B : $n_2 = 10$, $\bar{x}_2 = 560$ hrs, $\sigma_2^2 = 121$.

Find students 't' and test whether there is a significant difference in the two means. ($t_{0.05} = 2.10$ and $t_{0.01} = 2.88$). **(07 Marks)**

c. Genetic theory states that children having one parent of blood type M and the other of blood type N will always be one of the three types M, MN, N and that the proportions of these types will on an average be 1 : 2 : 1. A report states that out of 300 children having one M parent and one N parent, 30% are found to be of type M, 45% of type MN and the remainder of type N. Test the theory by ψ^2 (chi-square) test. **(07 Marks)**

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10ES42

Fourth Semester B.E. Degree Examination, June/July 2017
Microcontrollers

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Give comparison between microprocessor and microcontroller. **(06 Marks)**

b. Explain with neat diagram, Harvard architecture and Van-Neumann architecture. **(06 Marks)**

c. With the help of block diagram, list the specific features of 8051 microcontroller. **(08 Marks)**

2 a. Explain the following instructions with suitable examples:
i) MOVX A, @dptr ii) ACALL Target iii) DJNZ R1, up **(06 Marks)**

b. Differentiate between jump and CALL instructions. **(06 Marks)**

c. Write an assembly language program with comments using 8051 mnemonics to convert ASCII to hexadecimal. **(08 Marks)**

3 a. Briefly explain the different assembler directives used in an assembly language program. **(04 Marks)**

b. Write an ALP to find the number of negative and positive numbers in a given array of ten bytes of data. The number is available from memory location 8000 h. **(08 Marks)**

c. Write an 8051 software time delay subroutine to generate a time delay of 1 second when called. Assume crystal frequency as 11.0592 MHz. Show delay calculations. Do not use timers? **(08 Marks)**

4 a. Explain with a diagram, how the DAC 0808 can be interfaced to 8051 microcontroller. Write an 8051 C program to create the triangular wave. **(10 Marks)**

b. With a neat diagram show how a stepper motor is interfaced to 8051. Write a program to rotate it continuously. **(10 Marks)**

PART – B

5 a. Differentiate between a counter and timer. Explain the timer modes of operation in 8051. **(04 Marks)**

b. Assuming that XTAL = 11.0592 MHz, write a program to generate a square wave of 2 kHz frequency on pin P1.5. Use timer 1 and mode 1 operation. Duty cycle = 50%. **(08 Marks)**

c. Explain TMOD and TCON registers with its bit pattern. **(08 Marks)**

6 a. Explain briefly the interrupts of 8051, indicate their vector addresses. **(05 Marks)**

b. Explain the format of SCON register in details. **(05 Marks)**

c. Write a program with proper comments to transfer the message "YES" serially at 9600 baud rate, 8 bit data, 1 stop bit. Do this continuously. **(10 Marks)**

7 a. Write the steps required for programming 8051 to receive data serially. **(08 Marks)**

b. With a block schematic, explain the features of 8255 PPI chip and its mode of operation. **(06 Marks)**

c. What is the need for serial communication? Explain half duplex and full duplex transmission. **(06 Marks)**

8 a. Explain the architecture of MSP 430 CPU with its internal block schematic. **(10 Marks)**

b. Mention the features and functions of the watch-dog timer and explain. **(10 Marks)**

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10ES43

Fourth Semester B.E. Degree Examination, June/July 2017
Control System

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Graph and semi log required.

PART – A

1 a. Write down the differential equations governing the system below and write the force voltage analogy circuit. **(10 Marks)**

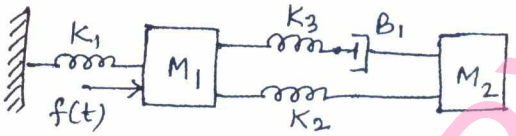

Fig.Q1(a)

b. For the Fig.Q1(b). Derive the expression for the TF : $\frac{Q_1(s)}{T_1(s)} = \frac{1}{s(s^2 J_{eq} + B_{eq})}$. **(10 Marks)**

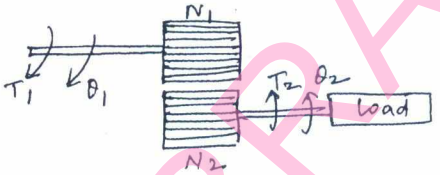

Fig.Q1(b)

2 a. Find the TF of the system by using block diagram reduction method. **(10 Marks)**

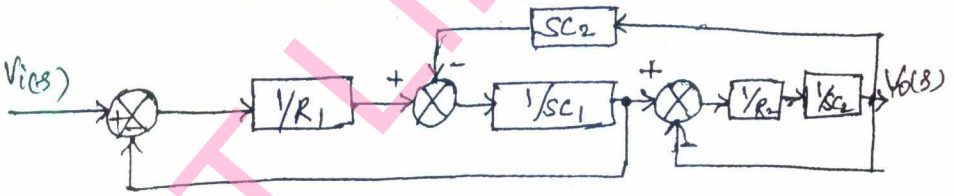

Fig.Q2(a)

b. Find the C/R for the following system using Mason's gain formula. **(10 Marks)**

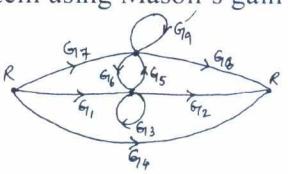

Fig.Q2(b)

3 a. Give the definition for the following transient response of a control systems to a unit step input interms of time domino specifications.
i) Delay time, t_d ii) Rise time, t_r iii) Peak time, t_p iv) Maximum overshoot Mp v) Settling time, t_s with equations. **(10 Marks)**

b. A closed loop servo is represented by the differential equation : $\frac{d^2c}{dt^2} + \frac{8dc}{dt} = 64e$ where 'c' is the displacement of the output Shaft 'r' is the displacement of the input shaft and e = r – c, determine undamped natural frequency, damping ratio. **(10 Marks)**

4 a. A system with oscillating frequency w, if it has poles at s = ±jw, no poles to the right half of the S plane. Determine the value of 'K' and so that the system is shown below oscillates at a frequency of 2 rad/sec. **(10 Marks)**

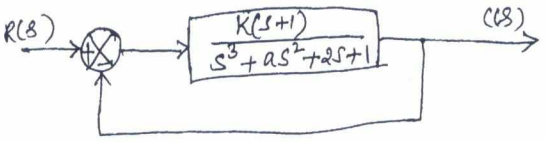

Fig.Q4(a)

b. The open loop transfer function of servo system with unity feedback is $G(s) = \frac{10}{s(0.1s+1)}$. Evaluate the static error constant of the system. Obtain the steady – state error of the system, when subjected to an input given by the polynomial $r(t) = a_0 + a_1 t + \frac{a_2}{2} t^2$. **(10 Marks)**

PART – B

5 For a unity feedback system the open–loop transfer function is given by :

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

i) Sketch the root locus for $0 \le k \le \infty$
ii) At what value of K the system becomes unstable?
iii) At this point of instability, determine the frequency of oscillation of the system.
(20 Marks)

6 Sketch the Nyquist plot for the open loop transfer function :

$G(s)H(s) = \frac{10}{(s+2)(s+4)}$. Determine the stability of the closed loop system by Nyquist criterion. **(20 Marks)**

7 The open loop transfer function of unity feedback system is : $G(s) = \frac{K}{s(s+1)(s+10)}$.

Draw the Bode plot and determine :
i) Limiting value of K for the system to be stable
ii) The value of 'K' for gain margin of 7dB
iii) The value of K for phase margin of 40° $G(s) = \frac{k}{s(s+1)(s+10)}$. **(20 Marks)**

8 a. Write the state equation for the network shown : **(10 Marks)**

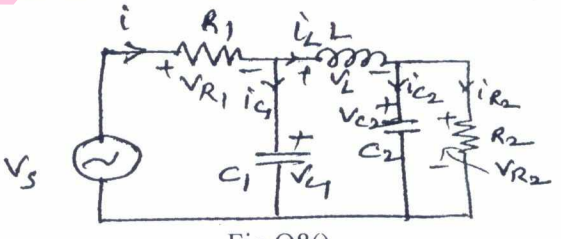

Fig.Q8()

b. Obtain the characteristic equation of the matrix :

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 3 & 0 & 2 \\ -12 & -7 & -6 \end{bmatrix}.$$ **(10 Marks)**

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10EC44

Fourth Semester B.E. Degree Examination, June/July 2017

Signals and Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Discuss the classification of signals with example. **(07 Marks)**

b. Derive an expression to find even and odd components of continuous time signal. **(04 Marks)**

c. For the CTS x(t) shown in Fig.Q1(c), sketch (i) x(3t + 2), (ii) x(3t) + x(3t + 2).

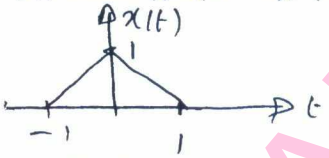

Fig.Q1(c) **(04 Marks)**

d. Determine whether following signals are periodic or not, if periodic find the fundamental period, (i) $x(t) = \{\cos(2\pi t)\}^2$, (ii) $x(n) = \cos 2n$. **(05 Marks)**

2 a. Verify whether the following system is linear, time invariant, memoryless, causal and stable $y(t) = at^2x(t) + bt\,x(t-4)$. **(07 Marks)**

b. Compute the convolution of $x_1(n) = \{\underset{\uparrow}{2}, 3, 4\}$ and $x_2(n) = \{1, 2, \underset{\uparrow}{3}, 4\}$. **(03 Marks)**

c. Compute the convolution of the following : $x(t) = e^{-4t}[u(t) - u(t-2)]$, $h(t) = e^{-2t}u(t)$. **(10 Marks)**

3 a. Find the step response for the LTI system represented by impulse response $h(u) = \left(\frac{1}{4}\right)^n u(n)$. **(03 Marks)**

b. Find the forced response of the system given by $5\frac{dy}{dt} + 10y(t) = 2x(t)$ with $x(t) = 2u(t)$. **(05 Marks)**

c. Find the response of the system described by the difference equation $y(n) - \frac{1}{9}y(n-2) = x(n-1)$ with $y(-1) = 1$, $y(-2) = 0$ and $x(n) = U(n)$. **(07 Marks)**

d. Draw the direct from I and direct form II implementation for $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 5y(t) = \frac{dx(t)}{dt}$. **(05 Marks)**

4 a. Prove the following properties of DTFS:
i) Convolution in time domain
ii) Modulation theorem. **(08 Marks)**

b. Determine the DTFS coefficients of $x(n) = \cos\left(\frac{6\pi}{13}n + \frac{\pi}{6}\right)$. Draw magnitude and phase spectrum. **(06 Marks)**

c. Determine the time domain signal corresponding to the following spectra:

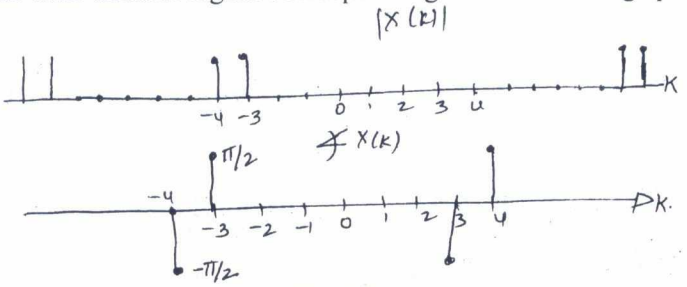

Fig.Q4(c) **(06 Marks)**

PART – B

5 a. Prove time property of discrete time aperiodic sequences. **(03 Marks)**

b. Determine DTFT of $x(n) = a^n u(n)$ and plot magnitude and phase plot. **(05 Marks)**

c. Determine the time domain expression of :

i) $X(e^{j\Omega}) = \dfrac{3 - \frac{1}{4}e^{-j\Omega}}{-\frac{1}{16}e^{-j2\Omega} + 1}$

ii) $X(e^{j\Omega}) = \dfrac{6}{e^{-j2\Omega} - 5e^{-j\Omega} + 6}$

iii) $X(e^{j\Omega}) = \dfrac{6 - \frac{2}{3}e^{-j\Omega} - \frac{1}{6}e^{-j2\Omega}}{-\frac{1}{6}e^{-j2\Omega} + -\frac{1}{6}e^{-j\Omega} + 1}$ **(12 Marks)**

6 a. A causal and LTI system has frequency response, $H[j\omega] = H[\omega] = \dfrac{j\omega + 4}{6 - \omega^2 + 5j\omega}$.

i) Obtain the differential equation for the system.

ii) Determine the impulse response h(t) of s.

iii) What is the output of s if $x(t) = e^{-4t}u(t) - te^{-4t}u(t)$? **(10 Marks)**

b. The input and output of a causal LTI system are related by differential equation:

$$\frac{d^2y(t)}{dt^2} + 6\frac{dy(t)}{dt} + 8y(t) = 2x(t)$$

i) Find h(t).

ii) Find the response of the system for $x(t) = t \cdot e^{-2t}u(t)$. **(10 Marks)**

7 a. Prove the time shifting and differentiation properties of z-transform. **(06 Marks)**

b. Determine the z-transform and ROC of the following sequence $x(n) = -a^n u(-n-1)$. **(04 Marks)**

c. Find the inverse z-transform of $X(z) = \dfrac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$ for (i) $|z| > 1$, (ii) $|z| < 0.5$. **(10 Marks)**

8 a. A causal system has input x(n) and output y(n). Find the impulse response of the system:

$x(n) = \delta(n) + \frac{1}{4}\delta(n-1) - \frac{1}{8}\delta(n-2)$; $y(n) = \delta(n) - \frac{3}{4}\delta(n-1)$ **(10 Marks)**

b. Solve the difference equation for the given initial conditions and input using unilateral z-transform. $y(n) - \frac{1}{9}y(n-2) = x(n-1)$ with $y(-1) = 0$, $y(-2) = 1$ and $x(n) = 3u(n)$. **(10 Marks)**

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10EC45

Fourth Semester B.E. Degree Examination, June/July 2017
Fundamentals of HDL

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain in brief verilog data types and operators with example. **(11 Marks)**

b. List different modeling styles. Define significances of each modeling style. **(06 Marks)**

c. Find the value of expression X_1, X_2, X_3 for the following VHDL signal declaration,

```
Signal a : bit : = '1' ;
Signal b : bit – vector (3 down to 0) : = "1010";
Signal c : bit – vector (0 to 3) : = "0010" ;
X1 = C sll 2
X2 = b sra 3
X3 = a b(2) c(1)
```

(03 Marks)

2 a. Design a 4 : 1 Mux and implement the same using Boolean equation in verilog. **(05 Marks)**

b. Design 3×3 unsigned combinational array multiplier in VHDL assigning a delay 5 ns. **(10 Marks)**

c. Write a verilog description for a SR latch: (i) Use a characteristic equation. (ii) Use two logic gates. **(05 Marks)**

3 a.
```
architecture sig of dummy is
Signal trigger, sum : integer : = 0 ;
Signal Sig 1 : integer : = 1 ;
Signal Sig 2 : integer : = 2 ;
Signal Sig 3 : integer : = 3 ;
begin
        process (trigger)
          begin
              Sig 1 <= Sig2 + Sig3 ;  Sig2 <= Sig1 ;
              Sig 3 <= Sig2 ;  Sum <= Sig1 + Sig2 + Sig3 ;
          end process; eng Sig ;
architecture Var of dummy is
Signal trigger, Sum : integer : = 0;
Begin
        Process (trigger)
        Variable Var 1 : integer : = 1 ;
        Variable Var 2 : integer : = 2 ;
        Variable Var 3 : integer : = 3 ;
        Begin
              Var1 : = Var2 + Var3 ;  Var 2 : = Var 1;
              Var3 : = Var2 ;  Sum <= Var1 + Var2 + Var3 ;
        end process ; end Var ;
```

The trigger value changes at t = 10 ns, the statements are executed only once.
Evaluate the value of sum at t = 10 nS + Δ for above 2 cases. **(06 Marks)**

b. Design 4-bit ripple adder using for loop only and implement the same using VHDL. **(07 Marks)**

c. Write a behavioral description in verilog for JK flip flop using if and else if statement only. With active low clock and asynchronous reset. **(07 Marks)**

4 a. Design a 3-bit synchronous even counter using D flip flop with active high hold and implement the same in structural description in verilog. **(10 Marks)**

b. Write the HDL programs for N+1 bit magnitude comparator using,

(i) Generate and generic in VHDL.

(ii) Generate and Parameter in verilog. **(10 Marks)**

PART – B

5 a. Write a code to convert integer to signed Binary (4 – bit) using procedure. **(08 Marks)**

b. Bring out the difference between procedure and function with an example. **(07 Marks)**

c. Write a note on verilog file processing. **(05 Marks)**

6 a. Write the block diagram and function table of a SRAM, using this write VHDL description of 16×8 SRAM. **(08 Marks)**

b. Package array is

```
    Constant P : integer : = 2 ;
    Constant N : integer : = 2 ;
    Constant M : integer : = 1 ;
Subtype wordg is integer ;
type Single 1 is array (P downto 0) of wordg ;
type Single 2 is array (N downto 0) of Single 1 ;
type arry 3 is array (M downto 0) of single 2 ;
end array;
library 1EEE;
Use 1EEE.STD-LOGIC-1164.ALL;
Use work.arry.all;
Entity Ex is
    Part (N, M, P: integer ; z : out integer);
End Ex;
Architecture Ex1 of Ex is
Begin
  Process (N, M, P)
  Variable t ;  integer ;
  Constant y; arry 3:=(((5, 4, 3),(8, 9, 10),(32, 33, 34)),((42, 43,44),(52, 53,54),(-10, -7, -5)));
begin
    t : = y(M)(N)(P);
    z <= t ; end process ; end  Ex1 ;
```

(i) What is the value of the following element of y?
Y(0, 0, 0), Y(0, 0, 1), Y(0, 0, 2), Y(0, 1, 2), Y(1, 1, 2), Y(1, 2, 2)

(ii) If we change all (N downto 0) and (M downto 0) in package arry to (0 to N) and (0 to M). What will be the values of the elements in part (i). **(08 Marks)**

c. Which line in the above program 6(b) attaches a package to the VHDL program? Explain each word in that line and significance of each word. **(04 Marks)**

7 a. Write mixed-language description of a master slave JK-ff with a clear input invoking a VHDL entity from a verilog module. **(12 Marks)**

b. Discuss the facts of the mixed language description. **(08 Marks)**

8 a. Define synthesis. With a neat flow chart, explain the steps involved in a synthesis. **(08 Marks)**

b. Write a behavioral code in verilog for a 2 to 4 decoder with a active low output. Show the gate level synthesis for the code. **(06 Marks)**

c. Extract the gate level synthesis for the verilog code below:

```
module example (BP, ADH);
input [2 : 0] BP;
output [3 : 0] ADH;
reg [3 : 0] ADH;
always @ (BP)
    begin
        if (BP<=2) ADH = 15 ;
        else if (BP>=5) ADH = 0;
          else ADH = BP*(-5) + 25 ;
        end    end module
```

(06 Marks)

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10EC46

Fourth Semester B.E. Degree Examination, June/July 2017

Linear ICs and Applications

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of standard resistance and capacitance values table is permitted.***

PART – A

1 a. With a neat circuit diagram, explain the working of a basic op-amp circuits. **(07 Marks)**

b. Sketch an op-amp difference amplifier circuit. Explain the operation of the circuit and derive an equation for the output voltage. **(07 Marks)**

c. Two signals each ranging from 0.1V to 1V are to be summed and amplified by a factor of 5. Using 741 op-amp design a suitable inverting summing amplifier circuit. **(06 Marks)**

2 a. Sketch and explain the operation of a capacitor coupled non-inverting amplifier circuit using single polarity power supply with necessary design steps. **(08 Marks)**

b. What is meant by setting upper cutoff frequency in a capacitor coupled op-amp? Explain how it is done in an inverting op-amp. **(06 Marks)**

c. Design a high input impedance capacitor coupled voltage follower using 741 op-amp. The lower cutoff frequency for the circuit is to be 50 Hz and the load resistance of 3.9 KΩ. Also determine the minimum theoretical input impedance of the circuit. (Consider M_{min} = 50000). **(06 Marks)**

3 a. Explain Miller effect compensation. **(08 Marks)**

b. List the precautions to be observed for op-amp stability. **(06 Marks)**

c. Determine the upper cutoff frequency and the maximum distortion free output amplitude for a voltage follower.
i) When a 741 op-amp is used and
ii) When a LF 353 op-amp is used.
For 741: f_2 = 800 kHz, s = 0.5 V/μs.
For LF353 : f_2 = 5 MHz, s = 13 V/μs **(06 Marks)**

4 a. Draw the circuit of an instrumentation amplifier and explain its working and show how voltage gain can be varied. **(08 Marks)**

b. Explain the working of precision full wave rectifier using bipolar op-amp. **(06 Marks)**

c. Sketch the circuit of a current amplifier with floating load. Explain circuit operation and derive an equation for current gain. **(06 Marks)**

PART – B

5 a. With a neat circuit diagram and waveforms, explain the working of triangular/rectangular waveform generator. **(08 Marks)**

b. With a neat circuit diagram, explain multiplier and divider. **(06 Marks)**

c. Using a 741 op-amp with ±12 V supply, design a phase shift oscillator to have an output frequency of 5 kHz. **(06 Marks)**

6 a. With a neat circuit diagram, explain the operation of an inverting Schmitt trigger circuit. **(06 Marks)**

b. Using op-amp, design a second order high pass filter to have a cutoff frequency of 7 kHz. **(06 Marks)**

c. With a neat circuit diagram and waveforms, explain the operation of a stable multivibrator using op-amp. Also include design steps. **(08 Marks)**

7 a. What is an voltage regulator? With a neat sketch, explain the working of series op-amp regulator. **(06 Marks)**

b. Design a voltage regulator using IC 723 to get an output voltage of 5V. **(06 Marks)**

c. Explain the basic principle of operation of switching regulator. Discuss its advantages and limitations. **(08 Marks)**

8 a. Explain monostable multivibrator using IC 555. **(06 Marks)**

b. Explain the operation of phase locked loop (PLL) with the help of neat block diagram. **(07 Marks)**

c. With a neat block diagram, explain successive approximation ADC. **(07 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, June/July 2017
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Find the angle between any two diagonals of a cube. **(06 Marks)**

b. Find the angle between two lines whose direction cosines are given by $\ell + 3m + 5n = 0$ and $2mn - 6n\ell - 5\ell m = 0$. **(07 Marks)**

c. Find the coordinates of the foot of the perpendicular from A(1, 1, 1) to the line joining the points B(1, 4, 6) and C(5, 4, 4). **(07 Marks)**

2 a. Find the equation of the plane through (2, -1, 6) and (1, -2, 4) and perpendicular to the plane $x - 2y - 2z + 9 = 0$. **(06 Marks)**

b. Find the equation of a straight line through (7, 2, -3) and perpendicular to each of the lines. $\frac{x-1}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ and $\frac{x+2}{4} = \frac{y-3}{5} = \frac{z-4}{6}$. **(07 Marks)**

c. Find the angle between the planes $x - y + z - 6 = 0$ and $2x + 3y + z + 5 = 0$. **(07 Marks)**

3 a. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are any three vectors then prove that

$$\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a} \cdot \vec{c}\right)\vec{b} - \left(\vec{a} \cdot \vec{b}\right)\vec{c}$$ **(06 Marks)**

b. If $\vec{A} = 4i + 3j + k$, $\vec{B} = 2i - j + 2k$ find a unit vector N perpendicular to the vectors $\vec{A}$ and $\vec{B}$ also show that $\vec{A}$ is not perpendicular to $\vec{B}$. **(07 Marks)**

c. Find the value of λ so that the points A(-1, 4, -3), B(3, 2, -5), C(-3, 8, -5) and D(-3, λ, 1) lie on the same plane. **(07 Marks)**

4 a. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is time. Find the components of its velocity and acceleration in the direction of the vector $i - 3j + 2k$ at $t = 1$. **(06 Marks)**

b. Find the angle between tangents to the curve $x = t^2 + 1$, $y = 4t - 3$, $z = 2t^2 - 6t$ at $t = 1$ and $t = 2$. **(07 Marks)**

c. Find the directional derivative of $x^2yz + 4xz^2$ at (1, -2, -1) in the direction of $2i - j - 2k$. **(07 Marks)**

5 a. Prove that $\text{div}(\text{curl}\,\vec{A}) = 0$. **(06 Marks)**

b. Find the divergence and curl of the vector.

$\vec{F} = (xyz + y^2z)i + (3x^2y + y^2z)j + (xz^2 - y^2z)k$ **(07 Marks)**

c. Find the constants a, b, c so that the vector,

$\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is irrotational. **(07 Marks)**

6 Find :

a. $L[\sin 5t \sin 3t]$ **(05 Marks)**

b. $L[te^{8t} \cos 2t]$ **(05 Marks)**

c. $L\left[\frac{1-e^{at}}{t}\right]$ **(05 Marks)**

d. $L\left[\int_0^t e^{2t} \frac{\sin at}{t} dt\right]$ **(05 Marks)**

7 a. Find $L^{-1}\left[\frac{2s-1}{s^2+2s+17}\right]$. **(05 Marks)**

b. Find $L^{-1}\left[\frac{s+1}{(s-1)^2(s+2)}\right]$. **(05 Marks)**

c. Find $L^{-1}\left[\cot^{-1}\left(\frac{s}{a}\right)\right]$. **(05 Marks)**

d. Using convolution theorem evaluate $L^{-1}\left[\frac{s}{(s+2)(s^2+9)}\right]$. **(05 Marks)**

8 a. Using Laplace transforms, solve $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$ given $y(0) = y'(0) = 0$. **(10 Marks)**

b. Using Laplace transforms, solve $\frac{dx}{dt} + y = \sin t$, $\frac{dy}{dt} + x = \cos t$, given x = 2, y = 0 when $t = 0$. **(10 Marks)**

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