IV EC, EE, ML

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10MAT41

Fourth Semester B.E. Degree Examination, June 2012

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. Using the Taylor's method, find the third order approximate solution at x = 0.4 of the problem $\frac{dy}{dx} = x^2y + 1$, with y(0) = 0. Consider terms upto fourth degree. **(06 Marks)**

b. Solve the differential equation $\frac{dy}{dx} = -xy^2$ under the initial condition y(0) = 2, by using the modified Euler's method, at the points x = 0.1 and x = 0.2. Take the step size h = 0.1 and carry out two modifications at each step. **(07 Marks)**

c. Given $\frac{dy}{dx} = xy + y^2$; y(0) = 1, y(0.1) = 1.1169, y(0.2) = 1.2773, y(0.3) = 1.5049, find y(0.4) correct to three decimal places, using the Milne's predictor-corrector method. Apply the corrector formula twice. **(07 Marks)**

2 a. Employing the Picard's method, obtain the second order approximate solution of the following problem at x = 0.2.

$$\frac{dy}{dx} = x + yz; \quad \frac{dz}{dx} = y + zx; \quad y(0) = 1, \quad z(0) = -1.$$ **(06 Marks)**

b. Using the Runge-Kutta method, solve the following differential equation at x = 0.1 under the given condition:

$$\frac{d^2y}{dx^2} = x^3\left(y + \frac{dy}{dx}\right), \quad y(0) = 1, \quad y'(0) = 0.5.$$

Take step length h = 0.1. **(07 Marks)**

c. Using the Milne's method, obtain an approximate solution at the point x = 0.4 of the problem $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$, y(0) = 1, y′(0) = 0.1. Given y(0.1) = 1.03995, y′(0.1) = 0.6955, y(0.2) = 1.138036, y′(0.2) = 1.258, y(0.3) = 1.29865, y′(0.3) = 1.873. **(07 Marks)**

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

b. If f(z) is a regular function of z, prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$. **(07 Marks)**

c. If w = ϕ + iy represents the complex potential for an electric field and $y = x^2 - y^2 + \frac{x}{x^2 + y^2}$ determine the function ϕ. Also find the complex potential as a function of z. **(07 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

4 a. Discuss the transformation of $w = z + \frac{k^2}{z}$. **(06 Marks)**

b. Find the bilinear transformation that transforms the points $z_1 = i$, $z_2 = 1$, $z_3 = -1$ on to the points $w_1 = 1$, $w_2 = 0$, $w_3 = \infty$ respectively. **(07 Marks)**

c. Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$ where c is the circle $|z| = 3$, using Cauchy's integral formula. **(07 Marks)**

PART – B

5 a. Obtain the solution of $x^2 y'' + xy' + (x^2 - n^2)y = 0$ in terms of $J_n(x)$ and $J_{-n}(x)$. **(06 Marks)**

b. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre polynomials. **(07 Marks)**

c. Prove that $\int_{-1}^{+1} P_m(x) \cdot P_n(x) dx = \frac{2}{2n+1}$, $m = n$. **(07 Marks)**

6 a. From five positive and seven negative numbers, five numbers are chosen at random and multiplied. What is the probability that the product is a (i) negative number and (ii) positive number? **(06 Marks)**

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

c. In a certain college, 4% of boy students and 1% of girl students are taller than 1.8 m. Furthermore, 60% of the students are girls. If a student is selected at random and is found taller than 1.8 m, what is the probability that the student is a girl? **(07 Marks)**

7 a. A random variable x has the density function $P(x) = \begin{cases} Kx^2, & 0 \le x \le 3 \\ 0, & \text{elsewhere} \end{cases}$. Evaluate K, and find: i) $P(x \le 1)$, (ii) $P(1 \le x \le 2)$, (iii) $P(x \le 2)$, iv) $P(x > 1)$, (v) $P(x > 2)$. **(06 Marks)**

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

c. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks are normally distributed. It is given that $P(0 < z < 1.2263) = 0.39$ and $P(0 < z < 1.4757) = 0.43$. **(07 Marks)**

8 a. A random sample of 400 items chosen from an infinite population is found to have a mean of 82 and a standard deviation of 18. Find the 95% confidence limits for the mean of the population from which the sample is drawn. **(06 Marks)**

b. In the past, a machine has produced washers having a thickness of 0.50 mm. To determine whether the machine is in proper working order, a sample of 10 washers is chosen for which the mean thickness is found as 0.53 mm with standard deviation 0.03 mm. Test the hypothesis that the machine is in proper working order, using a level of significance of (i) 0.05 and (ii) 0.01. **(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% were found to be of type M, 45% of type MN and the remainder of type N. Test the theory by χ^2 (Chi square) test. **(07 Marks)**

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10ES42

Fourth Semester B.E. Degree Examination, June 2012
Microcontrollers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain briefly the Harvard and Von-Neumann CPU architecture. **(06 Marks)**

b. Sketch the internal block schematic of 8051, list its salient features and briefly explain its register set. **(10 Marks)**

c. Briefly explain the dual functions of port-3 pins of 8051. **(04 Marks)**

2 a. Briefly explain any four addressing modes of data of 8051 with an example for each. **(06 Marks)**

b. Explain the operations of the 8051 instructions:
i) RLC A ii) DA A iii) MUL AB and iv) AJMP addr **(08 Marks)**

c. Write an ALP (assembly language program) in 8051 to count the number of positive and negative numbers present in the internal memory block starting with the address 20H, containing N bytes. Store the counts after the last data byte in the memory block. **(06 Marks)**

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

b. Write an 8051 ALP to find the value of N!/R! using a subroutine that calculates the factorial of a given number. Assume the values of N and R are stored in locations 10H and 11H. Store the value of N!/R! in 12 H. Assume N!, R! and N!/R! are all maximum 8 bit values. **(10 Marks)**

c. Write an 8051 software time delay subroutine to generate a time delay of 100 μsec when called. Assume crystal frequency as 12 MHz. Show delay calculations. Do not use timers. **(06 Marks)**

4 a. Interface an LCD display unit to 8051 and write an ALP to display the message 'DONE'. **(10 Marks)**

b. Interface a stepper motor to 8051 and rotate it by checking the status of a simple toggle switch connected to pin P2.0 as follows:
i) If switch is open rotate motor in clock wise direction.
ii) If switch is closed rotate motor in counter clockwise direction. **(10 Marks)**

PART – B

5 a. With regard to the interrupts of 8051,
i) Give the vector addresses of the interrupts.
ii) Briefly explain the procedure of enabling / disabling the entire interrupt system and enabling / disabling of individual interrupts.
iii) Indicate the default priority on reset and procedure to alter this default priority. **(06 Marks)**

b. With regard to timers of 8051,
i) Explain briefly the difference between the timer and counter operation modes.
ii) Indicate how to start / stop the timer if GATE control is also used.
iii) Explain mode – 2 operation. **(06 Marks)**

c. Write an ALP in 8051 to generate a square wave of frequency 5 kHz on pin P2.7 using Timer-1 in interrupt mode. Assume crystal frequency as 11.0592 MHz. **(08 Marks)**

6 a. i) Explain briefly the asynchronous serial communication format.
ii) Indicate steps of programming 8051 to transmit a character and receive a character serially. **(09 Marks)**

b. Write a 8051 C program to transmit the character '*' continuously serially in the 8 bit, 1 start bit, 1 stop bit, 2400 baud rate format. Assume the crystal frequency as 11.0592 MHz. **(08 Marks)**

c. What is the advantage of using the chip 8255 with 8051? Indicate the functions of the pins A_0 and A_1 of 8255. **(03 Marks)**

7 a. Explain the architecture of MSP430 with its internal block schematic. **(10 Marks)**

b. Give the details of memory map of MSP430. **(06 Marks)**

c. Write a note on clock system of MSP430. **(04 Marks)**

8 a. Write an assembly program to generate a waveform with ON time of 7msec and OFF time of 21 msec on P0.5. Assume XTAL of 11.0592 MHz. Use timer 0. **(12 Marks)**

b. Explain the bits of SCON register. **(08 Marks)**

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10ES43

Fourth Semester B.E. Degree Examination, June 2012

Control Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Distinguish between open loop and closed loop systems, with examples. **(06 Marks)**

b. Write the differential equations of performance for the mechanical system shown in Fig.Q1(b). Draw its F-V analogous circuit.

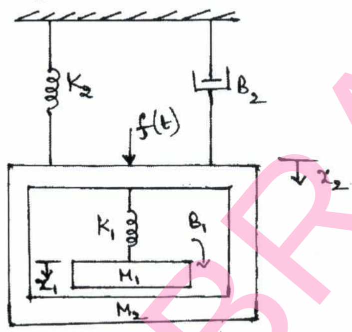

Fig.Q1(b) **(08 Marks)**

c. Obtain the transfer function of an armature controlled dc servomotor. **(06 Marks)**

2 a. Obtain the transfer function for the block diagram shown in Fig.Q2(a) using block diagram reduction technique.

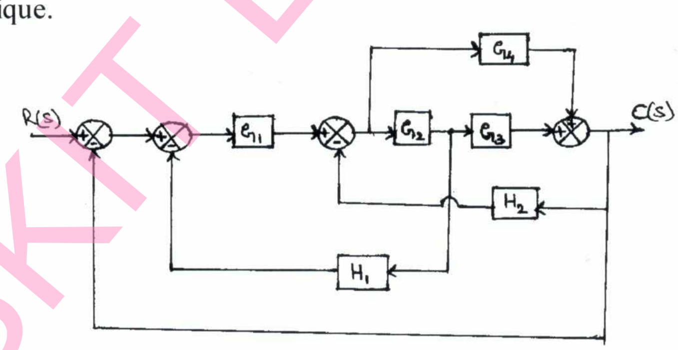

Fig.Q2(a) **(10 Marks)**

b. Obtain the closed loop transfer function $\frac{C(s)}{R(s)}$ for the signal flow graph of a system shown in Fig.Q2(b) by use of Mason's gain formula.

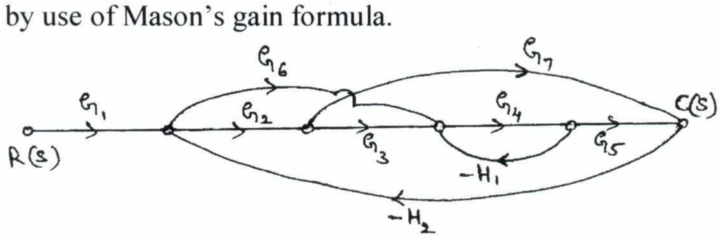

Fig.Q2(b) **(10 Marks)**

3 a. Derive expressions for peak response time t_p and maximum overshoot M_p of an under damped second order control system subjected to step input. **(06 Marks)**

b. A second order control system is represented by a transfer function given below:

$$\frac{\theta_0(s)}{T(s)} = \frac{1}{Js^2 + Fs + K}$$

where θ_0 is the proportional output and T is the input torque. A step unit of 10 N-m is applied to the system and test results are given below:

i) Maximum overshoot is 6%
ii) Peak time is 1 sec
iii) The steady state value of the output is 0.5 radian.

Determine the values of J, F and K. **(08 Marks)**

c. For a unity feedback control system with $G(s) = \frac{10(s+2)}{s^2(s+1)}$. Find:

i) The static error coefficients
ii) Steady state error when the input transform is $R(s) = \frac{3}{s} - \frac{2}{s^2} + \frac{1}{3s^2}$. **(06 Marks)**

4 a. Explain Routh-Hurwitz's criterion for determining the stability of a system and mention any three limitations of R-H criterion. **(10 Marks)**

b. A unity feedback control system is characterized by the open loop transfer function:

$$G(s) = \frac{K(s+13)}{s(s+3)(s+7)}$$

i) Using the Routh's criterion, calculate the range of values of K for the system to be stable
ii) Check if for K = 1, all the roots of the characteristic equation of the above system are more negative than –0.5. **(10 Marks)**

PART – B

5 a. Sketch the root locus for a unity feedback control system with open loop transfer function:

$$G(s) = \frac{K(s+2)(s+3)}{s(s+1)}$$ **(12 Marks)**

b. Show that the root loci for unity feedback control system with

$$G(s) = \frac{K(s^2+6s+10)}{(s^2+2s+10)}$$

are the arcs of circle of radius $\sqrt{10}$ and centered at the origin. **(08 Marks)**

6 a. Sketch the Bode plot of a unity feedback system whose open loop transfer function is given by $G(s) = \frac{K}{s(1+0.1s)(s+0.05s)}$.

i) Find the value of K for a gain margin of 10 dB.
ii) Find the value of K for a phase margin of 30°. **(14 Marks)**

6 b. Determine the open loop transfer function of a system whose approximate plot is shown in Fig.Q6(b).

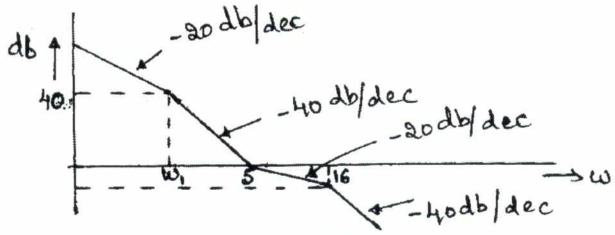

Fig.Q6(b) **(06 Marks)**

7 a. State and explain Nyquist stability criterion. **(06 Marks)**

b. Sketch the Nyquist plot for a system whose open loop transfer function is $G(s)H(s) = \dfrac{K(4s+1)}{s(2s-1)}$. Determine the range of K for which the system is stable. **(14 Marks)**

8 a. Define state variable and state transition matrix. List the properties of the state transition matrix. **(08 Marks)**

b. Obtain the state model of the electrical network shown in Fig.Q8(b) by choosing $V_1(t)$ and $V_2(t)$ as state variables.

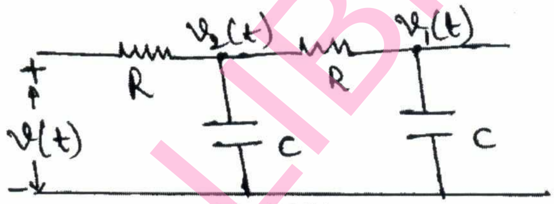

Fig.Q8(b) **(12 Marks)**

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10EC44

Fourth Semester B.E. Degree Examination, June 2012

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. Give a brief classification of signals. **(04 Marks)**

b. Check whether the following systems are linear, causal and time invariant or not.

i) $\frac{d^2y(t)}{dt^2} + 2y(t)\frac{dy(t)}{dt} + 3t\,y(t) = x(t)$ ii) $y(n) = x^2(n) + \frac{1}{x^2(n-1)}$. **(08 Marks)**

c. Classify the following signals or energy signals or power signals:

i) $x(n) = 2^n u(-n)$ ii) $x(n) = (j)^n + (j)^{-n}$. **(05 Marks)**

d. A system consists of several sub-systems connected as shown in Fig.Q(1) d. Find the operator H relating x (t) to y (t) for the following sub-system operators:

H_1: $y_1(t) = x_1(t)\ x_1(t-1)$ H_3: $y(t) = 1 + 2x_3(t)$

H_2: $y_2(t) = |x_2(t)|$ H_4: $y_4(t) = \cos(x_4(t))$. **(03 Marks)**

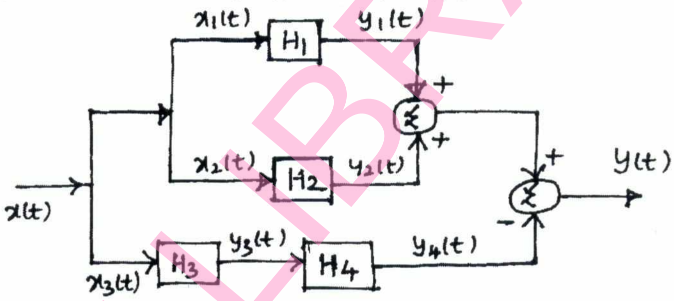

Fig.Q1(d)

2 a. Find the continuous-time convolution integral given below:

$Y(t) = \cos(\pi t)\{u(t+1) - u(t-3)\} * u(t)$. **(06 Marks)**

b. Consider the i/p signal x (n) and impulse responses (n) given below:

$$x(n) = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & \text{otherwise} \end{cases}, \qquad h(n) = \begin{cases} \alpha^n & 0 \le n \le 6\ ,\ |\alpha| < 1 \\ 0\ , & \text{otherwise} \end{cases}.$$

Obtain the convolution sum $y(n) = x(n) * h(n)$. **(08 Marks)**

c. Derive the following properties:

i) $x(n) \times h(n) = h(n) \times x(n)$ ii) $x(n) \times [h(n) \times g(n)] = [x(n) \times h(n)] \times g(n)$. **(06 Marks)**

3 a. For each impulse response listed below, determine whether the corresponding system is memoryless, causal and stable:

i) $h(n) = (0.99)^n u(n+3)$ ii) $h(t) = e^{-3t} u(t-1)$. **(08 Marks)**

b. Evaluate the step response for the LTI system represented by the following impulse response: $h(t) = u(t+1) - u(t-1)$. **(04 Marks)**

c. Draw direct form I implementation of the corresponding systems:

$$\frac{d^2y(t)}{dt^2} + 5\frac{d}{dt}y(t) + 4y(t) = x(t) + 3\frac{d}{dt}x(t).$$ **(04 Marks)**

d. Determine the forced response for the system given by:

$5\frac{dy(t)}{dt} + 10\,y(t) = 2\,x(t)$, with input x (t) = 2 u (t). **(04 Marks)**

4 a. State and prove time shift and periodic time convolution properties of DTFS. **(06 Marks)**

b. Evaluate the DTFS representation for the signal x (n) shown in Fig.Q4(b) and sketch the spectra. **(08 Marks)**

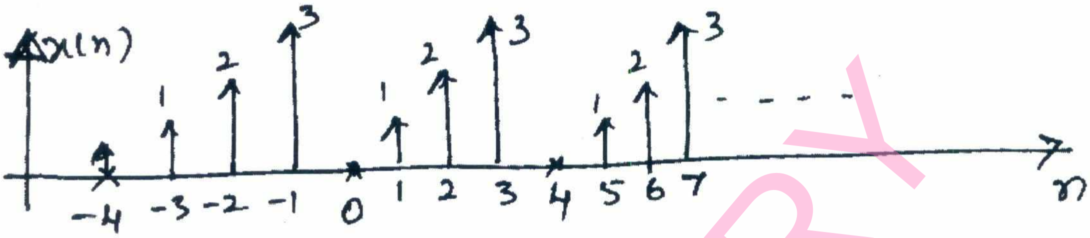

Fig.Q4(b)

c. Determine the time signal corresponding to the magnitude and phase spectra shown in Fig.Q4(c), with $W_o = \pi$. **(06 Marks)**

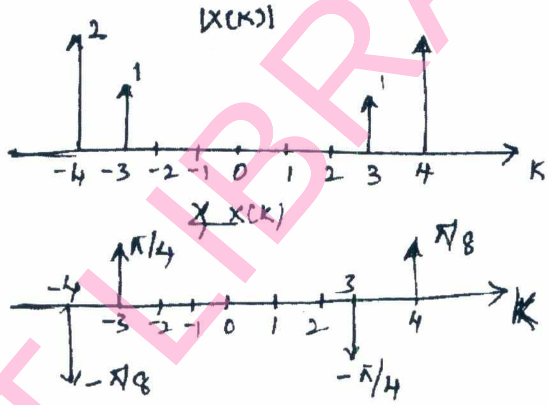

Fig.Q4(c)

PART – B

5 a. State and prove the frequency-differentiation property of DTFT. **(06 Marks)**

b. Find the time-domain signal corresponding to the DTFT shown in Fig.Q5(b). **(05 Marks)**

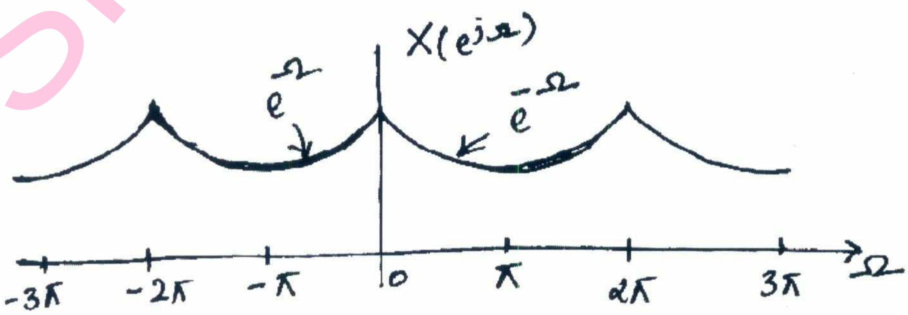

Fig.Q5(b)

c. For the signal x (t) shown in Fig.Q 5(c), evaluate the following quantities without explicitly computing x (w). **(09 Marks)**

i) $\int_{-\infty}^{\infty} x(w)\, dw$ ii) $\int_{-\infty}^{\infty} |x(w)|^2\, dw$ iii) $\int_{-\infty}^{\infty} x(w)\, e^{j2w}\, dw$.

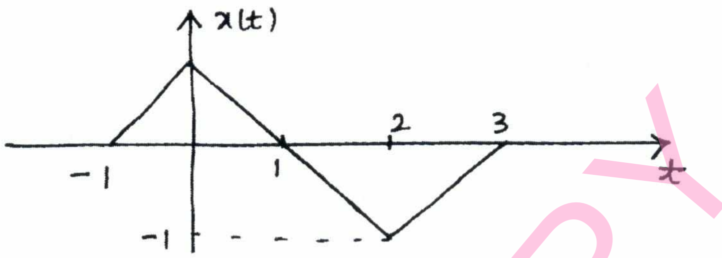

Fig.Q5(c)

6 a. The input and output of causal LTI system are described by the differential equation.

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

i) Find the frequency response of the system
ii) Find impulse response of the system
iii) What is the response of the system if $x(t) = te^{-t}u(t)$. **(10 Marks)**

b. Find the frequency response of the RC circuit shown in Fig.Q6(b). Also find the impulse response of the circuit. **(10 Marks)**

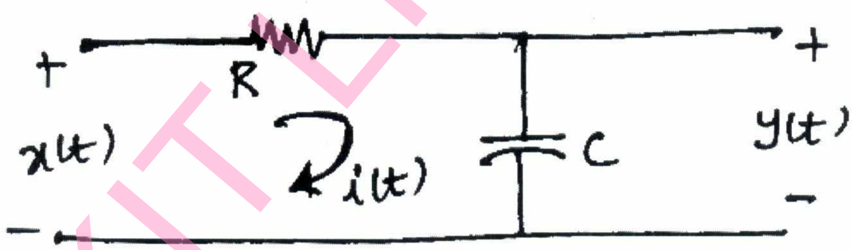

Fig.Q6(b)

7 a. Briefly list the properties of Z-Transform. **(04 Marks)**

b. Using appropriate properties, find the Z-transform $x(n) = n^2\left(\frac{1}{3}\right)^n u(n-2)$. **(06 Marks)**

c. Determine the inverse Z-transform of $x(z) = \frac{1}{2 - 4z^{-1} + 2z^{-2}}$, by long division method of:

i) ROC; |z| > 1. **(04 Marks)**

d. Determine all possible signals x (n) associated with Z-transform. **(06 Marks)**

$$x(z) = \frac{\left(\frac{1}{4}\right)z^{-1}}{\left[1 - \left(\frac{1}{2}\right)z^{-1}\right]\left[1 - \left(\frac{1}{4}\right)z^{-1}\right]}.$$

8 a. An LTI system is described by the equation
$y(n) = x(n) + 0.81\,x(n-1) - 0.81\,x(n-2) - 0.45\,y(n-2)$. Determine the transfer function of the system. Sketch the poles and zeros on the Z-plane. Assess the stability. **(05 Marks)**

b. A systems has impulse response h (n) $(1/3)^n$ u (n). Determine the transfer function. Also determine the input to the system if the output is given by:

$$y(n) = \frac{1}{2}u(n) + \frac{1}{4}\left(-\frac{1}{3}\right)^n u(n).$$ **(05 Marks)**

c. A linear shift invariant system is described by the difference equation.

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + x(n-1)$$

with $y(-1) = 0$ and $y(-2) = -1$.
Find:
i) The natural response of the system.
ii) The forced response of the system and
iii) The frequency response of the system for a step. **(10 Marks)**

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Fourth Semester B.E. Degree Examination, June 2012
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 the structure of VHDL module and verilog module. **(06 Marks)**
b. Explain verilog data types. **(06 Marks)**
c. Discuss different logical operators used in HDLs. **(08 Marks)**

2 a. Explain the execution of signal assignment statement in HDL with example. **(06 Marks)**
b. Write VHDL code for 2×1 multiplexer with active low enable in data flow description. **(07 Marks)**
c. Write verilog code for 2×2 unsigned combinational array multiplier. **(07 Marks)**

3 a. With the suitable example, explain the case statement in both VHDL and verilog. **(06 Marks)**
b. Explain the flowchart of booth multiplier algorithm with example. Also write VHDL code for 4×4 bit booth algorithm. **(14 Marks)**

4 a. What is binding in VHDL? Explain.
i) Binding between entity and architecture in VHDL.
ii) Binding between entity and component in VHDL.
iii) Binding between library and module in VHDL. **(08 Marks)**
b. Write verilog structural description of full adder. Use this full adder to design 3-bit comparator and write the verilog structural code for the same. **(12 Marks)**

PART – B

5 a. Write HDL code for converting an unsigned binary to an integer using procedure and task. **(10 Marks)**
b. Explain built-in procedures for file-processing in VHDL. **(10 Marks)**

6 a. Why mixed type description needed? Explain. **(04 Marks)**
b. Write HDL code (both VHDL and verilog) for finding the greatest element of an array. **(12 Marks)**
c. Discuss VHDL package with example. **(04 Marks)**

7 a. How to invoke a VHDL entity from verilog module? Explain with an example. **(08 Marks)**
b. Write mixed language description of a 3-bit adder with zero flag. If the output of the adder is zero, the zero flag is set to 1; otherwise it is set to 0. **(12 Marks)**

8 a. Explain synthesis steps with flow chart. (10 Marks)

b. Find the gate level mapping for the following verilog code:

```
module if_st(a, y);
input [2 : 0] a;
output y ;
reg y ;
always @ (a)
begin
        if (a < 3′b101)
           y = 1′b1;
        else
           y = 1′b0;
end
end module
```

(06 Marks)

c. Discuss synthesis information extraction from entity in VHDL. (04 Marks)

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10EC46

Fourth Semester B.E. Degree Examination, June 2012
Linear IC's and Applications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain common mode input, common mode voltage gain and common mode rejection ratio for operational amplifiers. **(06 Marks)**

b. Sketch an op-amp difference amplifier circuit. Explain the operation of the circuit and derive an equation for the output voltage. **(08 Marks)**

c. Design an inverting amplifier using a 741 op-amp. The voltage gain is to be 50 and the output voltage amplitude is to be 2.5V. **(06 Marks)**

2 a. Sketch the circuit of a capacitor-coupled voltage follower and explain its operation. **(08 Marks)**

b. Sketch the circuit of a capacitor coupled voltage follower using a single polarity supply and explain its operation. **(06 Marks)**

c. Using a LF 353 BIFET op-amp, design a high z_{in} capacitor coupled non-inverting amplifier to have a low cut-off frequency of 200Hz. The input and output voltages are to be 15mV and 3V respectively, and minimum load resistance is 12 K Ω. **(06 Marks)**

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

b. Discuss the effects of stray capacitance on op-amp circuit stability. **(08 Marks)**

c. Calculate the slew rate limited cut-off frequency for a voltage follower circuit using a 741 op-amp. If the peak of sine wave output is to be 5V. Also determine the maximum peak value of the sinusoidal output voltage that will allow the circuit to operate at the 800 kHz, unity gain cut off frequency. Given typical slew rate for the 741 op-amp is 0.5 V/rs. **(04 Marks)**

4 a. Draw the circuit of a precision voltage source using an op-amp and a zener diode. Explain the circuit operation. **(06 Marks)**

b. Draw the circuit of a simple current-to-voltage converter, then show how it should be modified to function as a current amplifier/attenuator with a grounded load. **(06 Marks)**

c. Sketch the complete circuit of an instrumentation amplifier and explain its operation. **(08 Marks)**

PART – B

5 a. Draw the circuit of an op-amp precision clamping circuit and explain its operation. **(06 Marks)**

b. Draw the circuit of an precision peak detector and explain its operation. **(06 Marks)**

c. Draw the op-amp sample-and-hold circuit and explain its operation. **(08 Marks)**

PART – B

5 a. A series resonant circuit includes 1μF capacitor and a resistance of 16Ω. If the BW is 500 rad/sec, determine : i) W_r ii) Q iii) L. **(06 Marks)**

b. Derive the expression for parallel resonance circuit, containing resistance in both the branches. Also show that the circuit will resonate at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$. **(10 Marks)**

c. Give the comparison between the series resonance and parallel resonance. **(04 Marks)**

6 a. In the network shown in Fig. Q6(a), the switch is moved from position '1' to position 2 at t = 0, the steady – state having reached before switching. Calculate i, $\frac{di}{dt^2}$, and $\frac{d^2i}{dt^2}$ all at $t = 0^+$. **(10 Marks)**

b. In the network shown in Fig. 6(b), a steady state is reached with the switch K open. At t = 0, the switch K is closed. Obtain the initial values of

i) i ii) i_2 iii) v_c iv) $\frac{di_1}{dt}$ v) $\frac{di_2}{dt}$ and $\frac{di_1}{dt}$ at t = ∞. **(10 Marks)**

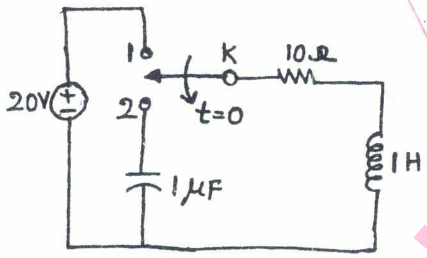

Fig. Q6(a)

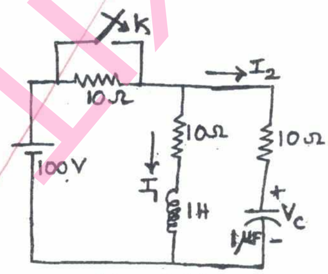

Fig. Q6(b)

7 a. In the circuit of Fig. Q7(a), the source voltage is v(t) = 50 sin 250 t. Using Laplace transforms, determine the current, when switch K is closed at t = 0. **(10 Marks)**

b. In the network shown in Fig. 7(b), the switch K is closed and the steady state is reached. At t = 0, the switch is opened. Find the expression for the current in the inductor using Laplace transform. **(10 Marks)**

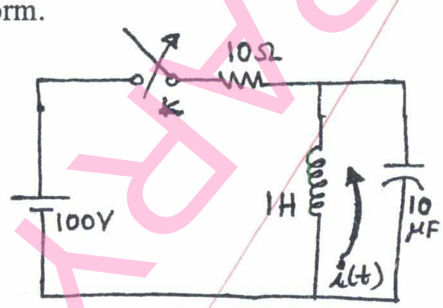

Fig. Q7(a)

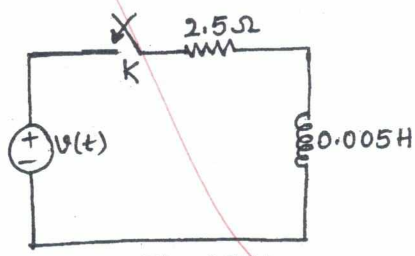

Fig. Q7(b)

8 a. Derive Y – parameters and transmission parameters in terms of Z – parameters. **(10 Marks)**

b. Find the transmission parameters for the given R – C network shown in Fig. 8(b). **(10 Marks)**

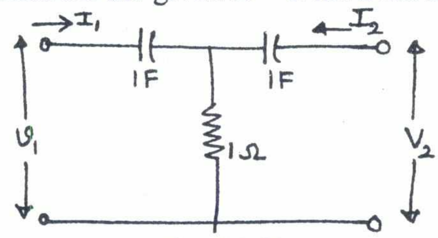

Fig. Q8(b)

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6 a. Draw the circuit of a capacitor coupled crossing detector and explain its operation. **(06 Marks)**
b. With a neat circuit diagram, explain the operation of inverting Schmitt trigger circuit. **(06 Marks)**
c. Draw the circuit of an op-amp monostable multivibrator, show the voltage wave forms and explain the operation of the circuit. **(08 Marks)**

7 a. What is an voltage regulator? With neat figure explain the working of series op-amp regulator. **(07 Marks)**
b. Explain the current limiting feature of 723 regulator. **(07 Marks)**
c. Explain the principles of switching regulator. Mentions its advantages. **(06 Marks)**

8 a. Draw the block schematic of the PLL and explain its operation. **(06 Marks)**
b. With a neat block diagram, explain the operation of a astable multivibrator using 555 timer. **(08 Marks)**
c. With a neat figure explain the working of weighted resistor DAC. **(06 Marks)**

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USN | | | | | | | | | | | **MATDIP401**

Fourth Semester B.E. Degree Examination, June 2012
Advanced Mathematics - II

Time: 3 hrs. Max. Marks:100

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

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

b. Find the equations of two planes, which bisect the angles between the planes $3x - 4y + 5z = 3$, $5x + 3y - 4z = 9$. **(07 Marks)**

c. Find the image of the point (1, 2, 3) in the line $\frac{x+1}{2} = \frac{y-3}{3} = -z$ **(07 Marks)**

2 a. Find the equation of the plane through the point (1, -1, 0) and perpendicular to the line $2x + 3y + 5z - 1 = 0 = 3x + y - z + 2$. **(06 Marks)**

b. Find the value of k such that the line $\frac{x}{k} = \frac{y-2}{2} = \frac{z+3}{3}$ and $\frac{x-2}{2} = \frac{y-6}{3} = \frac{z-3}{4}$ are coplanar. For this k find their point of intersection. **(07 Marks)**

c. Find the distance of the point (1, -2, 3) from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$. **(07 Marks)**

3 a. Show that the position vectors of the vertices of a triangle $\vec{a} = 3(\sqrt{3}\hat{i} - \hat{j})$, $\vec{b} = 6\hat{j}$, $\vec{c} = 3(\sqrt{3}\hat{i} + \hat{j})$ form an isosceles triangle. **(06 Marks)**

b. Find the unit normal to both the vectors $4\hat{i} - \hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$. Find also the sine of the angle between them. **(07 Marks)**

c. Prove that the position vectors of the points A, B, C and D represented by the vectors $-\hat{j} - \hat{k}$, $4\hat{i} + 5\hat{j} + \hat{k}$, $3\hat{i} + 9\hat{j} + 4\hat{k}$ and $-4\hat{i} + 4\hat{j} + 4\hat{k}$, respectively are coplanar. **(07 Marks)**

4 a. 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) may lie on one plane. **(06 Marks)**

b. If $\vec{a}, \vec{b}, \vec{c}$ are the position vectors of points A, B, C, prove that ($\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}$) is a vector perpendicular to the plane of triangle ABC. **(07 Marks)**

c. Find a set of vectors reciprocal to the set $2\hat{i} + 3\hat{j} - \hat{k}$, $\hat{i} - \hat{j} - 2\hat{k}$, $\hat{i} + 2\hat{j} + 2\hat{k}$. **(07 Marks)**

5 a. Find the maximum directional derivative of $\log(x^2 + y^2 + z^2)$ at (1, 1, 1). **(06 Marks)**

b. Find the unit normal vector to the curve $\vec{r} = 4\sin t\hat{i} + 4\cos t\hat{j} + 3t\hat{k}$. **(07 Marks)**

c. Show that $\vec{F} = \frac{x\hat{i} + y\hat{j}}{x^2 + y^2}$ is both solenoidal and irrotational. **(07 Marks)**

6 a. Find the Laplace transforms of $\sin^2 3t$ and $\sqrt{t}$. **(06 Marks)**

b. Find L[f(t)], given that $f(t) = \begin{cases} t-1 & 0 < t < 2 \\ 3-t & t > 2 \end{cases}$. **(07 Marks)**

c. Find the Laplace transform of $e^{2t} \cos t + t\, e^{-t} \sin 2t$. **(07 Marks)**

7 a. Find the Laplace transform of $\int_0^t \cos 2(t-u) \cos 3u\, du$. **(06 Marks)**

b. Find the inverse Laplace transform of

i) $\dfrac{s+1}{s^2 - s + 1}$ ii) $\dfrac{1}{s(s^2 + a^2)}$. **(14 Marks)**

8 a. Find the inverse Laplace transform by using convolution theorem of $\dfrac{1}{(s^2 + a^2)^2}$. **(10 Marks)**

b. By applying Laplace transform, solve the differential equation $\dfrac{d^2y}{dt^2} + 5\dfrac{dy}{dt} + 6y = 5e^{2t}$. Subject to the conditions $y(0) = 2$, $y'(0) = 1$. **(10 Marks)**

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