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

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

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

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06MAT41

Fourth Semester B.E. Degree Examination, June 2012
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Use of statistical tables is permitted.

PART – A

1 a. Employ Taylor's method to obtain approximate value of y at x = 0.1 and x = 0.2 for the differential equation $y' = x^2y - 1$, y(0) = 1 considering upto the fourth degree term. **(06 Marks)**

b. Using Runge-Kutta method of fourth order, solve : $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with y(0) = 1 at x = 0.2, 0.4. **(07 Marks)**

c. Given $\frac{dy}{dx} = x^2 (1 + y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979, evaluate y(1.4) by Adams – Bashforth method. **(07 Marks)**

2 a. Obtain the Cauchy-Riemann equations in polar form. **(06 Marks)**

b. Verify that $v = e^x (x \sin y + y \cos y)$ is harmonic. Find u such that f(z) = u + iv is an analytic function. Also find f(z). **(07 Marks)**

c. Find the region in the W-plane bounded by the lines x = 1, y = 1, x + y = 1 under the transformation $W = Z^2$. Indicate the region with sketches. **(07 Marks)**

3 a. State and prove Cauchy's integral formula. **(06 Marks)**

b. Find the Laurent's expansion for $f(z) = \frac{z^2}{(z-1)(z-3)}$ in the region i) $1 < |z| < 3$; ii) $|z-1| < 2$. **(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 $|z| = 3$, by Cauchy's residue theorem. **(07 Marks)**

4 a. Obtain the series solution of the equation $4xy'' + 2(1 - x)y' - y = 0$. **(06 Marks)**

b. Obtain the series solution of Legendre's differential equation $(1 - x^2)y'' - 2xy' + n(n + 1)y = 0$. **(07 Marks)**

c. Express $4x^3 - x^2 - 3x + 8$ interms of Legendre polynomial. **(07 Marks)**

PART – B

5 a. Fit a parabola of the form $y = a + bx + cx^2$ to the following data : **(06 Marks)**

x	0	1	2	3	4	5
y	1	3	7	13	21	31

b. Obtain the lines of regression and hence find the coefficient of correlation for the data :

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(07 Marks)

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

6 a. Find mean and standard deviation of the binomial distribution. **(06 Marks)**

b. The probability that an individual suffers a bad reaction from a certain injection is 0.001. Using Poisson distribution, determine the probability that out of 2000 individuals :

i) Exactly 3 and

ii) More than 2 will suffer a bad reaction. **(07 Marks)**

c. The weekly wages of workers in a company are normally distributed with mean of Rs.700/- and standard deviation of Rs.50. Find the probability that the weekly wage of a randomly chosen worker is i) between Rs.650 and Rs.750, and ii) more than Rs.750. **(07 Marks)**

7 a. The mean and standard deviation of marks scored by a sample of 100 students are 67.45 and 2.92. Find : i) 95% and ii) 99% confidence intervals for estimating the mean marks of the student population. **(06 Marks)**

b. Ten individuals are chosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that the mean height of the universe is 66 inches. ($t_{0.5} = 2.262$ for 9 d.f). **(07 Marks)**

c. Explain the following terms :

i) Null hypothesis

ii) Confidence limits

iii) Type I and type II errors. **(07 Marks)**

8 a. A fair coin is tossed thrice. The random variables x and y are defined as follows : x = 0 or 1 according as head or tail occurs on the first toss. y = number of heads.

i) Determine the marginal probability distribution of x and y.

ii) Determine the joint distribution of x and y.

iii) Determine E(x), E(y), E(xy).

iv) Determine σ_x, σ_y. **(06 Marks)**

b. Define Stochastic matrix. Show that the matrix P is a regular Stochastic matrix and also find its unique fixed probability vector.

$$P = \begin{bmatrix} 0.5 & 0.25 & 0.25 \\ 0.5 & 0 & 0.5 \\ 0 & 1 & 0 \end{bmatrix}$$ **(07 Marks)**

c. A software engineer goes to his office everyday by motor bike or by car. He never goes by bike on two consecutive days. But if he goes by car on a day then he is equally likely to go by car or by bike the next day. Find the transition probability matrix of the Markov chain. If car is used on the first day of the week, find the probability that after 4 days

i) Bike is used

ii) Car is used. **(07 Marks)**

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06EC44

Fourth Semester B.E. Degree Examination, June 2012
Signals and Systems

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the even and odd components of the following signals :
i)

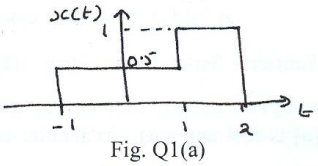

Fig. Q1(a)

ii) $x[n] = [1, 2, \underset{\uparrow}{0}, 1, -2]$. **(04 Marks)**

b. Determine if following signals are energy or power signals :
i) $x(t) = A; -T/2 \le t \le T/2$ ii) $x[n] = [1/4]^n u[n]$
$= 0$; elsewhere **(06 Marks)**

c. Given x(t) as shown in Fig. Q1(c), plot x(2t + 2) and x(–t –1). **(04 Marks)**

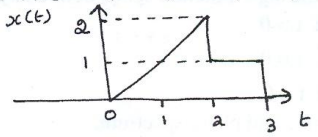

Fig. Q1(c)

d. The input –output relationship in a system is given by y[n] = x[n – 5] + x[n – 7], where x[n] is the input and y[n] the output. Determine the properties of the system. **(06 Marks)**

2 a. Prove that if the impulse response h(t) and the input x(t) are unit step functions the output is a ramp. **(05 Marks)**

b. If h(t) = u(t) – u(t – 3) and x(t) = u(t) = u(t – 1), determine the output y(t). **(08 Marks)**

c. If the input of a discrete LTI system is
$x[n] = [1, \underset{\uparrow}{3}, 2, 2]$ and the impulse response is,
$h[n] = [1, \underset{\uparrow}{4}, 2, 1]$, find the output. **(07 Marks)**

3 a. The output of an LTI system is given by y[n] = x[n + 1] + 2x [n] – x[n – 1]. Find the impulse response if x[n] is the input. Is the system stable? **(04 Marks)**

b. Obtain the natural response of a system described by the differential equation :

$$\frac{d^2y(t)}{dt^2} + \frac{2dy(t)}{dt} + y(t) = \frac{dx(t)}{dt}; \quad y(0) = 1; \left.\frac{dy(t)}{dt}\right|_{t=0} = 1.$$ **(06 Marks)**

c. Determine the impulse response of an LTI system described by the difference equation :
$y[n] - 0.6y[n-1] + 0.08y[n-2] = x[n]$. **(06 Marks)**

d. Draw the direct form I and II representations for a system described by the equation :

$$\frac{dy(t)}{dt} + 5y(t) = x(t).$$ **(04 Marks)**

4 a. Find x(t) if the Fourier - Series coefficients are as shown in Fig. Q4(a). The phase spectrum is a null spectrum. **(06 Marks)**

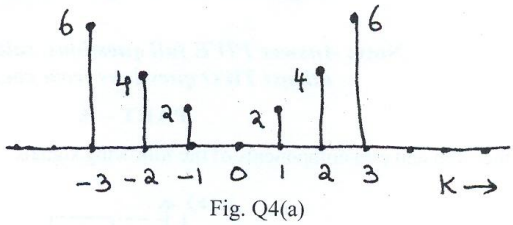

Fig. Q4(a)

b. Determine the Fourier – Series of the signal $x(t) = 3\cos\left(\frac{\pi}{2}t + \frac{\pi}{3}\right)$. Plot the magnitude and phase spectra. **(07Marks)**

c. Show that if x[n] is real and even, its Fourier coefficients are real. Hence find the DTFS coefficients for the signal $x[n] = \sum_{P=-\infty}^{\infty} \delta[n - 2p]$. **(07 Marks)**

PART – B

5 a. Find the FT of the sig—function sgn(t) defined by,

$$\text{sgn}(t) = \begin{cases} +1 & t > 0 \\ 0 & t = 0 \\ -1 & t < 0 \end{cases}$$

plot the magnitude and phase spectrum. **(07 Marks)**

b. If the Fourier transform of x(t) is X(jw) then, find the Fourier transform of x(at). **(06 Marks)**

c. Find the DTFT of the signal x[n] = u[n + 2] – u4[n – 3]. **(07 Marks)**

6 a. Find the FT of the train of unit impulses shown in Fig. Q6(a). **(07 Marks)**

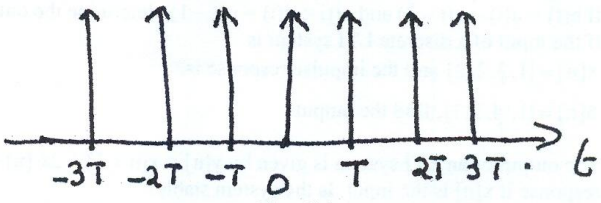

Fig. 6(a)

b. Determine the difference equation description for the system with the impulse response $h[n] = \delta[n] + 2(\frac{1}{2})^n u[n] + (-\frac{1}{2})^n u[n]$. **(06 Marks)**

c. Find the frequency response and impulse response of the system described by the differential equation :

$$2\frac{dy(t)}{dt} + 3y(t) = 7x(t).$$ **(07 Marks)**

7 a. Determine the Z-transform of
$x[n] = -u[-n-1] + (\frac{1}{4})^n u[n]$.
Determine the ROC and pole – zero locations of x(t). **(05 Marks)**

b. If the z-transform of x[n] is X(Z), derive the Z – transform of $a^n x[n]$. **(05 Marks)**

c. Using Z-transform, find the convolution of $x[n] = [\underset{\uparrow}{1},2,-1,0,3]$ and $y[n] = [\underset{\uparrow}{1},2,-1]$. **(05 Marks)**

d. Find the inverse Z – transform of

$$x(z) = \frac{\frac{1}{4}z^{-1}}{\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)}; \text{ROC} : |z| > \tfrac{1}{2}.$$ **(05 Marks)**

8 a. Given the Z –transform of the impulse response h[n] is

$$H(z) = \frac{1}{\left(1-\frac{1}{3}z^{-1}\right)\left(1-\frac{3}{2}z^{-1}\right)}.$$ **(06 Marks)**

What are the possible ROC? Comment on the stability and causality in each case.

b. Determine the transfer function and impulse response of the system described by

$$y[n] - \frac{1}{2}y[n-1] = 2x[n-1].$$ **(07 Marks)**

c. If the impulse response is given by $h[n] = (\frac{1}{3})^n u[n] + (\frac{1}{2})^{n-2} u[n-1]$, find the difference equation of the system. **(07 Marks)**

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06EC45

Fourth Semester B.E. Degree Examination, June 2012
Fundamentals of HDL

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Describe verilog data types with an example. **(08 Marks)**

b. For the following VHDL code, determine legal and illegal operations between data of different types.

```
SIGNAL a : BIT ;
SIGNAL b : BIT_VECTOR (7 DOWNTO 0);
SIGNAL c : STD_LOGIC ;
SIGNAL d : STD_LOGIC_VECTOR (7 DOWN TO 0);
SIGNAL e : INTEGER RANGE 0 TO 255;
...
   a < = b(5) ;
   b(0) < = a ;
   c < = d(5) ;
   d(0) < = c ;
   a < = c ;
   b < = d ;
   e < = b ;
   e < = d ;
```

(05 Marks)

c. Find the value of the expressions X1....X8, for the following VHDL signal declarations.

```
SIGNAL a : BIT : = '1' ;
SIGNAL b : BIT_VECTOR (3 DOWNTO 0) : = "1100";
SIGNAL c : BIT_VECTOR (3 DOWNTO 0) : = "0010";
SIGNAL d : BIT_VECTOR (7 DOWNTO 0) ;
```

i) X1 < = a and c;
ii) X2 < = c and b ;
iii) X3 < = b XOR c ;
iv) X4 < = a NOR b(3) ;
v) X5 < = b sll 2;
vi) X6 < = b sla 2;
vii) X7 < = b rol 2;
viii) X8 < = a AND NOT b(0) AND NOT c(1); **(07 Marks)**

2 a. Write a data – flow description in both VHDL and verilog of a system that has three 1 – bit input, a(1), a(2) and a(3) ; and one 1 – bit output b. The least significant bit is a(1); and b is I only when (a(3) a(2) a(1) = 1, 3, 6, or 7 (all in decimal), otherwise b is 0. Derive a minimized Boolean function of the system and write the data flow description. **(12 Marks)**

b. Write VHDL code using a data flow description of a full adder with enable. If the enable is low (0), the sum and carry are zero; otherwise, the sum and carry are the usual output of the adder. Draw the truth table of this adder, and derive the simplified Boolean function. **(08 Marks)**

3 a. Develop a VHDL model for a pipelined circuit that computes the average of corresponding values in three streams of input values, a, b and c. The pipeline consists of three stages : The first stage sums values of a and b and saves the value of c ; the second stage adds on the saved value of c, and third stage divides by three. The inputs and output are all signed fixed – point numbers indexed from 5 down to – 8. **(12 Marks)**

b. Explain the structure of the HDL behavioral description, with an example. **(08 Marks)**

4 a. Write a VHDL code, using structural description of a 3-bit comparator using adders. **(10 Marks)**

b. Develop a verilog model of a switch debouncer for a push button that uses a debounce interval of 10 ms. Assume the system clock frequency is 50 MHz. **(06 Marks)**

c. Write a verilog code of a pulse triggered master–slave JK flip flop, using structural description. **(04 Marks)**

PART – B

5 a. Explain how functions are described in VHDL and verilog. **(06 Marks)**

b. Develop VHDL code for signed vector multiplication, using procedure and tasks. **(14 Marks)**

6 a. Describe procedure for invoking a VHDL entity from a verilog module and a verilog module from a VHDL module. **(08 Marks)**

b. Develop mixed-language description of a 9-bit adder. **(08 Marks)**

c. Write a note on VHDL packages. **(04 Marks)**

7 a. List limitations of mixed-language description. **(04 Marks)**

b. Write mixed – language description of a simple RC filter. **(12 Marks)**

c. Describe instantiating CASEX in VHDL. **(04 Marks)**

8 a. With the help of flow chart. Explain synthesis steps in HDL. **(08 Marks)**

b. With an example, explain how mapping of procedure and task takes place in VHDL and verilog synthesis respectively. **(12 Marks)**

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06EC46

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 the working of basic operational amplifier circuit using transistors. **(05 Marks)**

b. Write the circuit diagram of 3 input inverting summing amplifier and derive the expression for the out put voltage. Explain how you can convert it into an adder and averager. **(08 Marks)**

c. A direct coupled non inverting amplifier is to amplify a 200mV signal to a level of 6V using an op-amp. Design a suitable circuit using op-amp 741. Given: For 741 $I_{b(max)}$ = 500nA and $V_{cc} = \pm 15V$. **(05 Marks)**

d. An op-amp with slew rate of 0.5 V/μs is used. Find the minimum time required for the circuit to change the output by 10V. **(02 Marks)**

2 a. Write the circuit diagram of a capacitor coupled voltage follower. Explain how you can increase the input impedance of that circuit and obtain the expression for the input impedance. **(07 Marks)**

b. Design a capacitor coupled inverting amplifier to have a gain of 100 and to operate in between 100Hz to 10 kHz. Assume signal voltage of 20mV, load resistance of 3.9 KΩ and $I_{b(max)}$ = 500nA. **(06 Marks)**

c. Design a capacitor coupled non-inverting amplifier using single polarity power supply. The specifications are V_{cc} = 20V, Gain =100, V_O = 4V, f_L = 100Hz, R_L = 4.7KΩ, $I_{b(max)}$ = 500nA. **(07 Marks)**

3 a. Explain Z_{in} mod technique of frequency compensation in op-amp. **(07 Marks)**

b. List 5 precautions to be taken for op-amp circuit stability. **(05 Marks)**

c. Explain slewrate effect on band width and output amplitude of an op-amp circuit. **(06 Marks)**

d. The gain-band width product of an op-amp circuit is 800 kHz. Calculate the upper cut off frequency if the closed loop gain is 100. **(02 Marks)**

4 a. Write the circuit diagram of three op-amp instrumentation amplifier and explain the working by deriving the expression for gain. **(07 Marks)**

b. Explain the working of peak clipper circuit using op-amp. **(05 Marks)**

c. Design a precission full-wave rectifier to produce a 2V peak output from a sinewave input with a peak value of 0.5V and a frequency of 1 MHz. Use supply of ±15V. Given $I_{b(max)}$ = 500nA. **(08 Marks)**

PART – B

5 a. Explain the working of positive clamper circuit using op-amp. **(04 Marks)**

b. Using block diagram of log and antilog amplifier explain the working of analog multiplier circuit. How you can convert it into a squarer? Explain. **(08 Marks)**

c. Design a phase shift oscillator using op-amp 741 to have an output frequency of 15kHz. The output amplitude is to be stabilized at ±14V, for the given op-amp $I_{b(max)}$ = 500nA. **(05 Marks)**

d. Write the circuit diagram of triangular rectangular wave generator with duty cycle and frequency controls. **(03 Marks)**

6 a. Write the circuit diagram and derive the expression for the voltage gain of the first order high pass filter using op-amp. Hence explain its working. **(08 Marks)**

b. Explain the working of inverting Schmitt trigger circuit. Explain how you can modify this circuit to get different trigger level with UTP ≠ LTP. **(07 Marks)**

c. Design an astable multivibrator to have ±9V output with a frequency of 1kHz, for the given op-amp $I_{b(max)}$ = 500nA. **(05 Marks)**

7 a. Write the functional diagram and explain the low voltage regulator using general purpose regulator IC723. **(06 Marks)**

b. State and explain the following terms with respect to 3 pin IC regulators:
   i) Load regulation
   ii) Source regulation
   iii) Drop out voltage. **(06 Marks)**

c. Describe how you can use 3 pin IC regulator as a current source. **(04 Marks)**

d. Design an adjustable voltage regulator circuit to get V_O =7.5V with load current of 25 mA using 7805 regulator IC. Given I_Q = 4.2 mA. **(04 Marks)**

8 a. Explain the principle of switch type analog phase detector. **(06 Marks)**

b. With circuit diagram, explain the working of Schmitt trigger using 555 timer IC. **(04 Marks)**

c. Explain basic DAC techniques. Hence describe the construction and working of R-2R ladder DAC. **(06 Marks)**

d. Explain the working of servo tracking A/P converter. **(04 Marks)**

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06ES42

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

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Differentiate between RISC and CISC cpu architectures. **(06 Marks)**

b. What is the internal memory capacity of 8051? Show the neat schematic of interface of external 8 K ROM and 16 K RAM to 8051. **(08 Marks)**

c. Explain briefly a machine cycle. What is the time taken to execute a two –cycle instruction ANL A, #n if crystal frequency is
i) 11.0592 MHz ii) 16 MHz. **(06 Marks)**

2 a. What is addressing mode? Put the number 1Ah in registers R_3, R_4 and R_5 in four different addressing modes? **(07 Marks)**

b. List bit-addressable instructions and their operation in 8051. Which flags are effected in such instructions. **(07 Marks)**

c. The number ECh is placed some where in external Ram, between locations 2000 h and 2020h. Write program to find the address of that location and put that address in R_6(LSB) and R_7(MSB). **(06 Marks)**

3 a. Explain different ranges in jump instructions, with figure. **(08 Marks)**

b. Compare jump and call instructions. **(04 Marks)**

c. Two multibyte numbers num1 and num2 are stored at locations 20h, 21h, - - - - and 30h, 31h, 32h, - - - -, Add num1 and num2 store the result at locations 40h, 41h, 42h, ----, Use CALL and RET instructions in the ALP. **(08 Marks)**

4 a. What are the reasons for writing programs in C language instead of assembly language? **(04 Marks)**

b. What are the ways to create a time delay in 8051C? Write C program to toggle all bits of ports p0 and p2 continuously, with a delay of few ms. **(08 Marks)**

c. List bit-wise logical operators in C, with examples. Write C program to read P1.0 and P1.1 bits and issue an ASCII character to P0, according to the table given below :

P1.1	P1.0	
0	0	Send '0' to P0
0	1	Send '1' to P0
1	0	Send '2' to P0
1	1	Send '3' to P0

(08 Marks)

PART – B

5 a. Explain the different modes of operation of timer/counter with relevant block diagrams. **(12 Marks)**

b. Write ALP to generate a square – wave of 2KHz, with a duty cycle of 66%. Use timer 0, mode 2. **(08 Marks)**

6 a. What is serial communication? How serial communication is carried- out with RS232 in 8051. **(06 Marks)**

b. Explain the bit pattern of SCON register. **(06 Marks)**

c. Write :

i) ALP to transfer serially letter 'A' continuously

ii) C program to receive bytes of data and put them in P1. Use baud rate of 9600, 8 bits and 1 stop bit, for both transmission and reception. Use timer 1, mode 2.

7 a. What are interrupts? Explain the interrupt system of 8051. **(08 Marks)**

b. With reference to Fig. Q7(b), normal status of INTI is high. Normal status of LED is OFF. When |NT| goes low, it turns ON LED and it remains ON for a fraction of second. Write program to perform the above function. **(06 Marks)**

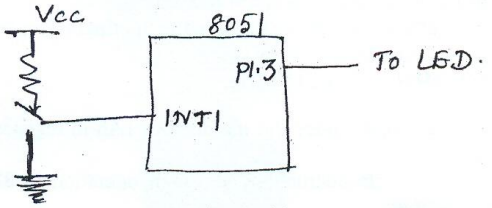

Fig. Q7(b)

c. Write C program that continuously gets a single bit of data from P1.7 and sends it to P1.0, while continuously creating a square wave of 200 μs period on P2.3. Use timer 0, mode2 to create square wave, assume XTAL = 11.0592 MHz. **(06 Marks)**

8 a. With a neat schematic diagram, show the interfacing of 8051 to ADC 0808 and write the steps to program 8051, to get data from ADC. **(10 Marks)**

b. Interface LCD module to 8051 and write program to display the word LCD. **(10 Marks)**

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06ES43

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. i) Describe in a simplified way, the components and variables of the biological control system involved in walking in a prescribed direction.
ii) Why is walking a closed loop operation?
iii) Under what conditions would the human walking apparatus become an open-loop system?
iv) Draw a block diagram assuming the person has a normal vision. **(08 Marks)**

b. What are the variables and elements of translational motion?
For the mechanical system shown in Fig.Q1(b),
i) Write the differential equations of performance.
ii) Draw and write loop and nodal equations based on F-V and F-I analogous networks.

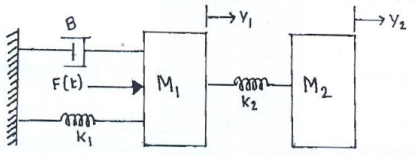

Fig.Q1(b) **(12 Marks)**

2 a. Find the closed loop transfer function of the system shown in Fig.Q2(a). **(10 Marks)**

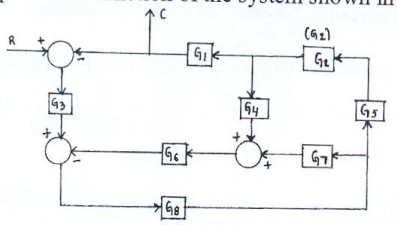

Fig.Q2(a)

b. For the signal flow graph shown in Fig.Q2(b), find $\frac{X_8}{X_1}$, using Mason's gain formula.

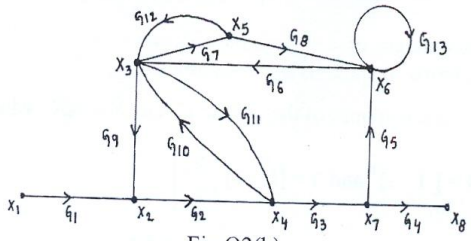

Fig.Q2(b) **(10 Marks)**

3 a. For a spring, mass, damper system shown in Fig.Q3(a)(i), an experiment was conducted by applying a force of 2 Newtons to the mass. The response X(t) was recorded using an X-Y plotter and the experimental result is as shown in Fig.Q3(a)(ii). Find the values of M, K and B. **(12 Marks)**

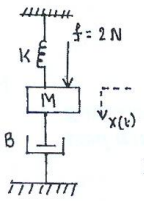

Fig.Q3(a)(i)

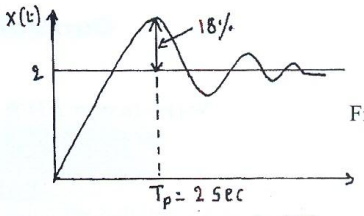

Fig.Q3(a)(ii)

b. Find K_p, K_v, K_a for the following unity feedback system $G(s) = \dfrac{100}{s^2(s+2)(s+5)}$.

Also determine the steady state error when the input is $r(t) = 1 + t + 2t^2$. **(08 Marks)**

4 a. Define: i) Marginally stable system; ii) Absolutely stable system; iii) Conditionally stable systems. **(06 Marks)**

b. Investigate the stability of the system represented by $s^6 + s^5 - 2s^4 - 3s^3 - 7s^2 - 4s - 4 = 0$, using R-H criterion. Ascertain the roots and indicate on S plan. **(08 Marks)**

c. The open loop transfer function of a unity feedback control system is given by,

$$g(s) = \frac{e^{-ST}}{s(s+2)}.$$

Investigate the stability. If stable or unstable, find the condition for T? **(06 Marks)**

PART – B

5 The open loop transfer function of negative feedback system is given by

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}.$$

Sketch the complete root locus with all pertinent details. **(20 Marks)**

6 a. Give step by step procedure to solve Nyquist criterion problem. **(06 Marks)**

b. For a certain control system $G(s)H(s) = \dfrac{K}{s(s+2)(s+10)}$. Sketch the Nyquist plot and hence calculate the range of values of K for stability. **(14 Marks)**

7 a. What are the various frequency response specifications? Define gain cross over frequency and phase cross over frequency. **(06 Marks)**

b. Sketch the Bode plot for the open loop transfer function for unity feedback control system and assess the stability, $G(s) = \dfrac{50}{(s+1)(s+2)}$. **(14 Marks)**

8 a. State the advantages of state variable analysis. **(04 Marks)**

b. Define the terms: i) state, ii) State variables. **(04 Marks)**

c. Obtain the time response of the system given: $\dot{X} = AX$, where $A = \begin{bmatrix} 0 & 1 \\ -2 & 0 \end{bmatrix}$;

given $X(t) = [1 \quad 1]^T$ and $Y = [1 \quad -1] \begin{bmatrix} X_1 \\ X_2 \end{bmatrix}$ **(12 Marks)**

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