

# CBCS SCHEME - Make-Up Exam

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BEC401

## Fourth Semester B.E/B.Tech. Degree Examination, June/July 2025 Electromagnetic Theory

Time: 3 hrs.

Max. Marks:100

**Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. M : Marks , L: Bloom's level, C: Course outcomes.

Module - 1			M	L	C
1	a.	State vector form of Coulomb's law of force between two point charges and indicate the units of quantities in the equation.	6	L2	CO1
	b.	$Q_1$ and $Q_2$ are the point charges located at $(0, -4, 3)$ and $(0, 1, 1)$ . If $Q_1$ is $2\text{nc}$ , find $Q_2$ such that the force on a test charge at $(0, -3, 4)$ has no Z component.	8	L3	CO1
	c.	Calculate the electric field intensity at a point $(3, 4, 5)$ due to a charge of $5\text{nc}$ placed at $(1, 2, 3)$ .	6	L3	CO1
OR					
2	a.	Derive an expression for the electric field intensity due to infinite line charge.	8	L2	CO1
	b.	Find $\vec{D}$ in Cartesian co-ordinate system at point $P(6, 8, -10)$ due to: i) a point charge of $40\text{mc}$ at the origin ii) a uniform line charge of $\rho_L = 40\text{ }\mu\text{c/m}$ on the Z-axis.	8	L3	CO1
	c.	Define electric flux and flux density.	4	L1	CO1
Module - 2					
3	a.	State and prove Gauss law as applied to an electric field.	8	L3	CO2
	b.	The flux density $\vec{D} = \frac{r}{3} \vec{a}_r \text{ nc/m}^2$ is in the free space i) Find $\vec{E}$ at $r = 0.2\text{m}$ ii) Find the total electric flux leaving the sphere of $r = 0.2\text{m}$ iii) Find the total charge within the sphere of $r = 0.3\text{m}$ .	8	L3	CO2
	c.	Find the divergence of $\vec{A}$ at $P\left(5, \frac{\pi}{2}, 1\right)$ where $\vec{A} = r \sin \phi \vec{a}_r + 3rZ^2 \cos \phi \vec{a}_\phi$ .	4	L3	CO2
OR					
4	a.	State and prove Gauss divergence theorem.	8	L3	CO2
	b.	If the potential field $V$ is $V = 100(x^2 - y^2)$ . Find $\vec{E}$ , $\vec{V}$ at a point $(2, -1, 3)$ and the equation representing the locus of all points having a potential of $300\text{V}$ .	4	L3	CO2
	c.	Derive continuity of current equation.	8	L2	CO2
Module - 3					
5	a.	Using Biot-Savart's law, determine the magnetic field intensity at a point due to infinite long straight conductor.	7	L3	CO3
	b.	Verify the potential field given below satisfies the Laplace's equation : $V = 2x^2 - 3y^2 + z^2$ .	5	L3	CO3
	c.	Derive Laplace and Poisson's equations and write Laplace equation in all 3 co-ordinate systems.	8	L2	CO3

OR

6	a.	State and explain Amperes circuital law.	8	L2	CO3
	b.	Given that the general vector $\vec{A}$ is $\vec{H} = 2.5\vec{a}_r + \vec{a}_\theta$ in spherical co-ordinates. Find the curl of H at $(2, \pi/6, 0)$ .	6	L3	CO3
	c.	Given that the vector magnetic potential $\vec{A} = x^2\vec{a}_x + 2yz\vec{a}_y + (-x)^2\vec{a}_z$ . Find the magnetic flux density.	6	L3	CO3
<b>Module - 4</b>					
7	a.	Derive the expression for the force between two differential current elements.	6	L2	CO4
	b.	A point charge of $Q = -1.2c$ has velocity $\vec{V} = (5\vec{a}_x + 2\vec{a}_y - 3\vec{a}_z)$ m/sec. Find the magnitude of the force exerted on the charge if : i) $\vec{E} = -18\vec{a}_x + 5\vec{a}_y - 10\vec{a}_z$ V/m ii) $\vec{B} = -4\vec{a}_x + 4\vec{a}_y + 3\vec{a}_z$ T iii) Both are present simultaneously.	9	L3	CO4
	c.	A conductor 6 m long lies along Z-direction with a current of 2A in $\vec{a}_z$ direction. Find the force experienced by conductor if $\vec{B} = 0.08\vec{a}_x$ T.	5	L3	CO4
<b>OR</b>					
8	a.	Write a note on : i) Magnetization ii) Permeability iii) Forces on magnetic materials.	6	L1	CO4
	b.	If $\vec{B} = 0.05x\vec{a}_y$ T in a material for which $x_m = 2.5$ . Find : i) $\mu_r$ ii) $\mu$ iii) $\vec{H}$ iv) $\vec{M}$ v) $\vec{J}$ .	8	L3	CO4
	c.	Discuss on magnetic boundary conditions.	6	L2	CO4
<b>Module - 5</b>					
9	a.	List Maxwell's equations for steady and time varying field in : i) Point form ii) Integral form.	6	L2	CO5
	b.	State and explain Faraday's law of electromagnetic induction.	6	L2	CO5
	c.	If the magnetic field $\vec{H} = [3x \cos \beta + 6y \sin \alpha]\vec{a}_z$ . Find current density $\vec{J}$ if fields are invariant with time.	8	L3	CO5
<b>OR</b>					
10	a.	Obtain solution of the wave equation for a uniform plane wave in free space.	8	L1	CO5
	b.	State and prove Poynting theorem.	8	L3	CO5
	c.	Wet marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\epsilon_r = 15$ and $\mu_r = 1$ . Show that at 60 Hz, it can be considered as good conductor. Hence at 60 Hz calculate : i) Skin depth ii) Intrinsic impedance iii) Propagation constant.	4	L3	CO3

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# CBCS SCHEME

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BEC402

## Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Principles of Communication Systems

Time: 3 hrs.

Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. M : Marks , L: Bloom's level , C: Course outcomes.*

Module – 1			M	L	C
Q.1	a.	Define Probability. Illustrate the relationship between sample space, events and probability.	6	L2	CO5
	b.	What are moments? Determine the characteristic function of a Gaussian random variable with a given mean and variance.	6	L2	CO5
	c.	Analyze the Gaussian process with Gaussian distribution curve. Infer the properties of a Gaussian process.	8	L2	CO5
<b>OR</b>					
Q.2	a.	Define a random process. Interpret mean and covariance function with respect to stationary random process.	6	L2	CO5
	b.	What is Autocorrelation function? State and prove the properties of Autocorrelation function.	6	L2	CO5
	c.	Analyze the PDF and CDF of a random experiment in which three coins are tossed and condition to get random variable is getting head.	8	L3	CO5
<b>Module – 2</b>					
Q.3	a.	Define Amplitude modulation. Derive an expression for Amplitude Modulation in time domain with necessary waveforms.	8	L2	CO1
	b.	A standard AM broadcast station is allowed to transmit modulating frequencies upto 5 kHz. If the AM station is transmitting on a frequency of 980 kHz, compute the maximum and minimum upper and lower side bands and the total bandwidth occupied by the AM station.	5	L3	CO1
	c.	Outline the block diagram of FDM transmitter. List the applications of FDM.	7	L2	CO1
<b>OR</b>					
Q.4	a.	Develop a code to generate Amplitude Modulation Waveforms and display its spectrum.	8	L3	CO1
	b.	Apply the concept of side bands to explain DSB and SSB, draw the relevant waveforms.	5	L2	CO1
	c.	Explain with diagrams, the working principle of Lattice-type balanced modulator.	7	L2	CO1
<b>Module – 3</b>					
Q.5	a.	Identify a method used to convert a Phase Modulated (PM) signal into a Frequency-Modulated (FM) signal.	6	L2	CO3
	b.	The input to an FM receiver has S/N of 2.8. The modulating frequency is 1.5 kHz. The maximum permitted deviation is 4 kHz. Determine (i) The frequency deviation caused by the noise and (ii) The improved output S/N.	6	L3	CO2

	c.	Interpret with a neat circuit diagram, the working principle of frequency modulation of a crystal oscillator with a Voltage Variable Capacitor (VVC).	8	L2	CO2
<b>OR</b>					
Q.6	a.	Define Modulation. Identify any five differences between Frequency Modulation and Amplitude Modulation.	6	L2	CO2
	b.	Why Pre-emphasis and de-amphasis are required? Explain how they are implemented?	6	L2	CO2
	c.	Draw the block diagram of a super heterodyne receiver and explain the function of each.	8	L2	CO2
<b>Module – 4</b>					
Q.7	a.	State and prove sampling theorem. Write a program for sampling and reconstruction of low pass signals and display the signals and its spectrum.	10	L3	CO3
	b.	Infer the working of TDM system with a neat block diagram.	5	L2	CO3
	c.	Explain briefly the block diagram of PPM generator.	5	L2	CO3
<b>OR</b>					
Q.8	a.	Identify and explain the basic elements of a PCM system with neat diagrams. For the data stream [0 1 1 0 1 0 0 1], draw the following line code waveforms: (i) Unipolar NRZ (ii) Polar NRZ (iii) Unipolar RZ (iv) Bipolar RZ (v) Manchester code	10	L3	CO3
	b.	Infer the advantages of digital signals over analog signals.	5	L2	CO3
	c.	Explain briefly the midtread and midrise Quantizers with relevant figures.	5	L2	CO3
<b>Module – 5</b>					
Q.9	a.	What is Intersymbol Interference (ISI)? With a neat block diagram outline the baseband binary data transmission system and write the necessary equations?	8	L2	CO4
	b.	Define SNR. Summarize the different types of external and internal noise.	7	L2	CO4
	c.	Illustrate the concept of Noise in cascaded stages with a diagram. Write Friis formula and mention its terms.	5	L2	CO4
<b>OR</b>					
Q.10	a.	What is Baseband digital transmission? Explain the following concepts briefly: (i) Nyquist criterion for distortionless transmission. (ii) Baseband M-ary PAM transmission.	8	L2	CO4
	b.	Define Noise. Classify the different types of semiconductor noise.	7	L2	CO4
	c.	What is Noise Factor and Noise Figure? An RF amplifier has an S/N ratio of 8 at the input and an S/N ratio of 6 at the output. Calculate the Noise factor and Noise figure.	5	L2	CO4

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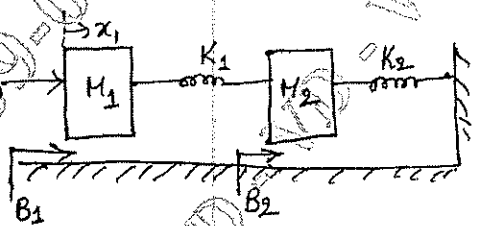
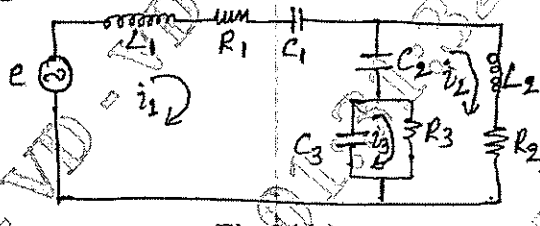

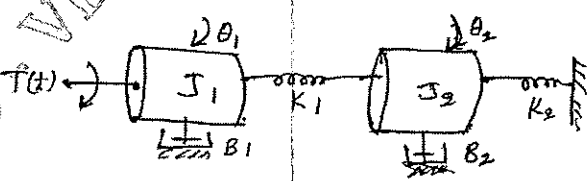
BEC403

## Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Control Systems

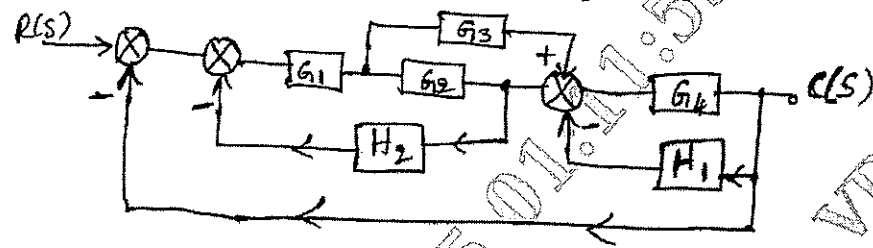
Time: 3 hrs.

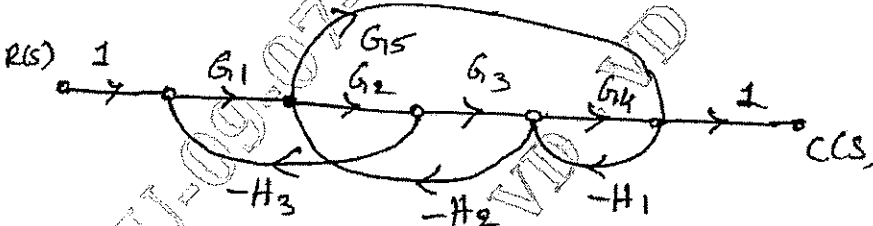
Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. M : Marks, L: Bloom's level, C: Course outcomes.*

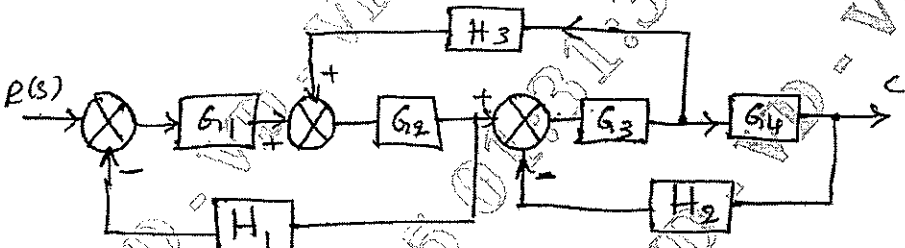
Module - 1		M	L	C		
<b>Q.1</b>	<b>a.</b>	Define control system with examples. Compare closed loop and open loop control systems.		06	L1 L2 L3	CO1
	<b>b.</b>	For the mechanical system shown in Fig.Q1(b), write the mechanical network, equilibrium equations and obtain the electrical network based on F-V analogy.		08	L1 L2 L3	CO1
		 <p style="text-align: center;">Fig.Q1(b)</p>				
	<b>c.</b>	The force-voltage analogy of a mechanical system is shown in Fig.Q1(c). Obtain its analogous mechanical network.		06	L1 L2 L3	CO1
		 <p style="text-align: center;">Fig.Q1(c)</p>				
<b>OR</b>						
<b>Q.2</b>	<b>a.</b>	Explain the effect of feedback on control systems.		06	L1 L2 L3	CO1
	<b>b.</b>	Find the force-voltage analogous electrical network for the given mechanical system shown in Fig.Q2(b).		06	L1 L2 L3	CO1
		 <p style="text-align: center;">Fig.Q2(b)</p>				
	<b>c.</b>	Derive the differential equation governing the mechanical rotational system shown in Fig.Q2(c). Draw the equivalent voltage and current analogy circuits.		08	L1 L2 L3	CO1
		 <p style="text-align: center;">Fig.Q2(c)</p>				

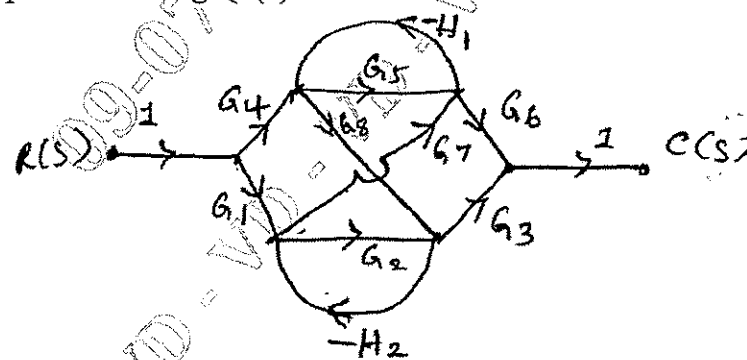
Module - 2

Q.3	<p>a. Determine the transfer function <math>C(S)/R(S)</math> for the system shown in Fig.Q3(a), using block diagram reduction technique.</p>  <p style="text-align: center;">Fig.Q3(a)</p>	10	L1 L2 L3	CO2
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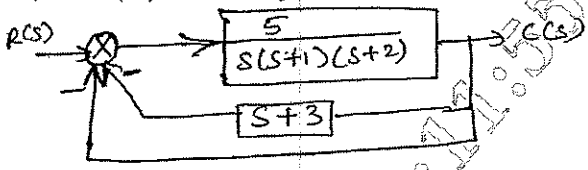
	<p>b. Determine the overall transfer function using Mason's gain formula for the signal flow graph shown in Fig.Q3(b).</p>  <p style="text-align: center;">Fig.Q3(b)</p>	10	L1 L2 L3	CO2
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OR

Q.4	<p>a. Find the transfer function by reducing the block diagram shown in Fig.Q4(a).</p>  <p style="text-align: center;">Fig.Q4(a)</p>	10	L1 L2 L3	CO3
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	<p>b. Find the transfer function by using Mason's gain formula for the signal flow graph shown in Fig.Q4(b).</p>  <p style="text-align: center;">Fig.Q4(b)</p>	10	L1 L2 L3	CO2
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## Module – 3

Q.5	<p>a. For the system shown in Fig.Q5(a), find the (i) System type (ii) Static error constants <math>K_p</math>, <math>K_v</math>, <math>K_a</math> (iii) the steady state error for an input <math>r(t) = 3 + 2t</math>.</p>  <p style="text-align: center;">Fig.Q5(a)</p>	08	L1 L2 L3	CO3
	<p>b. Find the step response <math>c(t)</math> for the system described by</p> $\frac{C(s)}{R(s)} = \frac{4}{s+4}$ <p>Also find time constant, rise time and settling time.</p>	05	L1 L2 L3	CO3
	<p>c. Derive the equation steady state error of simple closed loop system.</p>	07	L1 L2 L3	CO3

## OR

Q.6	<p>a. Given a unity feedback system with</p> $G(s) = \frac{20(1+s)}{s^2(2+s)(4+s)}$ <p>(i) What is the type of system?  (ii) Find static error coefficients.  (iii) Find steady error if the input is <math>r(t) = 40 + 2t + 5t^2</math></p>	06	L1 L2 L3	CO3
	<p>b. Write the general block diagram of the following and explain :  (i) PD type of controller (ii) PI type of controller</p>	06	L1 L2 L3	CO3
	<p>c. Derive the response of an under damped second order system for unit step input.</p>	08	L1 L2 L3	CO3

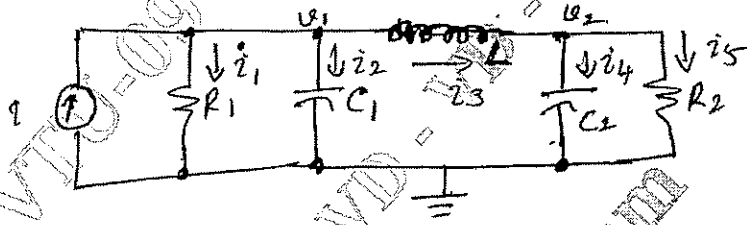
## Module – 4

Q.7	<p>a. Mention limitations of Routh's criterion.</p>	04	L1 L2 L3	CO4
	<p>b. Determine the range of <math>K</math> for which the system is stable such that a unity feedback system has <math>G(s) = \frac{K(s+13)}{s(s+3)(s+7)}</math> using RH criterion. Also find closed loop, poles more negative than <math>-1</math>.</p>	08	L1 L2 L3	CO4
	<p>c. Check the stability of the given characteristic equation using Routh's method.</p> $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$	08	L1 L2 L3	CO4

## OR

Q.8	<p>a. Sketch the complete Root locus of system having</p> $G(s)H(s) = \frac{K}{s(s+5)(s+10)}$	08	L1 L2 L3	CO4
	<p>b. Sketch the complete Root locus of system having</p> $G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)}$	12	L1 L2 L3	CO4

Module - 5

<p><b>Q.9</b></p>	<p><b>a.</b> Draw the Bode plot for the open loop transfer function of a system is</p> $G(s) = \frac{K(1+0.2s)(1+0.025s)}{s^3(1+0.001s)(1+0.005s)}$ <p>Determine that the system is conditionally stable. Find the range of K for which the system is stable.</p>	<p>10</p>	<p>L1 L2 L3</p>	<p>CO5</p>
	<p><b>b.</b> The transfer function of a system is</p> $G(s) H(s) = \frac{K}{s(s+2)(s+10)}$ <p>Sketch the Nyquist plot and hence calculate the range of values of K for stability.</p>	<p>10</p>	<p>L1 L2 L3</p>	<p>CO5</p>
<p>OR</p>				
<p><b>Q.10</b></p>	<p><b>a.</b> Obtain the state model of the network shown in Fig.Q10(a) assuming <math>R_1 = R_2 = 1 \Omega</math>, <math>C_1 = C_2 = 1F</math>, and <math>L = 1H</math>.</p>  <p style="text-align: center;">Fig.Q10(a)</p>	<p>10</p>	<p>L1 L2 L3</p>	<p>CO5</p>
	<p><b>b.</b> Obtain the state transition matrix for the state model whose A matrix is given by</p> $A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$	<p>10</p>	<p>L1 L2 L3</p>	<p>CO5</p>

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# CBCS SCHEME - Make-Up Exam

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BEC405A

## Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025 Microcontrollers

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. M : Marks , L: Bloom's level , C: Course outcomes.

Module- 1			M	L	C
Q.1	a.	With neat architecture diagram explain the features of 8051 microcontroller.	8	L2	CO1
	b.	Explain 4 I/O ports circuitry of 8051 with neat circuit diagram.	8	L2	CO1
	c.	Differentiate microprocessor and microcontroller.	4	L1	CO1
OR					
Q.2	a.	Interface the RAM of 8 Kbytes with starting address C000H and ROM of 32 Kbytes.	8	L3	CO1
	b.	With neat diagram explain the internal memory structure and programming model of 8051 microcontroller.	8	L2	CO1
	c.	Which are the criteria for choosing a microcontroller?	4	L1	CO1
Module- 2					
Q.3	a.	Explain different types of bit and byte Jump instructions.	6	L2	CO2
	b.	Analyse the following instructions with example : i. MOVX A, @DPTR ii. DA A iii. RLC A.	6	L3	CO2
	c.	Write an assembly language program to arrange the given array of numbers stored at starting address 30 H. (Assume array of 5, 8-bit numbers) in ascending order.	8	L3	CO2
OR					
Q.4	a.	Write an assembly level program to add the five consecutive 8 bit numbers located in RAM location with starting address 40 H. Store the 16 bit result in 50 H (lower byte) and 51 H (higher byte).	8	L3	CO2
	b.	Explain various addressing modes of 8051 microcontroller with example.	8	L2	CO2
	c.	What is stack? Explain the working of PUSH and POP instructions.	4	L1	CO2

## Module – 3

Q.5	a.	Explain the timer mode 1 and mode 2 operation.	6	L2	CO3
	b.	With neat diagram list and analyse the bit contents of TMOD and TCON registers.	6	L1	CO3
	c.	Write an assembly language program to generate a square wave with an ON time of 3 ms and on OFF time of 10 ms on all pins of port 0. Assume an XTAL of 22 MHz. Use Timer 0 in mode 1.	8	L3	CO3

## OR

Q.6	a.	Write an 8051 C program to transfer the message "HELLO" serially at 9600 baud continuously. Use 8-bit data, 1 stop bit.	8	L3	CO3
	b.	Write an 8051 C program to receive bytes of data serially and put them in port P0 and P2. Set the baud rate at 9600, 8 bit data and 1 stop bit. Use Timer 1 for baud rate generation.	8	L3	CO3
	c.	List and explain working of pins of RS 232 DB – 9 connector.	4	L1	CO3

## Module – 4

Q.7	a.	List out 8051 interrupt priority upon reset from highest to lowest with their vector address, what are the uses and function of six interrupts of 8051.	8	L2	CO4
	b.	Write an assembly program to generate two square wave. One of 5 KHz frequency at P1.3 and another of frequency 25 KHz at P2.3. Assume XTAL = 22 MHz.	8	L2	CO4
	c.	What is an interrupt? Compare interrupt vs polling.	4	L1	CO4

## OR

Q.8	a.	Write an assembly program I which 10 bytes of data stored in RAM locations starting from 45 H are transferred serially. At the end of data transfer the value of RO is displayed on P1. Use timer 1 mod 2 (baud rate 9600).	8	L3	CO4
	b.	What are the steps involved in executing interrupt.	4	L2	CO4
	c.	With neat diagram explain bit contents of interrupt priority (IP) register and interrupt enable (IE) register.	8	L2	CO4

## Module – 5

Q.9	a.	Explain the operation and pin description of LCD display.	6	L2	CO5
	b.	With neat diagram explain internal architecture of ADC 0804 chip.	8	L2	CO5
	c.	With the help of diagrams explain the working of DC motor rotation, clock wise and counter clock wise direction using H-bridge connection.	6	L2	CO5
<b>OR</b>					
Q.10	a.	A switch is connected to pin 2.7. Write a C program to monitor the status of switch (SW) and perform the following : i. If SW = 0, stepper motor moves clockwise ii. If SW = 1, the stepper motor moves counter clockwise.	10	L3	CO5
	b.	A door sensor is connected to the P1.1 pin and Buzzer is connected to P1.7. Write 8051 C program to monitor the door sensor and when it opens, sound the buzzer. You can sound the buzzer by sending square wave of few hundred Hz.	10	L3	CO5

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