CBCS SCHEME

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BEC401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.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
Q.1	a.	State and explain Coulomb's law of force between two point charges in vector form.	8	L1	CO1
	b.	Define Electric field intensity. Derive the expression for the electric field intensity at a point due to infinite line charges (Uniformly charged wire).	8	L2	CO1
	c.	Two very small conducting spheres, each of mass 1 × 10-4 kg are suspended at common point by very thin filaments of length 0.2m. A charge Q Coulomb is placed on each sphere. The electric force of repulsion separates the spheres and an equilibrium is reached when the suspending filaments make an angle of 10°. Assuming $e_r = 1$, g = 9.8N/kg and negligible mass for the filaments, find Q.	4	L3	CO1
		OR			
Q.2	a.	Define Point charge and using Coulomb's Law, derive expression for electric field intensity due to a point charge.	8	L2	CO1
	b.	Let a point Q1 = 25nc be located at A(4, -2, 7) and a charge Q2 = 60nc be at B(-3, 4, -2). Find $\vec{E}$ at C(1, 2, 3). Also find direction of the electric field. Given $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m.	8	L3	CO1
	c.	Two point charges of $+3 \times 10^{-9}$ C and -2×10^{-9} C are spaced two meter apart. Determine the electric field at a point which is one meter from each of the two point charges.	4	L3	CO1
		Module – 2			
Q.3	a.	State and prove Gauss Divergence theorem or divergence theorem.	8	L2	CO2
	b.	A point charge , Q = 30nc is located at the origin in Cartesian coordinates. Find the electric flux density and electric field intensity at (1, 3, -4)m.	8	L3	CO2
	c.	Derive an equation for equation of continuity (continuity of current).	4	L3	CO2
		OR			
Q.4	a.	State and prove Gauss law.	8	L2	CO2
	b.	Given that the potential field is $V = 2x^2y - 5z$. Find the potential , electric field intensity and volume charge density at point P(-4, 3, 6).	8	L3	CO2
	c.	State Gauss law in point form. Hence derive Maxwell's first equation.	4	L3	CO2

		Module – 3			
Q.5	**a.**	Starting from gauss law, derive Poisson's and Laplace equation. Hence define Laplace equation in all three coordinate systems.	**4**	**L2**	**CO3**
	b.	State and prove Stoke's theorem.	**8**	**L2**	**CO3**
	c.	Find the potential and volume charge density at P(0.5 , 1.5 , 1)m in free space. Given the potential field as under. i) $V = 2x^2 - y^2 - z^2$ volt ii) $V = 6\, r\, \phi\, z$ volt.	**8**	**L3**	**CO3**
		OR			
Q.6	**a.**	State and prove Biot – Savart's law.	**4**	**L1**	**CO3**
	b.	State and prove Ampere's circuital law.	**8**	**L1**	**CO3**
	c.	The magnetic field intensity is given in a certain region of space as : $\vec{H} = \left(\frac{x+2y}{z^2}\right)\hat{a}_y + \frac{2}{z}\hat{a}_z$ A/m. i) Find $\nabla \times \vec{H}$ ii) Find $\vec{J}$ iii) Use $\vec{J}$ to find total current passing through the surface , Z = 4 , $1 < x < 2$, $3 < y < 5$ in the $\hat{a}_z$ direction.	**8**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Define current element. Derive an equation for force on a differential current element in a magnetic field.	**8**	**L2**	**CO4**
	b.	A point charge Q = 18nc has a velocity of 5×10^6 m/s in the direction $\vec{a} = 0.6\,\hat{a}_x + 0.75\,\hat{a}_y + 0.3\,\hat{a}_z$. Calculate the magnitude of the force exerted on the charge by the field $\vec{B} = -3\,\hat{a}_x + 4\,\hat{a}_y + 6\,\hat{a}_z$ mT.	**8**	**L3**	**CO4**
	c.	Calculate the force on a straight conductor of length 0.3m carrying a current 5A in the Z – direction where the magnetic field is $\vec{B} = 3.5 \times 10^{-3}\,(a\hat{x} - a\hat{y})$ Tesla. ($a\hat{x}$ and $a\hat{y}$ are unit vectors).	**4**	**L3**	**CO4**
		OR			
Q.8	**a.**	Derive magnetic boundary condition for i) Tangential component of magnetic field. ii) Normal component of magnetic field.	**8**	**L2**	**CO4**
	b.	A conductor 4m long lies along the Y – axis with a current of 10A in the $a\hat{y}$ direction. Find the force on the conductor if the field in the region is $\vec{B} = 0.05\, a\hat{x}$ tesla.	**8**	**L3**	**CO4**
	c.	Find the magnetic field intensity inside a magnetic material for following conditions : M = 100A/m and $\mu = 1.5 \times 10^{-5}$ H/m B = 200μT , X_m (Magnetic susceptibility = 15).	**4**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Derive Integral and point form of Faraday's law.	**8**	**L2**	**CO5**
	b.	Given $\vec{E} = E_m \sin(wt - \beta z)\ \hat{a_y}$ in free space. Calculate $\vec{D}$, $\vec{B}$ and $\vec{H}$.	**8**	**L3**	**CO5**
	c.	A copper disc 40cm diameter is rotated at 3000 r.p.m on a horizontal axis perpendicular to and through the centre of disc axis, lying in magnetic meridian. Two brushes make contact with the disc at diametrically opposite points on the edge. If horizontal component of earth's field is 0.02 mT, find the induced e.m.f between brushes.	**4**	**L3**	**CO5**
		OR			
Q.10	**a.**	State and derive Poynting's theorem for uniform plane waves.	**8**	**L2**	**CO5**
	b.	Derive general wave equation in electric and magnetic fields.	**8**	**L2**	**CO5**
	c.	For silver, the conductivity is $\sigma = 3.0 \times 10^6$ s/m. At what frequency will depth of penetration be 1mm?	**4**	**L3**	**CO5**

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BEC402

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.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.	06	L1	CO1
	b.	Outline random processes and illustrate an ensemble of sample function with a neat diagram.	06	L2	CO1
	c.	Show that if a Gaussian process x(t) is applied to a stable linear filter, then the random process y(t) developed at the output of the filter is also Gaussian.	08	L3	CO2
		OR			
Q.2	a.	What is conditional probability? Prove that $P(B/A) = P(A/B) \cdot P(B) / P(A)$	06	L1	CO1
	b.	Define mean, correlation and covariance function.	06	L2	CO2
	c.	Develop a program to generate the probability density function of Gaussian distribution function.	08	L3	CO2
		Module – 2			
Q.3	a.	An antenna has an impedance of 40 Ω an unmodulated AM signal produces a current of 4.8 A. The modulation is 90 percent calculate i) The carrier power ii) The total power iii) The sideband power	06	L1	CO1
	b.	Explain with neat diagrams amplitude demodulation using the diode detector.	07	L1	CO1
	c.	Explain a general block diagram of an FDM system	07	L2	CO2
		OR			
Q.4	a.	Interpret the concept of modulation index and percentage of modulation write the necessary equations.	06	L1	CO1
	b.	Explain high level collector modulation with neat block diagram.	07	L2	CO1
	c.	Explain with diagrams the working principle of lattice type balanced modulator.	07	L2	CO2
		Module – 3			
Q.5	a.	Compare and contrast FM and AM.	06	L1	CO1
	b.	Explain with diagrams the working principle of frequency modulation using voltage controlled oscillator.	07	L2	CO2
	c.	Explain general block diagram of a super heterodyne receiver.	07	L2	CO2
		OR			
Q.6	a.	The input to an FM receiver having an S/N of 2.8. The modulating frequency is 1.5 KHz. The maximum permitted deviation is 4 KHz. What are (i) The frequency deviation caused by the noise (ii) The improved output S/N.	06	L2	CO2
	b.	Define PLL. Explain the basic block diagram of a PLL.	07	L1	CO2
	c.	Explain JFET mixer.	07	L2	CO2

Module – 4					
Q.7	**a.**	What are the advantages of digital signal over analog signals?	**04**	**L1**	**CO1**
	b.	Explain with basic elements of a PCM system with neat diagrams.	**08**	**L2**	**CO1**
	c.	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) Manchestor code	**08**	**L3**	**CO2**
OR					
Q.8	**a.**	State and prove Sampling theorem.	**04**	**L1**	**CO1**
	b.	What is multiplexing and why is it required in communication? Explain the working of TDM with a neat block diagram.	**08**	**L2**	**CO1**
	c.	Explain the generation of PPM with a relevant block diagrams and waveforms.	**08**	**L2**	**CO2**
Module – 5					
Q.9	**a.**	Define Intersymbol interference (ISI) outline baseband binary data transmission system with neat block diagram and equations.	**08**	**L2**	**CO1**
	b.	Develop a code to generate RZ pulse.	**04**	**L3**	**CO2**
	c.	Define signal to noise ratio. Explain different types of external and internal noise.	**08**	**L2**	**CO1**
OR					
Q.10	**a.**	Explain the following concept briefly: i) Nyquist criterion for distributors transmission ii) Baseband M-ary PAM transmission	**08**	**L1**	**CO2**
	b.	Develop a code to generate Raised cosine pulse.	**04**	**L2**	**CO2**
	c.	Illustrate the concept of noise in cascaded stages with a diagram. Write Friis formula and mention its terms.	**08**	**L2**	**CO3**

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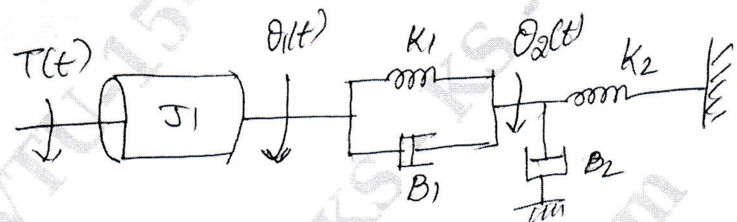
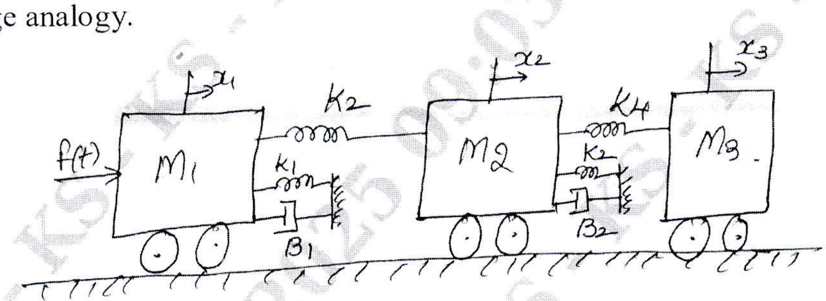
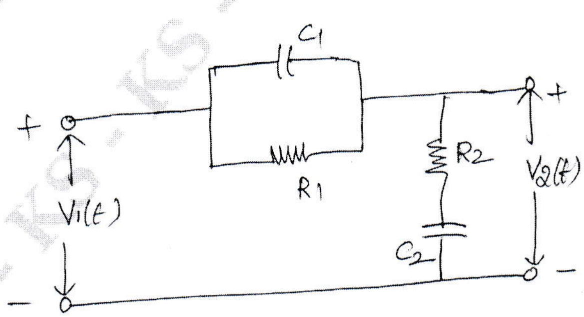
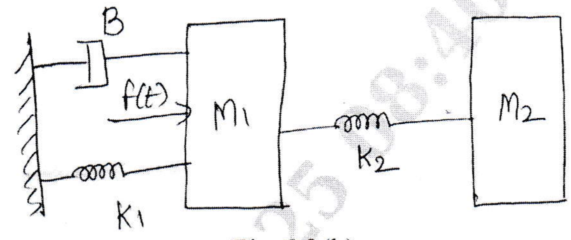
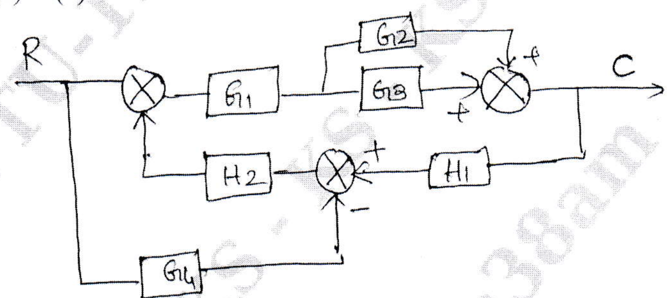
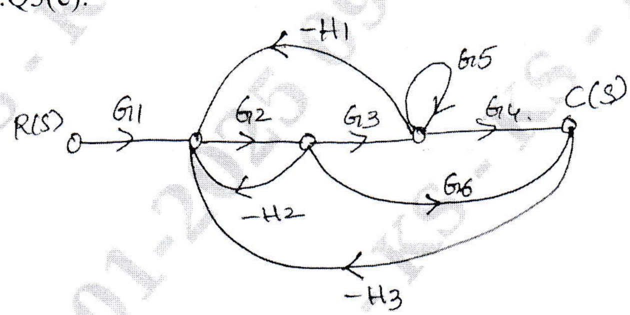
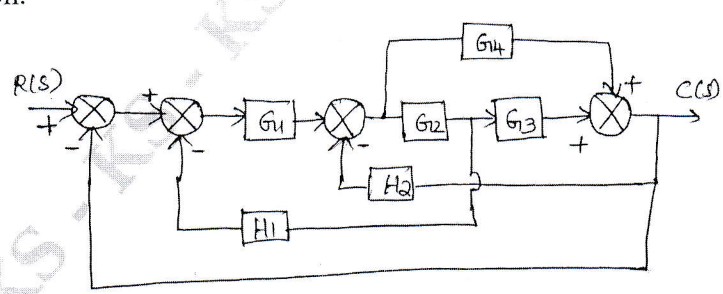
BEC403

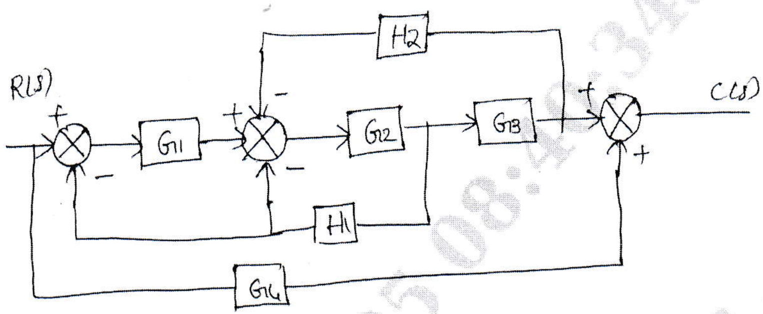
Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Control Systems

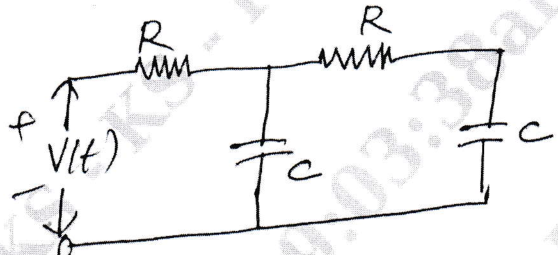
Time: 3 hrs. Max. Marks: 100

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
Q.1	a.	Compare open loop and closed loop control system with practical example.	06	L2	CO1
	b.	For the system shown in Fig.Q1(b). Find the transfer function $G(s) = \frac{\theta_2(s)}{T(s)}$ consider $J_1 = 1$ kgm^2, $K_1 = 1$ Nm/rad, $K_2 = 1$ Nm/rad, $B_1 = 1$ Nm/rad/sec, $B_2 = 1$ Nm/rad/sec.  Fig.Q1(b)	06	L2	CO1
	c.	Draw the mechanical network for the system shown in Fig.Q1(c). Write the equations of performance and draw its analogous circuit based one force voltage analogy.  Fig.Q1(c)	08	L2	CO1
		OR			
Q.2	a.	The circuit shown in Fig.Q2(a) is called lead-lag filter. Find the transfer function $\frac{V_2(s)}{V_1(s)}$ when $R_1 = 100\ \Omega$, $R_2 = 200\ K\Omega$, $C_1 = 1\ \mu F$ and $C_2 = 0.1\ \mu F$.  Fig.Q2(a)	10	L3	CO1

	b.	What are the variables and elements of translational motion? For the mechanical system shown in Fig.Q2(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.Q2(b)	**10**	**L2**	**CO2**
		Module – 2			
Q.3	**a.**	Give any six block diagram reduction rules to find the transfer function of the system.	**04**	**L1**	**CO2**
	b.	For the system represented in the given Fig.Q3(b), determine transfer function C(s)/R(s).  Fig.Q3(b)	**06**	**L2**	**CO1**
	c.	Find the overall transfer function of the system whose signal flow graph is shown in Fig.Q3(c).  Fig.Q3(c)	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	Interpret the transfer function by converting the block diagram into signal flow graph.  Fig.Q4(a)	**10**	**L2**	**CO2**

	b.	Obtain the transfer function for the block diagram shown in Fig.Q4(b) using block diagram reduction technique.  Fig.Q4(b)	**10**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Make use of the response curve of 2^{nd} order under-damped system to define and derive the expression for (i) peak time (ii) peak overshoot (iii) rise time	**10**	**L2**	**CO3**
	b.	Find K_p, K_v and K_a for a system having $G(s)=\frac{s+10}{s(s^3+7s^2+12s)}$. Also, evaluate the steady state error, when the I/P r(t) is given by: (i) $r(t)=5u(t)$ (ii) $r(t)=2t\,u(t)$ (iii) $r(t)=4t^2u(t)$	**10**	**L2**	**CO3**
		OR			
Q.6	**a.**	Derive an expression for the under damped response of a second order feedback control system for step input.	**10**	**L2**	**CO2**
	b.	Explain the static error constant and derive the expressions.	**06**	**L2**	**CO2**
	c.	Analyze the effect of PD controller for 2^{nd} order control system with appropriate equations.	**04**	**L2**	**CO2**
		Module – 4			
Q.7	**a.**	The open loop transfer function of a unity feedback system is given by $G(s)=\frac{K}{s(s+3)(s^2+s+1)}$. Find the valve of K that will cause sustained oscillation and hence find the oscillation frequency.	**08**	**L2**	**CO3**
	b.	Sketch the root locus plot for a negative feedback control system whose open loop transfer function is given by $G(s)H(s)=\frac{K}{s(s+1)(s+2)(s+3)}$. For all values of K ranging from 0 to α. Find the value of K for closed loop stability.	**12**	**L3**	**CO3**
		OR			
Q.8	**a.**	For the characteristic equations given below, determine number of roots with positive real part: i) $s^6+s^5+3s^4+2s^3+5s^2+3s+1=0$ ii) $s^8+s^7+4s^6+3s^5+14s^4+11s^3+20s^2+9s+9=0$	**10**	**L2**	**CO4**

	b.	Show that the part of root locus of a system with $G(s)H(s) = \frac{K(s+3)}{s(s+2)}$ is a circle having center (–3, 0) and radius at $\sqrt{3}$.	10	L3	CO3
		Module – 5			
Q.9	a.	Construct the bode plot for the transfer function $G(s) = \frac{80}{s(s+2)(s+20)}$. Determine GM and PM, ω_{pc}, ω_{gc}.	10	L2	CO3
	b.	Obtain the state transmition matrix for the following system: $\begin{bmatrix} x_1^1 \\ x_2^1 \end{bmatrix} = \begin{bmatrix} -1 & -0.5 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0.5 \\ 0 \end{bmatrix} u$	10	L2	CO5
		OR			
Q.10	a.	Using Nyquist stability criteria investigate the stability negative feedback control system whose open loop transfer function is given by $G(s)H(s) = \frac{100}{(s+1)(s+2)(s+3)}$. Assume $\omega_g = 1.253$ rad/sec.	10	L2	CO5
	b.	Obtain the state model of electrical network shown in Fig.Q10(b), by choosing $V_1(t)$ and $V_2(t)$ as state variables.  Fig.Q10(b)	10	L3	CO5

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CBCS SCHEME

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BEC405A

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.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.	Bring out the difference between Microprocessor and Microcontroller.	04	L2	CO1
	b.	With function of each pin, explain the pin layout of 8051 Microcontroller.	10	L2	CO1
	c.	Summarize the internal RAM configuration of 8051.	06	L2	CO1
		OR			
Q.2	a.	Differentiate between CISC and RISC processor architectures.	04	L2	CO1
	b.	With a neat architecture, explain the architectural features of 8051.	08	L2	CO1
	c.	Interface 8051 microcontroller to 16K bytes of EPROM and 8K bytes of RAM. Explain with neat sketch.	08	L3	CO1
		Module – 2			
Q.3	a.	What is an addressing mode? Explain 4 different addressing modes of 8051 with examples.	08	L2	CO2
	b.	Illustrate with a neat diagram different ranges of jump instructions.	06	L2	CO2
	c.	Write an ALP to convert a packed BCD number into two ASCII numbers. Store the result in R5 and R6 respectively.	06	L2	CO2
		OR			
Q.4	a.	Define assembler directives. Explain the same with examples.	08	L2	CO2
	b.	List and explain bit level logical instructions in 8051.	06	L2	CO2
	c.	Develop an assembly language program to swap the contents of R3 and R4 registers in BANKO using different methods.	06	L2	CO2
		Module – 3			
Q.5	a.	Explain the bit contents of TCON and TMOD registers.	06	L2	CO3
	b.	Develop an ALP to generate a square wave of frequency 1 kHz on Pin P1.2 using Timer 0 in mode 2. Show the delay calculation. Assume XTAL frequency = 22 MHz.	06	L3	CO3
	c.	Explain RS232 in serial communication using 8051 Microcontroller with DB-9 pin connector.	08	L2	CO3
		OR			
Q.6	a.	Explain the bit pattern of SCON register with diagram.	04	L2	CO3
	b.	Develop an 8051 C program to transfer letter "A" serially at 9600 baud rate, 8 bit data, 1 stop bit, do this continuously.	08	L3	CO3
	c.	Explain Mode 2 operations of timers and explain steps involved in programming timer in Mod 2, with necessary diagram.	08	L2	CO3
		Module – 4			
Q.7	a.	Explain the structure of interrupt priority and interrupt enable register.	08	L2	CO4
	b.	Explain interrupt vector table of 8051 Microcontroller.	06	L2	CO4
	c.	Explain programming of Timer interrupts.	06	L2	CO4

		OR			
Q.8	**a.**	List the steps involved in executing an interrupt.	**04**	**L2**	**CO4**
	b.	Write an ALP program using interrupts to generate a square wave on port pin P1.2 of 10 kHz using timer 0 in mode 2, XTAL = 22 MHz.	**08**	**L3**	**CO4**
	c.	Explain the steps involved in programming serial communication interrupts.	**08**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	With a neat diagram, write an 'C' language program to interface DAC to 8051 Microcontroller to generate staircase waveform with 20 steps.	**10**	**L3**	**CO5**
	b.	Explain the interfacing of DC motor using C programming.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	With neat diagram, write an C language program to interface stepper motor to 8051 Microcontroller.	**10**	**L3**	**CO5**
	b.	Write a C program to display 'HELLO WORLD' by interfacing LCD display to 8051 Microcontroller.	**10**	**L3**	**CO5**

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CBCS SCHEME

USN 1KS22EC029

BBOK407

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Biology for Engineers

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 cell. Explain the structure and function of plant cell with neat diagram.	08	L2	CO1
	b.	Define Stem Cell. Discuss the types and application of stem cells.	06	L2	CO1
	c.	Describe the properties and functions of hormones.	06	L2	CO1
		OR			
Q.2	a.	Discuss the properties and functions of nucleic acids in cellular processes.	07	L2	CO1
	b.	Discuss the properties and functions of enzymes.	07	L2	CO1
	c.	Discuss the properties of vitamins and its supplies.	06	L2	CO1
		Module – 2			
Q.3	a.	Apply the knowledge of nucleic acid in DNA finger printing in forensic applications.	08	L3	CO1
	b.	Discuss whey protein and plant based protein as protein based food.	06	L2	CO1
	c.	Write a note on PLA as bioplastic.	06	L1	CO1
		OR			
Q.4	a.	Apply your knowledge of lipids and outline the process of obtaining biodiesel from lipids.	07	L3	CO1
	b.	Define vaccine. Discuss the mechanism of RNA vaccine for COVID-19.	07	L2	CO1
	c.	Write a note on enzyme based biosensors.	06	L1	CO1
		Module – 3			
Q.5	a.	Compare human brain with computer's CPU.	07	L3	CO2
	b.	Explain lungs as a purification system.	07	L2	CO2
	c.	Write a note on dialysis systems of kidney.	06	L1	CO2
		OR			

Q.6	a.	Illustrate the engineering solutions available for Parkinson's disease.	07	L3	CO2
	b.	Explain heart as a pumping system.	07	L2	CO2
	c.	Write a note on optical correction and materials used for lens.	06	L1	CO2
		Module – 4			
Q.7	a.	Illustrate the HBOCs and PFCs as human substituents.	07	L3	CO3
	b.	Explain how the structure of shark skin reduces drag and how these properties have been applied to improve swim suit.	07	L2	CO3
	c.	Explain the term GPS and aircrafts technology as bio inspired by bird fly.	06	L2	CO3
		OR			
Q.8	a.	Compare the uses of ultrasonography and sonars.	07	L3	CO3
	b.	Discuss the king fisher beak shaped bullet train to the reduction of noise and improve the stability.	06	L2	CO3
	c.	Explain the term superhydrophobic and self-cleaning in lotus leaf effect.	07	L2	CO3
		Module – 5			
Q.9	a.	Explain bioimaging and artificial intelligence technique in disease diagnosis.	08	L2	CO4
	b.	Explain the working principles of electrical tongue and electrical nose in food industry.	06	L2	CO4
	c.	Write a note on bioengineering of Muscular dystrophy and oseteoporosis.	06	L1	CO4
		OR			
Q.10	a.	Explain the process of biomining via microbial surface adsorption.	07	L2	CO4
	b.	Describe the concept of DNA origami and its role in bio-computing.	06	L2	CO4
	c.	Write a note on self healing bio-concrete and bio-mineralization processes.	07	L1	CO4

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