ALIAH UNIVERSITY

End-Semester Examination – Autumn 2023
(B.Tech ECE 2nd Yr-3rd Semester)
Subject Name: Data Structures & Algorithms
Subject Code: CSEUGPC01

Full Marks- 80 Time-3hrs.

Group-A

Answer any five questions **5×2=10**

(1) Define function recursion with an example.

(2) Write the worst case time complexity to search an element in a linked list of length n and the worst case time complexity to search an element in a sorted array.

(3) Differentiate between chaining and open addressing.

(4) A binary search tree is formed from the sequence 6, 9, 1, 2, 7, 14, 12, 3, 8, 18. Find the minimum number of nodes required to be added to this tree to form an extended binary tree.

(5) Consider a two dimensional array A[25,4]. The base address of the array is 400, words per memory cell is 4 byte. Find the address of A[17,2] using row major and column major addressing.

(6) A circular queue is implemented using an array of size 10. The array index starts with 0, front is 6, and rear is 9. Find the index position where the next element is to be inserted.

Group-B

Answer any six questions **6×5=30**

(2) Consider B+ tree in which the search key is 12 bytes, block size is 1024 bytes, record pointer is 10 bytes and block pointer is 8 bytes. Find the maximum number of keys that can be accommodated in each non-leaf node of the tree.

(3) Write algorithm of insertion of elements into queue and deletion of elements from queue.

(4) Write the algorithm of mergesort technique.

(5) Explain the best case, average case and worst case time complexity of linear search algorithm with a suitable example.

(6) Evaluate the postfix expression using stack: 40 25 + 20 5 * 3 + -

(7) Create B-Tree of order 4 using the list of data items: 9, 7, 25, 13, 4, 16, 5, 10, 13, 15, 7, 11.

(8) What do you mean by stack overflow and stack underflow? Explain with suitable example.

Group-C

Answer any three questions **4×10=40**

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(9) The inorder and preordor traversal of a tree are given below:

Inorder: DBMINEAFCJUK
Preorder: ABDUIMNCFGJK

(a) Construct the corresponding binary tree.
(b) Determine the postorder traversal of the tree drawn.
(c) Write the properties of a B-tree.

(5+3+2)=10

(10)

(a) The keys 1, 5, 28, 19, 15, 20, 33, 12, 17, 10 are inserted into a hash table in which collision resolution is done by chaining. If the hash function, H(k)=k mod 4 and what is the length of the longest chain?.

(b) Discuss the collision resolution techniques in Hashing.

(c) A hash function H defined as H(key)=key mod 7, with linear probing , is used to insert the keys 37, 38, 44, 55, 70, 11, 63 into a table indexed from 0 to 6. 11 will be stored in the location-

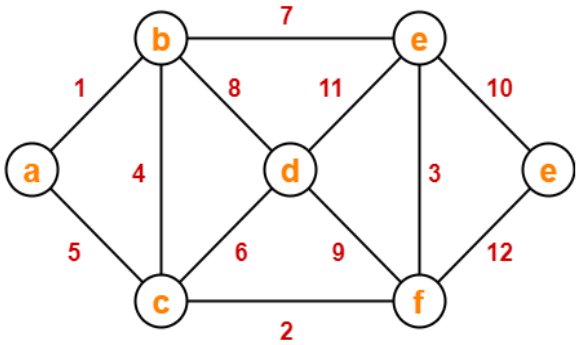
(3+5+2)=10

(11). (a) Construct a B+-Tree of order 3 using the key values: 55, 77, 60, 33, 100, 14, 11, 45.

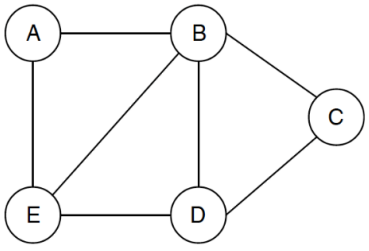
(b) Construct an AVL tree using the elements: 3, 5, 11, 8, 4, 1, 12, 7, 2, 6, 10.

(6+4)=10

(12). (a) Using Prim's Algorithm, find the cost of minimum spanning tree (MST) of the given graph:



(b) Apply BFS and DFS on the below graph:



(6+4)=10

B.Tech. End Semester Examination 2022-23
Electronics and Communication Engineering (ECE)
Odd Semester Regular and Supplementary
Analog Electronics (ECEUGPC01/ECE201)
ECE 2nd Year 3rd SEM

Full Marks: 80 **Times: 3.00 Hrs**

Answer any five questions.

****Candidates must draw appropriate circuit diagrams/block diagrams wherever required**

1 **a.** Explain the voltage divider biasing scheme of BJT and derive the expression of stability factor for the same scheme with proper circuit diagram and also Explain why the voltage divider biasing scheme is more preferred?

b. A G_e transistor with β=49 has voltage divider biasing arrangement with following specifications such as V_{CC}=10 V, R_C=1 kΩ, V_{BE}= 0.3 V, V_{CE}= 5 V, I_C =4.9 mA and stability factor S=10. Determine the Values of R_1, R_2 and R_E. . (Draw the appropriate circuit diagram) **10+6=16**

2 **a.** Discuss various types of feedback mechanism (connection). Show with the help of corresponding block diagram.

b. Show that voltage feedback connection tend to decrease the output impedance, whereas current feedback connection tend to increase the output impedance. **10+6=16**

3 **a.** State Barkhausen criteria for oscillation and basic block diagram of Oscillator.

b. Explain the working principal of RC Phase shift oscillator and write the expression of oscillation frequency.

c. For an emitter-bias configuration based circuit the following specifications are given such as I_{CQ}= (1/2) I_{sat}, I_{sat}= 8 mA, V_C =18 V and β=110. Determine R_C, R_E and R_B. (Draw the appropriate circuit diagram). **4+6+6 = 16**

4 **a.** With help of proper circuit diagrams explain active low pass filters, active high pass filters, active band pass filters and active band stop filter.

b. Calculate the cut-off frequencies of the band pass filter circuit with for R_1=R_2=10 kΩ, C_1=0.1 μF and C_2=0.002 μF, also find the gain if R_G= 10 kΩ, R_F=50 kΩ. (Draw the appropriate circuit diagram) **12+4=16**

5 **a.** Explain operation of astable multivibrator using IC 555 timer in-detail and also write down the expression of frequency in output waveform.

b. Design the circuit of astable multivibrator using IC 555 timer for generating square signal of 50% duty cycle without removing any existing passive components. **10+6=16**

6 **a.** Draw the common emitter configuration based voltage divider network for the ac response with the r_e model inserted between the appropriate terminals by including r_o and derive the expression of Z_i,Z_o and A_v.

b. A fixed bias network based on CE configuration has the following specifications such as V_{CC} =10 V, R_B= 470 kΩ, R_C= 3 kΩ, ,β=100 and C_1= C_2=10 μF. For this network determine the following parameters using the r_e model of transistor **8+8=16**

(i) r_e (ii) Z_i (with r_o=∞) (iii) Z_o (with r_o=∞) (iv) A_v

7 a. Draw and explain the fixed bias circuit of an *n*-channel JFET in common source configuration.

b. An *n*-channel JFET with voltage divider biasing scheme has the following device parameters such as V_P = -5 V, I_{DSS}=12 mA, R_1=400 kΩ, R_2= 90 kΩ, R_D=2 kΩ, R_S=2 kΩ and V_{DD}=18 V. Find the operating point. **8+8=16**

8 a. Write short notes on any one of the following:

(i) Monostable multivibrator
(ii) Square wave generation using OP-AMP
(iii) RC coupled amplifier **8+8=16**

End of Question Paper

B.Tech Examination-2022
Electronics and Communication Engineering
(Odd Semester Regular and Supplementary)
Signals and Networks (ECEUGPC02)

Full Marks: 80 Time: 3.00 Hrs

Attempt any five question from Q:2 to Q:8 (Each question carry equal marks here)
Answer all parts of a question in same place.
Figures on the right hand side margin indicate full marks.
Symbols have their usual meaning

1. *Answer any Ten questions(1×10)* **Marks**

(i) Energy of unit step signal is.....watts

(ii) The system $y(n) = x(n-3) - 4x(n-10)$ is
a) dynamic system
b) memory less system
c)time varying system
d)none of these

(iii) If a periodic signal has halfwave symmetry, the Fourier series contains

a) only sine terms

b) only cosine terms

c) constant and cosine term

d) both sine and cosine terms

(iv) The system y[n]=ax[t]+b is a

a) Linear and time variant

b) Linear and time-invariant

c) Non-linear and time variant

d) Non-linear and time-invariant

(v) The Z-Transform X(z) of a discrete **causal sequence x(n)** is defined as:

a) $\sum_{n=-\infty}^{\infty} x(n)z^{n}$
b) $\sum_{n=-\infty}^{\infty} x(n)z^{-n}$
c) $\sum_{n=0}^{\infty} x(n)z^{n}$
d) None of the mentioned

(vi) What is the ROC of the signal $x(n)=\delta(n-k)$, $k>0$?

a) z=0

b) z=∞

c) Entire z-plane, except at z=0

d) Entire z-plane, except at z=∞

(vii) The Fourier transform of a dc signal is

a) Impulse function

b) Triangular pulse

c) Sine function

d) Sinc function

(viii) The convolution of u(t) with u(t) is equal to

a) u(t)

b) δ(t)

c) tu(t)

d) None

(ix) ROC of a causal signal x(t) is

a) Entire s-plane

b) Right half of s-plane

c) Left half of s-plane

d) None

(x) The amplitude spectrum of a sinc function is

a) a rectangular pulse b) a sine function

c) Gaussian d) an impulse function

(xi) If a signal is folded about the origin in time then its

a) magnitude spectrum undergoes change in sign

b) Phase spectrum undergoes change in sign

c) magnitude remains unchanged

d) both (b) and (c)

(xii) A two port network is reciprocal if

a) $Z_{11}=Z_{22}$ b) AD-BC=1 c) $Y_{12=}-Y_{21}$ d) $h_{12}=h_{21}$

2. (a) Find out the z-transform and ROC of the following sequence of the following ramp function, 5

$$x(n)=nu(n)$$

(b) Find the transfer function of the following system 4

$$y(n)-4y(n-1)+4y(n-2)=x(n-1)$$

(c) Find the inverse Z transform of the function, 5

$X(z)=(3-5/6z^{-1}\ )/(1-1/4\ z^{-1})(1-1/3\ z^{-1}\ )$

ROC: $1/4 < |z| < 1/3$

3. (a) Prove that output of an LTI system is the convolution sum of input x(n) and impulse response h(n) , i.e. $y(n)=x(n)* h(n)$ 5

(b) Obtain the convolution of the following two sequences 5

$x(n)=\{\underset{\uparrow}{3}, 2, 1, 2\}$ and $h(n)=\{\underset{\uparrow}{1}, 2, 1, 2\}$

(c) What is aliasing? What is an anti-aliasing filter? 3+1

4. (a) Check the followings for the system y(t)= tx(t) 6

i) Static & Dynamic

ii) Linear & Nonlinear

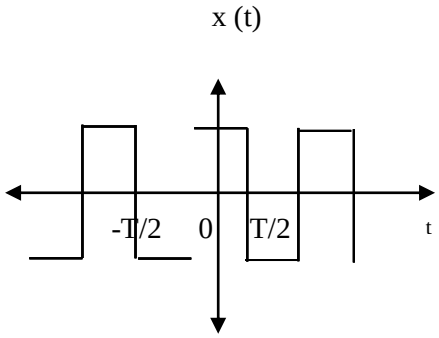
iii) Causal & Non-Causal

(b) Explain the even symmetry and odd symmetry of Fourier series. 3

(c) Find the Fourier series coefficients for the continuous time periodic signal 5

x (t)= A for $0 \le t < T/4$

= -A for $T/4 \le t < T/2$



5. **(a)** State and prove the final value theorem of Laplace transform. 4

(b) Find the Laplace transform and its ROC of the following sequence 5

$x(t) = (t^2+2t+1)u(t)$

(c) Find the inverse Laplace transform of 5

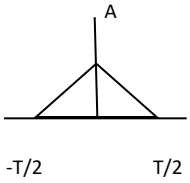
$$X(s) = \frac{s}{s^2+4s+3} \qquad \text{ROC: } |s|>2$$

6. **(a)** Prove the following properties of Fourier transform: 2+3

i) Frequency shifting

ii) Time differentiation

(b) Find the Fourier transform of triangular pulse x(t) shown as follows: 5

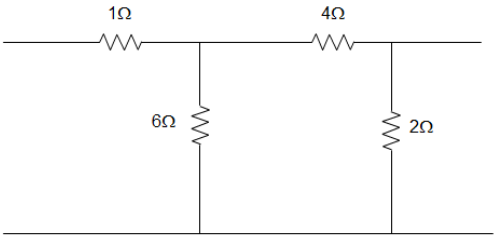


(c) State the relation between Fourier transform and Laplace transform 4

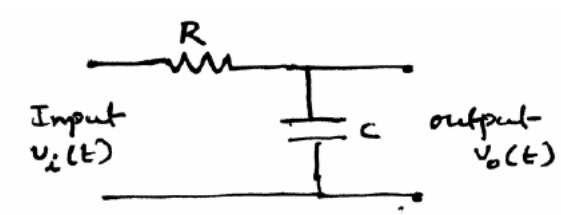
7. **(a)** Express the two port network in terms of open circuit impedance [Z] parameter. 4

(b) What is symmetry and reciprocity condition of Z parameter, prove them. 6

(c) For the given network , find the Z parametes . Also draw its equivalent circuit. 4



8. **(a)** 4+4



(b) Derive the Laplace transform of periodic signal. 6

-End-

B.Tech. Examination-2022
Electronics and Communication Engineering
(Odd Semester Regular and Supplementary)
Physics of Semiconductor Devices (ECEUGPC03/ECE203)

Full Marks: 80 Time: 3.00 Hrs

- ***Answer <u>any five</u> questions only.***
- *Figures on the right hand side margin indicate full marks.*
- *Symbols have their usual meanings*
- *Assume all necessary parameters*

			Marks
1	(a)	What is the significance of Schrödinger equation.	4
	(b)	Find the ground state of an electron in an one-dimensional infinite quantum well of width '*a*', and uniform well potential of V_0.	12
2	(a)	Write the equations relating of the basis vectors of direct lattice to the basis vectors of inverse lattice.	2
	(b)	Discuss, with example diagrams, the various symmetries found in crystal lattices.	6
	(c)	Prove that unit cell of the inverse lattice of a FCC direct lattice is a BCC. FCC and BCC are of usual meanings. What is the volume of the unit cell of the inverse lattice.	8
3	(a)	What are a direct and an indirect band gap semiconductors ?	4
	(b)	What is effective mass?	3
	(c)	A semiconductor has the following dispersion relation for valence and conduction bands. $E(k) = \gamma(0.5n + (0.10/n)(k^2 - 2ak + a^2))$ in eV, where γ=+1 for conduction band and -1 for valence band, $n > 0$ is the subband index in conduction and valence bands, a=0.1 for conduction band and 0.0 in valence band.	1+4x2
		(i) Is it a direct/indirect bandgap semiconductor?	
		(ii) Calculate the effective mass values in Kilogram of an equivalent electron in subband n=1 and 2 in both conduction and valence bands. The electronic charge e=1.602x10^{-19} Coulombs, Plank's constant h=6.625x10^{-34} Joule-second.	
4		Consider a GaAs p-n junction diode with the following parameters. $N_a = N_d = 10^{18}$ cm^{-3}, $D_n = 200$ cm^2.s^{-1}, $D_p = 10$ cm^2.s^{-1}, $\tau_{p0} = \tau_{p0} = 5 \times 10^{-8}$ s, $\varepsilon_{Si} = 12.7\varepsilon_0$, and $n_i = 2.1 \times 10^6$ cm^{-3}.	6+2x5
		(i) Calculate the ideal reverse bias saturation current at the room temperature.	
		(ii) Optimize the p-n junction by tuning the doping densities of both regions to achieve electron and hole current densities J_n = 100 A.cm^{-2} and J_p = 5 A.cm^{-2} m, respectively, at a forward bias of V=0.65 V. Calculate the values of N_a and N_d.	
5	(a)	Derive an expression of the reverse bias generation current in an abrupt p-n junction.	8
	(b)	Consider a Si p-n junction reverse biased by 5v and having N_a=N_d=10^{16} cm^{-3}, D_n=25 cm^2.s^{-1}, D_p=10 cm^2.s^{-1}, n_i= 1.5x10^{10} cm^{-3}, $\tau_{p0} = \tau_{n0}$= 5x10^{-7} s, ε_{Si} =11.7 and ε_0= 8.85418x10-12 F.m^{-1}. Find	4+4
		(i) the width of the depletion regions, and	
		(ii) the value of the reverse bias generation current.	

6 Derive the expressions of the steady state minority carrier distributions in the neutral regions of an n-p-n Bipolar Junction Transistor biased in forward active operating mode. Define all necessary quantities. 16

7 (a) Derive an approximate expression of the base transport factor of a Bipolar Junction Transistor (BJT). 10

(b) It is required to optimize the base width of an n-p-n BJT for the specified base transport factor of 0.9960. In the base region, the electron diffusion constant is 25 $cm^2.s^{-1}$ and the excess electron life time is $\tau_{n0}=5x10^{-7}$ s. Find the base width. 6

8 Consider an n-MOS transistor with p-type Si substrate with doping density of $N_a = 10^{16}$ cm^{-3}, and n^{++} polysilicon gate, both being separated by a layer of SiO_2 insulator of thickness t_{ox}=50 nm. The fixed oxide charge density per unit area is 10^{11} electrons per cm^2. 6+1+5+4

(i) Draw the band diagram of the MOS structure in thermal equilibrium with numerical values.

(ii) Calculate the oxide capacitance per unit area.

(iii) Calculate the ϕ_{ms}.

(iv) Calculate the flat band voltage V_{FB}.

-End-

ALIAH UNIVERSITY
THIRD SEMESTER EXAMINATION, 2022
PAPER MATUGBS03 (ENGINEERING MATHEMATICS- III) (ECE, EEN)
Full Marks 80 Time 150 Minutes
Unless Otherwise Stated Notations Carry their Usual Meanings
Use separate answer scripts for each group.

GROUP - A

Answer any FOUR questions. $10 \times 4 = 40$

1. (a) Transform the following equation for the parallel axes through the point $(2, -3)$ [3]
$$2x^2 + 4xy + 3y^2 - 2x - 4y + 7 = 0.$$
(b) Find the angle through which the axes are to be rotated so that the equation $x + y + 6 = 0$ may be reduced to the form $x = c$. Also determine the value of c.[3]
(c) To what point the origin is to be moved so that one can get rid of the first degree terms from the equation $x^2 + xy + 2y^2 - 7x - 5y + 12 = 0$. [4]

2. (a) Show that the equation $x^2 + 3xy + 2y^2 = 0$ represents pair of straight lines. Find them and angle between them. [3]
(b) Show that the equation to the pair of straight lines through the origin perpendicular to the pair of straight lines [3]
$$ax^2 + 2hxy + by^2 = 0 \quad \text{is} \quad bx^2 - 2hxy + ay^2 = 0.$$
(c) Find the value of a and f for which the equation
$$ax^2 - 12xy + 9y^2 + 20x - 2fy - 11 = 0$$
may represents a pair of parallel lines. [4]

3. (a) Find the foci, directrix, end of the latus recta and length of the latus rectum of the ellipse $9x^2 + 25y^2 = 225$. Is it a central conic ? Justify your answer. [5]
(b) If the normal to the hyperbola $xy = c^2$ at the point $(ct_1, \frac{c}{t_1})$ meets the curve again at the point $(ct_2, \frac{c}{t_2})$, then show that $t_1^3 t_2 + 1 = 0$. [5]

4. (a) Find the equation to the common tangent of the circle $x^2 + y^2 = 4ax$ and the parabola $y^2 = 4ax$. [5]
(b) Prove that two tangents can be drawn from a point to a parabola. If these two tangents are perpendicular to one another, the locus of their point of intersection is the directrix. [5]

5. (a) Find the ratio in which the line segment joining the points $(2, -3, 5)$ and $(7, 1, 3)$ is divided by the xy-plane. [3]

(b) Find the centroid of the triangle whose vertices are the points $A(x_1, y_1, z_1)$, $B(x_2, y_2, z_2)$ and $C(x_3, y_3, z_3)$. [3]

(c) Find the equation of the plane passing through the points $(1, 1, 2)$ and $(2, 4, 3)$ and perpendicular to the plane $x - 5y + 7z = 0$. [4]

6. (a) Find the distance of the point $(1, 2, -3)$ from the plane $5x - 3y + z + 5 = 0$. [3]

(b) Find the points on the following conic whose radius vector is 2 [3]

$$14/r = 3 - 8\cos\theta.$$

(c) Prove that the straight lines [4]

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} \quad \text{and} \quad 4x - 3y + 1 = 0 = 5x - 3z + 2$$

are coplanar. Find the equation of the plane.

7. (a) Show that the triangle formed by the points $(2, 3, 1), (-2, 2, 0)$ and $(0, 1, -1)$ is right-angled. Find also the other angles. [3]

(b) Find the centre and radius of the sphere [3]

$$3x^2 + 3y^2 + 3z^2 + 2x - 4y - 2z - 1 = 0.$$

(c) Find the equation of the cylinder whose generating line is parallel to the z-axis and guiding curve is $x^2 + y^2 = z, \quad x + y + z = 1$. [4]

Group - B

1. Answer any **one** question from the following Questions:

(a) Solve by Lagrange's method: [5]

$$\frac{y^2 z}{x} p + xzq = y^2.$$

(b) Solve the partial differential equation: [5]

$$\frac{\partial^2 z}{\partial x^2} + 2\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = 2x + 3y.$$

2. Answer any **one** question from the following Questions:

(a) Solve the partial differential equation: [5]

$$\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = 12xy.$$

(b) Determine the points (x, y) at which the partial differential equation [5]

$$(x^2 - 1)\frac{\partial^2 z}{\partial x^2} + 2y\frac{\partial^2 z}{\partial x \partial y} - \frac{\partial^2 z}{\partial y^2} = 0,$$

is hyperbolic, parabolic or elliptic.

3. Answer any **one** question from the following Questions:

(a) Solve the wave equation [10]

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$

with $u(0,t) = u(l,t) = 0$ and $u(x,0) = f(x)$, $\frac{\partial}{\partial t}u(x,0) = 0$, $0 < x < l$.

(b) The faces $x = 0$ and $x = l$ of an infinity slab are maintained at zero temperature. Given that the temperature $u(x,t) = f(x)$ at $t = 0$. Determine the temperature at a subsequent time t. [10]

4. Answer any **one** question from the following Questions:

(a) Find the fourier series of the function: [10]

$$f(x) = x - x^2, \qquad -\pi < x < \pi.$$

Hence deduce that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots = \frac{\pi^2}{12}$.

(b) Obtain the Fourier expansion of the function [10]

$$f(x) = x \sin x \quad \text{in} - \pi \leq x \leq \pi,$$

and hence deduce that $\frac{\pi}{4} = \frac{1}{2} + \frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \cdots$.

5. Answer any **one** question from the following Questions:

(a) Find the Fourier transform of the function given by [5]

$$f(x) = \begin{cases} x^2, & |x| \leq a \\ 0, & |x| > a \end{cases}.$$

(b) Find $F(x)$, if its Fourier Sine transform is $\frac{s}{1+s^2}$. [5]

6. Answer any **one** question from the following Questions:

(a) Evaluate: [5]

$$L\{(t^2 - 3t + 2)\sin 3t\}.$$

(b) Using Laplace transform, solve the differential equation : [5]

$$\frac{d^2 y}{dt^2} + 2\frac{dy}{dt} + 5y = e^{-t}\sin t$$

with $y = 0$, and $\frac{dy}{dt} = 1$ at $x = 0$.

Odd Semester Examination, 2022
UG Section
Sub: Indian Constitution (UCCUGAU03)

Full Marks: 80 Time: 3hrs

1. **Answer the following questions:** (within 30 words each) 2x5=10

   a. Define 'Fundamental Rights'.
   b. What Principles were added to the Constitution of India by the 42nd Amendment Act?
   c. Discuss Article 21A of the Constitution of India.
   d. Discuss any two functions of the Speaker of the Lok Sabha.
   e. Discuss the composition of the Upper House of the Indian Parliament.

2. **Write any six questions:** (within 100 words each) 5x6=30

   a. Write a short note on the writs of Habeas Corpus and Mandamus.
   b. Discuss in brief Articles 23 and 24 as enumerated in Part III of the Constitution of India.
   c. Enumerate the differences between the Fundamental Rights and the Directive Principles of State Policy.
   d. Describe the election procedure of the President of India.
   e. Mention Five Fundamental Duties mentioned in our Constitution.
   f. Discuss the method of appointment of the Chief Minister of Indian States.
   g. Discuss the position of the Governor of an Indian state.
   h. Critically discuss the Right to Freedom of Religion.

3. **Write any four questions:** (Within 350 words each) 10x4= 40

   a. Discuss Article 19 as enumerated in the Constitution of India and point out its reasonable restrictions.

   b. "The Constitution of India is neither purely federal nor unitary but a combination of both". Do you agree with this view? Give reasons in support of your answer.

   c. Discuss the powers and position of the President of India.

   d. Analyse the relation between the two houses of the Parliament.

   e. Discuss the composition and powers of the Supreme Court of India.