MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Autonomous)
B.Tech. III Semester End Examinations
(Model Question Paper)

MR-21

Course Title: Electronic Devices and Circuits **Course Code: EC301PC**
Time: 3 hours Max. Marks: 70

Note: Answer ALL Questions
Part-A (10 x 2 = 20 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Write the Applications of Diode	2	1	1	1
1. b)	Differentiate between Clipper and Clamper	2	2	1	3
	Unit-II				
1. c)	What is Early Effect	2	1	1	1
1.d)	Explain the concept of Thermal runaway in detail	2	2	1	3
	Unit-III				
1. e)	Distinguish between avalanche and Zener mechanisms of a diode	2	1	1	3
1.f)	How FET work as a Voltage variable Resistor	2	2	2	2
	Unit-IV				
1. g)	Draw the small signal low frequency h-parameter model of a CB Transistor	2	2	4	5
1.h)	Why CC Amplifier is called Emitter Follower	2	2	4	5
	Unit-V				
1. i)	What are the advantages of FET over BJT	2	1	4	1
1.j)	Draw the Drain characteristics of E-MOSFET	2	1	4	1

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2.a)	Design a negative Clipper Circuit with Reference voltage is 3V.	6	6	2	3
2.b)	The voltage across a silicon diode at room temperature is 0.7 V when 2 mA current flows through it. If the voltage increases to 0.75 V, calculate the diode current. Assume V_T = 26 mV.	4	4	2	2
	OR				
2. c)	Draw and explain the circuit diagram of full wave rectifier with L-section filter	5	2	1	4
2.d)	Derive the Diffusion Capacitance in PN Junction Diode	5	4	1	1
	Unit-II				
3. a)	From the transistor current components, develop the current equation of transistor.	5	6	2	3
3. b)	An NPN transistor if β=50 is used in common emitter circuit with Vcc=10V and Rc=2kΩ. The bias is obtained by connecting 100kΩ resistor from collector to base. Find the quiescent point and stability factor	5	4	3	2
	OR				
3. c)	Draw and Explain the Voltage divider Bias technique and derive its stability factor S.	5	3	3	11
3.d)	Explain the Input and Output characteristics of CB configuration with neet diagram.	5	1	2	1
	Unit-III				
4. a)	Explain the Construction and operation of N-Channel JFET	5	1	4	3
4. b)	Explain the construction and working of SCR	5	2	2	3
	OR				
4. c)	Draw the V-I Characteristics of Tunnel diode with the help of Energy band diagram.	4	3	4	3

4.d)	An n-channel JFET has I_{DSS} =10mA and V_P = - 2V. Determine the drain source resistance r_{ds} for (i) V_{GS} =0V. (ii) V_{GS} = - 0.5V.	4	4	3	2
Unit-IV					
5. a)	Sketch the circuit diagram of CE amplifier and explain its operation in detail	5	2	4	11
5. b)	A transistor in CB configuration circuit has the following set of 'h' parameters. h_{ib} = 20 Ω, h_{fb} = 0.98, h_{rb}=3×10-4 , h_{ob} = 0.5×10-6 A/V . Find the values R_i , R_o, A_i and A_v, if R_s = 600Ω and R_L = 5 kΩ.	5	3	4	2
OR					
5. c)	Compare the performance of BJT as an amplifier in CE, CB, CC configuration	5	2	4	1
5.d)	Draw the Common emitter amplifier with Emitter resistor and explain its operation.	5	3	4	1
Unit-V					
6. a)	Explain the Construction and operation of Enhancement mode MOSFET	5	2	2	4
6. b)	Why CD Aplifier is Known as Source Follower. Explain in detail.	5	3	4	1
OR					
6. c)	Derive the expressions for Z i , Zo and Av for common source J-FET amplifier	6	4	4	3
6.d)	Write the differences between J-FET and MOSFET	4	3	4	1

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
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(Model Question Paper)

MR-21

Course Title: Network Analysis & Transmission Lines **Course Code: EC302PC**

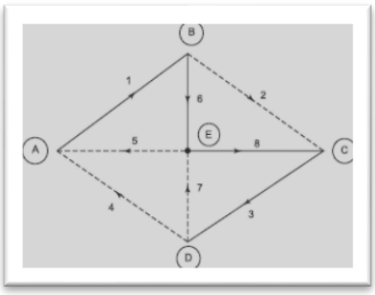
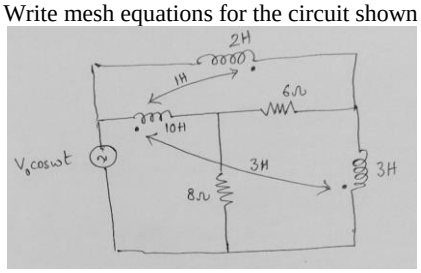
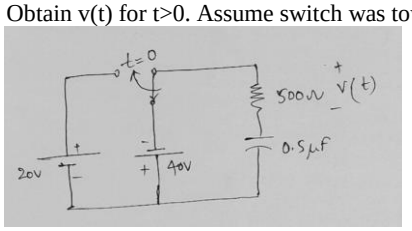
Time: 3 hours Max. Marks : 70

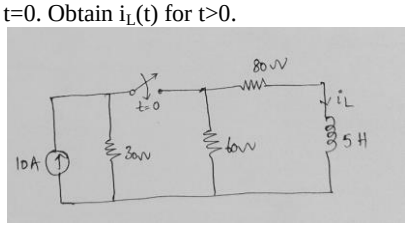
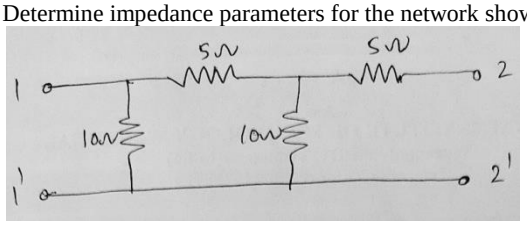
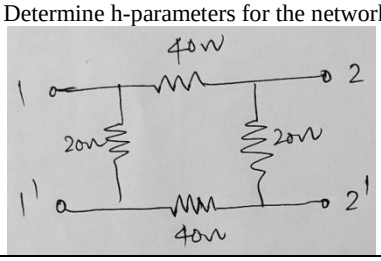
Note: Answer ALL Questions

Part-A (10 x 2 = 20 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Define tree and co-tree.	2	1	1	2
1. b)	Obtain the equivalent inductance in the case of series aiding inductors.	2	2	1	1, 2
	Unit-II				
1. c)	Derive the expression for bandwidth of a series RLC circuit.	2	3	2	1, 2
1. d)	Prove that a LPF acts as an integrator for integrator for large time constants.	2	2	2	1, 2
	Unit-III				
1. e)	Write the symmetry and reciprocity conditions in terms of h-parameters.	2	2	3	1, 2
1. f)	Write short notes on driving point functions.	2	1	3	2
	Unit-IV				
1. g)	What is meant by loading of transmission lines?	2	2	4	3
1. h)	A lossless transmission line has P = j0.003 rad/m. Find the phase velocity.	2	2	4	1, 2
	Unit-V				
1. i)	Give the significance of λ/4 transmission line.	2	2	4	2
1. j)	Find the reflection coefficient seen when a 50 ohms line is terminated with 80 ohms load.	2	2	4	1, 2

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	What is an f-tieset? Explain the procedure for obtaining f-Tieset matrix.	5	2	1	1, 2
2. b)	Obtain f-cutset matrix for the graph given below. 	5	2	1	1, 2
	OR				
2. c)	Derive the expression for coupling coefficient in terms of L1, L2 and M.	5	2	1	2
2. d)	Write mesh equations for the circuit shown below. 	5	3	1	1, 2
	Unit-II				
3. a)	Discuss the resonant characteristics of parallel RLC circuit.	5	2	2	1, 2, 3
3. b)	Obtain v(t) for t>0. Assume switch was towards 40V for long period of time. 	5	3	2	1, 2
	OR				
3. c)	Explain and draw the step response of a second order circuit for under damped case.	5	4	2	1, 2

3. d)	In the circuit shown below the switch was open for a long period of time before it is closed at t=0. Obtain $i_L(t)$ for t>0. 	5	3	2	1, 2
Unit-III					
4. a)	Determine impedance parameters for the network shown. 	5	2	3	1, 2
4. b)	Discuss T type attenuator.	5	2	3	3
OR					
4. c)	Write the properties of network transfer function.	4	2	3	2
4. d)	Determine h-parameters for the network shown. 	6	3	3	1, 2
Unit-IV					
5. a)	Derive transmission line equations.	6	3	4	1, 2
5. b)	The secondary constants of a certain line are P = 0.002 + j0.001 /m and Z_0 = 230 – j40 ohms. Deduce the primary constants of the line.	4	2	4	1, 2
OR					
5. c)	Prove that an infinite line is identical to a line terminated with its characteristic impedance.	5	3	4	2
5. d)	Derive the condition for distortion less transmission.	5	3	4	1, 2
Unit-V					
6. a)	Discuss the applications of Smith chart.	5	4	4	2
6. b)	A 100 ohms UHF line of length 1.75λ is terminated with (60 - j20) ohms load. Using Smith chart find Reflection coefficient, SWR, and input impedance of the line.	5	3	4	1, 2
OR					
6. c)	Discuss single stub matching in detail.	6	4	4	3
6. d)	The short circuit and open circuit impedances of a certain line are j120 ohms and –j80 ohms respectively. Find the characteristic impedance of the line and as well its electrical length.	4	3	4	1, 2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
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MR-21

Course Title: DIGITAL SYSTEM DESIGN **Course Code: EC303PC**
Time: 3 hours Max. Marks : 70

Note: Answer ALL Questions
Part-A (10 x 2 = 20 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Convert 12.125 decimal into binary	1	1	1	2
1. b)	Find 1s complement of 0101110	1	1	1	2
	Unit-II				
1. c)	How many cell are there in a 5 variable kmap.	1	2	2	1
1. d)	What is the general size of any multiplexer?	1	3	2	1
	Unit-III				
1. e)	Write the truth table of D flip flop	1	3	3	1
1. f)	How may no. of flip flops are required to design a mod-5 counter?	1	3	3	1
	Unit-IV				
1. g)	The number of flip flops required to design a machine having 6 states is		5	3	3
1. h)	What is even parity?	1	1	3	1
	Unit-V				
1. i)	Which logic family is fastest.	1	2	4	1
1. j)	Define fan out	1	2	4	1

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Perform subtraction operation using 2's complement representation (80) - (70).	5	1	1	1
2. b)	Implement EXOR gate using only 4 NAND gates.	5	3	1	3
	OR				
2. c)	perform the following conversions i) Find the octal equivalent of $(73.75)_{10}$ ii) Determine the hexadecimal equivalent of (82.25)10 iii) Find the binary equivalent of (13.375)10	6	2	1	1
2. d)	Implement AB+CD +EF using only NAND gates	4	3	1	3
	Unit-II				
3. a)	Simplify the following Boolean function using product of sums F(a,b,c,d) = ∑(0,2,3,5,7,8,10,11,14,15)	5	2	2	2
3. b)	Design a full adder using two half adders and one OR gate	5	3	2	4
	OR				
3. c)	Simplify the Boolean function using Kmap F(a,b,c,d)= ∑(0,1,2,3,810,14,15)	5	2	2	2
3. d)	Design a binary to gray code converter	5	4	2	3
	Unit-III				
4. a)	Derive the characteristic equations of SR and Jk flip flops	4	2	3	1
4. b)	Draw and explain the operation of a 5 bit shift register.	6	3	3	1
	OR				
4. c)	Design a twisted ring counter.	5	2	3	3
4. d)	Explain the operation of master slave JK flip flop.	5	2	3	2
	Unit-IV				
5. a)	Design a mod – 5 Counter.	5	4	3	4
5. b)	Design a even paring bit generator.	5	4	3	3
	OR				
5. c)	Design a sequence detector circuit to detect 1010 sequence.	6	6	3	3
5. d)	Draw mealy machine diagram for 3-bit counter.	4	5	3	1

Unit-V					
6. a)	Explain the operation of TTL totem pole output gate.	5	1	4	1
6. b)	Draw and explain CMOS transmission gate.	5	2	4	1
OR					
6. c)	Implement AND, OR gates using diodes.	5	1	4	2
6. d)	Compare noise margin, fan-in fan out for all logic families.	5	2	4	1

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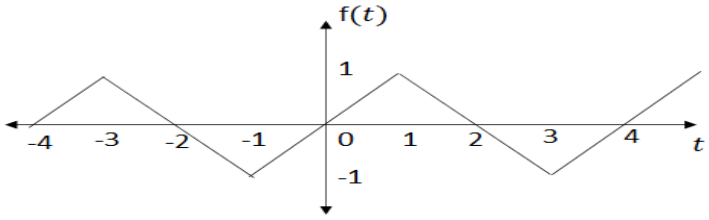
MR-21

Course Title: Signals and Systems **Course Code: EC304PC**
Time: 3 hours Max. Marks : 70

Note: Answer ALL Questions
Part-A (10 x 2 = 20 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Check whether the signal $x(t) = te^{-3t}u(t)$ is energy or power or neither?	2	2	1	1, 2
1. b)	Solve the integral $\int_{-\infty}^{+\infty} \delta(1-t)(t^3+4)dt$	2	3	1	1, 2
	Unit-II				
1. c)	List out the Dirichlet's conditions for the existence of Fourier series	2	4	2	1
1. d)	Prove that the compression of a signal in time domain leads an expansion in frequency domain with the help of Fourier Transform?	2	5	2	4
	Unit-III				
1. e)	Verify the linearity of the system$y(t) = e^{x(t)}$?	2	2	3	2
1. f)	What are the properties of convolution?	2	1	3	1,1 2
	Unit-IV				
1. g)	How the stability of a system can be found in Laplace Transform?	2	1	4	1
1. h)	What is meant by aliasing? How can you minimize it?	2	1	4	1
	Unit-V				
1. i)	Distinguish between Laplace Transform and Z-Transform?	2	4	4	1
1. j)	Find the relation between convolution and correlation?	2	2	3	1,1 2

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Prove that $sin\ (n\omega_0 t)$ and cos $(m\omega_0 t)$ are orthogonal with each other over the interval $\left(t_0, t_0 + \frac{2\pi}{\omega_0}\right)$	4	2	1	2
2. b)	A rectangular function $f(t)$ is defined by $f(t) = \begin{cases} 1, & 0 < t < \pi \\ -1, & \pi < t < 2\pi \end{cases}$ Approximate rectangular function by a finite series of sinusoidal function $sin(rt)\,, r = 1,2,3$ ....over the interval (0,2π). Show that as the no. of terms in approximation increases, the error decreases.	6	4	1	2
	OR				
2. c)	Check whether the following signals are periodic or not? Find the period if they are periodic? i) $x(n) = \cos\left(\frac{2\pi n}{3}\right) + \sin\left(\frac{3\pi n}{4}\right)$ ii) $x(t) = sin^2 t$	6	2	1	1,2
2. d)	Derive the expression for evaluating the mean square error in the approximation of the signal	4	1	1	1
	Unit-II				
3. a)	 Find the Trigonometric Fourier Series of the above periodic signal.	6	2	2	2

3. b)	State and prove the Parseval's relation property of the Fourier Series	4	1	2	1
OR					
3. c)	Find the Fourier Transform of $e^{-at}u(t)$? Also sketch the magnitude and phase spectrum	5	2	2	2
3. d)	State and prove Time differentiation and Frequency shifting properties of Fourier Transform	5	1	2	1
Unit-III					
4. a)	Convolve the signals $x_1(t) = e^{-2t}u(t-2)$ and $x_2(t) = e^{-3t}u(t)$?	5	3	3	1,2
4. b)	"All the ideal filters are non-causal". Justify?	5	5	3	1,4
OR					
4. c)	Check the stability and causality of LTI system is described as $\frac{dy(t)}{dt} + 2y(t) = x(t)$.	4	2	3	2,3
4. d)	A causal LTI system having a frequency response $H(j\omega) = \frac{1}{(3+j\omega)}$ is producing an output $y(t) = e^{-2t}u(t) - e^{-4t}u(t)$ for a particular input $x(t)$. Determine $x(t)$?	6	5	3	2,3
Unit-IV					
5. a)	Find the inverse Laplace Transform of the following: $X(s) = \frac{5s+4}{s^2+2s+1} \quad Re(s) > -1$	5	3	4	2,3
5. b)	Find the Laplace Transform of $x(t) = \delta(t) + 3e^{-2t}u(t) - 2e^{-t}u(t)$. Also draw the region of convergence.	5	3	4	2,3
OR					
5. c)	Find the Inverse Z-Transform of $X(Z) = \frac{Z(Z^2-4Z+5)}{(Z-1)(Z-2)(Z-3)}$ for the following ROCs i) |z|>3 ii) |z|<1 iii) 1<|z|<3	6	3	4	2,3
5. d)	Define the Region Of Convergence of Z-Transforms and explain its Properties.	4	1	4	1
Unit-V					
6. a)	Define sampling theorem. Explain the recovery of the band limited signal from its sampled version.	5	2	4	1
6. b)	Calculate the Nyquist rate and Nyquist interval of the signal, $x(t) = 3\cos(500\pi t) + 15\sin(200\pi t)$	5	1	4	1,2
OR					
6. c)	Derive the relationship between Autocorrelation function and Power Spectral Density	5	4	3	1
6. d)	Prove that any arbitrary signal can be recovered from noise using cross correlation.	5	3	3	1,3

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MR-21

Course Title: Probability Theory and Stochastic Processes **Course Code: EC305PC**
Time: 3 hours Max. Marks : 70

Note: Answer ALL Questions
Part-A (10 x 2 = 20 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit -I				
1. a)	Define probability based on Relative frequency	2	1	1	1
1. b)	Explain the classifications of Random variable with example	2	2	1	1,2
	Unit-II				
1. c)	Write short notes on Moments	2	1	2	1
1. d)	Define covariance	2	1	2	1
	Unit-III				
1. e)	Define Stationary random Process	2	1	3	1
1. f)	Explain Ergodic random processes	2	2	3	1,2
	Unit-IV				
1.g)	State the properties of power spectral density	2	2	3	1
1.h)	The auto correlation function of a stationary random process X(t) is given by $R_{xx}(T)=25+4/(1+6\ T^2)$ find mean and variance	2	3	3	2
	Unit-V				
1. i)	Define Noise Figure	2	1	4	1
1. j)	What is the relation between channel capacity and mutual information	2	2	4	1,2

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	State and Prove Bayes Theorem	4	2	1	1.2
2. b)	Two fair dice are thrown independently. Three events A,B,C are respectively defined as follows: i)Odd face with first die ii) Odd face with second die iii)The sum of two numbers in the two dice is odd. Are the events A, B, C mutually independent or pair wise independent	6	3	1	1.2
	OR				
2. c)	state and prove the properties of probability Distribution function	4	2	1	1,2
2. d)	A random variable X has the following probability density function f(x)=x 0<x<1 = k(2-x) 1≤x≤2 =0 else where i) Find the value of k ii) Find P(0.2<x<1.2) iii) Find the distribution function of X	6	3	1	1.2
	Unit-II				
3. a)	State and prove the properties of Moment generating function	4	2	2	1,2
3. b)	Find the mean and variance of Poisson Distribution function	6	2	2	1,2
	OR				
3. c)	Explain the statistical independence of random variables with example.	4	2	2	1,2
3. d)	Two random variables X and Y have zero mean and variance $\sigma_X^2=16$, $\sigma_Y^2=36$ correlation coefficient is 0.5 determine the following i) The variance of the sum of X and Y ii) The variance of the difference of X and Y	6	3	2	1,2
	Unit-III				
4. a)	Explain types of random process in detail.	4	2	3	1
4. b)	A random process is given as X(t) = At, where A is a uniformly distributed random variable on (0,2). Find whether X(t) is wide sense stationary or not.	6	4	3	1,2

OR					
4. c)	Define covariance of the random process and derive its properties.	4	2	3	1,2
4. d)	Find mean square value and auto correlation function of response of LTI system.	6	2	3	1,2,3
Unit-IV					
5. a)	Derive the expression for cross power spectral density between input and output of LTI system	6	5	3	1,2,3
5. b)	State and prove the properties of cross correlation	4	2	3	1,2
OR					
5. c)	Find the cross correlation function corresponding to the cross power spectrum $S_{XY}(\omega)=\frac{6}{(9+\omega^2)(3+j\omega)^2}$	6	3	3	1,2
5. d)	Write short notes on cross power density spectrum.	4	2	3	1,2
Unit-V					
6. a)	Derive noise figure in terms of network transfer function	4	2	4	1,2,3
6. b)	Compute the overall noise figure in the case of four amplifier stages cascaded, given the following data Noise Figure / Available Gain 1st Stage 10 / 50 2nd Stage 5 / 20 3rd Stage 8 / 10 4th Stage 12	6	3	4	1,2
OR					
6. c)	Explain Huffman coding with example	6	3	4	1,2
6. d)	How to trade-off between bandwidth and SNR	4	2	4	1,2

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MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
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MR-21

Course Title: Constitution of India **Course Code: MC301HS**
Time: 3 hours Max. Marks : 70

Note: Answer ALL Questions
Part-A (10 x 2 = 20 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Define Constitution of India	1	1	1	6,8
1. b)	List the drafting committee of constitution of India	1	1	1	6,8
	Unit-II				
1. c)	What do you mean by fundamental duties in Indian constitution	1	1	2	6,8
1. d)	List the fundamental rights.	1	1	2	6,8
	Unit-III				
1. e)	List the classification of directive principles of state policy.	1	1	3	6,8
1. f)	Briefly write about directive principles	1	2	3	6,8
	Unit-IV				
1. g)	List out the three types of emergencies under Indian Constitution	1	1	4	6,8
1. h)	State the important amendments.	1	1	4	6,8
	Unit-V				
1. i)	What is Union Public service commission?	1	1	5	6,8
1. j)	Define Election commission of India.	1	1	5	6,8

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Give detail account on the historical background of Indian Constitution.	5	1	1	6,8
2. b)	Define. Explain the importance of preamble in the implementation of constitution.	5	2	1	6,8
	OR				
2. c)	Describe the salient features of Indian Constitution.	5	3	1	6,8
2. d)	Discuss in detail the fundamental right to equality.	5	3	1	6,8
	Unit-II				
3. a)	Explain the scope of the right to life and personal liberty.	5	2	2	6,8
3. b)	Discuss in detail the fundamental duties of every citizen.	5	3	2	6,8
	OR				
3. c)	Explain the needs and importance of fundamental duties of an Indian Citizen.	5	2	2	6,8
3. d)	Explain fundamental right to certain freedom	5	2	2	6,8
	Unit-III				
4. a)	State the Directive Principles of State Policy and explain its significance.	5	1	3	6,8
4. b)	Distinguish between fundamental rights and directive principles of state policy.	5	5	3	6,8
	OR				
4. c)	Discuss the views of Gandhian Principles in Directive Principles of State Policy.	5	3	3	6,8
4. d)	State the importance of directive principles of state policy.	5	1	3	6,8
	Unit-IV				
5. a)	Explain the power of the parliament to amend the constitution referring to decided case	5	2	4	6,8
5. b)	Describe the procedure of amendment of the constitution.	5	2	4	6,8
	OR				
5. c)	Discuss in detail the federal structure and distribution of legislative and financial powers between the union and states.	5	3	4	6,8
5. d)	List out the effects of financial emergency.	5	1	4	6,8
	Unit-V				
6. a)	Classify the role of Local Government.	5	2	5	6,8
6. b)	Write shorts on finance commission of India	5	3	5	6,8
	OR				
6. c)	What are the important provisions relating to the Election Commission in the Indian Constitution	5	2	5	6,8
6. d)	List the important constitutional bodies and explain about election commission of India	5	1	5	6,8

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome