

MULTIPLE CHOICE QUESTIONS CONSTITUTION OF INDIA

1) Fundamental rights are the rights guaranteed under _____ of the Constitution of India.

- A) Part III (Articles 12-32)
- B) Part II (Articles 13-35)
- C) Part III (Articles 12-35)
- D) Part IV (Articles 12-35)

Answer -C) Part III (Articles 12-35)

2) Under which Article of Constitution of India, a writ petition can be filed in the Supreme Court

- A. Article 226 of the Constitution of India
- B. Article 34 of the Constitution of India
- C. Article 26 of the Constitution of India
- D. Article 32 of the Constitution of India

Answer D. Article 32 of the Constitution of India

3. How many Fundamental Rights are there in the Indian Constitution?

- A. Six
- B. Seven
- C. Eight
- D. Nine

Answer – A. Six

4. Which fundamental right has been abolished by the 44 Amendment Act 1978?

- A. Right to Life
- B. Right to property
- C. Right to Education
- D. Right against exploitation

Ans- B. Right to property

5. Which article of the constitution of India abolished untouchability?

- A.Article 14 of the Indian constitution
- B.Article 13 of the Indian constitution
- C.Article 16 of the Indian constitution
- D. Article 17 of the Indian constitution

Ans- D. Article 17 of the Indian constitution

6. Which article of the Constitution of India guarantees the equality of opportunity?

- A.Article 14 of the Indian constitution
- B.Article 13 of the Indian constitution
- C.Article 16 of the Indian constitution
- D. Article 17 of the Indian constitution

Ans- C. Article 16 of the Indian constitution

7. Which fundamental right has been added to the Constitution by the 86th Amendment of the Indian Constitution in 2002?

- A.Right to Education
- B.Right to Life
- C.Right to Religion
- D.Right against exploitation

Answer – A.Right to Education

8. Which article is cultural and educational rights _____?

- A.Article 25 and 33 of the constitution of India
- B.Article 29 and 30 of the constitution of India
- C.Article 27 of the constitution of India
- D. Article 28 of the constitution of India

Answer- B. Article 29 and 30 of the constitution of India

9. Which article of the Indian Constitution did Dr BR Ambedkar term as the heart and soul of the Indian Constitution?

- A.Article 28 of the constitution of India
- B.Article 29 of the constitution of India

- C. Article 32 of the constitution of India
- D. Article 21 of the constitution of India

Answer C. Article 32 of the constitution of India

10) Which features of Indian constitution was borrowed from USA _____?

- A. Fundamental rights
- B. Fundamental Duties
- C. Emergency Provisions
- D. Citizenship

Answer- A. Fundamental rights

11). Which one of the following right of Indian Constitution guarantees all the fundamental rights to every resident of country?

- A Right against exploitation
- B Right to freedom
- C Right to equality
- D Right to constitutional remedies

Answer: Option [D]

12). Which one of the following is true with respect to Fundamental Rights of Indian Constitution?

- A Sovereignty of the people
- B Equality of opportunity for all resident
- C Limited government
- D Democracy

Answer: Option [B]

13). Dr. B. R. Ambedkar termed Article 32 of the Indian Constitution as the "Heart and Soul of the Indian Constitution". Which one of the following fundamental right it contains?

- A** Right to freedom
- B** Right to constitutional remedies
- C** Right to elementary education
- D** Right to freedom of religion

Answer: Option [B]

14. Which of the following is correct with respect to "Right against exploitation"?

- A** Prohibition of traffic in human beings and forced labour
- B** Freedom as to payment of taxes for promotion of any particular religion
- C** Protection of interests of minorities
- D** Equality before law

Answer: Option [A]

15. Which Article of the Constitution envisages free and compulsory education for children up to the age of 14 years?

- A** Article 19
- B** Article 31
- C** Article 32
- D** Article 45

Answer: Option [D]

16. In which part of Indian Constitution Fundamental rights are provided.

- A** Part II
- B** Part III
- C** Part IV
- D** Part V

Answer: Option [B]

17. The protection of Human Rights Act in India was enacted in the year

(A) 1993

(B) 1994

(C) 1995

(D) 1996

Answer: (A)

18. Which one of the following categories of Fundamental Rights incorporates ‘Abolition of Untouchability’?

(A) Right to Religion

(B) Right to Equality

(C) Right to Freedom

(D) Right against Exploitation

Answer: (B)

19. Helsinki Declaration, 1964 is concerned with

(A) War prevention

(B) Human Experimentation

(C) Gender discrimination

(D) Child Abuse

Answer: (B)

20. Who introduced the concept of third generation Human Rights?

(A) Tullius Cesero

(B) Jermy Bentham

(C) John Finnis

(D) Karel Vasak

Answer: (D)

21. The Universal Declaration of Human Rights was adopted on

- (A) December 1, 1948
- (B) December 10, 1948
- (C) December 11, 1948
- (D) December 31, 1948

Answer: (B)

22. Right to Education is guaranteed under Article

- (A) 14
- (B) 19
- (C) 21-A
- (D) 21

Answer: (C)

23. Fundamental Duties are contained in

- (A) Part IV Article 51-A
- (B) Part IV Article 51-B
- (C) Part III Article 35
- (D) Part III Article 17

Answer: (A)

24. Which of the following is not a fundamental right in the Constitution of India?

- A. Right to work
- B. Right to Equality
- C. Right to Freedom
- D. Right to Freedom of Religion

Answer:Righttowork

25. The Panchayath Raj system came in existence by the ____?

- A. 42nd Constitutional Amendment
- B. 52nd Constitutional Amendment
- C. 26th Constitutional Amendment
- D. 73rd Constitutional Amendment

Ans: 73rd Constitutional Amendment

26. Fundamental Rights have no value without.

- A. Right to Freedom
- B. Right to Freedom of Religion
- C. Right to Property
- D. Right to Constitutional Remedies

Answer: Right to Constitutional Remedies

27. Who certifies a bill as a money bill when it goes to other house or for President's assent?

- A. Prime Minister
- B. Speaker of the House of People
- C. Speaker of the Council of states

Answer: Speaker of the House of People

28. Indian citizenship can be acquired by.

- A. Birth
- B. Descent
- C. Registration
- D. Naturalization
- E. Any of the above

Answer: Any of the above

29. Clause (4) of Article 15 has been added to the Constitution by

- (A) The Constitution First Amendment Act.
- (B) The Constitution Second Amendment Act
- (C) The Constitution Fourth Amendment Act.
- (D) The Constitution Sixth Amendment Act.

Answer: (A)

30. The State shall endeavor to secure for the citizens a Uniform Civil Code throughout the territory of India as per

- (A) Article 40
- (B) Article 43
- (C) Article 44
- (D) Article 48

Answer: (C)

31. In India sovereignty lies with

- (A) The Constitution
- (B) The Supreme Court
- (C) The Parliament
- (D) The People

Answer: (D)

32. The Supreme Court of India formulated the doctrine of eclipse in

- | | | |
|-------------------------------------|----|------------------------------|
| (A) Bhikaji Narain Dhakras | Vs | State of M.P. www.netugc.com |
| (B) Bashesharnath | Vs | Income Tax Commissioner. |
| (C) State of W.B. | Vs | Anwar Ali Sarkar |
| (D) Maneka Gandhi Vs Union of India | | |

Answer: (A)

33. The satisfaction of the President means the satisfaction of the Council of Ministers and not his personal satisfaction, held in

- (A) Samsher Singh Vs State of Punjab
- (B) U.N. Rao Vs Indira Gandhi
- (C) Ram Jawaya Kapoor Vs State of Punjab
- (D) Sardar Lal Vs Union Government

Answer: (A)

34. The Concurrent List was described as a ‘Twilight Zone’, as it were for both the Union and the States are competent to legislate in this field without coming in to conflict” is stated by

- (A) Basu, D.D.
- (B) Dicey, A.V.
- (C) Pyle, M.V.
- (D) Ambedkar, B.

Answer: (C)

35. Article 360 has been invoked

- (A) Only one time.
- (B) two times.
- (C) three times.
- (D) Never invoked

Answer: (D)

36. The Supreme Court held in which of the following cases that preamble is not the part of the Constitution of India

- (A) Berubaricase
- (B) A.K. Gopalancase
- (C) Balaji Case
- (D) Minerva Mill's case

Answer: (A)

37. Article 16(4A) which gives power to the State to make laws regarding reservation in favor of Scheduled Castes and Scheduled Tribes was added by the

- (A) 75th Amendment to the Constitution of India.
- (B) 76th Amendment to the Constitution of India.
- (C) 77th Amendment to the Constitution of India.
- (D) 78th Amendment to the Constitution of India.

Answer: (C)

38. The protection and improvement of environment including forests and wild life of the country is

- (A) Directive Principle of State Policy
- (B) Fundamental National Policy
- (C) Fundamental Duty of a Citizen
- (D) Both Directive Principles of State Policy and Fundamental Duty of a Citizen

Answer: (D)

39. Originally the Supreme Court consisted of a Chief Justice and

- (A) Seven other judges
- (B) Twelve other judges
- (C) Thirteen other judges
- (D) Fifteen other judges

Answer: (A)

40. A resolution passed under Clause (1) of Article 249 shall remain in force for such period not exceeding

- (A) Three months
- (B) Six months
- (C) Nine months
- (D) Twelve months

Answer: (D)

41. The President's rule under Article 356 of the Constitution of India remains valid in the State for maximum period of

- (A) One month
- (B) Three months
- (C) Six months
- (D) One year

Answer: (B)

42. The power of the Parliament to amend the Constitution of India is a constituent power laid down in Article 368 by

- (A) Twenty Fourth Amendment Act
- (B) Twenty Sixth Amendment Act
- (C) Forty Second Amendment Act
- (D) Forty Fourth Amendment Act

Answer: (A)

43. Social, economic and political Justice is

- (A) an idea enshrined in the Preamble to the Constitution of India
- (B) guaranteed by Fundamental Rights in the Constitution of India
- (C) a Directive Principle of State Policy taken into consideration while making enactments
- (D) guaranteed to the people by the writs issued by the High Courts and Supreme Court

Answer: (A)

44. Without paying proper remuneration, labour taken from the prisoners is 'forced labour' and violation of

- (A) Art. 20 of the Constitution of India
- (B) Art. 21 of the Constitution of India
- (C) Art. 22 of the Constitution of India
- (D) Art. 23 of the Constitution of India

Answer: (D)

45. Art. 51A of the Constitution of India provides for the Fundamental Duties of

- (A) Citizens of India
- (B) Public Servants
- (C) All those who run public and private sectors
- (D) Prime Minister and his Council of Ministers

Answer: (A)

46. The appropriate writ issued by Supreme Court to quash the appointment of a person to a public office is

- (A) Certiorari
- (B) Mandamus
- (C) Prohibition
- (D) Quo-Warranto

Answer: (D)

47. The power of the President of India to issue an ordinance is a

- (A) Legislative power
- (B) Executive power
- (C) Quasi-judicial power
- (D) Judicial power

Answer: (A)

48. The jurisdiction of Supreme Court of India may be enlarged by

- (A) The President of India
- (B) The Parliament by resolution

- (C) The Parliament by Law
- (D) The President in consultation with the Chief Justice of India

Answer: (C)

49. At the first instance, the President can issue a proclamation of financial emergency for a period of www.netugc.com

- (A) Fifteen days
- (B) Two months
- (C) One month
- (D) Six months

Answer: (B)

50. “It is likely that free India may be federal India, though in any event there would be a great deal of Unitary Control.” This statement was made by

- (A) Sir Alladi Krishna Swami Iyyer
- (B) Dr. B.R. Ambedkar
- (C) Pt. Jawahar Lal Nehru
- (D) Sardar Vallabh Bhai Patel

Answer: (C)

51. Judicial Review in the Constitution of India is based on

- (A) Precedents and conventions
- (B) Rule of law
- (C) Due process of law
- (D) Procedure established by law

Answer: (D)

52. The Constitution of India embodies the parliamentary form of government because:

- (A) The Council of Ministers is collectively responsible to the Lok Sabha.
- (B) The Council of Ministers is responsible to Lok Sabha and Rajya Sabha.
- (C) The President, the head of the executive, is answerable to Parliament.

(D) The Prime Minister, the Head of the Cabinet, is accountable to Parliament.

Answer: (A)

53. The Supreme Court held that Election Commissioners could not be placed on par with the Chief Election Commissioner in terms of power and authority in the following case:

- (A) S.S. Dhanoa Vs Union of India
- (B) T.N. Seshan Vs Union of India
- (C) A.C. Jose Vs Sivan Pillai
- (D) Venkatachalam Vs A. Swamickan

Answer: (A)

54. The maximum interval between the two sessions of each House of Parliament is

- (A) Three months
- (B) Four months
- (C) Five months
- (D) Six months

Answer: (D)

55. The Supreme Court observed, “Parliamentary proceedings are not subject to Fundamental Rights” in the following case:

- (A) Keshav Singh Vs Speaker, U.P. Assemblywww.netugc.com
- (B) Gunapati Vs Habibul Hasan
- (C) M.S.M. Sharma Vs Srikrishna Sinha
- (D) State of Punjab Vs Satpal Dang

Answer: (C)

56. For the purpose of creating a new State in India an amendment to the Constitution of India must be passed by

- (A) 2/3rd majority of the members of both Houses of Parliament present and voting.
- (B) 2/3rd majority of the members of both Houses of Parliament and ratification by not less than 2/3rd majority of the States.
- (C) A simple majority in Parliament and ratification by not less than half of the States.
- (D) A simple majority by the Parliament.

Answer: (D)

57. The word ‘Secular’ was added in the Preamble to the Constitution of India by

- (A) First Amendment Act
- (B) Seventh Amendment Act
- (C) Forty-Second Amendment Act
- (D) Forty-Fourth Amendment Act

Answer: (C)

58. Article 15(1) prohibits discrimination against any citizen on the grounds of

- (A) Religion, race and caste only.
- (B) Religion, caste and sex only.
- (C) Religion, caste, sex and place of birth only.
- (D) Religion, race, caste, sex, place of birth or any of them.

Answer: (D)

59. Which provision of the Constitution imposes a duty on the Union to ensure that the Government of every State is carrying on in accordance with the provisions of the Constitution?

- (A) Article 352
- (B) Article 355
- (C) Article 356
- (D) Article 360

Answer: (B)

60. ‘Right to life’ under Article 21 of the Constitution does not include ‘right to die’. The Supreme Court in made this observation

- (A) P. Rathinam V. Union of India
- (B) Gian Kaur V. State of Punjab
- (C) Both (A) and (B) above.
- (D) None of the above.

Answer: (B)

61. A Judge of the Supreme Court can be removed from his office on the ground(s) of

- (A) Proved misbehavior or incapacity.
- (B) Violation of the Constitution.
- (C) Both (A) and (B) above.
- (D) None of the above.

Answer: (A)

62. Parliament has power to legislate with respect to a matter in the State List, provided it is in the

- (A) Public interest
- (B) National interest
- (C) Both (A) and (B) above
- (D) None of the above

Answer: (B)

63. The Chief Election Commissioner can be removed from his office under Article:

- (A) 125
- (B) 352
- (C) 226
- (D) 324

Answer: (D)

64. ‘Power of Parliament to modify the rights conferred by this part in their application to forces etc.’ is the basis of which of the following Articles of the Indian Constitution?

- A. Article 32
- B. Article 33
- C. Article 33(1)
- D. Article 32(1)

Ans. B

65. Article 36 of the Indian Constitution says “In part IV, unless the context otherwise requires, ‘the State’ has the same meaning as in Part III”. Which of the following statements regarding the definition of ‘the State’ is/are found to be correct?

- I. Since this Article adopts the definition of ‘state* in Article 12, of the Indian Constitution it would include courts and statutory tribunals, so that they cannot overlook the objectives of the Directives.

II. Any statutory corporation, which answers the tests of a state instrumentality or agency even though it may not be a ‘public utility undertaking’, is bound to act in consonance with the Directive Principles.

- A. Only I
- B. Only II
- C. Both I and II
- D. None of them

Ans. C

66. In which of the following respects the Directives differ from the Fundamental Rights?

- A. The Directives are not enforceable in the courts and do not create any justiciable rights in favour of individuals
- B. The Directives require to be implemented by legislation, and so long as there is no law carrying out the policy laid down in a Directive, neither the state nor an individual can violate any existing law or legal right under the colour of following a Directive
- C. The Courts are not competent to compel the Government to carry out any Directive or to make any law for that purpose
- D. All of them

Ans. D

67. Which of the following interpretations of the Constitution regarding the utility of Directives is/are found to be correct?

- I. Even though the implementation of a Directive Principle may cause hardship to a few individuals, it should be upheld in the larger interests of the community.
- II. In view of the absolute prohibition of consumption of liquor in Article 47, there cannot be any fundamental right to manufacture and sell intoxicating liquor.

- A. I and II
- B. Neither I nor II
- C. Only I
- D. Only II

Ans. A

68. Which kinds of justice have been mentioned in Article 38 in Part IV of the Indian Constitution?

- A. Social
- B. Economic
- C. Political
- D. All of them

Ans. D

69. According to Article 39 of the Indian Constitution the State shall, in particular, direct its policy towards securing:

- I. That the citizens, men and women equally, have the right to an adequate means of livelihood.
- II. That the ownership and control of the material resources of the community are so distributed as best to subserve the common good.
- III. That there is equal pay for equal work for both men and women.

- A. I, II and III
- B. II and III
- C. I and III
- D. I and II

Ans. A

70. Which of the following directives has been given the Supreme Court for the welfare of the children according to clauses (e), (f) of Article 39 of the Indian Constitution?

- A. The Children should not be employed in hazardous jobs in factories for manufacture of matchboxes and fire works
- B. Positive steps should be taken for the welfare of such children as well as for improving the quality of their life
- C. The employer of children below 14 years must comply with the provisions of the child labour Act providing for compensation, employment of their parents/guardians and their education
- D. All of them

Ans. D

71.‘Right to work, to education and to public assistance in certain cases’ is an essence of which of the following Articles of the Indian Constitution?

- A. Article 40
- B. Article 41

- C. Article 39
- D. Article 42

Ans. B

72. Which of the following statements regarding ‘Right to education’ is/are found to be correct?

- I. The duty of the State, under this directive is not only to establish educational institutions but also to effectively secure the right to education, by admitting students to the seats available at such institutions, by admitting candidates found eligible according to some rational principle.
- II. Even though this right is not a fundamental right and is not judicially enforceable as such, once the State, by legislative or administrative actions, provides facilities for education, its action must conform to the standard of equality and rationality underlying Article 14 of the Indian Constitution.

- A. Only I
- B. Only II
- C. I and II
- D. None of them

Ans. C

73. Living, wage etc. for workers have been mentioned in Article of Indian Constitution.

- A. 41
- B. 43
- C. 43A
- D. 42

Ans. B

74. ‘Uniform Civil code for the citizens’ is mentioned in which of the following Articles of the Indian Constitution?

- A. Article 43
- B. Article 43A
- C. Article 44
- D. Article 45

Ans. C

75. Which of the following Articles says, “The State shall endeavour to provide early childhood care and education for all children until they complete the age of six years”?

- A. Article 44
- B. Article 45
- C. Article 43A
- D. Article 46

Ans. B

76. According to Article 47 of the Indian Constitution, it is the duty of the state to raise the level of nutrition and the standard of living and to improve public health. Which of the following statements regarding public health is/are correct?

- I. Article 47 makes improvement of public health a primary duty of the State.
- II. In case of need, the local authority should approach the State Government to grant loan or aid, and the latter should supply the money required in view of primary duty of the ‘State’ under Article 47.

- A. I and II
- B. Only II
- C. Only I
- D. None

Ans. A

77. In which of the following situations shall the duties of Chairman be performed by the Deputy of Legislative Council?

- A. When the office of chairperson is vacant
- B. During the absence of the chairperson from any sitting of the council
- C. Both (A) and (B)
- D. None of them

Ans. C

78. Which of the following Articles is associated with Fundamental Duties?

- A. Article 50
- B. Article 51
- C. Article 49
- D. Article 51A

Ans. D

79. Fundamental Duties have been added in the Constitution by which of the following Amendment Acts?

- A. 40th Amendment Act
- B. 42nd Amendment Act
- C. 48th Amendment Act
- D. 44th Amendment Act

Ans. B

80. Which of the following statements regarding Fundamental Duties is/are found to be correct?

- I. Fundamental Duties are not enforceable by mandamus or any other legal remedy.
- II. If the state seeks to promote any of these duties, that can be done only through methods permitted by and in consonance with the constitution.

- A. I and II
- B. Only I
- C. Only II
- D. Neither I nor II

Ans. A

81. Which of the following directions has/have been issued by the Supreme Court to the Central Government to take a number of steps to improve the environment?

- A. To direct all educational institutions throughout India to give weekly lessons in the first ten classes, relating to the protection and improvement of the natural
- B. To get books written for the said purpose and to distribute them free of cost
- C. To introduce short-term courses for training up teachers who teach this subject
- D. All of them

Ans. D

82. Which of the following Articles of the Indian Constitution states that there shall be a President of India?

- A. Article 51
- B. Article 51A
- C. Article 52

D. Article 53

Ans. C

83. Which of the following statements regarding Executive Power of the Union is/are found to be correct?

I. The executive power of the union shall be vested in the President and shall be exercised by him either directly or through officers subordinate to him in accordance with the constitution.

II. Without prejudice to the generality of the foregoing provision, the supreme command of the Defense Forces of the union shall be vested in the President and the exercise thereof shall be regulated by law.

A. I and II

B. Neither I nor II

C. Only I

D. Only II

Ans. A

84. In the exercise of its executive power, a Government may do any act provided:

I. it is not an act assigned by the constitution to any other authority or body such as the Legislature or the Judiciary or the Public Service Commission.

II. It is not contrary to the provision of the Constitution or of any law.

III. The powers required for carrying out a policy are not available from the existing law.

Which of the above statements is/are found to be correct?

A. All are incorrect

B. All are correct

C. I and II

D. I and III

Ans. B

85. By-laws are certain authorized rules, orders and constitutions of corporation:

A. For the governing of their members made by common assent

B. For cases to which the public law doth not extend

C. Either (A) and (B)

D. Both (A) and (b)

Ans. D

86. In which of the following questions will the Judiciary not enter or involve?

- A. Political Questions
- B. Policy involving Questions
- C. Either (A) or (B)
- D. Both (A) and (B)

Ans. D

87. The election of the Parliament is mentioned in which of the following Articles of the Indian Constitution?

- A. Article 52
- B. Article 53
- C. Article 54
- D. Article 53(1)

Ans. C

88. The President shall be elected by the members of an electoral college consisting of:

- A. The elected members of both Houses of Parliament
- B. The elected members of the Legislative Assemblies of the States
- C. The members of State legislative Assemblies, councils and All M.P.'s
- D. Both (A) and (B)

Ans. D

89. The main object of Article 54 of the Indian Constitution is

- A. To prescribe qualifications required electors to elect the President
- B. To fix the time for the election to fill the vacancy before the expiration of the term of the outgoing president
- C. To prevent the holding of the election before expiration of that term by reason of dissolution of the legislative Assembly of a state
- D. All of them

Ans. A

90. Which of the following method is adopted for the election of the President of India?

- A. Direct
- B. Indirect
- C. Proportional Representation
- D. Both (A) and (C)

Ans. C

91. Which of the following Articles of the Indian Constitution describes the term of the office of the President?

- A. Article 55(1)
- B. Article 56
- C. Article 54
- D. Article 55

Ans. B

92. The term of the office of President can be limited by which of the following?

- A. The President may, by writing under his hand addressed to the Vice President, resign his office
- B. The President may, for violation of the constitution, be removed from office by impeachment
- C. The President shall, notwithstanding the expiration of his term, continue to hold office until his successor enters upon his office
- D. All of them

Ans. D

93. The ‘Eligibility for re-election’ of President is the basis of the Indian Constitution.

- A. Article 56
- B. Article 57
- C. Article 58
- D. Article 54

Ans. B

94. Which of the following are the qualifications for the President of India?

- A. Citizen of India

- B. Completion of the age of 35 years
- C. Having qualifications for election as a member of the House of People
- D. All of them

Ans. D

95. In order to prove the incurring of disqualification of the election of President, which of the following conditions must be satisfied?

- A. A permanent office
- B. Income or profit accrued from that office
- C. The candidate held that office
- D. All of them

Ans. D

96. Which of the following conditions of Presidents' office is/ are found to be correct?

- I. The President shall not be a member of either house of Parliament.
 - II. The President shall not hold any other office of profit.
 - III. The emoluments and allowance of the President shall not be diminished during his term of office.
- A. I, II and III
 - B. Only II
 - C. I and III
 - D. II and III

Ans. A

97. Who among the following administers the oath to the President of India?

- A. Governor
- B. Vice President
- C. Speaker
- D. Chief Justice of Supreme Court

Ans. D

98. When a President is to be impeached for violation of the Constitution, the charges shall be preferred by _____ of Parliament.

- A. Lok Sabha
- B. Rajya Sabha

- C. Either House
- D. None of them

Ans. C

99. Which of the following statements regarding mandatory time limit of Presidential election according to Article 62 of the Indian Constitution is/are found to be correct?

- I. The election of the President must be completed within the time fixed by the Article and there is no provision for extension of this time limit.
 - II. Because of the rigidity of the time limit, the election must be held and completed before the expiration of the outgoing President, notwithstanding the fact that at the time of such election, the Legislative Assembly of a state has been dissolved.
- A. Only I
 - B. Only II
 - C. Neither I nor II
 - D. I and II

Ans. D

100. The Vice President shall be _____ the chairman of the council of states and shall not hold any other office of Profit.

- A. Ex-officio
- B. Permanent
- C. Deputy
- D. Regular

Ans. A

101. When the President is unable to discharge his functions owing to absence, illness or any other cause, _____ shall discharge his functions until the date on which the President resumes his duties.

- A. Speaker
- B. Vice President
- C. Chief Justice of Supreme Court
- D. Prime Minister

Ans. B

102. An electoral college that elects the Vice President of the country consists of:

- A. Elected members of both houses of Parliament
- B. Elected members of both houses of Parliament and Legislative Assemblies
- C. Elected members of State Legislative Assemblies and Legislative councils
- D. All of them

Ans. A

103. Which of the following Articles of the Indian Constitution is associated with the term of office of Vice President?

- A. Article 65
- B. Article 67
- C. Article 68
- D. Article 65

Ans. B

104. Vice President of India addresses his letter of resignation to the:

- A. President
- B. Prime Minister
- C. Speaker
- D. Chief Justice of India

Ans. A

105. Who among the following administers the oath to Vice President of India?

- A. Prime Minister
- B. Attorney General
- C. Speaker
- D. President

Ans. D

106. Which of the following statements is/are found to be correct?

- I. All doubts and disputes arising out of or in connection with the election of a President or Vice President shall be inquired into and decided by the Supreme Court whose decision shall be final
- II. Subject to the provisions of this constitution, Parliament may by law regulate any matter relating to or connected with the election of a President or Vice President

III. The election of a person as President or Vice President shall not be called in question on the ground of the existence of any vacancy for whatever reason among the members of the Electoral College electing him

- A. I and II
- B. I, II and III
- C. II and III
- D. I and III

Ans. B

107. The Police Power of the State cannot be _____

- A. Absolute
- B. Arbitrary
- C. Oppressive
- D. All of them

Ans. D

108. Subject to the provisions of the constitution, according to Article 73, of the Indian Constitution the executive power of the Union shall extend:

- I. To the matters with respect to which Parliament has power to make laws.
- II. To the exercise of such rights, authority and jurisdiction as are exercisable by the Government of India by virtue of any treaty or agreement.

Which of the above statements is/are found to be correct?

- A. I and II
- B. Only I
- C. Only II
- D. None of them

Ans. A

109. Freedom of Residence under Article 19 of the Indian Constitution is available in which of the following clauses?

- A. Clause (1) (e)
- B. Clause (1) D
- C. Clause (1) B
- D. Clause (1) C

Ans. A

110. Which of the following statements regarding Council of Ministers is/are found to be correct?

- I. Council of Ministers shall be headed by the Prime Minister to aid and advise the President who shall, in the exercise of his functions, act in accordance with such advice.
- II. The question whether any, and if so what, advice was tendered by Ministers to the President shall not be inquired into in any court.

- A. Only I
- B. Only II
- C. Neither I nor II
- D. I and II

Ans. D

111. Which of the following can be used to interpret the Articles 74-75 of the Indian Constitution?

- A. Canadian Constitution
- B. British Conventions
- C. Ideology of French Revolution
- D. Irish Conventions

Ans. B

112. The total number of ministers, including the Prime Minister in the Council of Ministers shall not exceed _____ of the total number of members of the House of the people.

- A. 15%
- B. 10%
- C. 20%
- D. 1/4th

Ans. B

113. Which of the following statements regarding the meaning of “Collective Responsibility” is/are correct?

- I. All members of a Government are unanimous in support of its policies and exhibit that unanimity on public occasions although while formulating the policies, they might have differed in the Cabinet meeting.

II. The Ministers, who had an opportunity to speak for or against the policies in the cabinet are thereby personally and morally responsible for its success and failure.

- A. Only I
- B. Only II
- C. I and II
- D. None of them

Ans. C

114. Consider the following statements:

The Indian Constitution is

- (1) unwritten Constitution
 - (2) written Constitution
 - (3) largely based on Government of India Act, 1935
- A. 2 and 1 are correct
 - B. 2 and 3 are correct
 - C. 1 and 2 are correct
 - D. 1 and 3 are correct.

Ans. B

115. Democracy and federalism are essential features of our Constitution and basic feature of its structure. This observation was made in S.R. Bommai case by:

- A. J. A.M. Ahmadi
- B. J. J.S. Verma
- C. J. P.B. Sawant
- D. J. S.R. Pandian.

Ans. C

116. The text of the Preamble of the Constitution of India aims to secure:

- A. fundamental rights to all individuals
- B. fundamental duties to citizen of India
- C. dignity of the individual and unity and integrity of the nation
- D. security of service to Government Servant.

Ans. C

117. In Tinsukia Electricity Company v. State of Assam, the Supreme Court pointed out that the term ‘Socialist’ used in the Preamble to the Constitution of India, means State whose basic policy is to:

- A. prohibit concentration of wealth and distribute equitably the natural resources
- B. prohibit equitably the natural resources
- C. distribute equitably the natural resources
- D. prohibit concentration of wealth and uplift the living standard of people.

Ans. C

118. The Preamble to the Constitution of India secures “Justice, Liberty, Equality and Fraternity” to:

- A. all persons
- B. those who reside within the territory of India
- C. all citizens
- D. those citizens who reside within the territory of India.

Ans. C

119. ‘Justice, social, economic and political’ is:

- A. guaranteed by Fundamental Rights in the Constitution of India
- B. guaranteed to the people by the writs issued by the Supreme Court of India
- C. an idea enshrined in the Preamble to the Constitution of India
- D. a Directive Principle of State Policy taken into account making enactments.

Ans. C

120. Consider the following statements with reference to the term ‘secularism’:

- 1. Secularism means that the State has no recognized religion of State
- 2. Secularism means that the State treats all the religions equally
- 3. Secularism means that the State regulates the relation of man with God.

Which of these statements are correct –

- A. 1, 2, and 3
- B. 1 and 2
- C. 2 and 3
- D. 1 and 3

Ans. B

121. The concept of Directive Principle of State policy is borrowed from:

- A. Germany
- B. France
- C. Ireland
- D. USA.

Ans. C

122. India has borrowed the scheme of federation i.e. ‘Union of States’ from which country:

- A. USA
- B. Russia
- C. Ireland
- D. Canada.

Ans. D

123. Which of the following said that “In any event, whatever system of Government we may establish here must fit in with the temper of the people and be acceptable to them”:

- A. Jawaharlal Nehru
- B. Dr. B. R. Ambedkar
- C. D. D. Basu
- D. M. V. Pylee.

Ans. A

124. By which amendment Act ‘Unity of the Nation’ was substituted by ‘Unity and integrity of the Nation’ in the Preamble of the Constitution:

- A. Forty-second Amendment Act, 1976
- B. Forty-fifth Amendment Act, 1980
- C. Forty-fourth amendment Act, 1979
- D. None of the above.

Ans. A

125. Who among the following said that “The new Constitution establishes, indeed a system of Government which is at the most quasi-federal, almost devolutionary in character; a unitary state with subsidiary federal features rather than the federal state with unitary features”:

- A. Dr. K.C. Wheare
- B. Subash Kashyap
- C. Dr. B.R. Ambedkar
- D. Dr. Rajendra Prasad.

Ans. A

126. _____ is the Preamble a part of the Constitution:

- A. It is the part of the Constitution
- B. It is not the part of the Constitution
- C. Still this question is to be decided by the court
- D. None of the above.

Ans. A

127. Which of the following feature is not borrowed from United Kingdom:

- A. The Cabinet system of Government
- B. The Parliamentary type of Government
- C. Bicameral Parliament
- D. Written Constitution.

Ans. D

128. The feature ‘power of judicial review’ is borrowed from which of the following country:

- A. UK
- B. USA
- C. Canada
- D. Ireland.

Ans. B

129. Under Article 11 of the Constitution the Parliament passed the Citizenship Amendment Act, 2003 (assented in January 2004) which provides the overseas citizenship to the People of Indian Origin in:

- A. 12 specified countries
- B. 16 specified countries
- C. 18 specified countries
- D. 20 specified countries

Ans. B

130. Which of the following Articles describe about the person voluntarily acquiring citizenship of a foreign state not to be citizens:

- A. Article 5
- B. Article 7
- C. Article 8
- D. Article 9.

Ans. D

131. The expression ‘every person’ in Article 5 includes:

- A. a prisoner
- B. member of armed forces
- C. persons living within the territory of India
- D. all of the above.

Ans. D

132. Under the Indian Constitution it was held in the case Pradeep v. Union of India:

- A. there is only one domicile of the country
- B. there are two domicile of the Union as well as of the State
- C. in case of Jammu & Kashmir, there are two domiciles one of the Union and other of the State
- D. both (a) & (c).

Ans. A

133. Article 6 enshrines the provision conferring Rights of citizenship of certain persons who have migrated to India from Pakistan. Which one of the following provision is incorrect:

- A. he or either of his parents or any of his grand-parents was born in India as defined in the Government of India Act, 1935
- B. such person has so migrated before 19 July, 1948.
- C. such person has so migrated on or after the 19 July, 1948, he has been registered as a citizen
- D. such person has got married in India.

Ans. D

134. The Fundamental rights secured to the individual are:

- A. limited to the State action only
- B. meant to protect persons against the conduct of private persons
- C. meant to protect persons against the police action
- D. all of the above are correct.

Ans. A

135. The term ‘other authorities’ as given under Article 12 includes:

- A. such bodies as are functioning as agents of the Executive Government only
- B. all authorities are created by the Constitution or statute and persons on whom powers are conferred by law
- C. none of the above
- D. all of the above.

Ans. B

136. Which of the following are included in the concept of ‘the State’ under Article 12:

- A. Railway Board and Electricity Board
- B. Judiciary
- C. University
- D. all of the above.

Ans. D

137. Article 12 of the Constitution defines ‘State’ for the purpose of enforcement of fundamental rights. Against which of the following writs cannot be issued for the enforcement of fundamental rights:

- A. High Court
- B. Income Tax Tribunal
- C. Delhi Municipal Corporation
- D. Port Trust.

Ans. A

138. In light of the definition of ‘State’ which of the following are not States:

- A. Indian Statistical Institute
- B. Institute of Constitution and Parliamentary Affairs
- C. Council of Scientific and Industrial Research

D. Prathama Bank.

Ans. B

139. For the purpose of fundamental rights an authority must come within the definition of ‘State’. Which of the following are not State:

- A. ONGC
- B. Industrial and Finance Corporation
- C. NCERT
- D. Kerala Legislative Assembly.

Ans. C

140. In the light of the definition of State as including other authorities, which of the following are not States:

- A. Consumer Protection Society
- B. Gram Panchayat, Phoolpur
- C. Town Area Committee, Ambala
- D. Punjab Legislative Assembly.

Ans. A

141. An Electricity Board terminated the services of certain employees arbitrarily without giving notice. Which one of the following alternative remedies can be best adopted by the concerned employees:

- A. the employees can move the High Court by a writ as Electricity Board is included within the definition of the State
- B. the employees can make an appeal to the State Government
- C. the employees can move the High Court after getting the permission of Electricity Board only
- D. the employees can directly approach the Supreme Court for violation of a fundamental right.

Ans. D

142. Which of the following is not State for the purpose of Article 12 of the Constitution:

- A. NCERT
- B. A Nationalised Bank
- C. Institute of Medical Research, Chandigarh

D. Griha Kalyan Kendra.

Ans. A

143. In which Indian case it has been quoted that “A man’s liberty of movement is regarded so highly by the law of England that it is not to be hindered or prevented except on the surest grounds” “Article 12”:

- A. Maneka Gandhi v. Union of India
- B. Joginder Kumar case
- C. Amarawati case
- D. None of the above.

Ans. A

144. In which of the following cases did the Supreme Court hold that an amendment of the Constitution under Article 368 was ‘law’ within the meaning of Article 13:

- A. Golaknath v. State of Punjab
- B. Sajjan Singh v. State of Rajasthan
- C. Shankari Prasad v. Union of India
- D. Keshvananda Bharti v. State of Kerala.

Ans. A

145. The term ‘State’ as mentioned in Article 12 of the Constitution includes also:

- A. LIC
- B. Indian Law Institute
- C. Institute of Constitutional and Parliamentary Studies
- D. Affiliated but privately owned and managed colleges.

Ans. A

146. In which recent case it was held that “State” within the meaning of Article 12 of the Constitution of India should have placed full facts before the High Court:

- A. Nehru Yuva Kendra Sangathan v. Mehbub Alam Laskar
- B. Abhijit Gupta v. S.N.B. National Centre Basic sciences
- C. Dhananjay v. Chief Executive Officer, Zila Parishad
- D. None of the above.

Ans. A

147. In which recent judgment it was held that if landlord being State within the meaning of Article 12 of the Constitution is required to prove fairness and reasonableness on its part in initiating proceeding, it is for it to show how its prayer meets the constitutional requirements of Article 14 of the Constitution:

- A. Ashoka Marketing Ltd. v. Punjab National Bank
- B. New India Assurance Company Ltd. v. Nusli Neville Wadia ”
- C. Narendra Kumar Maheswari v. Union of India
- D. None of the above.

Ans. B

148. The term “law in force” in clause (3) of Article 13 means:

- A. only statutory law
- B. customs and usages only
- C. both (a) & (b)
- D. newly formed public order only.

Ans. C

149. Under Article 13(1) pre-Constitution laws:

- A. become completely void
- B. not void
- C. become void (from the date of the commencement of the Constitution) insofar as they are inconsistent with the fundamental rights
- D. none of the above.

Ans. C

150. Article 13(2):

- A. includes law amending the Constitution
- B. does not include a law amending the Constitution
- C. states that the State shall not make any law which takes away or abridges the fundamental rights
- D. none of the above.

Ans. C

CTFS

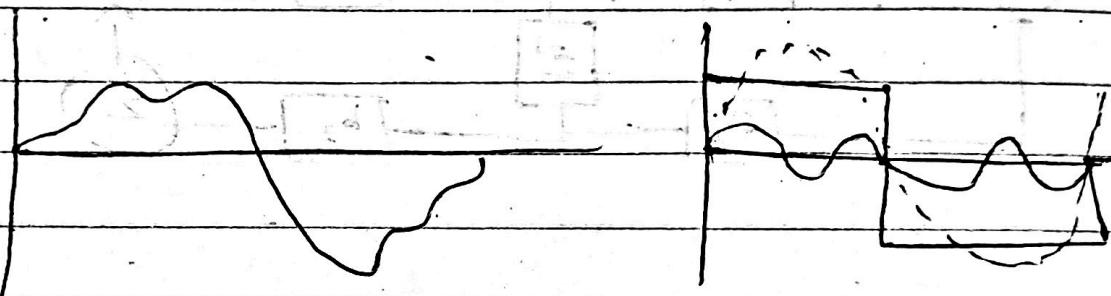
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Fourier Series :-

CTFS

DTFS

A Fourier series can be used to represent a periodic signal in terms of harmonically related complex exponentials or sinusoidal signals.



CTFS \Rightarrow

① Trigonometric Fourier series \Rightarrow

"Periodic signal $x(t)$ can be represented

$$\text{as, } x(t) = a_0 + \sum_{n=1}^{\infty} a_n \cos n\omega t + \sum_{n=1}^{\infty} b_n \sin n\omega t$$

Where $a_0 = \frac{1}{T} \int_{-T/2}^{T/2} x(t) dt \Rightarrow \text{DC or avg. value of } x(t)$

$\sin \rightarrow$ odd
 $\cos \rightarrow$ even

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$$a_n = \frac{2}{T} \int_{-T/2}^{T/2} x(t) \cos n\omega t dt$$

$$b_n = \frac{2}{T} \int_{-T/2}^{T/2} x(t) \sin n\omega t dt$$

Case I \Rightarrow Signals with even symmetry

For even signal, $[x(t) = x(-t)]$

For such signals having even symmetry,

$$[b_n = 0]$$

$$a_0 = \frac{1}{T} \int_{-T/2}^{T/2} x(t) dt$$

$$a_n = \frac{1}{T} \int_0^{T/2} x(t) \cos n\omega t dt$$

even \rightarrow



Case II \Rightarrow Signals having Odd Symmetry: (B)

For odd signal

$$x(t) = -x(-t)$$

For such signals having odd symmetry

$$a_n = 0$$

$$a_0 = 0$$

$$a_0 = \frac{1}{T} \int_{-T/2}^{T/2} x(t) dt = 0$$

$$b_n = \frac{4}{T} \int_0^{T/2} x(t) \sin n\omega_0 t dt$$

Case III \Rightarrow Signals having half wave symmetry

(A) Signals with half wave odd symmetry:

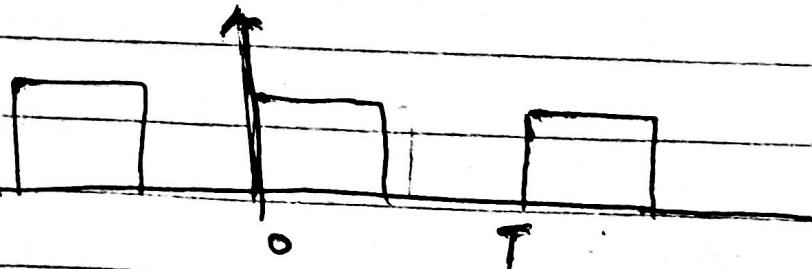
$$x(t) = -x(t \pm \frac{T}{2})$$

For such signals

$$\begin{cases} a_n = 0 \\ b_n = 0 \end{cases} \text{ when } n \text{ is even}$$

For signals having half wave odd symmetry
only odd harmonics are present.

i_{ext}



⑥ Half wave even symmetry

$$a_n = 0 \quad \left. \begin{array}{l} \\ b_n = 0 \end{array} \right\} \text{when } n \text{ is odd}$$

Alternate Representation of trigonometric Fourier series:-

$$x(t) = a_0 + \sum_{n=1}^{\infty} [a_n \cos n\omega t + b_n \sin n\omega t]$$

$$x(t) = a_0 + \sum_{n=1}^{\infty} [a_n \cos n\omega t + b_n \sin n\omega t]$$

Let $a_n = A_n \cos \phi_n$
 $b_n = A_n \sin \phi_n$

$$a_n^2 + b_n^2 = A_n^2$$

$$A_n = \sqrt{a_n^2 + b_n^2}$$

$$\phi_n = \tan^{-1} \frac{b_n}{a_n}$$

$$\therefore x(t) = a_0 + \sum_{n=1}^{\infty} A_n [\cos \phi_n \cos n\omega t + \sin \phi_n \sin n\omega t]$$

$$= a_0 + \sum_{n=1}^{\infty} A_n \cos(n\omega t - \phi_n)$$

Fourier Spectrum

Above representation of Fourier series gives the Fourier spectrum of the signal which consist of amplitude as well as phase spectrum.

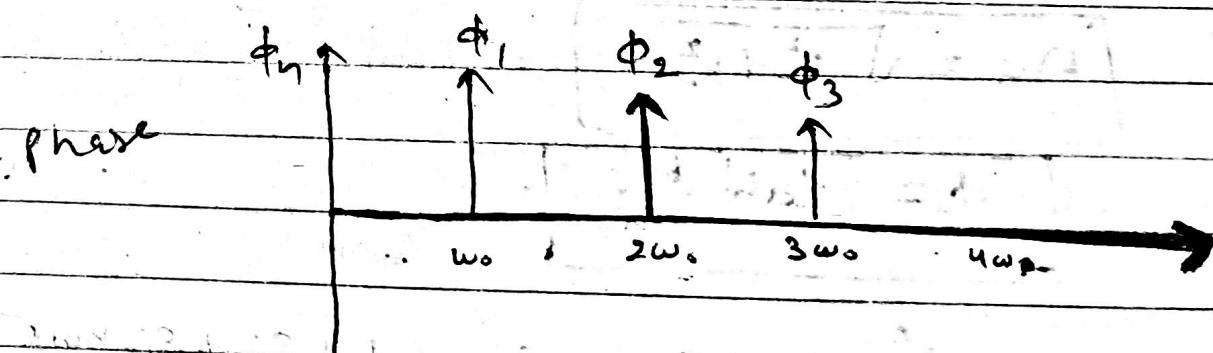
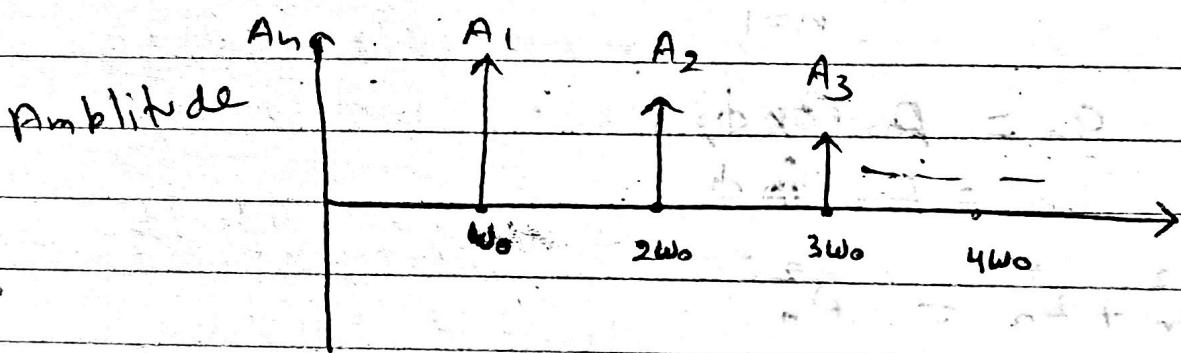
In the above representation

$A_n \rightarrow$ Amplitude

$\phi_n \rightarrow$ phase angle of the nth harmonic of the signal

One sided amplitude \Rightarrow phase spectrum of such periodic signal are impulses at discrete frequencies as shown

below



Fourier spectrum is freq. domain representation of a signal

A continuous and periodic function of time becomes aperiodic and discrete function of frequency in frequency domain.

Exponential Fourier series:-

$$x(t) = \sum_{n=-\infty}^{\infty} c_n e^{jn\omega_0 t}$$

$$\text{where } c_n = \frac{1}{T} \int_{-T/2}^{T/2} x(t) e^{-j n \omega_0 t} dt$$

$e^{jn\omega_0 t}$ → Complex exponential signal

Complex exponential Fourier series has both sided spectrum which include both +ve as well as -ve frequency. whereas sinusoidal Fourier series has one sided spectrum which includes only +ve frequency.

If $x(t)$ is a real signal

$$c_n^* = \left[\frac{1}{T} \int_{-T/2}^{T/2} x(t) e^{-j n \omega_0 t} dt \right]^*$$

$$c_n^* = \frac{1}{T} \int_{-T/2}^{T/2} x(t) e^{+j n \omega_0 t} dt$$

Amb → even fn of freq
phase → odd fn of freq.

$$-\frac{1}{T} \int_{-T/2}^{T/2} x(t) e^{-jn\omega_0 t} dt = C_n$$

$$C_n^* = C_{-n}$$

$$|C_n^*| = |C_{-n}|$$

Amplitude spectrum is always an even function of frequency.
whereas phase spectrum is always odd function of frequency.

Relationship between trigonometric \Rightarrow
exponential Fourier [signal] series \Rightarrow

$$x(t) = a_0 + \sum_{n=1}^{\infty} a_n \cos n\omega_0 t + \sum_{n=1}^{\infty} b_n \sin n\omega_0 t$$

$$\cos n\omega_0 t = \frac{e^{jn\omega_0 t} + e^{-jn\omega_0 t}}{2}$$

$$\sin n\omega_0 t = \frac{e^{jn\omega_0 t} - e^{-jn\omega_0 t}}{2j}$$

$$\therefore x(t) = a_0 + \sum_{n=1}^{\infty} a_n \left[\frac{e^{jn\omega_0 t} + e^{-jn\omega_0 t}}{2} \right]$$

$$+ \sum_{n=1}^{\infty} b_n \left[\frac{e^{jn\omega_0 t} - e^{-jn\omega_0 t}}{2j} \right]$$

$$x(t) = a_0 + \sum_{n=1}^{\infty} \left(\frac{a_n - jb_n}{2} e^{jn\omega t} \right)$$

$$+ \sum_{n=1}^{\infty} \left(\frac{a_n + jb_n}{2} e^{-jn\omega t} \right)$$

$$\text{let } \frac{a_n - jb_n}{2} = c_n$$

$$\frac{a_n + jb_n}{2} = c_n^* = c_{-n}$$

$$x(t) = a_0 + \sum_{n=1}^{\infty} c_n e^{jn\omega t} + \sum_{n=1}^{\infty} c_{-n} e^{-jn\omega t}$$

Replacing $-n$ by n in second term

$$x(t) = a_0 + \sum_{n=1}^{\infty} c_n e^{jn\omega t} + \sum_{n=-\infty}^{\infty} c_n e^{-jn\omega t}$$

$$x(t) = \sum_{n=0}^{\infty} c_n e^{jn\omega t} + \sum_{n=-\infty}^{-1} c_n e^{-jn\omega t}$$

where $c_0 = a_0$

$$x(t) = \sum_{n=-\infty}^{\infty} c_n e^{jn\omega t}$$

Dirichlet Condition of convergence of Fourier series:-

- ① The signal must be absolutely integrable over a finite period.

$$\left| \int_T x(t) dt \right| < \infty$$

- ② In any finite interval $x(t)$ must have finite number of minima & maxima.
- ③ In any finite interval $x(t)$ should have finite number of discontinuities and each discontinuity should be finite.

Condition ② & ③ are called strong Dirichlet condition.

Dirichlet Condition are sufficient conditions for existence of Fourier series of a signal but these are not necessary conditions

301501**December, 2019**
B.Tech. (CE/CSE) - V SEMESTER
SIGNALS & SYSTEMS (ESC-501)
Time : 3 Hours]**[Max. Marks : 75]****Instructions :**

1. It is compulsory to answer all the questions (1.5 marks each) of Part - A in short.
2. Answer any four questions from Part - B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART - A

1. (a) What is random signal? Give an example. (1.5)
- (b) Find the Nyquist rate for the signal $x(t) = 1 + \cos 10\pi t$, in Hz. (1.5)
- (c) Convolve the signal $x[n] = \{1, 2, -2\}$ with $h[n] = \{1, 2, -2\}$. (1.5)
- (d) Evaluate the integral $\int_{-10}^{10} \cos \pi t + \delta(2t - 10) dt$. (1.5)

- (e) A signal $x(t) = 2 \cos 400\pi t + 6 \cos 600\pi t$ is sampled with a sampling frequency 800 Hz. Write the resultant discrete signal. (1.5)
- (f) Find the response $y(t)$ for the given input signal $x(t) = u(t)$ and $h(t) = \delta(t-1)$. (1.5)
- (g) Write the Parseval's relation for continuous time Fourier transform. (1.5)
- (h) Find the Fourier series representation of an impulse train. (1.5)
- (i) State the purpose of Fourier Series and Fourier Transform. (1.5)
- (j) Find the inverse DTFT of $X(e^{j\omega}) = 2e^{j\omega} + 1 - 2e^{-2j\omega}$. (1.5)

PART - B

2. (a) State the importance of ROC. Find the Laplace transform $\delta(t)$, $u(t)$ and $r(t)$. (7)
- (b) Derive the relationship between autocorrelation and energy spectral density of an energy signal. (8)
3. (a) How the unit pulse function $\pi(t)$, unit step function $u(t)$ and ramp function $r(t)$ can be related? Also provide the mathematical representation and graphical representation of the above three function. (7)

(b) Determine whether the signals are periodic or not?

If a signal is periodic, determine its fundamental period.

(i) $x(t) = \cos(\pi/3)t + \sin(\pi/4)t$ (ii) $x(n) = \cos(n/4)$.

(8)

4. (a) Find the Fourier series representation for the signal $x(t) = 2 + \cos 4t + \sin 6t$ and plots its magnitude and phase spectrum. (10)

(b) Write the various application of signal and system theory. (5)

5. (a) Given the differential equation representation of a continuous time system. $\frac{d}{dt}y(t) + 2y(t) = x(t)$, find the response $y(t)$ for the input $x(t) = e^{-3t} u(t)$ using Laplace transform. (5)

(b) State and prove sampling theorem for low pass signals. Also, discuss the effect of under-sampling ? (10)

6. (a) A continuous time LTI system is represented by the following differential equation.

$$\frac{d^2}{dt^2}y(t) + 3\frac{d}{dt}y(t) + 2y(t) = 2x(t).$$

Determine the impulse response of the system using Fourier transform. (3)

- (b) Explain the following system properties, from the perspective of impulse response (i) Linearity (ii) causality (iii) time-invariance. (12)
7. (a) Derive the condition for stability of a discrete time LTI system in terms of its impulse response. (3)
- (b) A system has input-output relationship given by $y(n) = nx(n)$. Determine whether the system is causal, linear, time invariant or stable. (6)
- (c) State and prove the time shifting and frequency shifting properties of Fourier transform. (6)
-

$$(iii) \quad x_1(n) = -5 \left(\frac{1}{2}\right)^n u(-n-1)$$

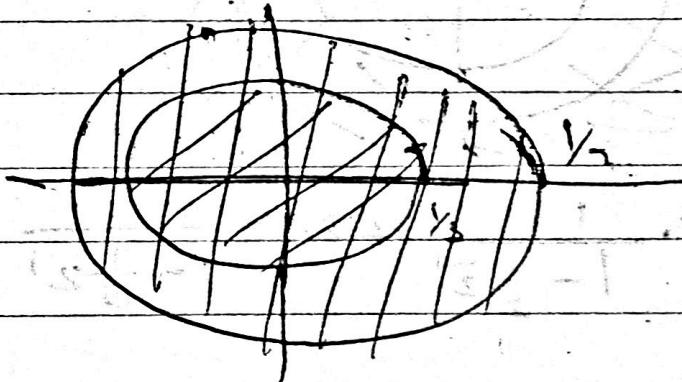
$$x_2(n) = -2 \left(\frac{1}{3}\right)^n u(-n-1)$$

$$X_1(z) = \frac{5}{1 - \frac{1}{2}z^{-1}}$$

$$X_2(z) = 2 \frac{1}{1 - \frac{1}{3}z^{-1}}$$

ROC of $x_1(z)$, $|z| < \frac{1}{2}$

ROC of $x_2(z)$, $|z| < \frac{1}{3}$



ROC of $x(z) \Rightarrow |z| < \frac{1}{3}$

$$X(z) = \frac{5}{1 - \frac{1}{2}z^{-1}} + \frac{2}{1 - \frac{1}{3}z^{-1}} ; |z| < \frac{1}{3}$$

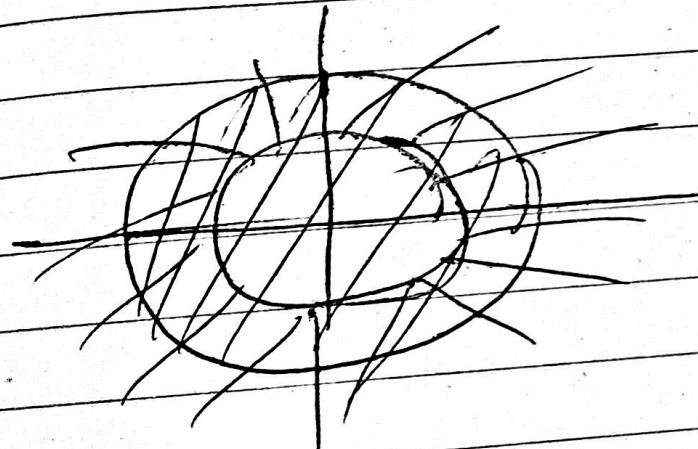
$$(iv) \quad x_1[n] = -5 \left(\frac{1}{2}\right)^n u(-n-1)$$

$$x_2[n] = 2 \left(\frac{1}{3}\right)^n u[n]$$

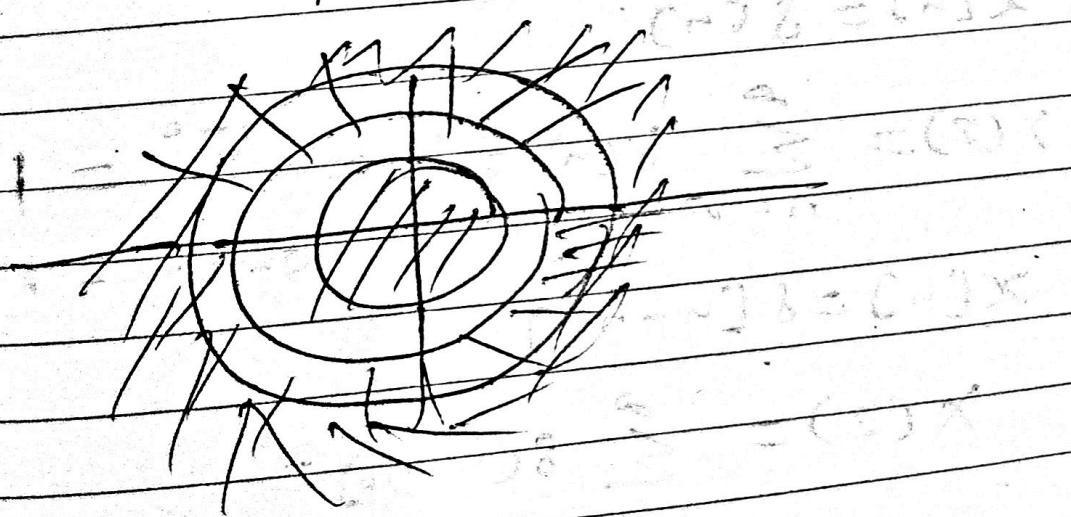
$$x_1(z) = \frac{5}{1 - \frac{1}{2}z^{-1}} \quad |z| < \frac{1}{2}$$

$$x_2(z) = \frac{2}{1 - \frac{1}{3}z^{-1}} \quad |z| > \frac{1}{2}$$

ROC $\rightarrow \frac{1}{3} < |z| < \frac{1}{2}$



(v)

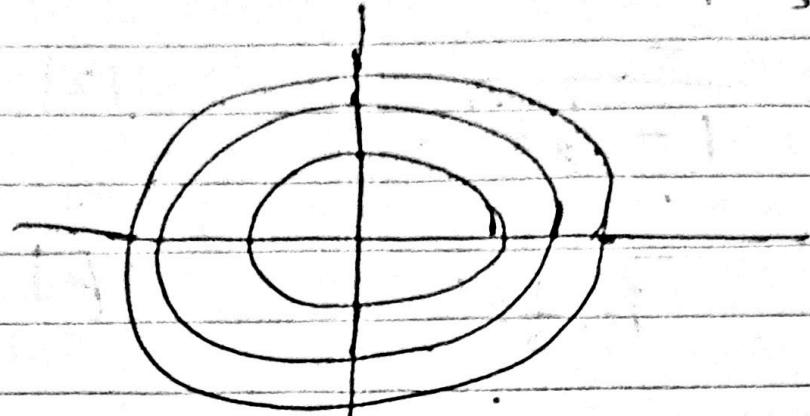


$$|z| < \frac{1}{2}$$

$$|z| > \frac{1}{3}$$

$$(vi) X[n] = 3 \left(\frac{1}{2}\right)^n u(-n-1) + 5 \left(\frac{1}{3}\right)^n u(n) + \left(\frac{1}{5}\right)^n u(n)$$

$$|z| > \frac{1}{5}$$



$$(vii) x[n] = \delta[n]$$

$$X(z) = \sum_{n=-\infty}^{\infty} \delta(n) z^n = \bar{z}^0 = 1$$

entire z -plane.

$$(viii) x[n] = \delta[n - n_0]$$

$$X(z) = \sum_{n=-\infty}^{\infty} \delta(n - n_0) z^n$$

$$= \frac{-n_0}{z} = \frac{1}{z^{n_0}}$$

ROC \rightarrow entire z -plane except $\underline{|z|=0}$

$$x[n] = s(n+n_0)$$

$$X(z) = \sum_{n=-\infty}^{n_0} s(n+n_0) z^{-n}$$

$$= z^{n_0}$$

$\text{ROC} \Rightarrow$ Entire z -plane except $|z|=\infty$

$$x[n] = u[n]$$

$$X(z) = \sum_{n=0}^{\infty} u[n] z^{-n}$$

$$= \frac{z}{z-1}$$

$$= \frac{z}{z-1}$$

$$\text{ROC} \Rightarrow |z| > 1$$

Properties of ROC

- ① ROC of $X(z)$ is circular strip centered at origin.
- ② ROC of $X(z)$ does not contain any pole of $X(z)$.
- ③ If $x[n]$ is right handed sequence then its ROC lie outside the outermost pole of $X(z)$.

- ④ If $x[n]$ is left handed sequence then its ROC lies inside the innermost pole of $X(z)$.
- ⑤ If $x[n]$ is algebraic sum of left handed and right handed sequences then ~~then~~ ROC of $X(z)$, area of ~~the~~ overlap of ROCs of individual sequence.
- ⑥ If $x[n]$ is of finite duration then its ROC is entire z -plane which may or may not include $z=0 \geq z=\infty$.

Inverse Z-Transform:-

$$x[n] = \frac{1}{2\pi j} \int_{-\pi}^{\pi} X(z) z^{n-1} dz$$

$$\stackrel{\stackrel{\leftrightarrow}{z}}{\int} \leftrightarrow \stackrel{\stackrel{\leftrightarrow}{z}}{\int}$$

Q:

Find the Inverse Z-transform of the function $x(z)$ if

$$(i) X(z) = \frac{3 - \frac{5}{6}z^{-1}}{\left(1 - \frac{1}{4}z^{-1}\right)\left(1 - \frac{1}{3}z^{-1}\right)}$$

$$ROC: |z| > \frac{1}{3}$$

$$= \frac{A}{(1 - \frac{1}{4}z^{-1})} + \frac{B}{(1 - \frac{1}{3}z^{-1})}$$

$$= \frac{1}{(1 - \frac{1}{4}z^{-1})} + \frac{2}{(1 - \frac{1}{3}z^{-1})}$$

Inverse z-transform

$$x(n) = \left(\frac{1}{4}\right)^n u(n) + 2\left(\frac{1}{3}\right)^n u(n)$$

(ii) Find the Inverse-z transform of function

$$X(z) \text{ if } X(z) = \frac{3 - \frac{5}{6}z^{-1}}{(1 - \frac{1}{4}z^{-1})(1 - \frac{1}{3}z^{-1})} ; |z| < \frac{1}{4}$$

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

$$= \frac{1}{(1 - \frac{1}{4}z^{-1})} + \frac{2}{(1 - \frac{1}{3}z^{-1})}$$

$$= -\left(\frac{1}{4}\right)^{n-1} u(-n) + 2\left(\frac{1}{3}\right)^{n-1} u(-n-1)$$

$$(iii) \text{ R.O.C: } \frac{1}{4} < |z| < \frac{1}{3}$$

$$x(n) = \left(\frac{1}{4}\right)^n u(n) - 2\left(\frac{1}{3}\right)^n u(-n-1)$$

$$\text{ROC: } 1 < |z| < 2$$

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Q3 Find the Inverse Z-transform of function

$$X(z) \text{ if }$$

$$X(z) = \frac{(1 - z^{-1} + z^{-2})}{(1 - \frac{1}{2}z^{-1})(1 - 2z^{-1})(1 - z^{-1})}$$

$$X(z) = \frac{A}{(1 - \frac{1}{2}z^{-1})} + \frac{B}{(1 - 2z^{-1})} + \frac{C}{(1 - z^{-1})}$$

$$= \frac{1}{(1 - \frac{1}{2}z^{-1})} + \frac{2}{(1 - 2z^{-1})} - \frac{2}{(1 - z^{-1})}$$

$$\therefore = \left(\frac{1}{2}\right)^n u(n) - 2(2)^n u(-n-1) - 2(1)^n u(n)$$

Q4 Find the inverse Z-transform for the function $X(z)$ if

$$X(z) = z^4 + z^2 + 2 + 5z^{-1} + 6z^{-2} + 3z^{-3}$$

$$x[n] = \delta[n+4] + \delta[n+2] + \delta[n+1]$$

$$+ 5\delta[n] + 6\delta[n-1] + 3\delta[n-3]$$

$$x[n] = \{1, 0, 1, 1, 5, 6, 0, 3\}$$

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

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Q) Find the inverse -z transform of the signal $x(z)$ if

$$x(z) = e^{\frac{1}{z}}$$

Soln

$$= 1 + \frac{\left(\frac{1}{z}\right)}{1!} + \frac{\left(\frac{1}{z}\right)^2}{2!} + \frac{\left(\frac{1}{z}\right)^3}{3!} + \dots$$

$$= \sum_{n=0}^{\infty} \frac{1}{1^n} \left(\frac{1}{z}\right)^n$$

$$= \sum_{n=0}^{\infty} \frac{1}{1^n} z^{-n}$$

$$= \sum_{n=-\infty}^{\infty} \frac{1}{1^n} u[n] z^{-n}$$

$$= \sum_{n=-\infty}^{\infty} x[n] z^{-n}$$

Where $x[n] = \frac{1}{1^n} u[n]$

$$x[n] = \frac{1}{1^n} u[n]$$

$$x[n] = \frac{1}{1^n} u[n]$$

Properties of Z-Transform :-

① Linearity :-

$$Z\{x_1[n] + x_2[n]\} = X_1(z) + X_2(z); R \rightarrow R_1 \cap R_2$$

② Time shifting :-

a) Time delay :-

$$Z\{x(n-k)\} = z^{-k} X(z) + \sum_{m=1}^{m-k} x[-m] z^m$$

$$\star Z\{x(n-1)\} = z^{-1} X(z) + x[-1]$$

$$\star Z\{x(n-2)\} = z^{-2} X(z) + x[-1] z^{-1} + x[-2]$$

$$Z\{x(n-3)\} = z^{-3} X(z) + x[-1] z^{-2} + x[-2] z^{-1} + x[-3]$$

b) Time Advance :-

$$Z\{x(n+k)\} = z^k X(z) - \sum_{m=0}^{K-1} x[m] z^{K-m}$$

$$\star Z\{x(n+1)\} = z X(z) - x(0) z$$

$$\star Z\{x(n+2)\} = z^2 X(z) - x(0) z^2 - x(1) z$$

③ Time Scaling:

$$z \{ \alpha^n x[n] \} = X\left[\frac{z}{\alpha}\right]$$

④ Time reversal:

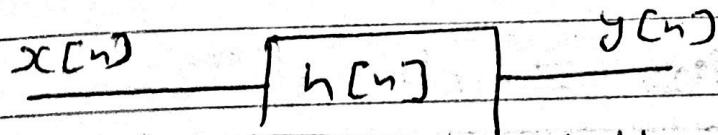
$$z \{ x(-n) \} = x(z')$$

⑤ Conjugation property:

$$z \{ x^*[n] \} = X^*(z^*)$$

⑥ Convolution Property:

$$z [x_1[n] * x_2[n]] = X_1(z) X_2(z)$$



Application of convolution property to LTI system

$$y[n] = h[n] * x[n]$$

$$Y(z) = H(z) X(z)$$

$$H(z) = \frac{Y(z)}{X(z)} = \text{Transfer function}$$

④ Time Scaling:

$$z \{x[n]\} = X\left[\frac{z}{a}\right]$$

⑤ Time Reversal:

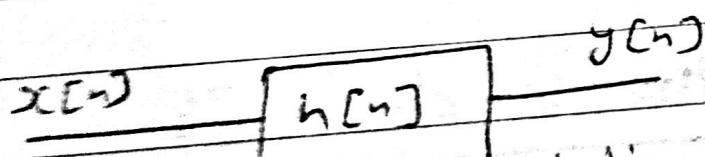
$$z \{x(-n)\} = x(z^1)$$

⑥ Conjugation Property:

$$z \{x^*[n]\} = X^*(z^*)$$

⑦ Convolution Property:

$$z [x_1[n] * x_2[n]] = X_1(z) X_2(z)$$



Application of convolution property to LTI system

$$y[n] = h[n] * x[n]$$

$$Y(z) = H(z)X(z)$$

$$H(z) = \frac{Y(z)}{X(z)} = \text{Transfer function}$$

$$\text{Q3} \quad T_D = \left\{ X(n) : |x(n)| = \left(\frac{1}{1 - \frac{1}{3}z} \right)^n, |z| < \frac{1}{3} \right\}$$

Then find $x(n) = ?$

$$Z\{X(z)\} = X(z)$$

$$Z\{X(z)\} = \left(\frac{1}{1 - \frac{1}{3}z} \right)^2$$

$$X(z) = \frac{1}{(1 - \frac{1}{3}z)^2}$$

$$X(z) = \frac{1}{z^2} \left(\frac{1}{1 - \frac{1}{3}z} \right)^2 = \frac{1}{z^2} \cdot \left(\frac{1}{1 - \frac{1}{3}z} \right)^2$$

⑦ Differentiation in z-domain

$$Z\{n^k x(n)\} = (-1)^k \frac{d^k}{dz^k} X(z)$$

$$\underline{\underline{G3}} \quad \underline{\underline{x[n] = n u[n]}}$$

$$\underline{\underline{\underline{SOL}}} \quad = (-1)^k \frac{d^k}{dz^k} U(z)$$

$$= (-1)^k \frac{d}{dz} \frac{z}{z-1}$$

$$= -\frac{(z-1)1 \cdot -2}{(z-1)^2} = \frac{2}{(z-1)^2}$$

$$= \frac{-2}{(1-z)^2}$$

⑧ Initial & Final value Theorems

Initial value:

$$x[0] = \lim_{n \rightarrow 0} x[n] = \lim_{z \rightarrow \infty} X(z)$$

Final value Theorem:

$$x[\infty] = \lim_{n \rightarrow \infty} x[n] = \lim_{z \rightarrow 1} [1 - z^{-1}] X(z)$$

$$= \lim_{z \rightarrow 1} (z-1) X(z)$$

⑨ Multiplication in Time domain:

$$z \{ x_1[n] x_2[n] \} = \frac{1}{2\pi j} \oint x_1(\omega) x_2\left(\frac{z}{e^{j\omega}}\right) e^{j\omega} d\omega$$

$$(\bar{z}) + (\bar{z}') \xrightarrow{L} = \frac{\bar{z}'}{1-\bar{z}'} = \frac{\bar{z}}{1-\frac{1}{\bar{z}}}$$

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(10) Z-transform of real part of signal

$$Z[\operatorname{Re}\{x[n]\}] = \frac{1}{2} [x(z) + x^*(z^*)]$$

$$Z[\operatorname{Im}\{x[n]\}] = \frac{1}{2} [x(z) - x^*(z^*)]$$

Z-Transform of important signals :-

$$\textcircled{1} \quad Z[\delta[n]] = 1$$

$$\textcircled{2} \quad Z[\delta[n-k]] = z^{-k}$$

$$\textcircled{3} \quad Z[\delta[n+k]] = z^k$$

$$\textcircled{4} \quad Z[U[n]] = \frac{z}{z-1} = \frac{1}{1-z}$$

Q3 Find the z transform of $x[n]$ if

$$x[n] = u[-n]$$

$$x[z] = \sum_{n=-\infty}^{\infty} x[n] z^{-n}$$

$$= \sum_{n=-\infty}^{\infty} u(-n) z^{-n}$$

$$\begin{aligned}
 &= \sum_{n=-\infty}^{\infty} z^{-n} \\
 &\quad \rightarrow \text{Replacing } n \text{ by } -n \\
 &= \sum_{n=\infty}^{\infty} z^n \\
 &= \sum_{n=0}^{\infty} z^n
 \end{aligned}$$

$$\begin{aligned}
 &= 1 + z + z^2 + z^3 + \dots \\
 &= \frac{1}{1-z} = \frac{1}{(1-\bar{z}^*)} \\
 &= -\frac{1}{z-1}
 \end{aligned}$$

(2) $x[n] = u[-n-1]$

$$\begin{aligned}
 X(z) &= \sum_{n=-\infty}^{\infty} x(n) z^{-n} \\
 &= \sum_{n=-\infty}^{\infty} u[-n-1] z^{-n}
 \end{aligned}$$

$$\begin{aligned}
 &= \sum_{n=-\infty}^{-1} z^{-n}
 \end{aligned}$$

$$\begin{aligned}
 &= \sum_{n=0}^{\infty} z^n
 \end{aligned}$$

$$\begin{aligned}
 &= \sum_{n=1}^{\infty} z^n
 \end{aligned}$$

$$\begin{aligned}
 &= \cancel{z} + z^2 + \dots \\
 &= \frac{z}{1-z} = -\frac{1}{1-\bar{z}^*}
 \end{aligned}$$

$$\begin{aligned}
 x[n] &= \cos(\omega_0 n) u[n] \\
 &= \left[\frac{e^{j\omega_0 n} + e^{-j\omega_0 n}}{2} \right] u[n] \\
 &= \left[\frac{1}{2} \alpha^n + \frac{1}{2} \bar{\alpha}^n \right] u[n]
 \end{aligned}$$

$$X(z) = \frac{1 - \bar{z}^{-1} \cos \omega_0}{1 - 2 \bar{z}^{-1} \cos \omega_0 + \bar{z}^2}$$

$$x[n] = \sin(\omega_0 n) u[n]$$

$$X(z) = \frac{z^{-1} \sin \omega_0}{1 - 2 z^{-1} \cos \omega_0 + z^2}$$

$$x[n] = \alpha^n \cos(\omega_0 n) u[n]$$

$$X(z) = \frac{1 - \alpha z^{-1} \cos \omega_0}{1 - 2 \alpha z^{-1} \cos \omega_0 + \alpha z^{-2}}$$

$$x[n] = \alpha^n \sin(\omega_0 n) u[n]$$

$$X(z) = \frac{\alpha z^{-1} \sin \omega_0}{1 - 2 \alpha z^{-1} \cos \omega_0 + \alpha z^{-2}}$$

Application of Z-Transform to LTI systems

Properties of LTI systems

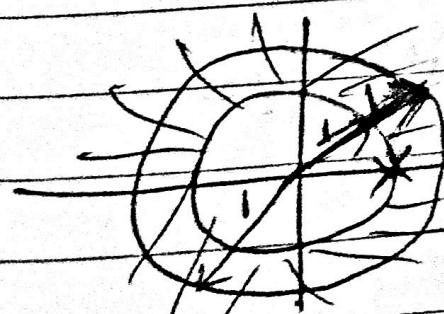
① Causality:

A system is said to be causal if its impulse response is zero for $n < 0$. Therefore impulse response of the system is right handed for the system to be causal. Then poles of transfer function in Z-domain lie ~~not~~ with in outermost pole \Rightarrow ROC lies outside the outermost pole of the transfer function.

② Stability:

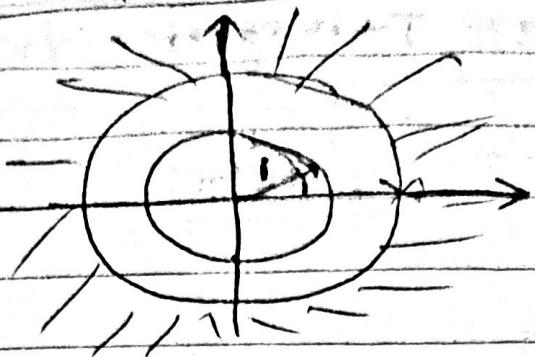
A system is said to be stable if its impulse response is absolutely summable \Rightarrow ROC of transfer function include unit circle.

Causal & stable system is

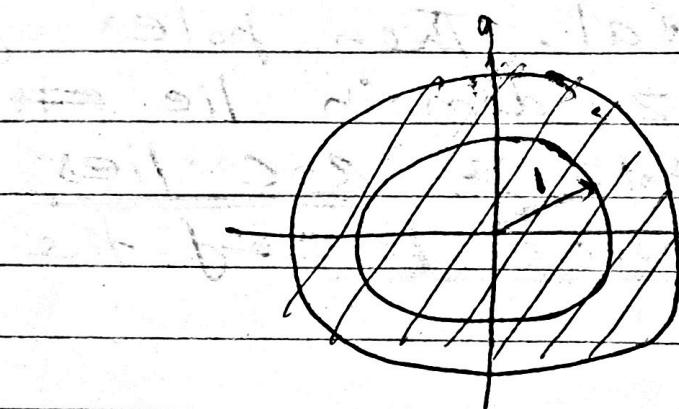


Poles are within the unit circle

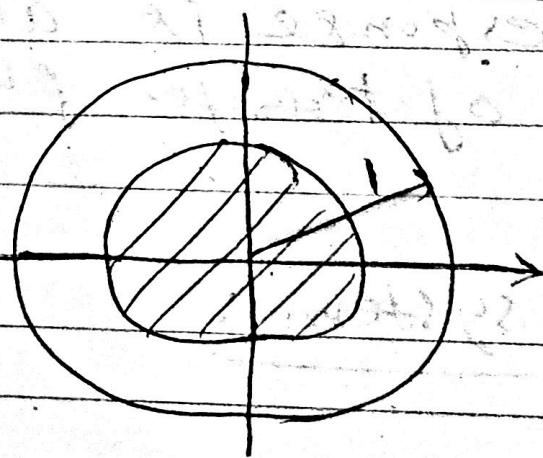
Causal \Rightarrow unstable



Non causal \Rightarrow stable



Non causal \Rightarrow unstable



* Causal \rightarrow ROC outside unit circle
stable \rightarrow include unit circle

non causal \rightarrow lie outside unit circle

Causal \rightarrow lie inside unit circle

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A Causal LTI system is described by the difference equation

$$y[n] = ay[n-2] - 2x[n] + bx[n-1]$$

Find the condition for stability of system.

$$z \Rightarrow T_{Kaiy} z^{-t}$$

$$y[z] = a[\bar{z}^2 y[z]] - 2x[z] + b\bar{z} x[z]$$

$$y[z] [2 - a\bar{z}^2] = [b\bar{z} - 2] x[z]$$

$$\frac{y(z)}{x(z)} = \frac{b\bar{z} - 2}{2 - a\bar{z}^2}$$

$$H(z) = \frac{b - z^2 (b\bar{z} - 2)}{2 [z^2 - \frac{a}{2}]}$$

Charac. Eqⁿ

$$z^2 - \frac{a}{2} = 0$$

$$z = \pm \sqrt{\frac{a}{2}}$$

$$|z| = \sqrt{\frac{a}{2}}$$

Causal

For system to be stable, pole must lie within the unit circle.

$$\sqrt{\frac{a}{2}} < 1$$

$$a < 2$$