Question Booklet Number

8110

M.Sc. (Sem.-VIII) Examination, 2022-23

Booklet Series
A

MATHEMATICS

GRAPH THEORY

(To be filled in by the Candidate / निम्न पूर्तियाँ परीक्षार्थी स्वयं भरें)

| Time : 1 : 30 Hours
| समय : 1 : 30 घण्टे

Roll No. (in figures) —
अनुक्रमांक (अंकों में)

| Maximum Marks : 75
| अधिकतम अंक : 75

Roll No. (in words) —
अनुक्रमांक (शब्दों में)

Enrolment No. (in figures) —

Name of College —
कॉलेज का नाम

Signature of Invigilator
कक्ष निरीक्षक के हस्ताक्षर

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 75 questions. Examinee is required to answer any 50 questions in the OMR Answer-Sheet provided and not in the question booklet. In case Examinee attempts more than 50 Questions, **first** 50 attempted questions will be evaluated. All Questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be immediately replaced.
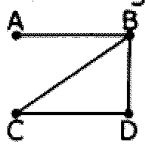
(Remaining Instructions on last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 75 प्रश्न हैं। परीक्षार्थी को किन्हीं 50 प्रश्नों को दी गई OMR उत्तर-पत्रक पर ही हल करना है। परीक्षार्थी द्वारा 50 से अधिक प्रश्नों को हल करने की स्थिति में, **प्रथम** 50 उत्तरों को ही मूल्यांकित किया जाएगा। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR उत्तर-पत्रक को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका, जिसमें कुछ भाग छपने से छूट गये हों या पृष्ठ तक से अधिक छपा गये हों या किसी भी प्रकार की कमी हो, उसे तुरन्त बदल लें।

(शेष निर्देश अन्तिम पृष्ठ पर)

1. If V={A,B,C,D}, then which of the following is a graph-

   (A) E = ({A,B},{A,C},{A,D},{B,C},{C,D})

   (B) E = ({A,B},{B,B},{A,D})

   (C) E = ({A,B},{B,C},{C,B})

   (D) None of the above

2. A fourth degree graph with '6' vertices contains how many edges-

   (A) 24

   (B) 12

   (C) 6

   (D) 18

3. In any tree with one or more vertices, there are at least-

   (A) One pendent vertex

   (B) One Isolated vertex

   (C) Two pendent vertices

   (D) Two Isolated vertices

4. If G be a connected graph with 4 vertices and 5 edges, then number of Chords will be-

   (A) 1

   (B) 5

   (C) 4

   (D) 2

5. If a graph has vertices of degree 0,2,2,3 and 9, then the total number of edges will be-

   (A) 16

   (B) 12

   (C) 8

   (D) 108

6. If a graph G contains K_5 or $K_{3,3}$ or a homeomorphic to either of these, then G is-

   (A) Planner Graph

   (B) Non-planner graph

   (C) Disconnected graph

   (D) Null graph

7. If two graphs have same incidents Matrix, then they are known as-

   (A) Isomorphic

   (B) Homeomorphic

   (C) Polymorphic

   (D) None

8. A simple graph G with '5' vertices will be connected if it has edges more than-

   (A) Five

   (B) Four

   (C) Three

   (D) None

9. A connected graph G is an Euler's graph if all vertices of G are of-

   (A) Same degree

   (B) Odd degree

   (C) Even degree

   (D) None of the above

10. Number of centres in every tree is-

   (A) 1

   (B) 2

   (C) 1 or 2

   (D) None of the above

11. For the graph-

   which of the following is a subgraph of G-

   (A) $V=\{B\}$ and $E=\phi$

   (B) $V=\{A,B,C,\}$ and

      $E = (\{A,B\},\{B,C\},\{C,D\})$

   (C) $V=\{A,B,D\}$ and

      $E = (\{A,B\},\{A,D\})$

   (D) All of the above

12. The number of edges in a regular graph of degree 'r' with 'n'-vertices will be:

   (A) Max (n,r)

   (B) n.r

   (C) (n+r)

   (D) 1/2 n.r

13. A graph 'G' will be self complementry if it has edges-

   (A) 8

   (B) 17

   (C) 25

   (D) All of the above

14. An unduected graph possesses an Eulerian Circuit if and only if it is connected and vertices are-

   (A) All of even degree

   (B) All of odd degree

   (C) Of any degree

   (D) All of the above

15. A complete graph K_n is Regular with degree-

   (A) (n−1)/2

   (B) (n−1)

   (C) n(n−1)

   (D) n(n+1)

16. A graph which has neither loops nor multiple edges is called a

    ⁄ (A) Simple graph

    (B) Multi-graph

    (C) Pseudo graph

    (D) Direct graph

17. A graph in which all vertices are of equal degree is called-

    (A) Null graph

    ⸰(B) Regular graph

    (C) Di graph

    (D) Complete graph

18. If a path in a graph G includes every edge exactly once then it is called-

    ⌃(A) Euler's path

    (B) Hamilton path

    (C) Simple path

    (D) Connected path

19. A connected planner graph with n-vertices, e-edges has f-regions, then f is-

    (A) e−n−2

    ⸰(B) e−n+2

    (C) e+n−2

    (D) e+n+2

20. Consider a simple graph G such that $|(V(G))| = 8, |E(G)| = 12$ then $|E(\overline{G})|$ is equal to-

    (A) 14

    (B) 15

    (C) 16

    (D) 20

21. Expression for the maximum number of edges in Bi-particle graph if m is degree of each n-vertices be-

    (A) m+n

    ⸰(B) m−n

    (C) m.n

    (D) $\frac{1}{2}(m^2 + n^2)$

22. A graph G is said to be planar if no two of its edges-

(A) intersects

(B) are parallel

(C) do not intersects

(D) All of the above

23. A graph has a dual G* iff it is-

(A) Planar

(B) Non-planar

(C) Homeomorphic

(D) None of these

24. Thickness of a planar graph is-

(A) One

(B) Two

(C) Three

(D) Zero

25. A graph with isolated vertices is-

(A) Bi chromatic

(B) 3-chromatic

(C) 1-chromatic

(D) 0-chromatic

26. Chromatic number of Null graph is-

(A) 0

(B) 1

(C) 2

(D) 4

27. A graph with n-vertices is 2-chromatic if-

(A) n is even

(B) n is odd

(C) n is zero

(D) n is a perfect square

8110\A\2023

[6]

28. The edge covering number of a complete graph on 6-vertices is-

(A) 20

(B) 36

(C) 21

(D) 15

29. If M is the adjacency Matrix of a graph with n-vertices consider $X=M+M^2+\ldots+M^{n-1}$ and there exist no entry in Matrix X that is zero, then G is-

(A) Connected

(B) Disconnected

(C) None of the above

(D) All of the above

30. In a complete graph with n-vertices, if n - is odd number≥3, then the number of edge-disjoint Hamltonian circuits are-

(A) $n(n-1)/2$

(B) n

(C) $(n-1)/2$

(D) $(n-1)$

31. Cycle graph is always-

(A) 2-Regular

(B) 3-Regular

(C) 4-Regular

(D) None

32. If G is a cyclic graph with 3-vertices, then chromatic polynomial is given by-

(A) $x(x-1)(x-2)$

(B) $x(x-1)$

(C) $x(x-2)(x-3)$

(D) $x^2\pm1$

33. If G is a tree with n-vertices then it has-

(A) $(n-1)$ edges

(B) $(n+1)$ edges

(C) $2n$ edges

(D) n^2 edges
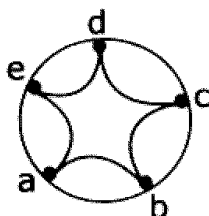
34. Number of branches in any spanning tree is called-

(A) Sibling

(B) Rank

(C) Nullity

(D) None

35. Longest path in a tree is called-

(A) Radius of tree

(B) Eccentricity of the tree

(C) Diameter of tree

(D) None

36. The number of regions in following graph are-

(A) 5

(B) 10

(C) 7

(D) 8

37. If e, r, v, μ and e*, r*, v*, μ* denotes the number of edges, regions vertices and Nullity of the graph G and dual graph G*, then which one is not correct:

(A) $e^* = e$

(B) $v^* = r$

(C) If G is connected, $v = v^*$

(D) $μ^* = Rank(G)$

38. In a simple, connected planar graph G, with r-regions, v-vertex (v≥3) and e-edges (e>1), which one is correct-

(A) $e \geq 3v - 6$

(B) $e \leq 3v - 6$

(C) $e \leq \frac{3}{2}v$

(D) $e \geq \frac{3}{2}v$

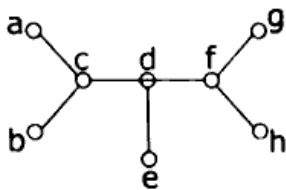39. If χ(G) is the chromatic number of a graph and Δ(G) is the largest degree of any vertex of G, then-

(A) $χ(G) \geq Δ(G)$

(B) $χ(G) \leq Δ(G)$

(C) $χ(G) - Δ(G) \geq 5$

(D) None of these

40. If G is a graph of older 3 and size 2, then the coefficient of λ^2 in chromatic polynomial will be-

(A) 2

(B) –2

(C) 4

(D) 3

41. Radius and diameter of the tree is-

, (A) 2, 4

(B) 3, 4

(C) 4, 2

(D) 3, 3

42. The number of distinct simple graphs with up to three vertices is-

(A) 15

(B) 10

(C) 7

(D) 1

43. Which of following is subgraph of a connected graph-

(A) Cut sets

(B) Circuit

(C) Path

(D) All of these

44. A graph is tree iff-

(A) Is planar

(B) Contains a circuit

(C) Is minimally connected

(D) Is completely connected

45. Complete graph of order n has connectivity number-

(A) (n–1)

(B) n

(C) n+1

(D) n(n 1)

46. For a complete graph with four vertices, which option is incorrect-

   (A) Planar

   (B) Non-planar

   (C) Regular

   (D) Connected

47. Chromatic polynomial for null graph of n-vertices is-

   (A) λ

   (B) λ^n

   (C) $\lambda(\lambda-1)$

   (D) $\lambda(\lambda-1)^n$
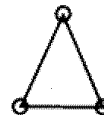
48. The chromatic polynomial of the following graph is-

   (A) $\lambda(\lambda-1)(\lambda-2)$

   (B) $\lambda(\lambda-1)3$

   (C) $\lambda(\lambda-1)(\lambda-2)(\lambda-3)$

   (D) None of these

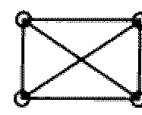49. A graph of order n is a tree iff its chromatic polynomial is equal to-

   (A) $x(x-1)^n$

   (B) $x(x-1)^{n-1}$

   (C) $x(x+1)^{n-1}$
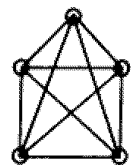
   (D) $x(x-1)^{n+1}$

50. Which of the following graph has perfect matching-
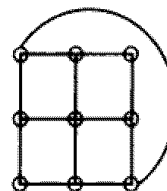

   (a)   (b)   (c)

   (A) (a) has perfect matching

   (B) (b) has perfect matching

   (C) (c) has perfect matching

   (D) (a) and (c) both have perfect matching

51. The chromatic number of the following graph is-

   (A) 2

   (B) 5

   (C) 6

   (D) None of these

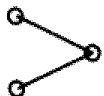52. The chromatic index of the complete biportite graph km, n is-

(A) max{m,n}

(B) min{m,n}

(C) m.n

(D) m+n

53. the chromatic polynomial of the above graph is-

(A) $\lambda(\lambda-1)$

(B) $\lambda(\lambda-1)^2$

(C) $\lambda(\lambda-1)(\lambda-2)$

(D) None of these

54. The number of colour required to properly colour the vertices of every planar graph is-

(A) 2

(B) 3

(C) 4

(D) 5

55. Choose the correct statement-

(A) Every edge of a tree is a cut-set

(B) Every edge of a tree is a bridge

(C) The edge connectivity of a tree is 1

(D) All of these

56. The complete graph with four vertices has K edges, where K is-

(A) 3

(B) 4

(C) 5

(D) 6

57. A graph G=(V,E) is said to be null graph is-
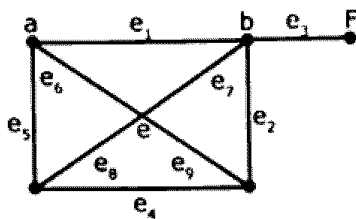
(A) $V \cap E = \phi$

(B) $V \cup E = \phi$

(C) $V = \phi$

(D) $E \neq \phi$

58. The size of a K-regular graph is

(A) $\dfrac{n}{2}$

(B) $\dfrac{n+K}{2}$

(C) $\dfrac{n-K}{2}$

(D) $\dfrac{n.K}{2}$

59. Cut set in the graph

(A) $\{e_3\}$

(B) $\{e_1, e_6, e_5\}$

(C) $\{e_5, e_8, e_4\}$

(D) All of these

60. If G is which out self loop then adjacent matrix of G which is not true-

(A) The principle diagonal contains all the entries O's

(B) The principle diagonal contains all entries 1's

(C) The total number of 1's gives the degree of corres

(D) The adjaceny matrix is symmetrix matrix

61. Consider a simple graph G. Such that $|E(G)| = 30$ and $|E(\bar{G})| = 36$ then $|V(G)|$ is

(A) 11

(B) 12

(C) 13

(D) None of these

62. A necessary and sufficient condition for a graph to be plannar is that G does not contain

(A) K_5

(B) K_4

(C) K_3

(D) K_2

63. Consider following graph which one is bipartite graph

(A) G_1:

(B) G_2:

(C) G_3:

(D) G_4:

64. The degree of every vertex in a circuit is

(A) Two

(B) Even

(C) Odd

(D) None of these

65. The Minimum number of colors that is sufficient to vertex colors any plannar graph is

(A) 4

(B) 5

(C) 6

(D) None of these

66. An open walk in which no vertex appears more than once is

(A) a Path

(B) disconnected graph

(C) a circuit

(D) None of these

67. Which is not a cover of a graph

(A) Graph is its own covering

(B) A spanning tree is covering of G

(C) A Hamiltonian circuit is covering of G

(D) If G have isolated vertex than G has covering

68. Choose the incorrect option

(A) Every tree with two or more vertices is 2-chromatic

(B) Every 2-chromatic is a tree

(C) A complete graph of n-vertices is n-chromatic

(D) A graph containing of only isolated vertices is 1-chromatic

69. If G be a simple connected planar graph with 13 vertices and 19 edges, then the number of faces in the planar embedding of the graph-

(A) 6

(B) 8

(C) 9

(D) 13

[13]

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8110\A\2023

70. Which of the following graphs is isomorphic to

(A)

(B)

(C)

(D)
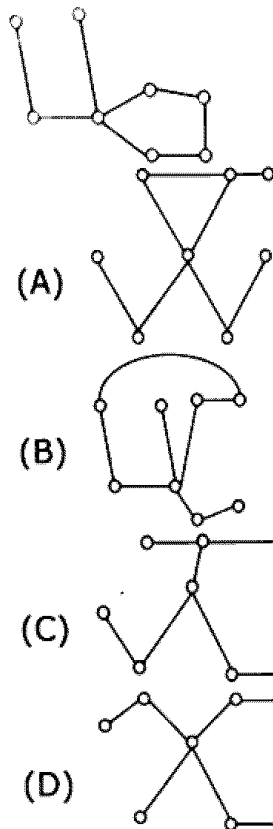
71. If for some positive integer K, degree of vertex $d(v)=K$ for every vertex v of the graph G then G is called

(A) K-graph

(B) K-regular graph

(C) Empty graph

(D) All of these

72. In a connected graph G of n-vertices and e-edges, then number of chords in spanning tree is

(A) $(n-1)$

(B) $e-(n-1)$

(C) $e-(n+1)$

(D) $n+1$

73. If a graph has p-loops at a vertex v and also q-edges incident to it then the degree of v is

(A) 2q

(B) 2p

(C) p+q

(D) 2p+q

74. The degree of intermediate vertice in a path is always

(A) 1

(B) 2

(C) 3

(D) 4

75. A complete bipartite graph km, n is Eulerian if

(A) m-odd, n-even

(B) m, n both odd

(C) m, n both even

(D) m-even, n-odd

4. Four alternative answers are mentioned for each question as A, B, C & D in the booklet. The candidate has to choose the most appropriate answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1   (A) ● (C) (D)

Q. 2   (A) (B) ● (D)

Q. 3   (A) ● (C) (D)

Illegible answers with cutting or over-writing or half filled circle will be cancelled.

5. In case the candidate does not fill the appropriate circle in the OMR Answer-Sheet and leave blank, 'Zero' mark will be given.

6. The candidate has to mark answers on the OMR Answer-Sheet with **black or blue ball point pen only** carefully as per directions.

7. **There will be no negative marking.**

8. Examinee must handover the answer-sheet to the invigilator before leaving the examination hall. Examinee can take away the Booklet along with them.

9. Rough-work, if any, should be done on the blank page provided for the purpose at the end of booklet.

10. Write your Roll Number and other required details in the space provided on the title page of the booklet and on the OMR Answer-Sheet with ball point pen. **Do not use lead pencil.**

11. **To bring and use log-book, calculator, pager & cellular phone in examination hall is prohibited.**

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर A, B, C तथा D हैं। परीक्षार्थी को उन चारों विकल्पों में से एक सबसे सही अथवा सबसे उपयुक्त उत्तर छाँटना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1   (A) ● (C) (D)

प्रश्न 2   (A) (B) ● (D)

प्रश्न 3   (A) ● (C) (D)

अपठित उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया उत्तर निरस्त कर दिया जाएगा।

5. यदि परीक्षार्थी OMR उत्तर-पत्रक में उपयुक्त गोले को नहीं भरता है और उत्तर-पत्रक को खाली छोड़ देता है, तो उसे 'शून्य' अंक प्रदान किया जाएगा।

6. अभ्यर्थी को प्रश्नों के उत्तर OMR उत्तर-पत्रक पर **केवल काले या नीले बाल प्वॉइंट पेन** से सतर्कतापूर्वक निर्देशानुसार अंकित करने होंगे।

7. **निगेटिव मार्किंग नहीं है।**

8. परीक्षार्थी उत्तर-पत्रक परीक्षा भवन छोड़ने से पहले कक्ष निरीक्षक को सौंप दें। परीक्षार्थी प्रश्न पुस्तिका अपने साथ ले जा सकते हैं।

9. रफ-कार्य, यदि कोई हो, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

10. प्रश्न-पुस्तिका के मुखपृष्ठ पर तथा OMR उत्तर-पत्रक पर निर्धारित स्थान में अनुक्रमांक तथा अन्य विवरण बॉल प्वॉइंट पेन से ही भरें। **पेन्सिल का प्रयोग न करें।**

11. परीक्षा कक्ष में लॉग-बुक, कैल्कुलेटर, पेजर तथा सैल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।