Reg. No.: | | | | | | | | |

G. VENKATASWAMY NAIDU COLLEGE (AUTONOMOUS), KOVILPATTI – 628 502.

PG DEGREE END SEMESTER EXAMINATIONS - NOVEMBER 2025.
(For those admitted in June 2025 and later)

PROGRAMME AND BRANCH: M.Sc., MATHEMATICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
I	PART - III	CORE ELECTIVE -1	P25MA1E1B	GRAPH THEORY AND ITS APPLICATIONS

Date & Session : 10.11.2025/FN **Time : 3 hours** **Maximum: 75 Marks**

Course Outcome	Bloom's K-level	Q. No.	**SECTION – A (10 X 1 = 10 Marks)** **Answer ALL Questions.**
CO1	K1	1.	A graph is __ if both its vertex set and edge set are finite. a) infinite b) loop c) finite d) simple
CO1	K2	2.	A ___ is closed if it has positive length and its origin and terminus are the same. a) walk b) triangle c) tree d) path
CO2	K1	3.	A graph is _____ if it contains a Hamilton cycle. a) walk b) hamiltonian c) cycle d) triangle
CO2	K2	4.	Every connected graph contains a a) tree b) cycle c) walk d) spanning tree
CO3	K1	5.	Every 3-regular graph without _____has a perfect matching. a) path b) cut edges c) walk d) components
CO3	K2	6.	Petersen graph is ____edge-chromatic. a) 3 b) 2 c) 4 d) 1
CO4	K1	7.	A subset S of V is called an _____ set if G if no two vertices of S are adjacent in G. a) dependent b) Cut vertex c) independent d) Spanning
CO4	K2	8.	A ____ of a simple graph G is a subset S of V such that G[S] is complete. a) loop b) walk c) clique d) path
CO5	K1	9.	Every critical graph is a _____. a) clique b) block c) loop d) walk
CO5	K2	10.	If G is __ chromatic the G contains a subdivision of K_4. a) 4 b) 3 c) 1 d) 2
Course Outcome	**Bloom's K-level**	**Q. No.**	**SECTION – B (5 X 5 = 25 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K2	11a.	Show that in any graph, the number of vertices of odd degree is even. **(OR)**
CO1	K2	11b.	Explain about the incidence and adjacency matrices in a graph with suitable examples.
CO2	K2	12a.	Prove that "If G is a tree, then $e = v - 1$". **(OR)**

CO2	K2	12b.	Write the proof of" If G is a simple graph with v≥3 and δ≥v/2, then G Hamiltonian".
CO3	K3	13a.	Prove that,"In a bipartite graph, the number of edges in a maximum matching is equal to the number of vertices in a minimum covering". **(OR)**
CO3	K3	13b.	If G is bipartite, then prove that $\chi' = \Delta$.
CO4	K3	14a.	Show that a set S $\subseteq$V is an independent set of G if and only if V\S is a covering of G. **(OR)**
CO4	K3	14b.	Show that if δ> 0 then $\alpha' + \beta' = v$.
CO5	K4	15a.	Analyze that, " If G is k -critical, then δ≥ k -1". **(OR)**
CO5	K4	15b.	Examine that " If G is simple, then $\pi_k(G) = \pi_k(G - e) - \pi_k(G \cdot e)$ for any edge e of G".

Course Outcome	Bloom's K-level	Q. No	**SECTION – C (5 X 8 = 40 Marks)** **Answer ALL Questions choosing either (a) or (b)**
CO1	K4	16a.	Analyze that a graph is bipartite if and only if it contains no odd cycle. **(OR)**
CO1	K4	16b.	Explain briefly about the paths and components in a graph with examples.
CO2	K5	17a.	"A Connected graph is a tree if and only if every edge is a cut edge"-Justify. **(OR)**
CO2	K5	17b.	Explain the proof of chavatal theorem.
CO3	K5	18a.	Prove or disprove that,"A matching M in G is a maximum matching if and only if G contains no M-augmenting path". **(OR)**
CO3	K5	18b.	Explain the statement and proof of vizing's Theorem.
CO4	K5	19a.	Evaluate that $r(k,l) \leq \binom{k+l-2}{k-1}$ **(OR)**
CO4	K5	19b.	Explain the statement and proof of Turan's Theorem .
CO5	K6	20a.	If G is a connected simple graph and is neither an odd cycle nor a complete graph, then construct a proof of $\chi \leq \Delta$. **(OR)**
CO5	K6	20b.	Formulate a reasoning that the statement "For any positive integer k, there exists a k-chromatic graph containing no triangle".