Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

M.Sc. (Second Semester - Regular) Examinations, May – 2026

(24MPEMA12005) – (Graph Theory)

(Mathematics)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions		CO #	Blooms Level
a.	Prove that, in a trace, any two vertices are connected by a unique path.	CO1	K1
b.	Find the no. of different perfect matching in k_4	CO1	K1
c.	Define edge cover and minimum edge cover	CO1	K1
d.	Define chromatic polynomial with an example	CO1	K1
e.	Show that in a directed graph $\sum deg^{-}(v) = \sum deg^{+}(v)$	CO1	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	Prove that, every simple graph on n-vertices is isomorphic to a subgraph of the complete graph K_n	5	CO1	K2
b.	Prove every induced subgraph of a complete graph is complete.	5	CO1	K2
	(OR)			
c.	Prove every subgraph of a bipartite graph is bipartite	5	CO1	K2
d.	Prove a tree with n vertices have $n-1$ edges.	5	CO1	K2
3.a.	Prove that a non-empty connected graph is Eulerian if and only if it has no vertices of odd degree.	5	CO2	K2
b.	Prove that a connected graph has Euler trail if and only if it has exactly two vertex of odd degree.	5	CO2	K2
	(OR)			
c.	State and Prove VIZING's theorem.	10	CO2	K2
4.a.	Prove that $\alpha + \beta = v$	5	CO3	K2
b.	Prove that If G is $k-$ critical, then $\delta \geq k-1$	5	CO3	K2
	(OR)			
c.	Prove every k chromatic graph has at least k vertices of degree at least $k-1$.	10	CO3	K2
5.a.	If G is a planar graph with $v \geq 3$ having no loop of $3\ vertices$, then prove that $e \leq 2v-4$	10	CO4	K2
	(OR)			
b.	State and prove five colour theorem.	10	CO4	K2
6.a.	Show that every tournament has a directed Hamilton Path.	10	CO5	K2
	(OR)			
b.	Let N be a network with a source x and sink y in which each arc has unit capacity then, prove that the value of maxflow in N is equal to the max number $'m'$ of arc-disjoint directed (x, y) paths in N	10	CO5	K2

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