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



PG DEGREE END SEMESTER EXAMINATIONS - NOVEMBER 2024.

(For those admitted in June 2023 and later)

PROGRAMME AND BRANCH: M.Sc., MATHEMATICS

SEM	CATEGORY	COMPONENT	COURSE CODE	COURSE TITLE
I	PART - III	CORE ELECTIVE-1	P23MA1E1B	GRAPH THEORY AND APPLICATIONS

Date : 12.11.2024 / AN

Time : 3 hours

Maximum: 75 Marks

Course Outcome	Bloom's K-level	Q. No.	SECTION - A (10 X 1 = 10 Marks) Answer <u>ALL</u> Questions.
CO1	K1	1.	(7, 6, 5, 4, 3, 3, 2) is _____. a) not Graphic b) graphic c) increasing d) none
CO1	K2	2.	In a multiple graph, $d(u, u) =$ _____. a) 2 b) 1 c) 0 d) ∞
CO2	K1	3.	Petersen graph is _____. a) Eulerian b) Hamiltonian c) either (a) or (b) d) neither (a) nor (b)
CO2	K2	4.	If G is simple with _____ then G is Hamiltonian. a) $\gamma \geq 3$ and $\delta \geq \frac{\gamma}{2}$ b) $\delta \geq 3$ and $\gamma \geq \frac{\delta}{2}$ c) $\gamma \geq 2$ d) $\delta \geq \frac{\gamma}{3}$
CO3	K1	5.	Every 3-regular graph without cut edges has a _____. a) loop b) Perfect matching c) independent set d) Complete graph
CO3	K2	6.	If G is _____ then $\chi' = \Delta$. a) Complete b) cycle c) bipartite d) none
CO4	K1	7.	$r(3,3) =$ _____. a) 5 b) 4 c) 9 d) 6
CO4	K2	8.	If S is a clique of G then S is an independent set of _____. a) G^c b) S c) G d) K_n
CO5	K1	9.	Every critical graph is _____. a) not connected b) Eulerian c) connected d) none
CO5	K2	10.	The length of the shortest cycle is called _____. a) Girth b) metric c) circumference d) Chromatic number
Course Outcome	Bloom's K-level	Q. No.	SECTION - B (5 X 5 = 25 Marks) Answer <u>ALL</u> Questions choosing either (a) or (b)
CO1	K2	11a.	Define the degree of vertex in a graph and prove that the sum of the degrees of the vertices of a graph is twice the number of edges of the graph. (OR)
CO1	K2	11b.	Show that $\delta \leq \frac{2E}{\gamma} \leq \Delta$.

CO2	K2	12a.	If G is a tree then prove that $E = \gamma - 1$. (OR)
CO2	K2	12b.	Prove that an edge e of G is a cut edge if and only if e is contained in no cycle of G .
CO3	K3	13a.	State and prove Hall's theorem. (OR)
CO3	K3	13b.	If G is simple then prove that either $\chi = \Delta$ or $\chi' = \Delta + 1$.
CO4	K3	14a.	Prove that $\alpha' + \beta' = \gamma$. (OR)
CO4	K3	14b.	Prove that $r(3,5) = 14$.
CO5	K4	15a.	Show that in a critical graph, no vertex cut is a clique. (OR)
CO5	K4	15b.	Prove that if G is simple then $\pi_K(G) = \pi_K(G - e) - \pi_K(G.e)$ for any edge e of G .

Course Outcome	Bloom's K-level	Q. No	SECTION - C (5 X 8 = 40 Marks) Answer <u>ALL</u> Questions choosing either (a) or (b)
CO1	K4	16a.	Define graphic sequence walk, path, cycle. (OR)
CO1	K4	16b.	Prove: A graph G is bipartite if and only if it contains no odd cycles.
CO2	K5	17a.	State and prove Cayley's theorem. (OR)
CO2	K5	17b.	Show that a non-empty connected graph is eulerian if and only if it has no vertices of odd degree.
CO3	K5	18a.	Show that a matching M in G is a maximum matching if and only if G contains no M -augmenting path. (OR)
CO3	K5	18b.	State and prove Tutte's theorem.
CO4	K5	19a.	Show that $r(k, l) \leq \binom{k+l-2}{k-l}$. (OR)
CO4	K5	19b.	Show that $r(k, k) \geq 2^{k/2}$.
CO5	K6	20a.	State and prove Brook's theorem. (OR)
CO5	K6	20b.	Show that if G is 4-chromatic then G contains a subdivision of K_4 .