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M.E./M.Tech. Degree Examinations, January 2017

First Semester

MECHATRONICS ENGINEERING

MA16184-ADVANCED ENGINEERING MATHEMATICS

(Regulation 2016)

**QP Code:667523**

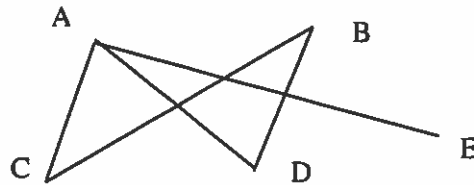
Time: Three hours

Maximum : 100 marks

Answer ALL questions

**PART A - (10 X 2 = 20 Marks)**

1. Define a subspace of a Vector space.
2. Find the sum of rank and nullity of  $A = \begin{pmatrix} 1 & 4 & 5 & 2 \\ 2 & 1 & 3 & 0 \\ -1 & 3 & 2 & 2 \end{pmatrix}$ .
3. State the sufficient condition for the convergence of Gauss- Seidal iterative method.
4. What is the condition for applying Simpson's  $\frac{1}{3}$  rule.
5. Given  $y' = -y$  and  $y(0) = 1$ , determine the value of  $y$  at  $x = 0.01$ .
6. Write the formula for Adam-Bashforth predictor corrector method.
7. Define Eulerian graph.
8. Find the Hamiltonian path in the following graph



9. Name two algorithms Commonly used to find minimum spanning trees of a Connected weighted graph.
10. What is the use of Dijkstra's algorithm?

**PART B - (5 X16 = 80 Marks)**

11. (a) (i) Prove that  $R^n$  is a vector space. (16)

(OR)

- (b) (i) Show that the following set of vectors  $S$ , is a basis for  $M_{22}$  where (16)

$$S = \left\{ \begin{pmatrix} 3 & 6 \\ 3 & -6 \end{pmatrix}, \begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & -8 \\ -12 & -4 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ -1 & 2 \end{pmatrix} \right\}.$$

12. (a) (i) Solve the system of equations by Gauss elimination method (8)  
 $x + 2y + z = 3, 2x + 3y + 3z = 10; 3x - y + 2z = 13.$
- (ii) The population of a town is as follows. (8)

Year $x$	1941	1951	1961	1971	1981	1991
Population in lakhs $y$	20	24	29	36	46	51

Estimate the population increase during the period 1946 and 1976.

(OR)

- (b) (i) Using Newton's divided difference formula, find the value of (8)  
 $f(8)$  given the following table

$x$	4	5	7	10	11	13
$f(x)$	48	100	294	900	1210	2028

- (ii) By dividing the range into ten equal parts, evaluate  $\int_0^{\pi} \sin x \, dx$  by (8)

Trapezoidal and Simpson's rule. Verify your answer with integration.

13. (a) (i) Using R.K. method of fourth order, find  $y(0.8)$  correct to 4 decimal (16)  
 places if  $y' = y - x^2, y(0.6) = 1.7379.$

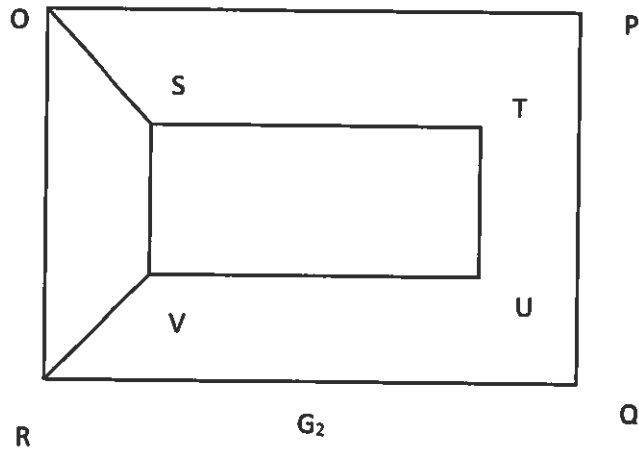
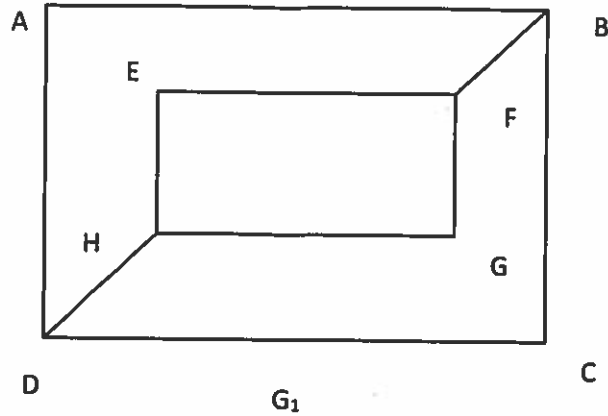
(OR)

- (b) (i) Given  $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$  and (16)

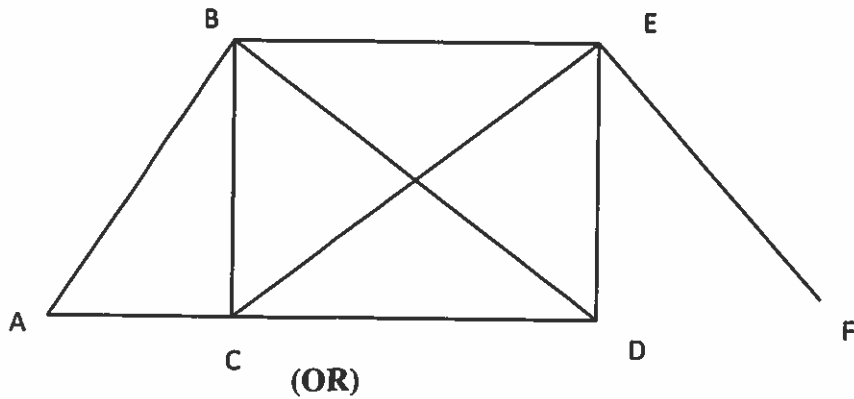
$$y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21$$

evaluate  $y(0.4)$  by Milne's predictor corrector method.

14. (a) (i) Determine whether the graphs shown in are isomorphic. (8)

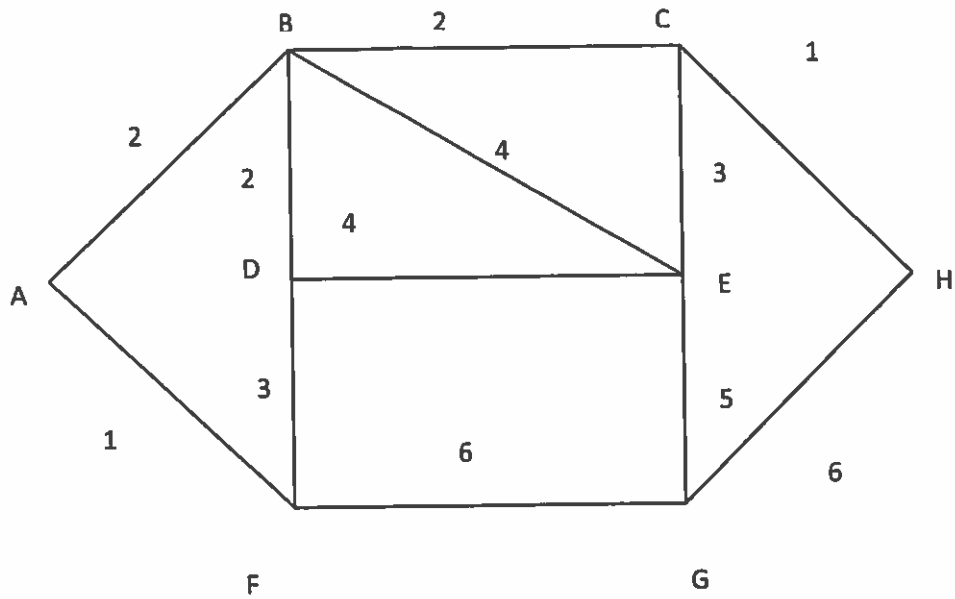


- (ii) Find the number of vertices, the number of edges and the degree of each vertex in the following undirected graphs, Verify also the handshaking theorem (8)



- (b) (i) Prove that a connected graph contains an Euler circuit if and only if each of its vertices are of even degree. (8)
- (ii) Draw all the subgroups of  $K_3$  containing at least one vertex. (8)

15. (a) (i) Use Dijkstra's algorithm to find the shortest path between the vertices A and H in the weighted graph given below. (16)
- A and H in the weighted graph given below.



(OR)

- (b) (i) Use Kruskal's algorithm to find a minimum spanning tree for the weighted graph shown below (16)
- weighted graph shown below

