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**Reg. No. :**

**Question Paper Code: 41002**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

First Semester

Civil Engineering

14UMA102 - ENGINEERING MATHEMATICS − I

(Common to ALL branches)

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | If the Eigen values of the matrix  are 2, -2 then the Eigen values of are | | | | | CO1- R | | |
|  | (a) | | | (b) 2, -2 | (c) 1, -1 | (d) 1, 3 | | |
| 2. | If two of the Eigen values of  are 2 and 8, then the third Eigen value is | | | | | CO1- R | | |
|  | (a) -2 | | | (b) 0 | (c) | (d) | | |
| 3. | A bounded sequence which does not converge is said to be | | | | | CO2- R | | |
|  | (a) Divergent | | (b)Oscillating infinitely | | (c)Oscillating finitely | (d) Monotonic | | |
| 4. | D’Alembert’s test is also called | | | | | CO2- R | | |
|  | (a) Ratio test | | | (b) Root test | (c) Abel’s test | (d) None of these | | |
| 5. | What is the radius of curvature at (3, 4) on the curve *x2 + y2 = 25*? | | | | | CO3- R | | |
|  | (a) | | | (b) | (c) | (d) | | |
| 6. | The radius of curvature of the curve *xy = c2* at (*c, c*) is | | | | | CO3- R | | |
|  | (a) | | | (b) | (c) | (d) | | |
| 7. | If u = (*x*-*y*)(*y*-*z*)(*z*-*x*), then | | | | | CO4- R | | |
|  | (a) 0 | | | (b) | (c) | (d) | | |
| 8. | If then the value of  is | | | | | CO4- R | | |
|  | (a) | | | (b) | (c) | (d) | | |
| 9. | The value of  is | | | | | CO5- R | | |
|  | (a) | | | (b) | (c) | (d) | | |
| 10. |  | | | | | CO5- R | | |
|  | (a) 9 | | | (b) | (c) | (d) | | |
|  | PART – B (5 x 2= 10Marks) | | | | | | | |
| 11. | Find the characteristic equation of the matrix CO1- App | | | | | | | |
| 12. | Show that the series  is convergent. CO2- U | | | | | | | |
| 13. | Find the radius of curvature of the curve at *x* = 0. CO3- App | | | | | | | |
| 14. | Change the order of integration in CO4- U | | | | | | | |
| 15. | State any two properties of Jacobian. CO5- U | | | | | | | |
|  | PART – C (5 x 16= 80Marks) | | | | | | | |
|  |  |  | | | | |  |  |
| 16. | (a) | Verify Cayley Hamilton’s theorem and hence find the inverse of the matrix. | | | | | CO1- App | (16) |
|  |  | Or | | | | |  |  |
|  | (b) | Reduce the Quadratic form *8x2 + 7y2 + 3z2− 12xy − 8yz + 4xz*to canonical form through an orthogonal transformation and hence show that it is positive definite. | | | | | CO1- U | (16) |
|  |  |  | | | | |  |  |
| 17. | (a) | Show that the series  is conditionally convergent. | | | | | CO2- App | (8) |
|  |  | Or | | | | |  |  |
|  | (b) | (i) Show that the sum of the series  . | | | | | CO2- Ana | (8) |
|  |  | (ii) Show that the series 1 − 2 + 3 − 4 + ... ∞ oscillates  infinitely. | | | | | CO2- Ana | (8) |
|  |  |  | | | | |  |  |
| 18. | (a) | Considering the evolute as the envelope of normals, find the evolute of . | | | | | CO-3 Ana | (16) |
|  |  | Or | | | | |  |  |
|  | (b) | (i) Find the radius of curvature at any point of the cycloid  and . | | | | | CO3- Ana | (8) |
|  |  | (ii) Find the evolute of the parabola *y2 = 4ax*. | | | | | CO3- Ana | (8) |
|  |  |  | | | | |  |  |
| 19. | (a) | A rectangular box open at the top, is to have a volume of 32cc. Find the dimensions of the box, that requires the least material for its constructions. | | | | | CO4-U | (16) |
|  |  | Or | | | | |  |  |
|  | (b) | If *u* is function of *x* and *y*; by changing to polar form with  *x = r cos θ, y = r sin θ*, show that . | | | | | CO4- Ana | (16) |
|  |  |  | | | | |  |  |
| 20. | (a) | (i) Change the order of integration inand hence  evaluate it. | | | | | CO5-App | (8) |
|  |  | (ii) Find the area lying between the parabola *y*= *x*2 and the line  *y* = *x*. | | | | | CO5-App | (8) |
|  |  | Or | | | | |  |  |
|  | (b) | (i) If the centre of curvature of the ellipse  at one end  of the ellipse of the minor axis lies at the other end, prove  that the eccentricity of the ellipse is . | | | | | CO5-App | (8) |
|  |  | (ii) Find the radius of curvature of the curve  *x = a [cosθ + log(tan)], y = a sinθ at θ*. | | | | | CO5-App | (8) |