MAT21

NEW SCHEME

USN

Second Semester B.E Degree Examination, July/August 2004

Common to all Branches

Engineering Mathematics II

Time: 3 hrs.] [Max.Marks : 100

Note: *1. Answer any FIVE full questions choosing at least one question from each part.*
2. All questions carry equal marks.

Part A

1. (a) Obtain the formula for the radius of curvature in polar form. (7 Marks)

   (b) If ρ_1, ρ_2 be the radii of curvature at the extremities of any focal chord of the cardioid $\gamma = a(1+cos\theta)$ show that (7 Marks)

   $$\rho_1^2 + \rho_2^2 = \frac{16a^2}{9}$$

   (c) State and prove Cauchy's mean value theorem. (6 Marks)

2. (a) Find the values of a and b such that (7 Marks)

   $$\lim_{x \longrightarrow 0} \frac{x(1+acosx)-bsinx}{x^3} = 1$$

   (b) Find the maximum and minimum distances from the origin to the curve (7 Marks)

   $$5x^2 + 6xy + 5y^2 = 8$$

   (c) Expand $x^2y - 3y - 2$ in powers of $(x-1)$ and $(y+2)$ using Taylor's theorem. (6 Marks)

Part B

3. (a) Find the value of (7 Marks)

   $$\int\int xy(x+y)dxdy$$

   taken over the region enclosed by the curves $y = x$ and $y = x^2$

   (b) Evaluate by change of order of integration (7 Marks)

   $$\int_0^1 \int_x^1 \frac{x}{\sqrt{x^2+y^2}} dydx$$

   (c) With usual notation show that (6 Marks)

   $$B(m,n) = \frac{\Gamma(m) \cdot \Gamma(n)}{\Gamma(m+n)}$$

4. (a) Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point $(1,-2,-1)$ in the direction of the vector $2\hat{I} - \hat{J} - 2\hat{K}$ (7 Marks)

   (b) Given that ϕ is a scalar point function and $\vec{A}$ is a vector point function, prove that (7 Marks)

   $$curl(\phi\vec{A}) = \phi(curl\vec{A}) - (grad\phi) \times \vec{A}$$

   (c) Evaluate $\int\int_S \vec{F} \cdot \vec{n} ds$ given (6 Marks)

   $$\overline{F} = x\hat{I} + y\hat{J} + z\hat{k}$$

   over the sphere $x^2 + y^2 + z^2 = a^2$

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