TAMIL NADU OPEN UNIVERSITY

Chennai - 15

School of Science

ASSIGNMENT

Programme Code No : 131
Programme Name : B.Sc., Mathematics
Course Code & Name : BMS-11, Elements of Calculus
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

Assignment – I

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Prove that the envelope of a family of curves touches each member of the family.
2. Find the area of the larger loop of the curve r = 2 + $4\cos\theta$.
3. .Write a note on Jacobians.
4. Write a note on Completeness of **R.**

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1. State and prove Leibnitz Theorem and hence find the n^{th} derivative of $e^x \log x$
2. Prove that $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2}$ can be transformd into $\frac{\partial^2 v}{\partial r^2} + \frac{1}{r^2}\ \frac{\partial^2 v}{\partial \theta^2} + \frac{1}{r}\ \frac{\partial v}{\partial r}$ using polar coordinates.
3. Derive the reduction formula for $\int sin^m x\, cos^n\, x\, dx$ and hence evaluate

   $\int_0^{\pi/2} sin^m x\, cos^n\, xdx$, where m and n positive integers.

Assignment – II

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Find the n^{th} derivative of $x^3 \sin 2x$
2. Find the envelope of the family of the curve $(x-a)^2 + (y-a)^2 = 4a$.
3. Prove that the perimeter of the Cardiod $r = a(1-\cos\theta)$ is $8a$.
4. Explain Comparison Test for convergence and prove.

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1. Define Gamma function, Show that the Gamma function $\Gamma(n)$ converges for n>0 and derive the recurrence formula.
2. Derive the formula for Radius of curvature.
3. Derive the reduction formula for $\int cos^m x \cos nx \; dx$ and hence evaluate

   $\int_0^{\pi/2} cos^m x \cos nx \; dx$, and hence prove that $\int_0^{\pi/2} cos^n x \cos nx \; dx = \frac{\pi}{2^{n+1}}$

Assignment – III

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Find the maximum and minimum values of $x - sin2x + \frac{1}{3} sin3x$ in $[-\pi, \pi]$.
2. Find the evolute of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$.
3. The cycloid $x = a(\theta - \sin\theta)$, $y = a(1-\cos\theta)$ rotates about the tangent at its vertex. Find the surface area formed.
4. State and prove Cauchy's first theorem on limits.

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1. State and prove D'Alembert's Ratio Test.
2. Derive the reduction formula for $\int sin^n x \, dx$ and hence evaluate $\int_0^{\pi/2} sin^n x \, dx$.
3. State and prove Cauchy's second theorem on limits.

Assignment – IV

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Find the extreme values of $y^2 + 4xy + 3x^2 + x^3$.
2. Find the radius of curvature of the cardiod r = $a(1 - \cos\theta)$.
3. Find the volume of the tetrahedron bounded by the plane $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ and the co-ordinate planes.
4. State and prove Sandwich Limit Theorem

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Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1. State and prove Raabe's Test.
2. Derive the reduction formula for $\int cos^n x\, dx$ and hence evaluate $\int_0^{\pi/2} cos^n x\, dx$.
3. Define Beta function and explain properties of Beta function.

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ASSIGNMENT

Programme Code No : 131
Programme Name : B.Sc., Mathematics
Course Code & Name : BMS-12, Trigonometry, Analytical Geometry (3d) and Vector Calculus
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

Assignment – I

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Sum the series : $\sin\theta + \frac{\sin 2\theta}{2} + \frac{\sin 3\theta}{3} + \ldots.\ \infty$
2. Find the equation of the plane through the point (1,-2,3) and the intersection of the planes $2x - y + 4z = 7$ and $x + 2y - 3z + 8 = 0$.
3. Derive the equation of the tangent plane to a sphere at a given point on it.
4. Verify the divergence theorem for $F = 4xzi - y^2j + yzk$ over the cube bounded by x = 0, x = 1, y = 1, z = 0, z = 1.

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1 (a). Find the equation of the right circular cone whose vertex is origin and guiding curve the circle $x^2 + y^2 + z^2 + 2x - y + 3z - 1 = 0, x - y + z + 4 = 0$.

(b). Find the equation of the sphere having its centre (5,-2,3) and which touches the line $\frac{x-1}{6} = \frac{y+1}{2} = \frac{z-12}{-3}$.

2. (a) Find the equation of a cone with vertex at the origin.

(b) Find the equation of the right circular cylinder of radius 2 whose axis passes through (1,2,3) and has direction cosines proportional to (2,-3,6).

3. Show that $\nabla^2 r^n = n(n + 1)\ r^{n-2}$.

Assignment – II

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Sum the series : $\frac{\cos\alpha}{1!} + \frac{\cos 2\alpha}{2!} + \frac{\cos 3\alpha}{3!} + \dots \infty$
2. Find the equation of the plane through the line of intersection of the planes x + y + z = 1, 2x + 3y + 4z – 7 = 0 and perpendicular to the plane x -5y + 3z = 5.

. 3. Find the equation of the cylinder whose generators are parallel to the line x = y = z and whose guiding curve is the circle $x^2 + y^2 + z^2 - 2x - 3 = 0, 2x + y + 2z = 0$.

4. Verify stoke's theorem for F = $x^2 i$ + xyj in the square region in the XOY plane bounded by the lines x = 0, y = 0, x = a, y = a

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1(a). Find the Length of the Tangent from an external point to the general sphere

(b) Find the condition that the plane *lx* + *my* + *nz* = *p* may be a tangent plane to the Sphere $x^2 + y^2 + z^2 + 2ux + 2vy + 2wz + d = 0$.

2 (a) Find the equation of the cylinder whose generators intersect the curve $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, z = 0 and are parallel to line $\frac{x}{l} = \frac{y}{m} = \frac{z}{n}$.

(b) Find the equation of the right circular cylinder whose generators are parallel to the line x = -2y = 2z and which touch the sphere $x^2 + y^2 + z^2 - 2y - 4z - 11 = 0$.

3. Verify Gauss's Divergence theorem over the cube bounded by the planes x = 0, x = 1; y = 0, y = 1; z = 0 and z = 1 for F = x^2 I + y^2 j + z^2 k.

Assignment – III

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Derive the equation of the plane in the Intercept form.
2. Find the equation of the plane through the line of intersection of the planes 2x – y + 5z - 3 = 0 and 4x + 2y –z + 7 = 0 and parallel to the z – axis.
3. Derive the equation of the right circular cylinder whose radius is r and axis is the line $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$.
4. If ∅ is a scalar point function, use Stoke's theorem to prove that curl (grad ∅) = 0.

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1. (a) Derive the condition for two general spheres to cut orthogonally.

   (b) Show that the spheres $x^2 + y^2 + z^2 + 3x + 5y – z – 7 = 0$ and $x^2 + y^2 + z^2 + 2x – 7y – 3z – 6 = 0$ are orthogonal.
2. Prove Curl curl **F** = grad div F - $\nabla^2 F$.
3. Verify Gauss's Divergence theorem for the function $F = 2xzi + yzj + z^2k$ over the upper half of the sphere $x^2 + y^2 + z^2 = a^2$.

Assignment – IV

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Find the angle between the planes x – y + 2z – 9 = 0 and 2x + y + z = 7.
2. Prove that the planes 5x – 3y + 4z = 1, 8x + 3y + 5z = 4 and 18x – 3y + 13z = 6 contain a common line.
3. If F = $x^2yi + y^2 zj + z^2 xk$, find curl F and curl curl F.
4. Prove by Stoke's Theorem that curl grad V = 0.

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1.(a) Derive the volume of a tetrahedron when the vertices are given.

(b) Find the equation of the cone whose vertex is at the point (α, β, γ) and whose generators intersect the guiding curve $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, $z = 0$.

2. Curl (u x v) = v ∇u -u ∇v + u div v – v div u.

3. Verify Gauss's divergence Theorem for $F = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$ taken over the rectangular parallelepiped $0 \leq x \leq a, 0 \leq y \leq b, 0 \leq z \leq c$.

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ASSIGNMENT

Programme Code No : 131
Programme Name : B.Sc., Mathematics
Course Code & Name : BMS-13, Differential Equations
Batch : AY 2018-19
No.of Assignment : One Assignment for Each 2 Credits
Maximum Marks : 100
Weightage : 25%

Assignment – I

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Solve : $2xy + (y^2 - x^2)\frac{dy}{dx} = 0$
2. Solve : $x(x^2 + y^2 - a^2)dx + y(x^2 - y^2 - b^2)dy = 0$.
3. Solve : $\frac{dx}{yz} = \frac{dy}{zx} = \frac{dz}{xy}$
4. Solve : $\sqrt{p} + \sqrt{q} = \sqrt{y}$

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1. (a) Solve : $(D^2 - 8D + 9)Y = 8\cos 5x$.

   (b) Solve : $(D^2 - 5D + 6)Y = x^2 - x + 2$
2. Solve: $x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = \frac{1}{(1-x)^2}$
3. Solve by the method of variation of parameters.

   $\frac{d^2y}{dx^2} + 4y = \text{cosec } 2x$

Assignment – II

Part – A (4 x 10 = 40 Marks)

Answer all questions. Each question carries 10 marks.

1. Solve : $x^2ydx - (x^3 + y^3)$ dy = 0
2. Solve : $(x^2 + y^2 + 2x)$ dx + 2*ydy* = 0.
3. Solve : $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$
4. Solve : Find L [t e^{-t}sint].

Part – B (2 x 30 = 60 Marks)

Answer any two of the questions. Each question carries 30 marks.

1 (a). Solve : $(D^2 - 4D + 3)Y = \sin 3x \cos 2x$.

(b). Solve : $(D^2 - 2D + 4)$ Y = e^x cosx.

2. Solve: $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \frac{\log x . sin(log\, x)+1}{X}$

3. Solve by the method of variation of parameters.

$$x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = x^2e^x$$