

Satyug Darshan Institute of Engineering & Technology, Faridabad

Department of Applied Science and Humanities

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Programme: B.Tech. CE/CSE	Year & Semester: 3 rd
Course Name: Calculus and ODE	Course Code: MTU-213-V
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Unit I

Short answer questions

Q.N.	Question	KL
1	Test the convergence of the series $\frac{5}{1.2.4} + \frac{7}{2.3.5} + \frac{9}{3.4.6} + \frac{11}{4.5.7} + \dots$	KL6
2	Does the sequence $\{\frac{1}{3}, \frac{-2}{3^2}, \frac{3}{3^3}, \frac{-4}{3^4}, \dots\}$ converges.	KL4
3	Define absolutely convergent series.	KL1
4	Define power series. Also explain the interval of convergence of power series.	KL1
5	Using Taylor series expansion, expand $\tan^{-1}x$ in power of $(x-1)$ up to four terms.	KL5

Long answer questions

Q.N.	Question	KL
1	Find the Taylor series expansion of $f(x)=\log \sin x$ about $x=3$.	KL1
2	Test for convergence the positive term series $1 + \frac{\alpha+1}{\beta+1} + \frac{(\alpha+1)(2\alpha+1)}{(\beta+1)(2\beta+1)} + \frac{(\alpha+1)(2\alpha+1)(3\alpha+1)}{(\beta+1)(2\beta+1)(3\beta+1)} + \dots$	KL4
3	Test for convergence the positive term series $\sum \frac{n^2}{2^n}$	KL4
4	Define Logarithmic test and test the convergence of the series $\frac{a+x}{1!} + \frac{(a+2x)^2}{2!} + \frac{(a+3x)^3}{3!} + \dots \infty$	KL1
5	Test the convergence or divergence of the series a) $\frac{1}{\sqrt{1.2}} + \frac{1}{\sqrt{2.3}} + \frac{1}{\sqrt{3.4}} + \dots \infty$ b) $\sum(\sqrt{n^2 + 1} - n)$	KL4
6	Examine the convergence or divergence of the series for $x>0$ $\frac{1}{2\sqrt{1}} + \frac{x^2}{3\sqrt{2}} + \frac{x^4}{4\sqrt{3}} + \frac{x^6}{5\sqrt{4}} + \dots$	KL4
7.	Examine the convergence or divergence of the series $\frac{a}{b} + \frac{a(a+d)}{b(b+d)}x + \frac{a(a+d)(a+2d)}{b(b+d)(b+2d)}x^2 + \dots$	KL4

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Unit II

Short answer questions

Q.N.	Question	KL
1	Find the stationary point of $f(x, y) = x^3y^2(1-x-y)$.	KL1
2	Define orthogonal curvilinear coordinates.	KL1
3	Find Div f and Curl f if $f = \text{grad}(x^3+y^3-3xyz)$	KL1
4	If $\vec{V} = (x + y + 1)i + j - (x + y)k$ find $\vec{V} \cdot \text{curl} \vec{V}$	KL1
5	Find the equation of tangent plane and normal to the surface of $2xz^2-3xy-4x=7$ at $(1,-1,2)$	KL1

Long answer questions

Q.N.	Question	KL
1	Prove that the rectangular solid of maximum value which can be inscribed in a sphere is a cube.	KL5
2	Show that $\nabla^2(r^n) = n(n+1)r^{n+2}$	KL1
3	Find the minimum value of the function $x^2+y^2+z^2$ subject to the condition $x+y+z=3a^2$	KL1
4	Test the continuity of the function $f(x, y) = \begin{cases} \frac{xy^2}{x^2+y^2}, & x \neq 0, y \neq 0 \\ 0, & \text{if } x = 0, y = 0 \end{cases}$	KL4
5	Find the directional derivative of $2yz+z^2$ in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$ at the point $(1, -1, 3)$	KL1

Unit III

Short answer questions

Q.N.	Question	KL
1	Evaluate $\int_0^1 \int_0^1 \frac{dx dy}{\sqrt{1-x^2} \sqrt{1-y^2}}$	KL5
2	Change the order of integration of $I = \int_0^1 \int_{x^2}^{2-x} xy dx dy$	KL4
3	Evaluate $\iint \sqrt{a^2 - x^2 - y^2} dx dy$ over the semi-circle $x^2 + y^2 = ax$ in the positive quadrant.	KL5
4	Define double and triple integration.	KL1
5	State green's theorem.	KL1

Long answer questions

Q.N.	Question	KL
1	Evaluate $\iint \frac{r dr d\theta}{\sqrt{a^2+r^2}}$ over one loop of the lemniscates $r^2 = \cos 2\theta$.	KL5

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2	Verify Green's theorem for $\int [(xy + y^2)dx + x^2 dy]$ where C is bounded by the curve $y=x$ and $Y=x^2$	KL5
3	Apply Gauss divergence theorem evaluate $\iint_S \vec{F} \cdot \vec{n} \, dS$ where $\vec{F} = 4xz \vec{i} - y^2 \vec{j} + yz \vec{k}$ and S is the surface of the cube bounded by the planes $x=0, x=2, y=0, z=0, z=2$.	KL3,5
4	Evaluate $\iint_S \sqrt{xy - y^2} \, dx \, dy$, where S is triangle with vertices (0,0), (1,0,1), (1,1).	KL5
5	Evaluate $\iint_0^2 \int_0^{\sqrt{2x-x^2}} \frac{x}{\sqrt{x^2+y^2}} \, dx \, dy$ changing in to polar co-ordinates.	KL5

Unit IV

Short answer questions

Q.N.	Question	KL
1	Find the integrating factor for differential equation $(1+xy) y \, dx + (1-xy) x \, dy = 0$.	KL1
2	Solve $(D^2+1)^3 y=0$, where $D=d/dx$.	KL1
3	Solve $(p x-y) (p y+x) = a^2 p$	KL3
4	Write the formula for Bessel's function of first kind of order n.	KL1
5	Find the P.I of $(D^2+5D+6) y=e^x$	KL1
6	Define order and degree of the differential equation.	KL1

Long answer questions

Q.N.	Question	KL
1	Find power series solution of the equation $\frac{d^2 y}{dx^2} + x \frac{dy}{dx} + x^2 y = 0$ about $x = 0$	KL1
2	Express the following in terms of Legendre polynomial: 1) $x^4+3x^3-x^2+5x-2$ 2) $5x^3+x$	KL2
3	State and prove orthogonal property of Legendre Polynomial	KL1
4	Solve: $\cos x \frac{dy}{dx} - y \sin x = y^3 \cos^2 x$	KL3
5	Solve the given equation using variation of parameters $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = e^x \log x$	KL3
6	Solve the differential equation: $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = 0$	KL3
7	Solve: $(1+y^2) dx = (\tan^{-1} y - x) dy$	KL3