

UNIT - 1

Q1. Define the convergence of an infinite series. Show that the n^{th} term of a convergent series tends to zero. Is the converse true? **(Refer Unit-1, Q4)**

Q2. State and prove comparison test. **(Refer Unit-1, Q8)**

Q3. Test the convergence or divergence of the series $1+\frac{1}{2^2}+\frac{2^2}{3^3}+\frac{3^3}{4^4}+\frac{4^4}{5^5}+....$ **(Refer Unit-1, Q12)**

Q4. Test the convergence of the series $\sum_{n=1}^{\infty}\left(\frac{1}{n^2+n}+\frac{1}{n}\right)$. **(Refer Unit-1, Q14)**

Q5. Test for convergence of the series $\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+...\infty$. **(Refer Unit-1, Q15)**

Q6. State and prove D-Alembert's ratio test. **(Refer Unit-1, Q16)**

Q7. Discuss the convergence of the exponential series $1+x+\frac{x^2}{2!}+\frac{x^3}{3!}+...$ **(Refer Unit-1, Q21)**

Q8. State and prove integral test. **(Refer Unit-1, Q25)**

Q9. Using the integral test, discuss the convergence of the series $\sum\frac{1}{2n+3}$ **(Refer Unit-1, Q28)**

Q10. Write about Cauchy's root test. **(Refer Unit-1, Q31)**

Q11. Test the convergence of the series $\left(\frac{2}{3}\right)x+\left(\frac{3}{4}\right)x^2+\left(\frac{4}{5}\right)x^3+...$ **(Refer Unit-1, Q35)**

Q12. State and prove Leibnitz's test. **(Refer Unit-1, Q38)**

Q13. Discuss the convergence of the series $\frac{x}{1+x}-\frac{x^2}{1+x^2}+\frac{x^3}{1+x^3}-\frac{x^4}{1+x^4}+...\ (0<x<1)$ **(Refer Unit-1, Q41)**

Q14. Verify Lagrange's mean value theorem for $f(x)=(x-1)(x-2)(x-3)$ in $[0, 4]$ **(Refer Unit-1, Q56)**

Q15. (a) State Cauchy's mean value theorem.

(b) Find 'c' of the Cauchy's mean value theorem for the functions $f(x)=\frac{1}{x^2}$ and $g(x)=\frac{1}{x}$ in $[a, b]$. **(Refer Unit-1, Q61)**

Q16. Find 'c' value of Cauchy's mean value theorem for the function $f(x)=e^x$, $g(x)=e^{-x}$ on $[a, b]$. **(Refer Unit-1, Q63)**

Q17. State Taylor's and Maclaurin's theorems. **(Refer Unit-1, Q64)**

Q18. Verify Mauclaurin's theorem for $f(x)=(1-x)^{5/2}$ with Lagranges form of remainder upto 3 terms in $[0,1]$ at $x=1$. **(Refer Unit-1, Q66)**

UNIT - 2

Q1. Define linear differential equation. Mention the steps involved in determining its general solution. **(Refer Unit-2, Q1)**

Q2. Solve $\cosh x\frac{dy}{dx}+y\sinh x=2\cosh^2 x\sinh x$. **(Refer Unit-2, Q5)**

Q3. Solve $(1-x^2)\frac{dy}{dx}+2xy=x\sqrt{1-x^2}$. **(Refer Unit-2, Q8)**

Q4. Solve the D.E $\frac{dy}{dx}=\frac{x^2+y^2+1}{2xy}$. **(Refer Unit-2, Q10)**

Q5. Solve $\frac{dy}{dx}+2y\tan x=y^2$. **(Refer Unit-2, Q13)**

Q6. Solve $\frac{dy}{dx}+\frac{y\cos x+\sin y+y}{\sin x+x\cos y+x}=0$. **(Refer Unit-2, Q17)**

Q7. Solve the D.E $y(x^4y^4+x^2y^2+xy)\,dx+x(x^4y^4-x^2y^2+xy)\,dy=0$. **(Refer Unit-2, Q22)**

Q8. Solve the D.E $(2xy^4e^y+2xy^3+y)dx+(x^2y^4e^y-x^2y^2-3x)dy=0$. **(Refer Unit-2, Q24)**

Q9. A copper ball is heated to a temperature of 80°C time $t = 0$, then it is placed in water which is maintained at 30°C. If at $t = 3$ minutes, the temperature of the ball is reduced to 50°C. Find the time at which the temperature of the ball is 40°C. **(Refer Unit-2, Q31)**

Q10. A bacterial culture, growing exponentially, increases from 100 to 400 grams in 10 hours. How much was present after 3 hours? **(Refer Unit-2, Q37)**

Q11. Find the orthogonal trajectories of the family of curves $x^2 + y^2 = a^2$. **(Refer Unit-2, Q40)**

Q12. Find the orthogonal trajectories of $r^2 = a \sin 2\theta$ **(Refer Unit-2, Q48)**

Q13. A resistance of 100 ohms, an inductance of 0.5 Henry is connected in series with a battery of 20 volts. Find the current in the circuit, if initially there is no current in the circuit. **(Refer Unit-2, Q52)**

Q14. An RL circuit has an Emf given (in volts) by 4 sint, a resistance of 100 ohms, an inductance of 4 henries with no initial current. Find the current at any time t. **(Refer Unit-2, Q55)**

UNIT - 3

Q1. Find the P.I of

(i) $(D^2 - 5D + 6)\, y = e^{4x}$ (ii) $(D^3 + 1)y = 3 + 5e^x$. **(Refer Unit-3, Q2)**

Q2. Solve $(D^2 - 1)y = \cosh 2x$. **(Refer Unit-3, Q8)**

Q3. Solve : $(D^2 - 9)y = \sin 2x$. **(Refer Unit-3, Q10)**

Q4. Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$. **(Refer Unit-3, Q12)**

Q5. Solve $(D^2 + 5D + 6)y = e^{2x} + \sin x$. **(Refer Unit-3, Q13)**

Q6. Solve $(D^2 + 3D + 2)y = e^{-x} + \cos x$. **(Refer Unit-3, Q15)**

Q7. Find the P.I of,

(i) $(D^2 + 1)y = x^2$. (ii) $(D + 2)^2\, y = x^2$. **(Refer Unit-3, Q17)**

Q8. Solve $(D^2 + D - 2)y = x + \sin x$. **(Refer Unit-3, Q20)**

Q9. Solve the D.E $y''' - 2y' + 2y = 1 + xe^x$. **(Refer Unit-3, Q25)**

Q10. Solve $(D^2 - 5D + 6)y = e^x \sin x$. **(Refer Unit-3, Q30)**

Q11. Solve the D.E $(D^2 + 2D + 1)y = x \cos x$. **(Refer Unit-3, Q33)**

Q12. Solve the D.E $(D^2 + 1)\, y = \sec^2 x$ by the method of variation parameters. **(Refer Unit-3, Q43)**

Q13. Solve the D.E. $(D^2 + D)\, y = \frac{1}{1+e^x}$. **(Refer Unit-3, Q47)**

Q14. Consider an electrical circuit containing an inductance L, Resistance R and capacitance C. Let q be the electrical charge on the condenser plate and 'i' be the current in the circuit at any time. There is applied E.M.F $E\sin\omega t$ in the circuit. Then find the charge on the capacitor. **(Refer Unit-3, Q51)**

Q15. A particle is executing simple harmonic motion with amplitude 5 meters and time 4 seconds. Find the time required by the particle in passing between points which are at distances 4 and 2 meters from the centre of the force and is on the same side of it. **(Refer Unit-3, Q57)**

UNIT - 4

Q1. Find $\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}$ for $f(x, y) = \log \sqrt{x^2+y^2}$. **(Refer Unit-4, Q2)**

Q2. If $x = r\cos\theta$, $y = r\sin\theta$, find $\left(\frac{\partial r}{\partial x}\right)^2 + \left(\frac{\partial r}{\partial y}\right)^2$ **(Refer Unit-4, Q3)**

Q3. If $u = x^2 \tan^{-1}\frac{y}{x} - y^2 \tan^{-1}\frac{x}{y}$, then show that $\frac{\partial^2 u}{\partial x \partial y} = \frac{x^2 - y^2}{x^2 + y^2}$. **(Refer Unit-4, Q4)**

Q4. Find $\frac{\partial^3 f}{\partial x\, \partial y\, \partial z}$ for $f(x, y, z) = e^{xyz}$. **(Refer Unit-4, Q6)**

Q5. State and prove Euler's theorem for homogeneous functions. **(Refer Unit-4, Q8)**

Q6. Find $\frac{du}{dx}$ if $u = \sin(x^2 + y^2)$, where $a^2x^2 + b^2y^2 = c^2$. **(Refer Unit-4, Q15)**

Q7. Find $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y}$ if $u = f(x + y, x - y)$. **(Refer Unit-4, Q19)**

Q8. If u = f(r, s, t) and $r = \frac{x}{y}, s = \frac{y}{z}, t = \frac{z}{x}$, find the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z}$. **(Refer Unit-4, Q24)**

Q9. If $x = r\cos\theta$, $y = r\sin\theta$, find $\frac{\partial(r,\theta)}{\partial(x,y)}$ and $\frac{\partial(x,y)}{\partial(r,\theta)}$. **(Refer Unit-4, Q28)**

Q10. If $x + y + z = u$, $y + z = uv$, $z = uvw$ then evaluate $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. **(Refer Unit-4, Q31)**

Q11. If $x = \sqrt{vw}$, $y = \sqrt{wu}$, $z = \sqrt{uv}$,

$u = r\sin\theta\cos\phi$, $v = r\sin\theta\sin\phi$, $w = r\sin\theta$ then find $J\left(\frac{x, y, z}{r, \theta, \phi}\right)$. **(Refer Unit-4, Q34)**

Q12. Determine whether the functions $U = \frac{x}{y-z}$, $V = \frac{y}{z-x}$, $W = \frac{z}{x-y}$ are dependent.

If dependent find the relationship between them. **(Refer Unit-4, Q37)**

Q13. Find Taylor's series expansion of function of $f(x) = \sqrt{1+x+y^2}$ in powers of $(x-1)$ and y upto second degree terms. **(Refer Unit-4, Q41)**

Q14. Examine the function for extreme values $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$ **(Refer Unit-4, Q54)**

Q15. Find the extreme values of $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 7$. **(Refer Unit-4, Q57)**

Q16. Find the maximum and minimum distance of the point (1, 2, 3) from the shpere $x^2 + y^2 + z^2 = 1$. **(Refer Unit-4, Q63)**

UNIT - 5

Q1. Evaluate

(i) $\int_0^3 \int_{-x}^{x} xy\,dx\,dy$

(ii) $\int_0^\infty \int_0^y \left(\frac{e^{-y}}{y}\right) dx\,dy$ **(Refer Unit-5, Q2)**

Q2. Evaluate $\int_0^\pi \int_0^{a(1+\cos\theta)} r^2\cos\theta\,dr\,d\theta$ **(Refer Unit-5, Q10)**

Q3. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{(1-x^2-y^2)}} xyz\,dx\,dy\,dz$. **(Refer Unit-5, Q19)**

Q4. By change of order of integration evaluate $\int_0^a \int_x^a (x^2+y^2)\,dy\,dx$ **(Refer Unit-5, Q26)**

Q5. Evaluate $\int_0^2 \int_0^{\sqrt{2x-x^2}} (x^2+y^2)\,dydx$ by changing into polar coordinates. **(Refer Unit-5, Q33)**

Q6. Find the area bounded by the lines x = 0, y = 1, x = 1 and y = 0. **(Refer Unit-5, Q45)**

Q7. Using double integral find the area bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. **(Refer Unit-5, Q47)**

Q8. Evaluate $\iiint xy^2z\,dxdydz$ taken through the positive octant of the sphere: $x^2 + y^2 + z^2 = a^2$. **(Refer Unit-5, Q58)**

Q9. Find by using triple integrals, the volume of the tetrahedron bounded by the planes $x = 0, y = 0, z = 0$ and $\frac{x}{a} + \frac{y}{y} + \frac{z}{c} = 1$

OR

Find the volume the tetrahedron bounded by the coordinate planes and $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$. **(Refer Unit-5, Q63)**