SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
Siddharth Nagar, Narayanavanam Road – 517583
QUESTION BANK (DESCRIPTIVE)

Subject with Code : Engineering Mathematics-III (16HS612)

Year &Sem:II-B.Tech& I-Sem **Regulation:** R16 **Course & Branch**: B.Tech Com to all

UNIT – I

1. a) Show that $w = \log z$ is analytic everywhere except at the origin and find $\frac{dw}{dz}$. [5M]

   b) If $f(z)$ is analytic function of z prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) log|f(z)| = 0$ [5M]
2. a) Show that $u = \frac{x}{x^2+y^2}$ is harmonic. [5M]

   b) Find the analytic function whose imaginary part is $e^x(xsiny + ycosy)$. [5M]
3. a) Determine p such that the function $f(z) = \frac{1}{2}\log(x^2 + y^2) + itan^{-1}\left(\frac{px}{y}\right)$ be an analytic.[5M]

   b) Find all the values of k, such that $f(z) = e^x(\cos ky + i \sin ky)$ [5M]
4. a) If $f(z) = u + iv$ is an analytic function of z and if $u - v = e^x(sin\, x - \cos y)$ find $f(z)$in terms of z. [5M]

   b) Find the analytic function $f(z)$ whose real part is $e^x(xsin\, y + y\cos y)$. [5M]
5. a)Show that $f(z) = z + 2\bar{z}$ is not analytic anywhere in the complex plane. [5M]

   b)Show that $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} = 4\frac{\partial^2}{\partial z \partial \bar{z}}$ [5M]
6. a) Evaluate line integral $\int f(z)\, dz$ where $f(z) = y - x - 3x^2 i$ and C consists of two Straight line segments one from $z = 0\ to\ z = i$ and the other from $z = i\ to\ z = 1 + i$ [5M]

   b) Evaluate $\int \frac{\cos z - \sin z}{(z+i)^3} dz$ with $C: |z| = 2$ using Cauchy's integral formula. [5M]
7. Calculate $\int f(z)\, dz$ where $f(z) = \pi exp\pi\bar{z}$ and C is boundary of the square with vertices at the points $0,1,1 + i, \& i$ where c being in the clockwise direction [10M]
8. Evaluate $\int_0^{1+3i}(x^2 - iy)\, dz$ along the paths. $i)\ y = x$ $ii)\ y = x^2$ [10M]
9. a) Evaluate $\int \frac{sin^2 z}{\left(z-\frac{\pi}{6}\right)^3} dz$ where $C: |z| = 1$ [5M]

   b) Evaluate $\int \frac{\log z}{(z-1)^3} dz$ where $C: |z - 1| = \frac{1}{2}$ using Cauchy's integral formula. [5M]
10. if C denotes the boundary of the square whose sides lie along the lines $x = \pm 2, y = \pm 2$ Where c is described in the positive sense, evaluate the integrals

    $i) \int \frac{e^{-z}}{\left(z-\frac{\pi i}{2}\right)} dz$ $ii) \int \frac{\cos z}{z(z^2+8)} dz$ [10M]

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UNIT – II

1. a) Determine the poles of the function $f(z) = \frac{z^2}{(z-1)^2(z+2)}$ and the residues at each pole [5M]
   b) Find the residue of the function $f(z) = \frac{1}{(Z^2+4)^2}$ where c is $|z - i| = 2$. [5M]
2. a) Find the residues of$f(z) = \frac{z^2}{1-z^4}$ at these singular points which lies inside the circle $|z| = 1.5$ [5M]
   b) Find the residues of $f(z) = \frac{z^2}{z^2+a^2}$ at $z = ai$ [5M]
3. a) Determine the poles of the function $f(z) = \frac{z^2+1}{z^2-2z}$ and the residues at each pole [5M]
   b) Determine the poles and residues of $\tan hz$. [5M]
4. a) Evaluate$\int_{-\infty}^{\infty} \frac{\cos ax}{x^2+1} dx,\ a > 0$ [5M]
   b) Find the residue of the function $f(z) = \frac{2e^z}{(z-3)z}$ where c:$|z| = 2$. [5M]
5. Evaluate$\int_0^{\pi} \frac{1}{a+bcos\theta} d\theta = \frac{\pi}{\sqrt{a^2-b^2}}$,$a > b > 0$ [10M]
6. Show that$\int_0^{2\pi} \frac{\cos 2\theta}{1+2acos\theta+a^2} d\theta = \frac{2\pi a^2}{1-a^2}$,$(a^2 < 1)$ using residue theorem. [10M]
7. a) Find the bilinear transformation which maps the point's $(\infty, i, 0)$ in to the points$(0, i, \infty)$[5M]
   b) Find the bilinear transformation that maps the point's$(0,1, i)$ in to the points $1 + i, -i,$ $2 - i$in w-plane [5M]
8. a) By the transformation $w = z^2$, show that the circles $|z - a| = c$ (a, c being real) in the Z-plane corresponds to the limacons in the w-plane [5M]
   b) Find the image of the region in the z-plane between the lines $y = 0$ & $y = \frac{\pi}{2}$ under the transformation$w = e^z$. [5M]
9. a) Find the bilinear transformation which maps the points $(\infty, i, 0)$ in to the points $(-1, -1, 1)$inw-plane. [5M]
   b) Find the bilinear transformation that maps the point's$(1, i, -1)$ in to the points $(2, i, -2)$ in w-plane [5M]
10. a) The image of the infinite strip bounded by $x = 0$ & $x = \frac{\pi}{4}$ under the transformation $w = \cos z$ [5M]
    b) Prove that the transformation $w = \sin z$ maps the families of lines $x = y = constant$ into two families of confocal central conics. [5M]

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UNIT –III

1. Find a positive root of $x^3 - x - 1 = 0$ correct to two decimal places by bisection method. [10 M]

2. Find out the square root of 25 given $x_0 = 2.0$, $x_0 = 7.0$ using bisection method. [10 M]

3. Find out the root of the equation $x\log_{10}(x) = 1.2$ using false position method. [10 M]

4. Find the root of the equation $xe^x = 2$ using Regula-falsi method.[10 M]

5. Find a real root of the equation $xe^x - \cos x = 0$ using Newton- Raphson method. [10 M]

6. Using Newton-Raphson Method

a) Find square root of 10. [5 M] b)Find cube root of 27.[5 M]

7. Using Newton's Forward Interpolation Formulae , find the polynomial $y = tanx$ satisfying the following data, Hence evaluate $tan(0.12) and tan(0.28)$ [10M]

X	0.10	0.15	0.20	0.25	0.30
Y	0.1003	0.1511	0.2027	0.2533	0.3093

8. a) Using Newtons forwardinterpolation formula. ,and the given table of values

x	1.1	1.3	1.5	1.7	1.9
f(x)	0.21	0.69	1.25	1.89	2.61

Obtain the value of f(x) when x=1.4 [5M]

b) Evaluate $f(10)$ given $f(x) = 168,192,336$ at $x = 1,7,15$ respectively,

use Lagrange interpolation. [5 M]

9. a) Use Newton's Backward interpolation formula to find $f(32)$given$f(25) = 0.2707, f(30) = 0.3027 f(35) = 0.3386, f(40) = 0.3794$ [5M]

b) Findthe unique polynomial $P(X)$ of degree 2 or less such that $P(1) = 1$ $P(3) = 27, P4 = 64$ using Lagrange's interpolation formula. [5M]

10. a)Using Lagrange's interpolation formula,find the parabola passing through the points (0,1),(1,3) and (3,55) [5M]

b) For $X = 0,1,2,4,5$; $f(X) = 1,14,15,5,6$ find $f(3)$ using forward difference table. [5M]

UNIT –IV

1.Fit the curve $y = ae^{bx}$ to the following data. [10 M]

x	0	1	2	3	4	5	6	7	8
y	20	30	52	77	135	211	326	550	1052

2.a)Fit the exponential curve of the form $y = ab^x$ for the data [5 M]

x	1	2	3	4
y	7	11	17	27

b) Fit a straight line y=a+bx from the following data [5 M]

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

3. a) Fit a second degree polynomial to the following data by the method of **least squares** [10 M]

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

b) Fit a straight line y=ax+b from the following data [5 M]

x	6	7	7	8	8	8	9	9	10
y	5	5	4	5	4	3	4	3	3

4. Fit a Geometric curve to the following data [5M]

x	1	2	4	6
y	6	4	2	2

and estimate y(2.5)

b) Fit a second degree polynomial to the following data by the method of **least squares** [5 M]

x	0	1	2	3	4
y	1	5	10	22	38

5. a) Fit the curve of the form $y = ae^{bx}$ [5 M]

x	77	100	185	239	285
y	2.4	3.4	7.0	11.1	19.6

b) Fit the curve of the form $y = ab^x$ for [5 M]

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	127.4

6. a) Using Simpson's $\frac{3}{8}$ rule, evaluate $\int_0^6 \frac{1}{1+x^2}dx$ [5M]

b)Evaluate $\int_0^1 \sqrt{1+x^3}\,dx$ taking h =0.1 using Trapizoidal rule [5M]

7. Dividing the range into 10 equal parts ,find the value of $\int_0^{\pi/2} \sin x dx$ using Simpson's $\frac{1}{3}$ rule.[10M]

8. Evaluate $\int_0^1 \frac{1}{1+x}dx$ [10 M]

i) By trapezoidal rule and Simpson's $\frac{1}{3}$ rule.

ii) Using Simpson's $\frac{3}{8}$ rule and compare the result with actual value.

9. a) Compute $\int_0^4 e^x dx$ by Simpson's $\frac{1}{3}$ rule with 10 subdivisions. [5 M]

b) .Find $\int_3^7 x^2 \log x dx$, usingTrapezoidal rule and Simpson's rule by 10 sub divisions. [5 M]

10.a)Evaluate approximately,byTrapizoidal rule, $\int_0^1 (4x-3x^2)dx$ by taking n=10. [5M]

b) Evaluate $\int_0^1 e^{-x^2}dx$ taking h = 0.2 using Simpson's $\frac{1}{3}$ rule [5M]

UNIT –V

1.a) Tabulate y (0.1), y (0.2), and y (0.3) using Taylor's series method given that [5 M]
$y^1 = y^2 + x$ and y(0) = 1

b) Find the value of y for x=0.4 by Picard's method given that $\frac{dy}{dx} = x^2+y^2$, y(0)=0 [5 M]

2. Using Taylor's series method find an approximate value of y at x = 0.2 for the [10M]

D.E $y^1 - 2y = 3e^x$, y(0) = 0. Compare the numerical solution obtained with exact solution.

3.a)Solve $y^1 = x + y$, given y (1)=0 find y(1.1) and y(1.2) by Taylor's series method [5 M]

b) Obtain y(0.1) given $y^1 = \frac{y-x}{y+x}$,y(0)=1 by Picard's method . [5 M]

4.a) Given that $\frac{dy}{dx}$ =1+xy and y (0) =1 compute y(0.1),y(0.2) using Picard's method [5 M]

b) Solve by Euler's method $\frac{dy}{dx} = \frac{2y}{x}$ given y(1) =2 and find y(2). [5M]

5.a)Using Runge-Kutta method of second order, compute y(2.5) from $y^1 = \frac{y+x}{x}$

y(2)=2, taking h=0.25 [5M]

b) Solve numerically using Euler's method $y' = y^2 + x$, y(0)=1. Find y(0.1) and y(0.2) [5M]

6. a)Using Euler's method, solve numerically the equation y^1=x+y , y(0)=1 [5M]

b)Solve $y^1= y-x^2$, y (0) =1 by picard's methodupto the fourth approximation. [5 M]

Hence find the value of y (0.1), y (0.2).

7.a) Use Runge- kutta method to evaluate y(0.1) and y(0.2) given that y^1=x+y , y(0)=1 [5 M]

b) Solve numerically using Euler's method $y' = y^2 + x, y(0) = 1$. Find y(0.1)and y(0.2) [5 M]

8. a)Using R-K method of 4th order , solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, y(0)=1 Find y(0.2) and y(0.4) [6 M]

b)Obtain Picard's second approximate solution of the initial value problem [4M]

$$\frac{dy}{dx} = \frac{x^2}{y^2+1}, y(0) = 0$$

9. Using R-K method of 4th orderfind y(0.1),y(0.2) and y(0.3) given that $\frac{dy}{dx} = 1 + xy, y(0) = 2$ [10M]

10. a)Find y(0.1) and y(0.2) using R-K 4th order formula given that $y^1=x^2-y$ and y(0)=1 [5 M]

b) Using Taylor's series method, solve the equation $\frac{dy}{dx} = x^2 + y^2$

for x = 0.4 given that y = 0 when x = 0. [5 M]