**MATHLAB-IV Masters Final 2017-18**

**Part-A: Mathematica**

**01.(a) Integration using Simpson 3/8 rules**

**Solution:**

**f[x\_]:=Exp[x\*x];**

**a=0;**

**b=1;**

**ev=N[Integrate[f[x],{x,a,b}]];**

**n=12;**

**h=(b-a)/n;**

**s=f[a]+f[b];**

**For[i=1,i<n,i++,If[Mod[i,3]==0,s=s+2\*f[a+i\*h],s=s+3\*f[a+i\*h]]];**

**mh=N[(3\*h/8)\*s];**

**Print["---------------- Result ----------------"];**

**Print["Actual Value = ",ev]**

**Print["Using Simpson's 3/8 =",mh]**

**Print["Error = ",ev-mh]**

1. **(b) Integration using Weddles’s rules**

**f[x\_]:= 1/(1+x\*x);**

**a = 0;**

**b = 6;**

**n = 12;**

**h = (b-a)/n;**

**ev = N[Integrate[f[x],{x,a,b}]];**

**y = {f[0]};**

**For[i=1,i< 13, i++ , AppendTo[y,f[a+i\*h]]]**

**w = (3\*h/10)\*( (Part[y,1]+Part[y,13])**

**+5\*( Part[y,2]**

**+Part[y,6]**

**+Part[y,8]**

**+Part[y,12])**

**+ 2\*Part[y,7]**

**+(Part[y,3]**

**+ Part[y,5]**

**+Part[y,9]**

**+Part[y,11])**

**+ 6\*(Part[y,4]**

**+Part[y,10]));**

**Print["-------- Output ----------"]**

**Print["Actual Value = ",ev];**

**Print["Using Weddles's Rule = ", N[w]];**

**Print["Error = ", ev-w]**

**02.(i) Solving Initial Value problems.**

**02.(ii)**

**02.(iii)**

**f=(x\*x-y[x]\*y[x]) -x\*y[x] \*y'[x]**

**DSolve[{f==0, y[1]==1},y[x],x]**

**03.(a) Solving System of linear equations.(Gauss Jacobi)**

**Print["Using Gauss Jacobi"];**

**xx = (85-6\*y+z)/27;**

**yy = (72-6\*x-28z)/15;**

**zz = (110-x-y)/54;**

**xs = 0.001;**

**ys = 0.002;**

**zs = 0.003;**

**For[i=1,i<16,i++,{**

**aa = (85-6\*ys+zs)/27;**

**bb = (72-6\*xs-2\*zs)/15;**

**cc = (110-xs-ys)/54;**

**Print[i," "," ",N[xs]," ",N[ys]," ",N[zs]] ;**

**xs = aa;**

**ys = bb;**

**zs = cc;**

**}];**

**Print["Actual Result"];**

**Solve[{27\*x+6\*y-z==85, 6\*x+15\*y+2\*z==72,x+y+54\*z==110},{x,y,z}] //N**

**3.(b) Solve system of linear equation using matrix**

**Print["Actual Solution"];**

**Solve[{x+2y+3z ==-4, 2x+4y+5z==-7,3x+5y+6z==-10},{x,y,z}]**

**A ={{1,2,3},{2,4,5},{3,5,6}};**

**B = {-4,-7,-10} ;**

**Print["Solution using Matrix Inversion"];**

**X = Inverse[A].B**

**3.(c) Solve System of Linear equation using Gauss Jordan Method**

**Print["Actual Solution"];**

**Solve[{x+2y+z ==8, 2x+3y+4z==20,4x+3y+2z==16},{x,y,z}]**

**A = {{1,2,1,8},{2,3,4,20},{4,3,2,16}};**

**Print["Reduced Matrix"];**

**RowReduce[A] //MatrixForm**

**Print["Result using Jordan Elimination method"];**

**RowReduce[A][[All,4]] // MatrixForm**

**04.(a) Complex Analysis – Testing Analytic function**

**----------------------------------------------------------------**

**u[x\_,y\_]=x\*x\*x+x\*y\*y;**

**v[x\_,y\_]=y\*y\*y+x\*x\*y;**

**ux=D[u[x,y],x];**

**uy=D[u[x,y],y];**

**vx=D[v[x,y],x];**

**vy=D[v[x,y],y];**

**If[ux===vy&&vx===-uy,Print[u[x,y]+Iv[x,y],"is Analytic"],Print["w=",u[x,y],"+",I\*v[x,y],"is not Analytic"]];**

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**04.(b) Harmonic Function Testing**

**f[x\_,y\_]= (1/2)\*Log[x\*x+y\*y];**

**fx = D[f[x,y],x];**

**fxx= D[fx,x];**

**fy = D[f[x,y],y];**

**fyy =D[fy,y];**

**If[Simplify[fxx+fyy] === 0 , Print["Harmonic"],Print["Not Harmonic"]];**

**fx = D[f[x,y],x] /. {x-> z , y-> 0};**

**fy = D[f[x,y],y] /. {x-> z , y-> 0};**

**m = Integrate[fx-I\*fy,z];**

**v = Im[m /. z-> x+I\*y] //ComplexExpand**

**5.(a) Application of newton’s Law of Cooling**

**diff = (T-20);**

**k =- Integrate[1/diff, {T,70,40}]/Integrate[1,{t,0,3}];**

**E1 = Integrate[1/diff,{T,70,T}];**

**E2 = -k\*Integrate[1,{t,0,6}];**

**s= Solve[E1 == E2 , T];**

**Print["Required temperature = ", s[[All,1,2]] ," Fahrenheit "];**

**5.(b) Solving ODE with NDSolve and DSolve**

**E1 = DSolve[{y'[x]==1+0.5\*y[x]\*y[x], y[0]==1},y[x],x];**

**s1[x\_] = E1[[1,1,2]];**

**E2 = NDSolve[{y'[x]==1+0.5\*y[x]\*y[x], y[0]==1},y[x],{x,0,1}];**

**s2[x\_]= E2[[1,1,2]];**

**data = Table[{x,s1[x],s2[x]},{x,0,1,.1}];**

**TableForm[data,TableHeadings->{None,{"x","Analytic","Numerical"}}]**

**Plot[{s1[x],s2[x]},{x,0,1}]**