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Kafrelsheikh University
Faculty of Engineering
Physics & Engineering Mathematics Dept.
Year: 1st year Civl. Eng.

Subject: Engineering Mathematics (2)

Date: /1/2017
Time allowed: 3 hours
Full mark: 100
Final Term Exam: 1page

Question 1: (20 Marks)

1. Discuss the continuity of the function: $f(x,y)=\begin{cases}\dfrac{x^2+y^2}{xy}, & (x,y)\neq(0,0)\\ 0, & (x,y)\neq(0,0)\end{cases}$.
2. Let $w=f(x,y)$, $u^2-v=3x+y$ and $u-2v^2=x-2y$ then find $\dfrac{\partial w}{\partial u}$.
3. Expand in Maclurin series the function $f(x,y)=e^{2x+3y}$.
4. Discuss the maximum and the minimum of $f(x,y)=x^2+2y^2+6x+1$.

Question 2: (20 Marks)

1. Prove that if $z=f(x,y)$ is homogeneous of degree k, then $xz_x+yz_y=kz$.
2. If $z=\sec^{-1}\dfrac{x^3+y^3+xy^2}{x+y}$ then find the value of xz_x+yz_y.
3. Verify Green's theorem for the integral $I=\oint_C (x+2y)dx+(y+3x)dy$ when C is the ellipse $4x^2+9y^2=36$.

Question 3: (20 Marks)

1. Prove that the integrating factor for the differential equation $y'+p(x)y=q(x)$ is $\mu=\exp(\int p(x)dx)$ and then deduce that the general solution is $y\mu=\int \mu q(x)dx+c$.
2. Solve the D. Eqs.:

   A) $y'=\sqrt{1-(\frac{y}{x})^2}+(\frac{y}{x})$ B) $y\sin(xy)dx+(1+x\sin(xy))dy=0$
3. Prove that $\mu(x,y)=x+y$ is an integrating factor for $(3xy+y^2)dx+(3xy+x^2)dy=0$ and solve this equation.
4. Find the orthogonal trajectories of $r=c\sin\theta$.

Question 4: (20 Marks)

Solve the D. Eqs.: 1) $D^2(D^4-16)y=e^x+\sin x$. 2) $(D^3+3D^2-D-3)y=2+\cos x$.
3) $y''+9y=\operatorname{cosec}3x$. 4) $(x^2D^2-9xD+25)y=\ln x$.

Question 5: (20 Marks)

1. Evaluate A) $L(\int_0^t e^{2u}\sin 5u\,\sin u\,du)$. B) $L(t^2e^{2t}u(t-1))$.

   C) $L^{-1}(\ln\dfrac{s+3}{s-2})$. D) $L^{-1}(e^{-2s}(\dfrac{6-s}{s^2-4s+3}))$.
2. Solve the following D.E. using Laplace transform $y''+y'-4y=2e^t$, $y(0)=y'(0)=0$.

With my best wishes
Dr. Samah El-kholy