أدى ترم ثانى

مدنى

Kafrelsheikh University
Faculty of Engineering
Physics & Engineering Mathematics Dept.
Year: First (Civil)

Subject: Engineering Mathematics (2)

Date: 27/5/2017
Time allowed: 3hours
Full Degree: 100
Final Exam: 2 pages

Answer as much as you can:

Question 3: (25 Marks)

(a) Fit the curve $y = \frac{1}{a + b\cos\theta}$ to the following data, and find the root mean square error.

i	1	2	3
θ_i	30	45	60
y_i	0.225	0.27	0.32

(b) Calculate $\sqrt{120}$ by using Lagrange interpolation.

(c) By using Bisection method, find the root of $3x - e^{-x} = 0$ in the interval [0.25,0.27], (correct to 3 decimal places)

Question 4: (25 Marks)

(a) Use Euler's method to approximate the solution for the initial value problem $y' = x^2 + y,\ 0 \le x \le 0.1,\ y(0) = 1\ with\ h = 0.02$.

(b) Find Eigen value and Eigen vectors, then solve the given initial value problem

$$X' = \begin{bmatrix} 1 & 9 \\ 1 & 1 \end{bmatrix} X, \quad X(0) = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

(c) Evaluate:

$$(i)\ \int_{-\infty}^{\infty} (e^{5x} - e^{x})\,dx$$

$$(ii)\ \int_{0}^{\frac{\pi}{2}} \sqrt{\cot\theta}\, d\theta$$

••••••••• **Good luck: Dr. Eng./ Manal El-Sayed** •••••••••••

تابع باقى الاسئلة خلف الورقة

اولى مدنى ترم ثانى

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Question 1: (25 Marks)

a) Deduce Parseval's identity for Fourier series

$$f(x)=\frac{a_0}{2}+\sum_{n=1}^{\infty}(a_n\cos\frac{2n\pi x}{T}+b_n\sin\frac{2n\pi x}{T})$$

of the periodic function $f(x)$ with period T.

b) Prove that Fourier series of x^2 on the interval $[-\pi,\pi]$ is given by:

$$x^2=\frac{\pi^2}{3}-4(\cos x-\frac{1}{2^2}\cos 2x+\frac{1}{3^2}\cos 3x-\frac{1}{4^2}\cos 4x+\ldots)$$

and then find the sum of the following series :

i) $\sum_{n=1}^{\infty}\frac{1}{n^2}$ ii) $\sum_{n=1}^{\infty}\frac{(-1)^n}{n^2}$ iii) $\sum_{n=1}^{\infty}\frac{1}{n^4}$

Question 2: (25 Marks)

a) Reduce the PDE $u_{tt}=c^2u_{xx}$ to its canonical form and find its general solution using the canonical transformation $\eta=x+ct$, $\theta=x-ct$.

b) Using the result obtained in part (a), deduce D'Alembert solution of the following wave equation:

$$u_{tt}=c^2u_{xx} \qquad ,-\infty<x<\infty$$

with initial deflection $f(x)$ and initial velocity $g(x)$ and then solve the PDE:

$$4u_{tt}=u_{xx} \qquad ,-\infty<x<\infty$$

with initial deflection $f(x)=\cos x$ and initial velocity $g(x)=\cos 3x$.

c) Solve the one dimensional heat equation:

$$u_t=u_{xx}$$

in a rod of length $\ell=\pi$ when the ends are at zero temperature ($u(0,t)=u(\pi,t)=0$) and the initial temperature is given by:

$$f(x)=\begin{cases}x & 0<x<\pi/2\\ 0 & \pi/2<x<\pi\end{cases}$$

········· **Good luck: Dr. Eng./ Samah El-Kholy** ···········

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