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

Engineering Mathematics (2) [PHM1004]

Date: 27/5/2018
Time allowed: 3 hours
Full mark: 90
Final Term Exam (1 page)

Question [1]: (30 marks) [ILOs: a1,c1] — Marks

a) Derive the formula of Fourier series coefficients a_0, a_n, and b_n. — 10

b) Find **Fourier series** for the function defined by: — 10

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

and sketch the graph of $f(x)$, and show that: $\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+.....$

c) Find the **Fourier series** of: $f(x)=|x|\ \ where\ -L<x<L$, and sketch the graph of $f(x)$. — 10

Question [2]: (30 marks) [ILOs: a1,a2,b1]

a) Expand $f(x)=e^{\frac{\pi x}{4}}$, $-4\le x\le 4$ in a complex Fourier series. — 10

b) Solve the following IVP by using D'Alembert's formula: — 10

$$\frac{\partial^2 u}{\partial x^2}=\frac{\partial^2 u}{\partial t^2},\quad u(x,0)=0,\quad u_t(x,0)=2\sin 4\pi x,\quad \forall x$$

c) Using method of separation of variables (MSV), solve the following heat equation: $u_{xx}=u_t$, $0\le x\le 2$, $t\ge 0$, $u(0,t)=u(2,t)=0$, $u(x,0)=x$ — 10

Question [3]: (30 marks) [ILOs: b2]

a) Fit the curve $y=\frac{1}{a+b\cos\theta}$ to the following data and find RMSE: — 7

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

b) Use the bisection method to find the required root of: $3x-e^{-x}=0$ in the interval [0.25,0.27], correct to 3-decimal places. Then find absolute error. — 7

c) Evaluate by using Gamma and Beta functions: — 8

$i)\ I=\int_0^{\infty}\frac{x^2}{2^x}dx,\qquad ii)I=\int_0^4 y^2\sqrt{4-y}\ dy$

d) Prove that: — 8

$i)\ \beta(n,n+1)=\frac{[\Gamma(n)]^2}{2\Gamma(2n)},\qquad ii)\beta(m,n)=\beta(m,n+1)+\beta(m+1,n)$

Good luck >>>>==========<<<< Dr. Manal El-Sayed

Manal