



Course Name & Code: Application of Difference and Differential Equation & MAT2002

Exam Duration: 90 Minutes

Maximum Marks: 50

Answer All the Questions ($5 \times 10 = 50$)

1. Find the Fourier series to represent the function

$$f(x) = \begin{cases} x & \text{for } 0 \leq x \leq \pi \\ 2\pi - x & \text{for } \pi \leq x \leq 2\pi \end{cases}$$

Hence find the sum of $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots \infty$.

[10 Marks]

2. The turning moment T on the crankshaft of a steam engine the crank angle θ degree is given as follows:

θ :	0	15	30	45	60	75	90	105	120	135	150	165	180
T :	0	2.7	5.2	7.0	8.1	8.3	7.9	6.8	5.5	4.1	2.6	1.2	0

Expand T in a series of sines upto the first harmonic.

[10 Marks]

3. (i). Find the constant term in the Fourier series corresponding to $f(x) = \cos^2 x$ expanded in the interval $(-l, l)$.

(ii). Find the eigen values of $\text{adjoint}(A)$ and $A^2 - 2A + I$, where $A = \begin{pmatrix} 2 & 3 & 4 \\ 0 & 4 & 2 \\ 0 & 0 & 3 \end{pmatrix}$.

[5+5 Marks]

4. Find the characteristic equation of the matrix $A = \begin{pmatrix} 1 & 3 & 4 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$. Show that the equation is

satisfied by A and hence obtain the inverse of the given matrix.

[10 Marks]

5. Reduce the quadratic form $2x_1x_2 + 2x_1x_3 - 2x_2x_3$ to a canonical form by an orthogonal reduction and discuss its nature.

[10 Marks]