(Please write your Enrollment Number)

Enrollment No. 08601012019

MID TERM EXAMINATION
(November, 2019)

Subject Code: BAS 101	
Time : 1 ½ Hours	**Subject: Applied Mathematics I**
Note: Q1 is compulsory. Attempt any two questions from the rest.	**Maximum Marks :** 30
Scientific Calculator Allowed	

Q1. **(3,3,2,2)**

(a) Obtain the Fourier series expansion of $x\sin x$ as a cosine series in (0, pi).

(b) Discuss the convergence of the series $\sum \frac{1}{x^n+x^{-n}}, x > 0$.

(c) Find the nth derivative of $\frac{1}{x^2-6x+8}$.

(d) Prove that Eigen values of a unitary matrix are of magnitude unity.

Q2. **(4,6)**

(a) Find the value of n so that $u = r^n(3cos^2\emptyset - 1)$ satisfies the equation $\frac{\partial}{\partial r}\left(r^2\frac{\partial u}{\partial r}\right) + \frac{1}{\sin\emptyset}\frac{\partial}{\partial\emptyset}\left(\sin\emptyset\frac{\partial u}{\partial\emptyset}\right) = 0$.

(b) Solve $x^2yz = e, xy^2z^3 = e, x^3y^2z = e$ using matrices.

Q3. **(4,3,3)**

(a) Change the differential equation $x^2z_{xx} - y^2z_{yy} = 0$ into one with u and v as the independent variables, where $u = xy$ and $v = x/y$.

(b) Discuss the convergence of the series $1 + \frac{2}{5}x + \frac{6}{9}x^2 + \frac{14}{17}x^3 + \cdots, (x > 0)$

(c) If $y^{1/m} + y^{-1/m} = 2x$, prove that $(x^2-1)y_{n+2} + (2n+1)xy_{n+1} + (n^2-m^2)y_n = 0$.

Q4. **(3,5,2)**

(a) Test the convergence of the series $\sum_{n=2}^{\infty} \frac{\ln n}{2n^3-3}$.

(b) Find the Fourier series of the periodic function f(x) of period 2, where $f(x) = \begin{cases} -1 & -1 < x < 0 \\ 2x & 0 < x < 1 \end{cases}$ and show that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$.

(c) Is the matrix $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$ diagonalizable?