MIDTERM EXAMINATION CALCULUS III
MI1134E. Term 20212. Time duration: 60 mins

All materials are forbidden. Problem sheet must be submitted with your answer sheets.

Question 1. Test for convergence

a) $\sum_{n=1}^{\infty} \frac{(n!)^2}{(2n+1)!}$ b) $\sum_{n=1}^{\infty} \left(\frac{2n+1}{2n+5}\right)^{n+2}$ c) $\sum_{n=3}^{\infty} \frac{(-1)^n}{n+2.(-1)^n}$

Question 2. Find the domain of convergence of the series

$$\sum_{n=2}^{\infty} \frac{(2x-3)^{2n}}{n \ln^3 n}.$$

Question 3. Solve the following problems

a) $xy' + 3y = \frac{1}{xe^x}$ thoả mãn $y(-1) = 2$.

b) $y' = \frac{x^2+3y^2}{2xy}$.

Question 4. Find an integrating factor and solve the differential equation $(3x^2y + 2xy + y^3)dx + (x^2 + y^2)dy = 0$.

Question 5. Expand the function $f(x) = \int_0^x \ln(t + \sqrt{1+t^2})dt$, $-1 < x < 1$, to a Maclaurin series.

Question 6. Expand the function $f(x) = \begin{cases} \cos x, & 0 < x \le \frac{\pi}{2}, \\ 0, & \frac{\pi}{2} < x < \pi, \end{cases}$ to a Fourier sine series.

Question 7. Find the sum

$$\sum_{n=1}^{\infty} \frac{(-1)^n(n+1)}{(2n)!!}.$$

—-END—-

SCHOOL OF APPLIED MATHEMATICS AND INFORMATICS

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