Jaypee University of Information Technology, Waknaghat
Test-2 Examination, April 2022
B.Tech (CSE/IT/ECE/ECM/CE)

Course Code/Credits: 18B11MA211/4
Course Title: Engineering Mathematics-II
Course Instructors: RAD, KAS, RKB, BKP

Max. Marks: 25

Max. Time: 90 min

Instructions: All questions are compulsory. Marks are indicated against each question.

1. Discuss the convergence of the series $\sum_{n=0}^{\infty} \dfrac{n+3}{2n+11}$. (2 Marks) [CO-1]

2. Test the convergence of the series $\sum_{n=0}^{\infty} (-1)^{n+1} \dfrac{1}{n\sqrt{n}}$. (2 Marks) [CO-1]

3. Find the *radius of convergence* of the series $1 + x + \dfrac{x^2}{2!} + \dfrac{x^3}{3!} + \cdots$. (2 Marks) [CO-1]

4. (a) Write down the formulae (without evaluating) for the Fourier coefficients a_o, a_n and b_n (whichever is required) for the *half-range cosine* series expansion of $f(x) = x^2 - x^3$ over $0 \le x < 34$. (2 Marks) [CO-2]

   (b) Graph the odd extension of the function depicted in the diagram: (1 Marks) [CO-2]
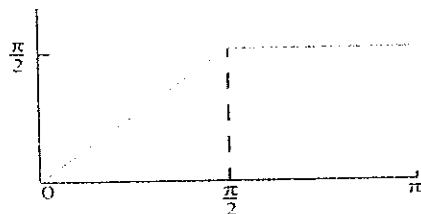
5. Find the Fourier series expansion for $f(x)$ extended periodically: $f(x+2) = f(x)$.
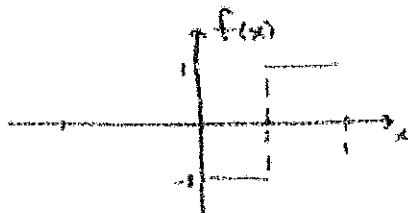
(3 Marks) [CO-2]

6. Consider the Fourier series of $f(x) = |x|$ on $[-\pi,\ \pi]$: (2 Marks) [CO-2]

$$|x| = \frac{\pi}{2} - \frac{4}{\pi} \sum_{n=0}^{\infty} \frac{\cos(2n+1)x}{(2n+1)^2}$$

Use Parseval's identity to show that $1 + \dfrac{1}{3^4} + \dfrac{1}{5^4} + \dfrac{1}{7^4} + \cdots = \dfrac{\pi^4}{96}$.

7. Answer the following questions. (2 Marks) [CO-2]

   (a) Find the order and degree of $\dfrac{d^3y}{dx^3} - \left(\dfrac{dy}{dx}\right)^{3/2} = 0$.

   (b) Write down the differential equation whose solution is $y = ax - a^2$.

8. Find the general solution of $\dfrac{d^3y}{dx^3} - 4\dfrac{d^2y}{dx^2} + 4\dfrac{dy}{dx} = \cos 3x$. (4 Marks) [CO-2]

9. Using the appropriate method, solve $x^2y'' - 4y' + 6y = x^3$. (3 Marks) [CO-2]

10. Answer the following questions. (2 Marks) [CO-2]

    (a) Second order homogeneous linear differential equations arise in a variety of practical applications. In most cases, the solutions to these equations cannot be stated in terms of elementary functions. Under what conditions, the existence of power series solution be guaranteed?

    (b) What are the *ordinary* and *singular* points of $y'' + \dfrac{\sin x}{x}y' + xy = 0$?

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