



INDIAN INSTITUTE OF INFORMATION TECHNOLOGY,
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AY 2020-21

In-house Cycle Test-II Examination (June 28, 2021)

B.Tech. ECE, Semester: II

MAC 221: Mathematics II

Duration: 60 MINUTES

Max. Marks: 20

Answer all questions

1. (a) Obtain Fourier series for the function $f(x)$ given by $f(x) = 1 + \frac{2x}{\pi}, -\pi \leq x \leq 0$ and $f(x) = 1 - \frac{2x}{\pi}, 0 \leq x \leq \pi$. [3]
(b) Deduce that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ [1]
2. (a) Express $f(x) = x$ as half range Sine series in $0 \leq x \leq 2$. [2]
(b) Describe the Dirichlet's conditions to expand a function as Fourier series. [2]
3. (a) If $f(x) = \frac{-\pi}{4} + \sum_{n=1}^{\infty} \left[\frac{(\cos n\pi - 1)}{\pi n^2} + \frac{(1 - 2\cos n\pi) \sin nx}{n} \right]$ prove that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}$ [2]
where $f(x) = -\pi, -\pi < x < 0$ and $f(x) = 0, 0 < x < \pi$
(b) Expand $f(x) = \frac{1}{4} - x, 0 < x < \frac{1}{2}$ and $f(x) = \frac{-3}{4} + x, \frac{1}{2} < x < 1$ as the Fourier Sine series [2]
4. (a) Define Harmonic analysis to find Fourier co-efficients in $(0, 2\pi)$. [2]
(b) If $\frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos \frac{n\pi x}{l}$ is the half range cosine series of $f(x)$ of period $2l$ in $(0, l)$, then show that the mean square value is $\frac{l}{2} \left(\frac{a_0^2}{2} + \sum_{n=1}^{\infty} a_n^2 \right)$. [2]
5. (a) Using Laplace transforms, find the solution of the initial value problem $y'' - 4y' + 4y = 64 \sin 2t, y(0) = 0, y'(0) = 1$ [2]
(b) Find the inverse Laplace transform of $\frac{s}{4s^2 - 25}$. [2]

*** Best Wishes ***