

DEPARTMENT OF PHYSICS



R.C.S. COLLEGE, MANJHAUL

(A CONSTITUENT UNIT OF L.N. MITHILA UNIVERSITY, DARBHANGA)

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Ref. No.

Date 18/10/2025

Assignment-MJCPHY05

Subject: Physics

Name of the Course: -Mathematical Physics-II & Introduction to computational Methods

Course Code: MJCPHY05

Semester: Semester-IV, Session: 2023-2027

Answer all questions.

Q.1

The amplitude $U(\rho, \varphi, t)$ of a vibrating circular membrane of radius a satisfies the wave equation

$$\nabla^2 U - \frac{1}{v^2} \frac{\partial^2 U}{\partial t^2} = 0.$$

Here v is the phase velocity of the wave fixed by the elastic constants and whatever damping is imposed.

(a) Show that a solution is

$$U(\rho, \varphi, t) = J_m(k\rho)(a_1 e^{im\varphi} + a_2 e^{-im\varphi})(b_1 e^{i\omega t} + b_2 e^{-i\omega t}).$$

Q.2

Evaluate

$$\int_0^\infty \frac{(\ln x)^2}{1+x^2} dx.$$

by contour integration to obtain

$$\frac{\pi^3}{8}.$$

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Assignment-MJCPHY07

Subject: **Physics**

Name of the Course: - **OPTICS**

Course Code: **MJCPHY07**

Semester: **Semester-IV**, Session: **2023-2027**

Answer all questions.

Q.1

Discuss in detail the Fraunhofer Diffraction Pattern formed by N parallel slits, each of width b ; the distance between two consecutive slits is assumed to be d .

Q.2

Explain in detail, with proper diagrams, the basic principle involved in the formation of LASER light through the lasing action.

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Date 18/10/2025

Assignment-MJCPHY06

Subject: Physics

Name of the Course: -Electrodynamics and Electromagnetism

Course Code: MJCPHY06

Semester: Semester-IV, Session: 2023-2027

Answer all questions.

Q.1

Imagine two parallel infinite sheets, carrying uniform surface charge $+\sigma$ (on the sheet at $z = d$) and $-\sigma$ (at $z = 0$). They are moving in the y direction at constant speed v . What is the electromagnetic momentum in a region of area A ?

Q.2

Consider a **resonant cavity** produced by closing off the two ends of a rectangular wave guide, at $z = 0$ and at $z = d$, making a perfectly conducting empty box. Show that the resonant frequencies for both TE and TM modes are given by

$\omega_{lmn} = c \pi \sqrt{\left(\frac{l}{a}\right)^2 + \left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2}$ for integers l, m , and n . Find the associated electric and magnetic fields.

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Date 18/10/2025

Assignment-MICPHY04

Subject: **Physics**

Name of the Course: - **ELECTRICITY AND MAGNETISM**

Course Code: **MICPHY04**

Semester: **Semester-IV**, Session: **2023-2027**

Answer all questions.

Q.1

Derive an expression for the resonance frequency and quality factor of a series LCR circuit.

Q.2

Explain Ampere's law in magnetized material and find the expression for H inside and outside of a long copper rod of radius R carrying a uniformly distributed (free) current I .