

S.R. FATEPURIA COLLEGE  
INTERNAL ASSESSMENT 2020

PHYSICS (HONOURS)      3<sup>RD</sup> YEAR      PAPER - VII

Full Marks: 20

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Answer any four questions from the following:

5×4=20

1. Obtain the resolving power of a grating having N lines per unit length.

In a plane transmission grating the angle of diffraction for 2<sup>nd</sup> order maxima for wavelength 5000Å is 30°. Calculate the number of lines in one cm of the grating. (4+1)

2. What do you mean by space-like and time-like separation in relativity?

Prove that,  $E^2 = P^2 C^2 + m_0^2 C^4$ .

Lorentz transformation equations reduce to Galilean transformation equation when  $V \ll C$  – Explain it.

How fast does a rocket ship have to go for its length to be contracted to 99% of its rest length? (1+2+1+1)

3. Describe the state of polarization of the E.M. wave represented by

$$\vec{E}(x,t) = \hat{i}E_0 \cos(kx - \omega t) - \hat{j}E_0 \cos(kx - \omega t)$$

Show that the dielectric constant for a gaseous medium when a plane electromagnetic wave is incident on it is given by  $k = 1 + \frac{ne^2}{m\epsilon_0} \sum_j \frac{f_j}{(\omega_j^2 - \omega^2) - i\gamma_j \omega}$ , where the symbols have their usual meanings.

What is poynting vector? What is its significance? (1+3+1)

4. Explain the formation of interference fringes by Lloyd's mirror.

In a Lloyd's mirror experlment the mirror reflects 81% of light incident upon it. Calculate the ratio of the intensities at the interference maxima and minima. (3+2)

5. Explain how Nicol prism works as polarizer and analyzer.

Explain the underlying principle of generation of Laser.

What are Einstein's A and B coefficient? (2+2+1)

**S.R. Fatepuria College**  
**INTERNAL ASSESSMENT 2020**

Sub: PHYSICS (HONOURS)

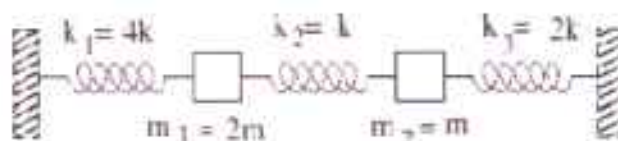
Year: 3rd

PAPER – VIII

**Full Marks: 20**

**(Answer any two of the following questions.)**

1. a. Explain the meaning of Scleronomous and Rheonomous constraints. Give illustrations of each.  
b. Discuss the virtual work done for motion of a system and derive the Lagrange's equation of motion for a conservative system from D'Alembert's principle. [(2+1) + (3+4)]
  
2. a. Describe the configuration space.  
b. What do you understand by cyclic coordinates? Show that the generalized momentum corresponding to a cyclic coordinate is a constant of motion.  
c. Derive the Hamilton's equation of motion. [2+ (2+2) + 4]
  
3. a. A simple pendulum hangs from the ceiling of an elevator which is moving down with a constant acceleration  $f$ . Obtain the Hamiltonian and hence the equation of motion of the simple pendulum.  
b. Consider a circular hoop of radius  $R$  rotating about a vertical diameter at a fixed angular velocity  $\Omega$ . On the hoop there is a bead of mass  $m$ , which slides without friction on the hoop. The only external force is gravity. Derive the Lagrangian and the Lagrange equation using the polar angle  $\theta$  as the unconstrained generalized coordinate. [5 + 5]
  
4. a. What do you mean by 'small oscillations' of a mechanical system? Define the terms normal coordinates and normal frequency.  
b. Consider two masses  $m_1 = 2m$  and  $m_2 = m$  connected by three springs, as shown.



Determine the eigen frequencies of the oscillations of the system. [2 + 2 + 6]

5. a. What do you mean by an ensemble? Describe the hypothesis 'equal a priori probability of microstates' in detail.  
b. Find the root mean square speed of a  $\text{CO}_2$  molecule at room temperature.  
c. Deduce the Fermi Dirac Statistics. [(1 + 2) + 3 + 4]

S.R FATEPURIA COLLEGE, BELDANGA, MURSHIDABAD

PART – III, INTERNAL ASSESMENT

PHYSICS (HONS)

PAPER: IX

F.M - 20

(Answer any two questions)

1. a. What is meant by "ISOBAR " ? Give an example of it. 2  
b. What is the working principle of "G.M counter" ? Give an drawback of it. 3  
c. Find the energy needed to remove a neutron from  ${}^4_2\text{He}$ . Also Find the energy needed to remove a proton from  ${}^4_2\text{He}$ . Compare the two.  
Atomic masses are given below  $M [{}^4_2\text{He}] = 4.002603 \text{ u}$ ,  $M [{}^3_2\text{He}] = 3.016029 \text{ u}$  &  
 $M [{}^3_1\text{He}] = 3.016050 \text{ u}$  5
2. a. An Amplifier with 10% negative feedback has an open loop gain of 50. If Open loop gain increases by 10%, what is the percentage change in closed loop gain? 3  
b. What is TUF? Give the significance for TUF in a power supply. 3  
c. In a Differential Amplifier with two inputs of  $110 \mu\text{V}$  &  $90 \mu\text{V}$ , The output is  $2.01 \text{ mV}$ . But the output is  $2 \text{ mV}$  when the inputs are  $10 \mu\text{V}$  &  $-10 \mu\text{V}$ . Find the CMRR of the amplifier. 4
3. a. What do you mean by Packing Fraction? Determine the Packing Fraction for an fcc lattice. 3  
b. Determine the relationship between lattice parameter 'a' & the atomic radius 'r' for monoatomic sc, bcc and fcc structure. 3  
c. What is the distance between the adjacent Millar Planes if the  $1^{\text{st}}$  order reflection from X-rays of wavelength  $2.29 \text{ \AA}$  occurs at  $27^\circ$ ? 4
4. a. Convert the Binary number  $101101_2$  into the decimal equivalent. 2  
b. What do you mean by 'Universal Gate'? 1  
c. Write down the truth table of a NOR gate. 2  
d. Draw the diagram of an inverting Op Amp with  $R_1 = 10 \text{ k}\Omega$ ,  $R_2 = 50 \text{ k}\Omega$  & Power supply  $\pm 12 \text{ V}$ . Find out the output voltage & Input current for an input voltage  $0.5 \text{ V}$ . 5
5. a. Draw the energy band diagram for p-type semiconductor. 2  
b. Explain how the position of the fermi level in semiconductor changes with increasing temperature & donor concentration. 3  
c. What do you mean by direct & indirect recombination? Write Down with their application. 3  
d. Determine the resistivity of intrinsic 'Si' at  $300 \text{ K}$ . Where  
Intrinsic carrier concentration =  $1.6 \times 10^{16} / \text{m}^3$   
Mobility of electron =  $0.13 \text{ m}^2/\text{V-s}$   
Mobility of holes =  $0.05 \text{ m}^2/\text{V-s}$  2



S. R. Fatepuria College, Beldanga, MSD

Assignment 2020

B. Sc. (General) – 3rd Year

Subject: Physics

Paper – IV

Full Marks: 20

[যে কোন দুটি প্রশ্নের উত্তর দাও]

- ১। চিত্র সহকারে হাই ডাকুয়াম বোটারী অয়েল পাম্পের কার্যপ্রণালী বর্ণনা কর। এই অয়েল পাম্পের সুবিধা গুলি লেখ। গ্রীনহাউস ক্রিয়া কী? নিউক্লীয় বিভাজন পদ্ধতিতে পারমাণবিক শক্তি আহরণের সুবিধা কী কী? (৪+২+২+২)
- ২। ক) আইনস্টাইনের A, B সহগগুলি কী? উভয়ের মধ্যে সম্পর্ক স্থাপন কর। ৪  
খ) শুদ্ধ ও অশুদ্ধ বর্ণালী কাকে বলে? শুদ্ধ বর্ণালী তৈরীর একটি পদ্ধতি চিত্র সহকারে আলোচনা কর। (২+৪)
- ৩। একটি একধাপ বিশিষ্ট CE বিভব বিবর্ধকের বর্তনীচিত্র আঁক যাতে n-p-n transistor ব্যবহার করা হয়েছে। এটির তুল্য বর্তনীচিত্র আঁক এবং বিভব বিবর্ধনের মান নির্ণয় কর। (৩+৩+৪)
- ৪। ক) NAND এবং NOR gate - কে universal gate - বলা হয় কেন বুঝিয়ে বল। ৩  
খ) Half adder - এর কার্যনীতি ব্যাখ্যা কর। একে Half adder বলে কেন? Full adder বলতে কি বোঝায়? (৩+১+৩)
- ৫। ক) OP AMP এর বৈশিষ্ট্যাবলী উল্লেখ কর। Inverting OP AMP কার্যনীতি ব্যাখ্যা কর। (২+৪)  
খ) বিস্তার প্রকল্পন কাকে বলে? বিস্তার প্রকল্পকের গাণিতিক বিশ্লেষণ উল্লেখ কর। ৪