

**ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)**  
**ORGANISATION OF ISLAMIC COOPERATION (OIC)**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**

**Mid Semester Examination**  
**Course Number: Phy 4121**  
**Course Title: Engineering Physics I**

**Winter Semester : 2020 - 2021**  
**Full Marks: 75**  
**Time: 1.5 Hours**

There are **6 (Six)** questions. Answer **4 (Four)** questions according to the instructions mentioned in Sec A and Sec B. The symbols have their usual meanings. The examination is **Online** and **Open Book**. Marks of each question and corresponding CO and PO are written in the brackets. **Q1 and Q6 are compulsory.**

**Sec A**

**Q1 is compulsory, Answer any one from Q2 and Q3.**

<b>1.</b>	(a) Why and how the Thompson's plum pudding model of an atom was modified by Rutherford? (b) Explain why diamond has higher melting temperature ( $\sim 4000^{\circ}\text{C}$ ) than that of iron ( $\sim 1500^{\circ}\text{C}$ )? Briefly discuss the existing bonds in these materials. (c) How will you construct extrinsic semiconductors (n-type and p-type) from a typical intrinsic semiconductor (say Si)?	[3+4+6.5] (CO1) (CO2) CO3 (PO 1, PO 2)
<b>2.</b>	(a) Why the interatomic bonds exist in solid? Explain briefly. (b) Explain the modification of Rutherford's atomic model by Bohr. Applying Bohr Model, show that the energy of the electron of $n^{\text{th}}$ orbit is proportional to $n^{-2}$ . (c) Evaluate the value of longest wavelengths in Lyman and Paschen series.	[3+6+3] (CO2, CO3) (PO 1, PO 2)
<b>3.</b>	(a) Briefly discuss how the energy bands are formed in a solid. What information do you get about materials from the energy bands? (b) Explain various sources of resistance of a material. Illustrate how the resistance varies with temperature for pure, impure metals, and semiconductor? (c) The ionization energy of the Potassium (K) is $4.34\text{ eV}$ and the electron affinity of Chlorine (Cl) is $3.61\text{ eV}$ . The Madelung constant for the KCl structure is $1.748$ and the distance between ions of opposite sign is $0.314\text{ nm}$ . If $n=9$ , evaluate cohesive energy for KCl crystal.	[3+6+3] (CO2, CO3) (PO 1, PO 2)

**Sec B**

**Q6 is compulsory, Answer any one from Q4 and Q5.**

<b>4.</b>	<p>(a) How the law of conservation of energy remains valid during interference of light? When two light waves interfere destructively what happens to their energy?</p> <p>(b) How Fresnel's bi-prism can be used to determine the wavelength of light.</p> <p>(c) Suppose that Young's experiment is performed with blue-green light of wavelength 800 nm. The slits are 1.10 mm apart, and the viewing screen is 6.40 m from the slits. How far apart are the bright fringes near the center of the interference pattern?</p>	<p>04 CO-1 PO-1</p> <p>05 CO-2 PO-2</p> <p>03 CO-1 PO-1</p>
<b>5.</b>	<p>(a) Why the central ring in Newton's ring experiment due to reflected light is dark?</p> <p>(b) "The wavelength of light can be determined with the help of Newton's ring experiment"- explain the procedure in your own way.</p> <p>(c) A Newton's rings apparatus is used to determine the radius of curvature of a lens. The radii of the <math>n^{\text{th}}</math> and <math>(n+10)^{\text{th}}</math> bright rings are measured and found to be 0.182 cm and 0.368 cm, respectively, in light of wavelength 556 nm. Calculate the radius of curvature of the lower surface of the lens.</p>	<p>03 CO-1 PO-1</p> <p>05 CO-2 PO-2</p> <p>04 CO-1, CO-2 PO-1, PO-2</p>
<b>6.</b>	<p>(a) How can you distinguish interference from diffraction? Write down the required condition for diffraction.</p> <p>(b) How can you consist a diffraction grating? What is its application? Write down grating equation by mentioning each term.</p> <p>(c) Monochromatic light of wavelength 441 nm is incident on a narrow slit. On a screen 3.00 m away, the distance between the second diffraction minimum and the central maximum is 2.50 cm. (i) Calculate the angle of diffraction of the second minimum. (ii) Find the width of the slit</p>	<p>04 CO-3 PO-3</p> <p>05 CO-3 PO-3</p> <p>4.5 CO-3 PO-3</p>