L-1/T-2/ME Date: 13/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

B. Sc. Engineering Examinations January 2020

Sub: **PHY 159** (Waves & Oscillation, Geometrical Optics and Wave Mechanics)

Full Marks: 180 Time: 2 Hours

The figures in the margin indicate full marks. Symbols have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION-A

There are **FOUR** questions in this Section. Answer any **THREE**

1. (a) Consider two independent simple harmonic motions having displacement $x = 2\sin\omega t$ and $y = 3\sin(\omega t + \pi/4)$ acting on a particle simultaneously, where symbols indicate their usual meaning. Illustrate the resultant motion of that particle using the graphical method. [20]

   (b) Briefly describe how to determine the unknown frequency using Lissajous figures? [10]

2. (a) If a spring of mass m is clamped vertically at a point, and is loaded with a mass m_0 at the other end, how to determine the effective mass of the spring mass system mathematically, and show it graphically? [20]

   (b) A pendulum of mass m raised to a height h and then released. The pendulum hits a spring obeying non-linear force law, $F = -2x - 3x^3$, situated at equilibrium. Calculate the compression x of the spring. [10]

3. (a) Write down a typical one-dimensional wave equation. Describe briefly the physical meaning of this equation. Show that the phase velocity and wave velocity are same. [20]

   (b) A plane progressive wave train of frequency 350 Hz has a phase velocity of 420 m/s. How far are the two points with 45° out of phase? [10]

4. (a) Draw schematically the wave function Ψ and the probability function $\Psi^*\Psi$ for an electron in a potential well for different n-values. What conclusions can be drawn from these schematic diagrams?

   (b) Explain why Schrödinger equation cannot be derived from other basic principles of Physics?

SECTION-B

There are **FOUR** questions in this Section. Answer any **THREE**

5. (a) How infinite square well energy quantization law can be obtained from the de Broglie hypothesis by fitting an integral number of half de Broglie wavelengths $\lambda/2$ into the width 'a' of the potential well? [15]

   (b) What comments you can draw on the energy eigen function of a bound electron and a free electron? [15]

6. (a) Draw schematically the three statistical distribution functions for the same value of α. How their probability of occupancy of a state of energy is change at the absolute temperature T? How Fermions are different from Bosons? [20]

   (b) Draw schematically the distribution of molecular speeds in oxygen molecules at 73 K and 273 K. What are your comments on the effect of temperature? [10]

7. (a) In astigmatism, how can you measure the distance from the surface of the sagittal or secondary focus? [15]

   (b) Two thin lenses of focal lengths f_1 and f_2 are separated by a distance d have an equivalent focal length of 100 cm. The combination satisfies the conditions for no chromatic aberration and minimal spherical aberration. Find the values of f_1, f_2 and d. Assume that both lenses are of the same material. [15]

8. (a) Draw the ray diagram of a compound microscope. What will be the magnification when the image is formed at a near point? [15]

   (b) In a compound microscope, the object is 1 cm from the field lens. The lenses are 30 cm apart and the intermediate image is 5 cm from the eyepiece. What is the magnification produced when the image is formed at a near point? [15]

L-1/T-2/ME Date:17/01/21

Bangladesh University of Engineering and Technology, Dhaka

L1/T2 B.Sc. Examinations of January 2021

Subject: Chem 141 (Chemistry of Engineering Materials)

Full Marks: 180 Time: 2 hours

Figure in the margin indicate the full marks

Use separate scripts for each section and upload in the LMS system separately

Section-A

(There are **FOUR** questions in the section. Answer any **THREE**)

1. (a) Write down the steps and associated chemical reactions that take place during the occurrence of corrosion by oxygen over metal surface. Justify, how Pilling-Bedworth rule determines the stability of oxide layer over metal surfaces? 20
   (b) Draw a schematic diagram of corrosion system occurred by concentration cell and analyze different reaction zone of the reactions. 10

2. (a) Discuss the viscoelastic behavior of polymers with schematic diagrams. 20
   (b) Correlate the changes in polymer properties with glass transition temperature? 10

3. (a) Identify the aspects on which ceramics are different from metals? 20
   (b) Summarize the effect and prevention of thermal spalling in refractory materials. 10

4. (a) Write down the properties of good lubricants? Explain the effect of viscosity index and total base number on the properties of lubricants. 20
   (b) Recommend the steps to avoid specific defects of paintings. 10

Section-B

(There are **FOUR** questions in the section. Answer any **THREE**)

5. (a) If a rubber is stretched, it becomes warm and heat is evolved. Explain the origin of such heat generation. 20
   (b) Why addition of sulphur drastically changes the physico-chemical properties of a raw rubber? Explain with the help of a suitable chemical reaction. 10

6. (a) Melamine is a trimer of dicyanidimide- explain. How melamine formaldehyde resin is formed? Mention their few potential fields of applications. 20
   (b) Why the anionic polymers are called living polymer? 10

7. (a) How polycarbonate polymer can be formed? Discuss their potential applications? 20
   (b) What is PTFE? Why PTFE coating is applied on a non-sticky fry-pan? 10

8. (a) What are the basic differences between pot furnace and tank furnace? 20
   (b) Why after annealing slow cooling is required to obtain high quality glass? 10

L-1/T-2/ME Date: 20/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-I/T-II B.Sc. Engineering Examinations- January 2020

Sub: **HUM 101** (English)

Full Marks: 180 Time 2 Hours

The Figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

There are 4 page(s) in this question paper.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**, including **Q. No. 1 as compulsory.**

Figures in the brackets indicate the marks of the questions.

1. Answer any **ONE** of the following: (20)

   (a) Discuss the unpleasant situation that Orwell encountered in Moulmein that led him to consider quitting from his position as a sub-divisional police officer.

   (b) "A Peculiar restlessness permeates the household." Discuss this statement in reference to the story "A Rocking-Horse Winner".

2. (a) Explain with reference to the context any **ONE** of the following: (15)

   (i) "... a story always sounds clear enough at a distance, but nearer you get to the scene of events the vaguer it becomes."

   (ii) "Here take your anna back. I am not used to such challenges."

   (b) Answer any **TWO** of the following: (20)

   (i) What were the strategies adopted by the astrologer to draw attention of the people?

   (ii) Why did the author feel compelled to shoot the elephant?

   (iii) Why did the crowd get excited at the sight of the flames in the "Fire on the Mountain"?

3. Amplify any **ONE** of the following ideas: (35)

   (a) "The saddest aspect of life right now is that science gathers knowledge faster than society gathers wisdom."

   (b) "The highest education is that which does not merely give us information but makes our life in harmony with all existence."

4. Write a précis of the following passage with a suitable title: (35)

Trees give shade for the benefit of others and while they themselves stand in sun and endure scorching heat, they produce the fruit by which others profit. The character of good men is like that of trees. What is the use of this perishable body, if no use of it is made for the benefit of mankind? Sandalwood – the more it is rubbed, the more scent does it yield. Sugarcane – the more it is peeled and cut into pieces, the more juice it does produce. Gold – the more it is burnt, the more brightly it does shine. The men who are noble at heart do not lose these even in losing their lives. What does it matter whether men praise them or not? What differences does it make whether riches abide with them or not? What does it signify whether they die at this moment or whether their lives are prolonged? Happen what may, those who tread in the right path will not set foot in any other. Life itself is unprofitable to a man who does not live for others. To live for the mere sake of living one's life is to live the life of dogs and cows. Those who lay down their lives for the sake of friends, or even for the sake of a stranger, will assuredly dwell in a world of bliss.

SECTION – B

There are **FOUR** questions in this section. Answer **Q. No.5** and any **TWO** from the rest.

5. Read the following passage carefully and answer the questions that follow: (20)

Marie Curie was one of the most accomplished scientists in history. Together with her husband, Pierre, she discovered radium, an element widely used for treating cancer, and studied uranium and other radioactive substances. Pierre

and Marie's amicable collaboration later helped to unlock the secrets of the atom.

Marie was born in 1867 in Warsaw, Poland, where her father was a professor of physics. At an early age, she displayed a brilliant mind and a blithe personality. Her great exuberance for learning prompted her to continue with her studies after high school. She became disgruntled, however, when she learned that the university in Warsaw was closed to women. Determined to receive a higher education, she defiantly left Poland and in 1891 entered the Sorbonne, a French university, where she earned her master's degree and doctorate in physics.

Marie was fortunate to have studied at the Sorbonne with some of the greatest scientists of her day, one of whom was Pierre Curie. Marie and Pierre were married in 1895 and spent many productive years working together in the physics laboratory. A short time after they discovered radium, Pierre was killed by a horse-drawn wagon in 1906. Marie was stunned by this horrible misfortune and endured heart-breaking anguish. Despondently she recalled their close relationship and the joy that they had shared in scientific research. The fact that she had two young daughters to raise by herself greatly increased her distress.

Curie's feeling of desolation finally began to fade when she was asked to succeed her husband as a physics professor at the Sorbonne. She was the first woman to be given a professorship at the world-famous university. In 1911 she received the Nobel Prize in chemistry for isolating radium. Although Marie Curie eventually suffered a fatal illness from her long exposure to radium, she never became disillusioned about her work. Regardless of the consequences, she had dedicated herself to science and to revealing the mysteries of the physical world.

Questions:

a. What did Marie do to get higher education?
b. What happened to Pierre and how did it affect Marie?
c. Comment on Marie's commitment to her work.
d. What inspiration do you get from Marie?

6. (a) Define a tender. Discuss different types of tenders. (10)

(b) Suppose you want to buy some furniture from Otobi. You need to know about the quality and price of their products. Write an inquiry letter to the Sales Manager of Otobi requesting for an updated catalog and a price list of their products. (Full Block) (25)

7. (a) Write a short note on the main components of a dialogue. (10)

(b) Write a dialogue between you and your friend on Technology and the COVID-19 Pandemic. (25)

8. Write a short essay on any **ONE** of the following topics: (35)

(a) Effects of Climate Change in Bangladesh

(b) Women Empowerment

L-1/T-2/ME Date:-20/01/2021

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B.Sc. Engineering Examination, January 2020

Sub: **HUM 103** (Economics)

Full Marks: 180 Time 2 Hours

The Figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

There are 03 page(s) in this question paper.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**

All the symbols have their usual meanings

Assume reasonable values for missing data.

1. (a) What are the factors that influence the shifting of the demand curve? (15)

   (b) How would you derive the market demand curve of a commodity? Explain graphically. (15)

2. (a) Show that price elasticity of demand varies from zero to infinity along any straight line demand curve. Explain graphically. (15)

   (b) Define income elasticity of demand. From the following table calculate elasticity of demand if you move from point B to C and explain what you understand from the result. (15)

POINT	Px	Qy
A	500	120
B	600	150
C	700	180

3. (a) Explain consumer's equilibrium with the help of budget line and indifference curve. (15)

   (b) From the following budget line and the utility function, calculate the amount of two commodities that maximizes satisfaction. What is the maximum amount of satisfaction? (15)

$$4000 = 25X + 35Y$$
$$U = 400\, X^{0.6}Y^{0.7}$$

4 (a) How is price determined in an economy Under competition? What will happen to the price and quantity due to simultaneous change in demand and supply? (15)

(b) From the following demand and supply functions, calculate equilibrium price and quantity and show the result in a graph. (15)

$$P = 0.50\,Q + 150$$
$$P = -0.40Q + 300$$

i) What will happen to the equilibrium price and quantity if government imposes a unit tax of TK 2 per unit?

ii) What will happen if government gives a subsidy of TK 3 per unit?

Describe the change in equilibrium. Show the equilibrium coordinates on the same graph.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**

All the symbols have their usual meanings

5. (a) What do you mean by the concept of cost of production? (5)

(b) Complete the following table and explain the relation among the various short run average cost curves. Plot all the short run average cost curves in a graph. (15)

Quantity	FC	VC	TC	AFC	AVC	AC	MC
1	80	30					
2	80	40					
3	80	45					
4	80	55					
5	80	75					
6	80	120					

(c) What is meant by the concept of market in Economics? Describe the various classifications of market. (10)

6. (a) Narrate the conditions of profit maximization. (5)

(b) What is meant by shut-down point of production? Graphically explain the shut-down point of production of a firm under perfect competition. (15)

(c) Given the following total revenue (TR) and total cost (TC) function for a firm (10)

$TR = 5900Q - 10Q^2$
$TC = 2Q^3 - 4Q^2 + 140Q + 845$
Where Q is the quantity of output.

(i) Set up the profit function,
(ii) Find the quantity which will make the profit maximization,
(iii) Calculate the maximum profit and verify that it is maximized.

7. (a) Describe the circular flow of income and expenditure in a two sector economy. (10)

(b) Calculate national income from the following information: (10)

GNP = TK. 1,25,000 Crore
Depreciation = TK. 11,000 Crore
Indirect Tax = TK. 13,000 Crore
Subsidy is 20% of indirect tax.

(c) Briefly discuss the various policies for controlling inflation. (10)

8. (a) Define sustainable development goals (SDGS). Briefly point out the various goals of SDGS. (20)

(b) Make a brief comparison between millennium development goals (MDGS) and SDGS. (10)