L-1/T-2/ME Date : 03/11/2022

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2020-2021

Sub : **HUM 101** (English)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

Symbols indicate their usual meaning.

1. Read the following passage carefully and answer all the questions that follow: **(45)**

You seemed at first to take no notice of your school-fellows, or rather to set yourself against them because they were strangers to you. They knew as little of you as you did of them, so that this would have been reason for their keeping aloof from you as well, which you would have felt as a hardship. Learn never to conceive a prejudice against others because you know nothing of them. It is bad reasoning and makes enemies of half the world. Do not think ill of them till they behave ill to you; and then strive to avoid the faults which you see in them. This will disarm their hostility sooner than pique or resentment or complaint. I thought you were disposed to criticize the dress of some of the boys as not so good as yours. Never despise any one for anything that he cannot help never at all, for his poverty. I would wish you to keep up appearances yourself as a defense against the idle sneers of the world, but I would not wish you value yourself upon them. I hope you will neither be the dupe nor victim of vulgar prejudices. Instead of saying above, "Never despise anyone for anything that he cannot help," I might have said, "Never despise anyone at all." For contempt implies a triumph over and pleasure in the ill of another. It means that you are glad and congratulate yourself on their failings or misfortunes.

You have hitherto been a spoilt child and have been used to have your own way a good deal, both in the house and among your playfellows, with whom you were too fond of being a leader but you have good nature and good sense, and will get the better of this in time. You have now got among other boys who are your equals, or bigger and stronger than yourself, and who have something else to attend to besides humouring your whims and fancies; and you feel this as a repulse or piece of injustice. But the first lesson to learn is that there are other people in the world besides yourself. The more airs of childish self-importance you give yourself, you will only expose yourself to be the more thwarted and laughed at. True equality is the only true morality or true wisdom. Remember always that you are but one among others, and you can hardly mistake your place in society. In your own house you might do as pleased; in the world, you will find competitors at every turn. You are not born to destroy or dictate to millions; you can only expect to share their fate, or settle your differences amicably with them.

Contd P/2

HUM 101/ME

Contd ... Q. No. 1

Questions:

(a) According to the author, what are the reasons for not harbouring a prejudice against others?

(b) What are some of the blessings of living with others in the same class or the same place?

(c) Comment on the statement, "contempt implies a triumph over and pleasure in the ill of another".

(d) The author says, "in the world you will find competitors at every turn." But competition is a very good thing. Why does he seem to warn us about it?

(e) What message does the author try to convey to the readers?

(f) Write down the meanings of the words as used in this passage:

Prejudice, resentment, vulgar, contempt, amicably.

2. (a) Describe in brief the elements of structure of a business letter. **(10)**

(b) Draft a suitable reply to a claim made by one of your business clients seeking appropriate steps to be taken in his favour regarding the problem that were identified with the electrical products supplied by you. **(10)**

(c) Write phonetic transcription of the following words: (Any Five) **(10)**

Baby, page, chair, frank, table, son.

3. (a) Write in brief the functions of different components of 'Front Matter' of a report. **(10)**

(b) Write an essay on any **ONE** of the following: **(10)**

(i) A Healthy Academic Environment: An Assurance for Quality Education

(ii) Reading Books: A Habit on the wane

(iii) Hall Life: A Guide to a Student's Future

(c) Write a dialogue between two conscientious citizens of the country about the intrusion of foreign culture upon Bangladesh culture. **(10)**

4. (a) What are the salient features of a Sales letter. **(5)**

(b) Transcribe the following sentences as directed: (Any Five) **(10)**

(i) Resign or you will be dismissed. (Simple)

(ii) It is difficult to explain, but it exists. (Simple)

(iii) This is a flower vase. (Complex)

(iv) Hearing the teacher's footsteps, the children kept silent. (Compound)

(v) The child went to her mother dancing. (Compound)

(vi) His success is almost certain. (Complex)

(c) Write short notes on any **THREE** of the following: **(15)**

(i) The Diphthongs

(ii) Importance of List of Reference in Academic Writing

(iii) Three 'C's in Précis writing

(iv) Difference between an Amplification and an Explanation

Contd P/3

HUM 101/ME

SECTION – B

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

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

(i) "There must be more money! There must be more money!"

(ii) "His forehead was resplendent with sacred ash and vermilion and his eyes sparkled with a sharp abnormal gleam"

(iii) "This is our island. It's a good island. Until the grownups come to fetch us we'll have fun."

(b) Answer any **One** of the following: **(15)**

(i) How does R. K. Narayan portray the character of the Astrologer in his story "An Astrologer's Day"? – Discuss.

(ii) In "The Rocking Horse Winner" Paul's mother defines *luck* as – "what causes you to have money." do you agree? Justify your stance.

(c) Answer any **Three** of the following: **(15)**

(i) How does R. K. Narayan describe the astrologer's knowledge of astronomy?

(ii) How does the astrologer's appearance help him attract customers?

(iii) What did the Conch symbolize in "Fire on the Mountain"?

(iv) What is the deal Paul makes with Bassett and Uncle Oscar?

(v) What does the *rocking horse* symbolize in "The Rocking-House Winner"?

6. (a) Recast and correct any **Ten** of the following sentences: **(15)**

(i) She's used to get up early.

(ii) Each of the girls must carry their bag.

(iii) They discussed about the whole matter.

(iv) I had spoken to them about my holiday.

(v) You must attend your teacher's instructions.

(vi) I visit them once in a week.

(vii) What is wanted are not large houses with modern conveniences, but small cottages.

(viii) I suggest you to apply for the post.

(ix) She requested for my help.

(x) We couldn't risk to leave him alone.

(xi) Scarcely had he gone, than a policeman knocked at the door.

(xii) The best does not lack integrity.

(b) Give the meaning of and make sentences with any **Ten** of the following words: **(15)**

Identical, explicit, concurrence, ponder, restrain, shabby, trivial, simultaneously, wrath, alluring, brink, congestion.

Contd P/4

HUM 101/ME

7. Amplify any **One** of the following: **(30)**

   (a) "A happy heart is better than a full purse."

   (b) A journey of thousand miles begins with a single step.

8. Write a précis of the following passage with a suitable title: **(30)**

Almost every organism has the tendency to react to certain stimuli for survival. This reaction to each and every situation has an evolutionary basis of adaptation. The study of human emotions dates back to the 19th century and psychologists have since then discovered many reasons for every emotion, yet these are just theories. The arousal of emotions and their assumed structures is said to occur due to repeated encounters with a situation followed by the adaptation of the encounter. Human emotions have been linked to adaptively regulate emotion-gathering mechanisms. The emotion of fear which is associated with ancient parts of the brain has presumably evolved among our pre-mammal ancestors while the emotion mother's love called the 'filial emotion' has seen to evolve among early mammals. Various emotions work as manipulative strategies that favours survival. Feigning emotions by an accused person may help him be saved from the punishment. An exaggerated display of anger is also associated with manipulating or threatening someone. Despite there being several emotions for various events, ironically the most interesting emotion is the emotion of disgust. Disgust is aroused when the body senses a danger to the immunity or the Physiology of the human. The disgusted memory is associated with alerting the brain of a potentially dangerous substance. A few studies have shown that the encoding triggered in adaptive memory for problems is stronger than any other behaviour. This makes us instantly have a disgusted expression at the sight of something that makes us uncomfortable or uneasy. These expressions are also closely linked to self-protective communication.

L-1/T-2/ME Date : 03/11/2022

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2020-2021

Sub : **HUM 103** (Economics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

Symbols indicate their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Illustrate the law of diminishing marginal utility with numerical and graphical presentations. How is the demand curve of the consumer derived using the law? Explain the condition for consumer equilibrium for a single commodity under the cardinal approach to utility analysis. **(20)**

   (b) Briefly describe the basic economic problems that every economy must face. How are these problems solved in different economic systems? Explain. **(15)**

2. (a) Illustrate the law of diminishing marginal returns and show the interrelationship between marginal physical product (MPP), average physical product (APP) and total physical product (TPP). The average revenue (AR) and total cost (TC) functions of a firm are given by **(20)**

   $$AR = 4350 - 13M$$

   $$TC = M^3 - 5.5M^2 + 150M + 675$$

   where, M refers to quantity of output. Find the profit maximizing level of output and maximum profit.

   (b) How would you construct the long run average cost curve? Why is the curve called an envelope curve? Explain the internal economies of scale of production. **(15)**

3. (a) "At Equilibrium Price, there should be no excess demand and excess supply, and market will be cleared" – Briefly explain this statement. **(10)**

   (b) Assume that 'Canon EOS M50 Mark-II' and 'Sony ZV-E10' are substitutable mirror less cameras. What will happen to the market for the 'Sony ZV-E10' if Canon raises the price of 'EOS M50 Mark-II' significantly, while the price of ZV-E10 remain constant? Explain with the help of partial equilibrium analysis. **(10)**

   (c) What is price elasticity of demand? Briefly explain elastic, inelastic and perfectly inelastic demand with appropriate diagrams and examples. **(15)**

Contd P/2

HUM 103/ME

4. Write short notes on any THREE of the following **(35)**

   (i) Indifference Curve (IC) and Marginal Rate of Substitution (MRS)

   (ii) Optimum combination of factors of production

   (iii) Monopolistic Competition

   (iv) Production and consumption externalities

SECTION – B

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

5. (a) Draw the circular flow diagram for a closed economy and explain why an economy's income must equal its expenditure. **(8)**

   (b) What is meant by Gross Domestic Product (GDP)? Explain each phrase in the definition of GDP and write down some limitations of it. **(12)**

   (c) **(15)**

Year	Price of Rice (Tk)	Quantity of Rice (kg)	Price of Fish (TK)	Quantity of Fish	Price of Cloth (TK)	Quantity of Cloth
2020	65	150	250	160	500	100
2021	80	220	350	200	650	140

   (i) Calculate Nominal GDP for the year 2020 and 2021.

   (ii) Calculate Real GDP for the year 2021.

   (iii) Calculate GDP deflator for the year 2021.

   (iv) Calculate economic growth rate for the year 2021 and interpret.

   Given that 2020 is the base year.

6. (a) The residents of Palashi spent all of their income on Cauliflower, Broccoli, and Carrots. In 2020, they bought 100 heads of Cauliflower for 2000 Tk, 50 bunches of Broccoli for 750 Tk, and 500 Carrots for 500 Tk. In 2021, they bought 75 heads of Cauliflower for 2250 Tk, 80 bunches Broccoli for 1200 Tk, and 500 Carrots for 1000 Tk. **(14)**

   (i) Using 2020 as the base year, calculate the CPI for each year.

   (ii) What is the inflation rate in 2021?

   (b) Briefly explain the process of money creation with fractional-reserve banking. **(14)**

   (c) What is the free-rider problem? Why does the free-rider problem induce the government to provide public goods? **(7)**

Contd P/3

HUM 103/ME

7. (a) What is Fiscal policy? When is fiscal policy referred to as contractionary? Distinguish between automatic and deliberate fiscal policy. **(10)**

   (b) How does crowding out create questions about the effectiveness of expansionary fiscal policy? Explain. **(7)**

   (c) What is Monetary policy? Briefly explain the Central Bank's tools (Open market operations, Discount window, and Reserve requirements) for monetary control. **(18)**

8. (a) Distinguish between 'economic growth' and 'economic development'. What are the common features of underdeveloped countries? Explain. **(10)**

   (b) How can we construct the 'Human Development Index' (HDI)? Briefly explain. **(13)**

   (c) Suppose the Ministry of Science and Technology wants to undertake a project incurring a total cost of Tk. 38,000,000.00 today. It will provide benefits of Tk. 15,000,000.00 in the 1st year, Tk. 14,000,000.00 in the 2nd year and Tk. 12,000,000.00 in the 3rd year. If the discount rate if 6%, will this project be approved by using Cost-Benefit Analysis (CBA)? Would your answer change if the discount rate if 3%? **(12)**

L-1/T-2/ME Date : 30/10/2022

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2020-2021

Sub : **CHEM 141** (Chemistry of Engineering Materials)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this 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) Define crevice corrosion. Illustrate the mechanism of crevice corrosion. Write down the factors that influence crevice corrosion. **(15)**

2. (a) Correlate the effect of temperature, pH and dissolved oxygen with corrosion. **(15)**

   (b) Cathodic protection is one of the electrochemical method for corrosion prevention. Name the types of cathodic protection methods and explain them. **(20)**

3. (a) Write down the properties of good lubricants. Explain the effect of flash point, viscosity index and total base number on the properties of lubricants. **(15)**

   (b) Discuss the mechanism of binders to act as film forming components of paint. **(10)**

   (c) Justify the use of primer to better prepare a surface to receive the paint. **(10)**

4. (a) Porosity is a very important property which has correlation with other properties of refractory materials. List the properties that depend on porosity and interpret the effect of porosity on them. **(20)**

   (b) Name the allotropes of carbon. Demonstrate the structure and properties of graphite. **(15)**

SECTION – B

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

5. (a) Outline the steps of chemical reactions associated with the cationic and free radical polymerizations with examples. **(12)**

   (b) Justify, why average molecular weight is used for polymers. Differentiate number average molecular weight and weight average molecular weight of polymers. **(12)**

   (c) State the formation of polyester from monomer? Describe the characteristics and applications of polyester resins. **(11)**

Contd P/2

CHEM 141

6. (a) Draw a graph to demonstrate the different stages of polymeric deformation during tensile loading. Relate the behavior on these stages with the polymer orientation. **(12)**

   (b) Compare the behavior of viscous, elastic, and viscoelastic polymers. Explain the changes in behavior of viscoelastic polymers during the increase in temperature. **(12)**

   (c) How is glass transition temperature measured for polymeric materials? Relate the glass transition temperature with the status of polymers. **(11)**

7. (a) Describe the process of manufacturing of glass. **(12)**

   (b) What are the fundamentals raw materials of glass? Write down the chemical reactions of raw materials take place during the glass formation. **(12)**

   (c) Compare the properties of ceramics and metals. **(11)**

8. (a) What are the common properties of rubber? Discuss the Joule effect of rubber materials. **(12)**

   (b) Interpret the types of chemical reactions occur in natural rubbers. **(12)**

   (c) How is vulcanization performed in rubber? Justify that vulcanization changes the mechanical behavior of rubber materials. **(11)**

L-1/T-2/ME Date: 19/10/2022

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2020-2021

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

Full Marks: 210 Time: 3 Hours

The figures in the margin indicate full marks

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) Show that the oscillation of a torsional pendulum is simple harmonic and find out the expression of its time period. **(10)**

   (b) The displacement of a vibrating particle at any instant is $x = A\cos(\omega t + \alpha)$. Show that total mechanical energy of the particle remains conserved. Draw the energy curve as a function of position. **(15)**

   (c) The amplitude of a simple harmonic oscillator is 10 cm. At what displacement the kinetic energy become $\frac{3}{4}$ th of the total energy of the oscillator? **(10)**

2. (a) Define phase velocity and group velocity. Establish the relation between the phase velocity and group velocity. Show that for non-dispersive medium phase velocity and group velocity are same. **(15)**

   (b) Deduce an expression for the resultant of two oscillations which are acting simultaneously on a particle perpendicular to each other having the same angular frequency but different amplitudes and phases. Under what conditions it will be a circle and straight line with negative slope. **(20)**

3. (a) Show that at steady state, the rate of supply of energy by the driving force is equal to the rate of energy dissipated by the frictional force. **(15)**

   (b) What is meant by reverberation time? Deduce the expressions of growth and decay of sound intensity inside a hall room. Hence obtain an expression of Sabine's reverberation time. **(20)**

4. (a) Distinguish between wave function and probability density function. **(10)**

   (b) What is an operator? Write down the expressions for energy operator and momentum operator. **(10)**

   (c) Derive infinite square well energy quantization law from the de Broglie hypothesis by fitting an integral number of half de Broglie wavelength into the width '*a*' of the potential well. **(15)**

Contd P/2

SECTION – B

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

5. (a) Write down the expressions for time independent and time dependent Schrödinger equations. **(10)**

(b) Explain that Schrödinger equation cannot be derived from other basic principles of physics; it is a basic principle in itself. **(10)**

(c) Explain 'Quantum Mechanical Tunneling' effect and write down its important applications in solid state physics. **(15)**

6. (a) Write down the mathematical expressions of the three statistical distribution functions by mentioning each term. **(10)**

(b) Distinguish between Fermion and Boson with appropriate examples. **(10)**

(c) Draw schematically the three statistical distribution functions for the same value of normalized exponential (α). What comments can be drawn on their probability of occupancy of a state of energy at absolute temperature T? **(15)**

7. (a) Explain briefly longitudinal and transverse chromatic aberrations with suitable optical diagram. Derive an expression for the longitudinal chromatic aberration for an object at an infinite distance. **(15)**

(b) Explain briefly the circle of least chromatic aberration with a suitable optical diagram and show that the diameter of the circle of least confusion depends on the diameter of the lens aperture and the dispersive power of the material of the lens. **(10)**

(c) The focal lengths of a lens for blue and red rays of light are 98 cm and 100 cm, respectively. Calculate the mean focal length and dispersive power of the material of the lens. **(10)**

8. (a) Derive the condition of achromatism for a telescope objective. Draw the schematic diagram of such objective, which is also free from spherical aberration. **(15)**

(b) Discuss the construction of a compound microscope with a simple ray diagram. Find its magnifying power in terms of the distance between objective and eyepiece and their focal lengths. **(10)**

(c) An objective of a telescope is an achromat of focal length 90 cm. The magnitudes of the dispersive powers of the two lenses are 0.024 and 0.036. Calculate their focal lengths. **(10)**

L-1/T-2/ME **Date: 15/10/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2 B. Sc. Engineering Examinations 2020-2021

Sub: **MATH 163** (Integral Calculus and Differential Equations)

Full Marks: 280 Time: 3 Hours

The figures in the margin indicate full marks

Symbols used have their usual meaning.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. Workout the following:

   (a) $\int \frac{dx}{x^2(2+3x)^2}$ **(15)**

   (b) $\int \frac{x^2+x+1}{\sqrt{x^2+2x+3}}dx$ **(15)**

   (c) $\int \frac{\sin x\,dx}{\sqrt{1+\sin x}}$ **(16⅔)**

2. (a) Evaluate $\lim_{n\to\infty}\left\{\left(1+\frac{1^2}{n^2}\right)\left(1+\frac{2^2}{n^2}\right)\cdots\cdots\left(1+\frac{n^2}{n^2}\right)\right\}^{1/n}$ **(15)**

   (b) If $I_n = \int_0^{\pi/4}\tan^n x\,dx$, show that $I_{n+1}-I_{n-1}=\frac{1}{n}$; use this relation to evaluate $\int_0^{\pi/4}\tan^{10}x\,dx$. **(16⅔)**

   (c) Define Beta function and Gamma function. Proof that, $\Gamma\left(n+\frac{1}{2}\right)=\frac{\Gamma(2n+1)\sqrt{\pi}}{2^{2n}\Gamma(n+1)}$. **(15)**

3. (a) Evaluate $\int_0^{\infty}\frac{dx}{(1+x^2)^n\sqrt{1+x^2}}$. **(12)**

   (b) Approximate $\int_0^2 x^2\ln(x^2+1)dx$ for h = 0.25 using composite trapezoidal rule and Simpson 1/3 rule. Also estimate the error. **(18⅔)**

   (c) Use any suitable method to determine whether the series converges, **(16)**

   (i) $\sum_{k=1}^{\infty}\frac{k!}{k^3}$ (ii) $\sum_{k=1}^{\infty}\left(1-e^{-k}\right)^k$

4. (a) Find the whole length of the loop of the curve $3ay^2 = x(x-a)^2$. **(15)**

   (b) Use cylindrical shells to find the volume of the solid generated when the region enclosed by the curves $y=2x-1$, $y=-2x+3$, $x=2$ is revolved about the y-axis. **(15)**

   (c) Find the area of the region inside the circle $r=3\sin\theta$ and outside the cardioid $r=1+\sin\theta$. **(16⅔)**

Contd P/2

MATH 163/ME

SECTION – B

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

5. (a) Find the differential equation for which the polar subtangent is constant. **(16⅔)**

(b) Solve the following differential equations: **(15+15)**

(i) $(x-2y+1)dx+(4x-3y-6)dy=0$.

(ii) $(3x+2y^2)dx+3xydy=0$.

6. (a) A large tank is filled to capacity with 500 gallons of pure water. Brine containing 2 pounds of salt per gallon is pumped into the tank at a rate of 5 gal/min. The well mixed solution is pumped out at the same rate. Find the number $A(t)$ of pounds of salt in the tank at time t. **(16⅔)**

(b) Solve: $\cos x\dfrac{dy}{dx}=y\sin x+y^3\cos^2 x$. **(15)**

(c) Find the value of k for which $2x^2y^2dx+3kx^3y\,dy=0$ will be exact, hence solve it. **(15)**

7. (a) Solve Cauchy-Euler differential equation $x^3\dfrac{d^3y}{dx^3}-4x^2\dfrac{d^2y}{dx^2}+8x\dfrac{dy}{dx}-8y=4\ln x$. **(23⅓)**

(b) Solve the higher order differential equation: **(23)**

$$y''+y'=4x+10\sin x;\ \ y(\pi)=1,\ \ y'(\pi)=2$$

8. (a) Using the method of variation of parameter, solve **(16⅔)**

$$(x^2+1)\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+2y=6(x^2+1)^2$$

(b) Apply factorization of operator method to solve $\dfrac{d^2y}{dx^2}-\dfrac{dy}{dx}-2y=4\cos 3x$. **(15)**

(c) Solve $x^2\left(\dfrac{dy}{dx}\right)^2-2xy\dfrac{dy}{dx}+2y^2-x^2=0$. **(15)**
