Shahriar Kabir GCE-17

Heaven's Light is Our Guide

Rajshahi University of Engineering & Technology

Department of Glass & Ceramic Engineering

B. Sc. Engineering 1st Year Odd Semester Examination, 2018

Course No: **GCE1101** Course Title: **Introduction to Glass and Ceramics**

Full Marks: 72 Time: **Three Hours**

N.B.

i. Answer **Six** questions taking **Three** from each section.
ii. Figures in the margin indicate full marks.
iii. Use separate answer script for each section.

SECTION-A

Q.1	(a)	What is material science and materials engineering? Classify materials with suitable examples.	05
	(b)	Why is it necessary to study material science?	03
	(c)	Define advanced materials. Write down the applications of advanced materials.	04
Q.2	(a)	What are smart materials? Mention their applications.	04
	(b)	Write a short note on "Modern Materials Needs".	04
	(c)	Briefly explain the concept of nanotechnology.	04
Q.3	(a)	What is glass? Draw the structure of glass.	04
	(b)	Illustrate the V-T diagram of glass.	03
	(c)	What are the materials used in glass production? Write down the physical and chemical properties of glass.	05
Q.4	(a)	What is meant by batch materials of glass? Write down the common applications of glass.	04
	(b)	Is glass attacked by acid or alkali? State your answer.	02
	(c)	Write a short note on soda-lime glass.	02
	(d)	How could you manufacture glass?	04

SECTION-B

Q.5	(a)	Define ceramic and mention the scope of ceramics.	05
	(b)	What do you know about conventional and advanced ceramic materials?	03
	(c)	Write a short note "Historical developments of ceramic materials".	04
Q.6	(a)	What are tiles? Write down the production process of tiles.	04
	(b)	What do you understand by abrasives? Write down the characteristics of ceramic insulator.	04
	(c)	Define refractories and also write down the significance of refractories.	04
Q.7	(a)	"Ceramic sector is developing day by day in Bangladesh" –Justify your answer.	05
	(b)	What is thermal expansion? What are the effects of porosity on thermal conductivity of ceramics?	04
	(c)	Define phosphorescence, laser and polarizability.	03
Q.8	(a)	Depict the following topics: i) Dielectric constant ii) Dielectric strength and iii) Dielectric loss	06
	(b)	Write a short note on "Magnetic Ceramics".	04
	(c)	Differentiate between piezo- and pyro-electric ceramics.	02

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Department of Glass &Ceramic Engineering

B.Sc. Engineering 1st Year Odd Semester Examination, 2018

Course Title: **Chemistry-I**

Course No: **Chem1125**

Time: **Three Hours**

Full Marks: **72**

N.B.
i. Answer **Six** questions taking **Three** from each section.
ii. Figures in the margin indicate full marks.
iii. Use separate answer script for each section.

SECTION-A

Q.1(a)	State and explain the postulates of Bohr's theory.	06
(b)	State Pauli's exclusion principle with suitable example.	03
(c)	Deduce De-Broglie's equation.	03
Q.2(a)	Define ionization potential. Explain why it is a periodic property.	07
(b)	Write down the electronic configuration of the followings: P(15), Na(11), Cu(29), Ag(47) and Cr(24).	05
Q.3(a)	Discuss the classification of elements in the periodic table on the basis of the electronic configuration of their atoms.	04
(b)	Explain how the size of atoms changes in a group and a period of the periodic table.	04
(c)	Explain the following giving appropriate reasons: i) Electron affinity value of chlorine is higher than that of fluorine. ii) Electron affinity values of Be, Mg and noble gases are zero.	04
Q.4(a)	Define chemical bonding. Write down the properties of ionic bonding.	04
(b)	*Draw the molecular orbital energy level diagram of N_2 and He_2 molecules and calculate their bond order.*	04
(c)	*Define hybridization.* Mention the rules of hybridization.	04

SECTION-B

Q.5(a)	What is photoelectric effect? Describe Einstein's explanation of photoelectric emission.	06
(b)	Discuss the laws of photoelectric emission.	06
Q.6(a)	Explain s-s, s-p, & p-p overlaps with examples.	04
(b)	Distinguish between σ- and π- bonds.	04
(c)	H_2 molecule exists but He_2 molecule does not exist-explain on the basis of MOT.	04
Q.7(a)	Deduce Henderson-Hasselbalch equation of acidic buffer solution.	04
(b)	A buffer solution contains 0.2 mole CH_3COONa and 0.15 mole CH_3COOH per litre. Calculate the pH value of the buffer solution. (Given $Ka = 1.8 \times 10^{-5}$).	04
(c)	Explain common ion effect with a suitable example.	04
Q.8(a)	Mention the main assumptions of Arrhenius theory of electrolytic dissociation.	04
(b)	Explain the buffer solution maintains fairly constant pH.	04
(c)	Mention the characteristics of buffer solution. Compare between solubility and solubility product.	04

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Department of Glass & Ceramic Engineering

B.Sc. Engineering 1st Year Odd Semester Examination, 2018

Course Title: **Engineering Math-I**

Course No: **Math1125**

Time: **Three Hours**

Full Marks: **72**

N.B.
i. Answer **Six** questions taking **Three** from each section.
ii. Figures in the margin indicate full marks.
iii. Use separate answer script for each section.

SECTION-A

Q.1 (a) If by the rotation of the rectangular co-ordinate axes about the origin, the expression $ax^2 + 2hxy + by^2$ change to $a'x'^2 + 2h'x'y' + b'y'^2$ then prove that, $a + b = a' + b'$ and $ab - h^2 = a'b' - h'^2$. 06

(b) Prove that, the pair of lines joining the origin to the point of intersection of the line $x\cos\alpha + y\sin\alpha = P$ at right angles if $2P^2 + 2P(g\cos\alpha + f\sin\alpha + c) = 0$. 06

Q.2 (a) Find the equations of the bisectors of the angles between the lines represented by $2x^2 + 7xy + 6y^2 + 13x + 22y + 20 = 0$. 06

(b) Reduce the equation: $16x^2 - 24xy + 9y^2 - 104x - 172y + 44 = 0$ to the standard form. Hence find the axis, focus and foot of directrix of the conic. 06

Q.3 (a) Find the direction cosines of the line perpendicular to the pair of mutually perpendicular lines with their direction cosines as (l_1, m_1, n_1) and (l_2, m_2, n_2) respectively. 06

(b) A variable plane makes intercepts on the co-ordinate axes the sum of whose squares is constant and equal to k^2. Show that the locus of the foot of the perpendicular from the origin to the plane is $(\bar{x}^2 + \bar{y}^2 + \bar{z}^2)(x^2 + y^2 + z^2) = k^2$. 06

Q.4 (a) Find the conditions that the equation $\varphi(x, y, z) \equiv ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ may represent pair of planes. Prove that, the product of the distance from (α, β, γ) to the two planes is $\frac{\varphi(\alpha,\beta,\gamma)}{\sqrt{[\sum a^2 + 4\sum f^2 - 2\sum bc]}}$. 06

(b) Find the equations of the line perpendicular to both the line $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z+2}{3}$; $\frac{x+2}{2} = \frac{y-5}{-1} = \frac{z+3}{2}$ and passing through their intersection. 06

SECTION-B

Q.5 (a) Define monotone function. 04

Show that $f(x) = \frac{x}{(1+x)}$ is monotone ascending for $x > 0$.

(b) 04

$$f(x) = \begin{cases} x \text{ for } 0 < x < 1 \\ 2 - x \text{ for } 1 \le x \le 2 \\ x - \frac{x^2}{2} \text{ for } x > 2 \end{cases}$$

Is $f(x)$ continuous at $x = 1$? Does $f'(x)$ exist for this point?

(c) Evaluate: $\lim_{x\to 0}\left(\frac{\tan x}{x}\right)^{1/x^2}$. 04

Q.6 (a) If $y = \sin^{-1} x$, then show that, $(1 - x^2)y_{n+2} + (2n + 1)xy_{n+1} - n^2 y_n = 0$. Find also the value of $(y_n)_0$. 04

(b) Find the maxima and minima, if any of $\frac{x^4}{(x-1)(x-3)^3}$. 04

(c) Expand $\log(1 + x)$ in ascending powers of x. 04

Q.7 (a) Evaluate: $\int_0^1 \frac{x\sin^{-1}x}{\sqrt{1-x^2}}\,dx$ 04

(b) Show that, $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\cot x} = \frac{\pi}{4}$. 04

(c) Obtain the reduction formula for $\int x^m (\log x)^n\,dx$. 04

Q.8 (a) Show that $\int_0^{\pi/2} \sin^m x\cos^n x\,dx = \frac{\left[\frac{m+1}{2}\right]\left[\frac{n+1}{2}\right]}{2\left[\frac{m+n+2}{2}\right]}$. 04

(b) Prove that $\beta(m, n) = \int_0^\infty \frac{y^{n-1}}{(1+y)^{m+n}}\,dy$. 04

(c) Find the area bounded by $a^2y^2 = a^2x^2 - x^4$. 04

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Department of Glass & Ceramic Engineering
B.Sc. Engineering 1st Year Odd Semester Examination, 2018

Course No: **Hum1125** Course Title: **Economics**

Full Marks: **72** Time: **Three Hours**

N.B.

i. Answer **Six** questions taking **Three** from each section.
ii. Figures in the margin indicate full marks.
iii. Use separate answer script for each section.

SECTION-A

Q.1 (a) What is utility, total utility and marginal utility? 06

(b) What is law of diminishing marginal utility? Explain using an example. 06

Q.2 (a) Define plant, firm and industry. 03

(b) What is market? What are the different types of market? 04

(c) Discuss the features of perfectly and imperfectly competitive market. 05

Q.3 (a) What is engineering economics? Why should you study engineering economics? 06

(b) What is ppf ? Explain using an example. 06

Q.4 (a) What is total cost (TC), marginal cost (MC) and average cost (AC)? Why the AC curve is U-shaped? 06

(b) Given that $C= 100+ 20q - 4q^2 + 3q^3$. Calculate TFC, TVC, AFC, AVC, AC and MC. 06

SECTION-B

Q.5 (a) Define macroeconomics. 03

(b) State the objectives of macroeconomics. 03

(c) Explain how to measure economic success in macro economics. GDP 06

Q.6 (a) What is economic development? Distinguish between economic growth and economic development. 06

(b) On May 11th 2018, space X successfully launched Bangabandhu satellite-1 from historic launch complex 39A at NASA's Kennedy Space Centre in Florida. How will Bangladesh be benefited by the Bangabandhu satellite-1? 06

Q.7 (a) What is economic planning? Why economic planning is important for Bangladesh? Explain. 07

(b) State the obstacles in implementing the planning. 05

Q.8 (a) What are terms of trade? 03

(b) Distinguished between free trade and trade protectionism. 03

(c) Explain the effect of imposing a quota graphically. 06

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Department of Glass & Ceramic Engineering

B.Sc. Engineering 1st Year Odd Semester Examination, 2018

Course No: **Phy1125** Course Title: **Physics-I**

Full Marks: **72** Time: **Three Hours**

N.B.

i. Answer **Six** questions taking **Three** from each section.
ii. Figures in the margin indicate full marks.
iii. Use separate answer script for each section.

SECTION-A

Q.1 (a) Distinguish between uniaxial stress and uniaxial strain. 03

(b) Explain the terms yield point, elastic limit, elastic fatigue and breaking stress with reference to the stress-strain curve. 04

(c) What is poisson's ratio? Show that the value of poisson's ratio must lie between -1 and +1/2 03

(d) Explain the factors affecting elasticity of materials. 02

Q.2 (a) Explain the terms: neutral surface, flexural rigidity and bending moment of a beam. 03

(b) Derive an expression for the couple required to bend a uniform straight metallic strip into an arc of a circle of small curvature. 06

(c) Find the greatest length of a steel wire that can hang vertically without breaking. Breaking stress for steel = 7.9×10^8 N/m^2. Density of steel = 7.9×10^3 kg/m^3. 03

Q.3 (a) Explain the coefficient of sliding friction. Show that the coefficient of sliding friction for a given pair of surfaces is equal to the tangent of the angle of friction for them. 04

(b) Give the physical significance of moment of inertia and radius of gyration. 03

(c) State and prove the theorem perpendicular axis in moment of inertia. 05

Q.4 (a) Show that the moment of inertia of a body is equal to twice the kinetic energy of the body rotating with an angular velocity of 1 radian per second. 03

(b) Calculate the moment of inertia of a solid cylinder rotating about an axis passing through its centre and perpendicular to its own cylindrical symmetry. 05

(c) A circular disc of mass m and radius r is set rolling on a table. If ω is its angular velocity, show that its total energy E is given by $E=\frac{3}{4}mr^2\omega$. 04

SECTION-B

Q.5 (a) Find an expression for electric field due to an electric dipole at a point on the perpendicular bisector of the angle. 05

(b) Deduce coulombs law from gauss's law. $E=\frac{1}{4\pi\varepsilon_0}\frac{2q}{r^2}$ 04

(c) Define electric potential and electric potential energy. 03

Q.6 (a) What is electric flux? Show that electric flux for a hypothetical cylinder of radius R immerged in a uniform electric field E is zero. 04

(b) State Gauss's theorem and apply it to obtain an expression for the electric field at a point (i) outside and (ii) inside a charged conducting sphere. 06

(c) What must the magnitude of an isolated positive point charge be for the electric potential at 10 cm from the charge to be 100V? 02

Q.7 (a) What is a solenoid? Find the magnetic field that is set-up in a solenoid having n number of turns per unit length and carrying a current i_0. 05

(b) A solenoid 0.5 m long has 2000 turns. The magnetic induction near the centre of the solenoid is 0.08T. What is the current in the solenoid? 03

(c) Show that the coefficient of coupling between two coils is given by $k=\frac{M}{\sqrt{L_1L_2}}$, where symbol's have their usual meanings. 04

Q.8 (a) Discuss the properties of diamagnetic and ferromagnetic materials. 04

(b) Briefly explain the hysteresis loop for a magnetic material and mention its importance. 06

(c) Write few uses of ferromagnetic materials. 02

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$V=\gamma W$