SECTION – A

1(a).	Define energy and energy resources. How the natural energy resources are classified globally? Explain in brief.	10
1(b).	What is meant by energy cycle? Explain the Earth energy cycle with necessary sketch.	12
1(c).	Define renewable and non-renewable energy sources. Write down the advantages and disadvantages of conventional energy sources.	08
1(d).	Distinguish between primary and secondary energy sources.	05

2(a).	Define the form of energy. Briefly explain the energy conversion in generators.	08
2(b).	Define nuclear energy. Explain the working principle of nuclear power plant with schematic diagram.	12
2(c).	Distinguish between nuclear fission and fusion. How does energy get liberated in nuclear reactor?	10
2(d).	Discuss in brief the hazards of using nuclear fuels.	05

3(a).	What are the different grades of coal? How coal is formed?	07
3(b)	Describe the several stages in the conversion of wood to coal with schematic diagram.	10
3(c).	What is coal? Explain the different methods of coal formation with necessary sketch..	12
3(d).	Write a brief note on advantages and disadvantages of using coal to produce power.	06

4(a).	What are the differences between the origin of coal and pertroleum oil?	08
4(b).	Illustrate the origin and formation of petroleum along with organic and inorganic theories.	13
4(c).	Mention the benefits of using natural gas as fuel. Compare the characteristics of NG and LPG.	8
4(d).	How different grades of petroleum are obtained from crude oil? Explain.	06

SECTION – B

5(a).	Which reactions are responsible for liberating energy within the sun? How solar radiation is reached on the earth surface?	07
5(b).	How solar radiation intensity is measured on the earth surface? When solar radiation data of a location is not available, how this information may be predicted?	07
5(c).	With a schematic diagram describe the construction of a flat plate collector.	07
5(d).	With a neat sketch describe how potable water is obtained from salt water by using solar energy.	07
5(e).	Discuss with neat sketch the working principle of a photovoltaic cell. What is doping?	07

6(a).	Define biomass and bioenergy. Why bioenergy is considered renewable?	05

6(b). Describe the origin of biomass energy. Explain the process of biochemical conversion of Biomass.

6(c). What is meant by anaerobic digestion process? Explain how biogas is obtained through this process.

6(d). What is biogas? Describe the different types of biogas plant. 0

7(a). How power is extracted from water? Briefly classify the hydropower plants. 0

7(b). Describe how pumped storage power plant works. 0

7(c). How wind is formed? How wind power can be exploited? 0

7(d). What factors are considered while selecting a WECS? Explain the effect of wind shear. 0

7(e). Write brief note on off-shore and on-shore wind mills. 0

8(a). What is meant by OTEC? With neat sketch describe open cycle OTEC system. 0

8(b). Describe with neat sketch the working of single basin tide cycle system. 0

8(c). Why geothermal energy resource is considered as renewable resource? Explain. 0

8(d). Write down the environmental effects of geothermal energy resources. 0

8(e). How energy can be extracted from waves? Explain any one method. 0

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
Ch 1113
(Chemistry I)

Time: 3 Hours.   Full Marks: 210

N.B. i)   Answer any THREE questions from each section in separate scripts.
     ii) Figures in the right margin indicate full marks.
     iii) Assume reasonable data if any missing.

SECTION – A

1(a). Deduce an expression and make a relation between K_p and K_c.   10

1(b). What is Le-Chatelier's principle? Describe the effect of temperature on equilibrium according to this principle.   10

1(c). "There is no effect of catalyst on equilibrium"-explain.   08

1(d). State the law of mass action. Is chemical equilibrium a dynamic process? Jusify.   07

2(a). What is orign of EMF? Derive Nernst's equaton of determining EMF.   11

2(b). Define transport number. Show that the sum of transport number of cation and anion of an electrolyte is equal to one.   09

2(c). What is standard hydrogen eletrode? Write the difficulties of using standard hydrogen electrode as reference electrode.   10

2(d). The standard reduction potential of lead electrode is -1.25 V and that of silver electrode is +0.799 V. Calculate the EMF of the cell : $Pb \mid Pb^{2+}(1.0M) \parallel Ag^{+}(1.0M) \mid Ag$.   05

3(a). Discuss the principle of determination of pH of a solution with the help of glass electrode.   13

3(b)   Construct a hydrogen fuel cell and describe its working pronciple with chemical reaction.   12

3(c). Draw the two dimentional schematic diagram of lithium ion battery and write down its charging and discharging chemical reactions.   10

4(a). Define the terms,   08
       (i)   Radioactivity
       (ii) Nuclear fission and
       (iii) Nuclear fusion.

4(b). Wha is nuclear binding energy? Mention ad explain the relationship between nuclear binding energy and mass defect.   10

4(c). Draw a two dimensional schematic diagram of a nuclear reactor. Mention the names of some common fuel, moderators and coolants used in nuclear reactor. How do moderators and coolants act in nuclear reactor? Discuss these in short.   12

4(d). Deduce 1 amu is equivalent to 931 MeV of energy.   05

SECTION – B

5(a). Explain the statement "All polymers are macromolecules but all macromolecules are not polymer." 08

5(b). Represent various types of structural polymers. 06

5(c). Thermosetting polymer cannot be recycled where thermoplastic polymers can be recycled, why? 09

5(d). Describe the mechanism of cationic polymerization process. 12

6(a). Define the terms, (i) Soliton, (ii) Living polymer. 06

6(b). A polymer mixture contains two polymers, one having molecular weight 100,000 and other having molecular weight 60,000. The two components are present in equimolar concentration. Establish that, $\overline{M_w} > \overline{M_n}$. 10

6(c). Vulcanized rubbers have high mechanical strength. Is it correct? Justify your statement. 08

6(d). What is conducting polymer? Write down some applications of conducting polymers. 11

7(a). Defne calorific value of a fuel with suitable example. Explain about thermal and catalytic cracking. 13

7(b). Write down the characteristic properties of a good fuel. 12

7(c). What is coal? Explain about bituminous and anthracite coal. 10

8(a). Discuss about the formation and depletion of ozone in the stratosphere. 10

8(b). Describe the biochemical effects of CO and NOx. 12

8(c). Why COD value is always greater than BOD value? 06

8(d). Write down the chemical reactions occurred for the determination of DO in water. 07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
HUM 1113
(Sociology and Behavioral Science)

Time: 3 Hours.   Full Marks: 210

N.B. i)   Answer any THREE questions from each section in separate scripts.
     ii) Figures in the right margin indicate full marks.
     iii) Assume reasonable data if any missing.

SECTION – A

1(a).   Define Sociology. Explain the importance of studying sociology in engineering education.   10

1(b).   What are the differences between society and community? Explain the vital role of community and association for a nation.   15

1(c).   Explain the basic elements of culture.   10

2(a).   What is social structure, and what are the basic elements of social structure?   10

2(b).   What is socialization? Explain how socialization happens?   10

2(c).   What is social stratification? Why is one human society stratified?   15

3(a).   Define culture. Explain anatomy of culture with example from your own society.   15

3(b)   What is marriage? Explain the role of marriage as a social institution.   10

3(c).   "Function of family are lost or modified"- what do you think? Give example from your own society.   10

4(a).   What is meant by urbanization? Explain the relation between industrialization and urbanization in the light of rapid urbanization in Bangladesh.   15

4(b).   What do you mean by energy consumption? Is there any relation between modernization and energy consumption? Explain with example.   10

4(c).   What is social control? Explain the role of social control to prevent deviant behavior.   10

SECTION – B

5(a).   Explain aims and objectives of behavioral science.   10

5(b).   Is there any implication of behavioral science for the students of Energy Science and Engineering? Explain how?   15

5(c).   Discuss the key elements of organizational behavior.   10

6(a).   What is meant by employee relation? Explain roles of an ideal employee.   12

6(b).   Explain way to improve employee relation in any organization.   10

6(c).   What is leadership? Discuss the traits of effective leaders.   13

7(a).   What is training? How training can help any employee in skill development and contribution in growth of organization.   15

7(b).   What is motivation? Critically explain Herzberg's 'Job Design' model and its implication in workplace.   20

8(a). What do you understand by counselling? Explain role of counselling in reducing stress of
       the employees.
8(b). What are the economic and social impact of unemployment in our society?   10
8(c). What is organizational designs? Discuss the types of organizational designs.   10

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1ˢᵗ Year 1ˢᵗ Term Examination, 2018
Math 1113
(Differential and Integral Calculus)
Time: 3 Hours. Full Marks: 210
N.B. i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION – A

1(a). Find the domain and range of $f(x) = \frac{x^2-4}{x-2}$. Sketch the graph of the function $y = |x - 1|$. — 10

1(b). Discuss the continuity and differentiability of $f(x)$ at $x = 2$, where — 15
$$f(x) = \begin{cases} 1 & when\ 1 \le x < 2 \\ 2x - 3 & when\ \ \ \ x \ge 2 \end{cases}$$

1(c). If $y = (\cos x)^{\sin x} + (\sin x)^{\cos x}$, find $\frac{dy}{dx}$. — 10

2(a). State Rolle's Theorem. Is Rolle's theorem applicable to the fuction $f(x) = |x|$ in any interval containing the origin? Justify your answer. — 12

2(b). State Euler's theorem on a homogenious function. If $u = f(z - x, x - y, y - z)$, then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. — 12

2(c). Find the maximum and minimum values of u where, $u = \frac{4}{y} + \frac{32}{x}$ and $x + y = 4$. — 11

3(a). State mean value theorem and verify it for $f(x) = 3 + 2x - x^2$ in $0 \le x \le 1$. — 12

3(b) Expand $\cos x$ in powers of $\left(x - \frac{\pi}{4}\right)$. — 11

3(c). Find the equation for the tangent plane to the surface $x^2 + y^2 + z^2 = 25$ at the point $(-3,0,4)$. — 12

4(a). Find the local linear approximation of the function $f(x) = \tan x$ at $x_0 = 0$ and use it to approximate $\tan 2°$, also compare your approximation to the result directly by your calculator. — 10

4(b). Find the radius of curvature of the curve $x = a(\theta + \sin \theta), y = a(1 - \cos \theta)$ at $\theta = 0$. — 10

4(c). Use implicit differentiaion to find $\frac{\partial y}{\partial x}$ if $x^2y + 3xy^3 - x = 3$. — 07

4(d). Use chain rule to find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$ where $w = e^{xyz}, x = 3u + v, y = 3u - v, z = u^2v$. — 08

5. Evaluate any THREE of the followings –   35

   (a) $\int \frac{dx}{x^3 - 1}$

   (b) $\int \frac{dx}{3 + 2\cos x - \sin x}$

   (c) $\int \frac{x\,dx}{(x^2 + 4)\sqrt{x^2 + 9}}$

   (d) $\int \frac{5\sin x + 4\cos x}{2\sin x + 3\cos x} dx$

6. Evaluate any THREE of the followings: 35

   (a) $\int_0^{\frac{\pi}{2}} \frac{dx}{5 + 4\cos x}$

   (b) $\int_0^1 x^3 (1 - x^2)^{5/2} \, dx$

   (c) $\int_0^{\pi/2} \frac{dx}{1 + \sqrt{\cot x}}$

   (d) $\int_0^1 \frac{\ln(1 + x)}{1 + x^2} dx$

7(a). Define Gamma and Beta functions. Prove that $\left| \frac{1}{2} \right. = \sqrt{\pi}$ 12

7(b). Obtain reduction formula for $\int \cos^n x \, dx$, hence find $\int \cos^5 x \, dx$.   12

7(c). Find the average value of the function $f(x) = \sqrt{2x}$ over the interval $[0,4]$ and find all points in the interval at which the value of $f(x)$ is the same as the average value.   11

8(a). Find the area bounded by the curve $r = a(1 + \cos\theta)$ 12

8(b). Find the length of the arc of the cycloid $x = a(\theta - \sin\theta), y = a(1 - \cos\theta)$ 11

8(c). Find the volume of the solid generated by the revolution of the region bounded by the curve $y = \sqrt{x}$, the x-axis and the line $x = 4$ about x- axis.   12

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
Ph 1113
(Physics)

Time: 3 Hours.   Full Marks: 210
N.B. i)   Answer any THREE questions from each section in separate scripts.
     ii) Figures in the right margin indicate full marks.
     iii) Assume reasonable data if any missing.

SECTION – A

1(a). Discuss nonlinear nonhomogeneous equation. Show that superposition principle is valid only in case of linear homogeneous equation.   12

1(b). Calculate the average kinetic energy and the total energy of a body executing simple harmonic motion. Show that the principle of conservation of energy is obeyed by a harmonic oscillator.   13

1(c). A simple harmonic motion is represented by $y = 10 \sin\left(10t - \frac{\pi}{6}\right)$; where y is measured in meters, t in seconds, and phase angle in radians. Calculate (i) frequency (ii) time period (iii) the maximum acceleration and (iv) maximum velocity   10

2(a). Explain clearly free, forced, and damped vibrations. Discuss the phenomenon of resonance and give some of its practical applications.   12

2(b). Obtain an expression for the displacement on the case of damped oscillatory motion.   13

2(c). Deduce the frequency and quality factor for a circuit with $L = 2\,mH, C = 6\mu$, and $R = 2.2\,\Omega$..   10

3(a). Show that, for BCC structure, atomic packing fraction can be written as $\frac{\pi\sqrt{3}}{8}$.   10

3(b). What are the assumptions of Einstein's theory of specific heat of solid? Derive relation for lattice heat capacity following Einstein model.   15

3(c). Draw the following planes and directions: (110), (123), (112), [101], and [111].   10

4(a). Obtain an expression for the specific heat capacity of a solids on the basis of Debye's theory. How far do the results from these theories agree with experimental data?   13

4(b). Write down the outstanding properties of metals.   04

4(c). Show that the average kinetic energy per electron for a three-dimensional free electron gas at 0 K is $\overline{E_0} = \left(\frac{3}{5}\right) E_{F_0}$; where E_{F_0} is the Fermi energy at 0 K.   08

4(d). Gold has the same structure as copper. The velocity of sound in gold is 2100 ms^{-1} and that in copper is 3800 ms^{-1}. If the Debye temperature of copper is 348 K, determine the Debye temperature of gold. The densities of gold and copper are 1.93×10^4 kgm^{-3} and their atomic weights are 197.0 and 63.54 amu respectively.   10

5(a). What is meant by stopping potential in connection with the photo-electric effect? Show that the stopping potential varies linearly with the frequency of the incident radiation but is independent of its intensity.   12

5(b). Show that $\lambda' - \lambda = \dfrac{h}{m_0 c}(1 - \cos \emptyset)$, where the symbols have their usual meanings.   13

5(c). Calculate the De-Broglie wavelength of an electron whose speed is $9 \times 10^7 m/sec$.   10

6(a). What led De-Broglie to propose his matter-wave hypothesis? Discuss briefly the wave nature of matter and obtain an expression for the De-Broglie wavelength of matter waves.   12

6(b). Give an account of various quantum numbers used to specify completely the state of an electron in an atom.   13

6(c). Write down two sets of quantum numbers of electron for n = 2.   10

7(a). Define fission and fusion. Distinguish between them.   10

7(b). Find a relation between half-life, mean life, and decay constant.   15

7(c). Calculate how much energy liberate from 1 Kg of $_{92}U^{235}$.   10

8(a). What do you mean by chronic dose and acute dose? Explain the terms Acute effect, Latent effect, Somatic effect, and Genetic effect.   15

8(b). Explain radioactive equilibrium in short. Distinguish between secular and transient equilibria.   10

8(c). Calculate the mass defect and binding energy of a deuteron. Given that,   10

$$_0n^1 = 1.008665 \text{ amu,}$$
$$_1H^1 = 1.007825 \text{ amu , and}$$
$$\text{Mass of deuteron, } _1H^2 = 2.01403 \text{ amu.}$$