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).	What is meant by energy resources? How the natural resources are classified? Explain in brief.	08
1(b).	Distinguish between commercial and non-commercial energy. State the advantages and disadvantages of renewable energy sources.	08
1(c).	What is meant by the energy and energy cycle? Briefly explain the Earth energy cycle with necessary sketch.	12
1(d).	State the importance of non-conventional energy sources. Write a brief note on various energy resources of Bangladesh.	07

2(a).	What are the forms of energy? Briefly explain the energy conversion in photocells.	08
2(b).	Define nuclear energy. Explain the principle of nuclear power plant with schematic diagram.	10
2(c).	Explain renewable energy. Mention its various forms and elaborate on its potential in Bangladesh scenario.	10
2(d).	Differentiate between nuclear fission and nuclear fusion. How energy is liberated in nuclear reaction?	07

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

4(a).	What is petroleum oil? Write down the composition of petroleum.	05
4(b).	Define natural gas. What are the sources of natural gas? How natural gas was formed in nature? Explain in brief.	10
4(c).	Describe the Abiogenic and Carbide theory for the origin of petroleum. What are the drawbacks of Carbide theory?	08
4(d).	Compare the characteristics between natural gas and LPG.	05
4(e).	What is crude oil? Why distillation of crude oil is necessary?	07

SECTION – B

5(a).	What reactions are responsible for energy liberated within the sun? How solar radiation is reach on the earth surface?	07
5(b).	Describe schematically the eight possible pathways for the conversion of solar energy.	07
5(c).	How solar collectors are classified? Describe the construction of FPC.	07
5(d).	How a photovoltaic cell works? Describe with a neat sketch.	07
5(e).	With neat sketch describe how solar energy is used for desalination of water.	07
6(a).	Define biomass and bioenergy. How is it formed? Briefly describe the resource potential of biomass energy.	08
6(b).	Describe the origin of biomass energy. Explain the process of thermo-chemical conversion of biomass.	10
6(c).	Discuss in details the anaerobic digestion process. Explain the parameter to be controlled to achieve the biogas production efficiently.	12
6(d).	Describe various types of biogas plant.	05
7(a).	How power is extracted from water? Describe the classification of hydropower.	08
7(b).	Differentiate water wheel from water turbine.	05
7(c).	How wind power can be exploited? Prove that at an hour with average wind velocity produce more power than an hour with constant wind velocity.	07
7(d).	Write a berief note on vertical axis rotor.	07
7(e).	What factors are considered for selection of WECS? Explain the effects of turbulence.	08
8(a).	How geothermal energy is considered as renewable energy source? Briefly explain its growth history.	08
8(b).	How geothermal resource system can be classified? Explain.	07
8(c).	What are the environmental effects of geothermal energy? Explain in brief.	05
8(d).	Explain with neat sketch the closed cycle OTEC system for power generation.	08
8(e).	Briefly describe the power generation from single basin tide cycle system.	07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2017
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). Define over potential. Explain electrical double layer based on Helmholtz model.   10

1(b). What is electrode potential? Draw a complete diagram of 3-electrode electrochemical cell, and indicate its different sections.   07

1(c). Calculate the cell potential at 35°C of the cell   06
$$Sn/Sn^{2+}(0.05M)||Fe^{2+}(0.1M)/Fe$$
Given, $E^0_{Fe/Fe^{2+}} = 0.44V$ and $E^0_{Sn/Sn^{2+}} = 0.14V$

1(d). What is a fuel cell? Explain with diagram the mechanism of fuel cell. Based on Bangladesh perspective, write down the future of fuel cell market in our country.   12

2(a). What is radioactive decay? Derive an expression for the rate of radioactive decay.   10

2(b). Define nuclear binding energy. Explain how nuclear reactor works.   12

2(c). The radioactive decay constant of Radium is 1.36×10^{-11}. How many disintregrations per second occurs in 100g of Radium?   07

2(d). Shortly describe the Neutron-Induced Fission and Fusion reactions.   06

3(a). Define free energy. Explain the difference between Li and Li^+ battery. If we ask you to replace Li^+ battery in future, what would you do?   12

3(b) Complete the following equations: 09
i) $_{13}Al^{27} + {_2He^4} \rightarrow ? + {_0n^1} \rightarrow {_{14}Si^{30}} + ?$
ii) $_5B^{10} + {_2He^4} \rightarrow ? + {_0n^1} \rightarrow ? + e^+$

3(c). Deduce Nerust equation.   08

3(d). Draw a cyclic voltammogram and indicate its difference sections.   06

4(a). What is thermal and catalytic cracking? Write down the difference between thermal and catalytic cracking.   10

4(b). What is coal? Write down different types of coal with examples.   06

4(c). Write down the advantages and disadvantages of gaseous fuel over liquid and solid fuel.   07

4(d). Define natural gas. Write down the composition of natural gas. Write down the difference between natural gas and LPG. Explain co-generation system.   12

5(a). Define homogeneous and heterogeneous equilibria. "Chemical equilibrium is a dynamic process" – explain.   10

5(b). Derive the relation –   09

$$\frac{d}{dT}(lnk_p) = \frac{\Delta H^0}{RT^2}$$

5(c). 13.5 ml of HI is produced by the interaction of 8.1 ml of Hydrogen and 9.3 ml of Iodine vapor at $444°C$. Calculate the equilibrium constant at this temperature of the reaction   06
$$H_2(g) + I_2(g) \leftrightarrows 2HI(g)$$

5(d). Describe the application of the law of mass action of the following reaction: 10
$$PCl_5(g) \leftrightarrows PCl_3(g) + Cl_2(g)$$

6(a). What is meant by living polymer? Discuss the reaction mechanism of free radical polymerization.   10

6(b). Distinguish between thermosetting polymer and thermoplastic polymer.   06

6(c). Describe briefly the method of obtaining crude rubber from latex.   12

6(d). What is conducting polymer? Write down the advantages of conducting polymer over traditional polymer.   07

7(a). Discuss Ozone layer depletion and its effect on environment.   12

7(b). Expalin the biochemical effects of CO.   08

7(c). Write down the difference between BOD and COD.   08

7(d). Describe the method for the estimation of DO in water sample.   07

8(a). Explain the terms: 10
    i)   Optical fiber
    ii)   Properties of macromolecules

8(b). Write notes on the preparation, properties, and uses of Nylon 6: 6.   09

8(c). Write down the difference between plastics and rubber.   08

8(d). Explain the terms: 08
    i)   Number-average molecular weight
    ii)   Weight average molecular weight

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2017
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).	"Sociology is the science of human behavior and groups" – explain it.	10
1(b).	What is social stratification? Why are human societies stratified?	10
1(c).	Explain different types of society with their distinct character.	15

2(a).	What is culture? Differentiate between material culture and non-material culture.	10
2(b).	Where does subculture differ from counter culture?	10
2(c).	Explain the carriers of culture.	15

3(a).	What is industrialization?	05
3(b)	What is urban ecology? Critically explain urban growth models.	15
3(c).	What are the consequences of urban living?	15

4(a).	What is social control? Explain the role of social control to prevent deviant behavior.	10
4(b).	What is index crime? Explain different types of crime.	10
4(c).	Explain demographic transition theory of population.	15

SECTION – B

5(a).	What is organizational behavior? Describe the importance of studying organizational behavior for the students of Energy Science and Engineering.	15
5(b).	What is employee relation? Describe dynamics of employee relation.	20

6(a).	What is training? Explain importance of training need assessment.	15
6(b).	What is training evaluation? Critically describe the steps of training evaluation program.	20

7(a).	What is motivation?	05
7(b).	"Human needs are not of equal strength, but may emerge ion some priority pattern" explain it in the light of Maslow's need theory.	15
7(c).	Critically discuss effectiveness of Alderfer's ERG model in workplace.	15

8(a). What is stress? Describe causes of stress in workplace. 10

8(b). What is "Flex-time"? Explain the importance of flexible work schedule. 10

8(c). What is leadership style? Critically explain Fiedler's contingency model of leadership style. 15

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Energy Science and Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2017
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 $y = \sqrt{4 - x^2}$. Sketch the graph of $y = (x - 2)^2 + 1$.   12

1(b). Determine the values of a and b such that the function   14

$$f(x) = \begin{cases} x + a\sqrt{2}\sin(x) & for\ 0 \le x < \dfrac{\pi}{4} \\[2mm] 2x\cot(x) + b & for\ \dfrac{\pi}{4} \le x \le \dfrac{\pi}{2} \\[2mm] a\cos(2x) - b\sin(x) & for\ \dfrac{\pi}{2} < x \le \pi \end{cases}$$

is continuous for $0 \le x \le \pi$.

1(c). A function $f(x)$ is defined as follows: 09

$$f(x) = \begin{cases} x^2 \sin\left(\dfrac{1}{x}\right) & ;\ when\ x \ne 0 \\[2mm] 0 & ;\ when\ x = 0 \end{cases}$$

Discuss the differentiability of $f(x)$ at $x = 0$.

2(a). The volume of a spherical balloon is increasing at the rate of $12\ cm^3/sec$. Find the rate   12
of change of its surface at the instant when its radius is $6\ cm$.

2(b). Find the local linear approximation of the function $f(x) = \sqrt{x + 1}$ at $x_0 = 0$, and use it   12
to approximate $\sqrt{0.9}$ and $\sqrt{1.1}$.

2(c). Suppose that the side of a square is measured with a ruler to be $10\ cm$ with a   11
measurement error of at most $\pm \dfrac{1}{32}\ cm$. Estimate the error in the computed area of the
square.

3(a). Given $xy = 4$. Determine the maximum and minimum values of $4x + 9y$.   12

3(b)   State Rolle's theorem. Find the first three Taylor's polynomials for $x^3 - 3x^2 + 7x + 2$ 11
about $x = 2$.

3(c). If $u = \log(x^2 + y^2 + z^2)$, then find the value of $x\dfrac{\partial^2 u}{\partial y \partial z} + y\dfrac{\partial^2 u}{\partial z \partial x} + z\dfrac{\partial^2 u}{\partial x \partial y}$.   12

4(a). Given that $z = e^{xy}$, $x = 2u + v$, and $y = \dfrac{u}{v}$. Find $\dfrac{\partial z}{\partial u}$ and $\dfrac{\partial z}{\partial v}$ by using the chain rule.   08

4(b). If $x^2 + y^2 + z^2 - 2xyz = 1$, then show that $\dfrac{dx}{\sqrt{1-x^2}} + \dfrac{dy}{\sqrt{1-y^2}} + \dfrac{dz}{\sqrt{1-z^2}} = 0$ 12

4(c). *Find the equation of circle of curvature at the origin on the curve $x + y = x^2 + y^2 + x^3$.*   15

5.   Integrate the followings :

(a) $\int \dfrac{dx}{x^3 - 1}$ 11

(b) $\int \sin^{-1}\left(\sqrt{\dfrac{x}{x + a}}\right) dx$ 12

(c) $\int \dfrac{2x + 5}{\sqrt{x^2 - 2x + 2}} dx$ 12

6.   Evaluate the followings:

(a) $\displaystyle\int_0^{\frac{\pi}{2}} \dfrac{dx}{5 + 4\cos(x)}$ 12

(b) $\displaystyle\int_0^1 \dfrac{dx}{(x + 1)\sqrt{1 + 2x - x^2}}$ 11

(c) $\displaystyle\int_0^1 \dfrac{\log(x)}{\sqrt{1 - x^2}} dx$ 12

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

7(b). Prove that $\Gamma\left(\dfrac{1}{2}\right) = \sqrt{\pi}$.   12

7(c). Find the average value of the function $f(x) = \sqrt{x}$ over the interval $[1,4]$ and find all points   11
in the interval at which the value of $f(x)$ is the same as the average.

8(a). Find the area of the segment cut off from the parabola $y^2 = 4x$ by the straight line $y = 2x$.   11

8(b). Find the arc length of the curve $x^{2/3} + y^{2/3} = a^{2/3}$.   12

8(c). The region bounded by the curve $y = \sqrt{x}$, $0 \leq x \leq 4$ and the x-axis is revolved about the   12
x-axis to generate a solid. Find the volume of the generated solid.

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 progressive wave and stationary wave. Distinguish between them.   10

1(b).   What are energy density and energy current of a plane progressive wave? Obtain   15
        expressions for both.

1(c).   A wave along a string is given by the relation $y = 0.02 \sin(30t - 4.0x)$, where x is in   10
        meters and t is in seconds. Find its amplitude, frequency, speed, and wavelength.

2(a).   What are free, damped, and forced vibrations?   09

2(b).   Obtain the differential equation for the particle that vibrating with forced harmonic 16
        oscillation and hence obtain –
            i.   Expression of amplitude and
            ii. General form of the solution of differential equation.

2(c).   Find whether the discharge of a condenser for the following inductive circuit is   10
        oscillatory.
        $C = 0.1\ \mu F, L = 10\ mH, R = 200\ ohms$.
        If the circuit is oscillatory, calculate its frequency.

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

3(b)   Show that, according to Einstein model, lattice heat capacity can be written as –   16

$$C_v = 3R \left(\frac{\theta_E}{T}\right)^2 \frac{e^{\frac{\theta_E}{T}}}{\left(e^{\frac{\theta_E}{T}} - 1\right)^2}$$

        Hence, at low and high temperature, compare the result with experimental observations.

3(c).   Draw the following planes in a cubic crystal: 09
        $(111), (210), (0\bar{1}\bar{1})$.

4(a).   Explain Hall effect. Show that Hall coefficient $R_H = \frac{1}{ne}$ in $e.m.u.$ 15

4(b).   Derive an expression for the thermal conductivity from the free electron theory of metals. 10

4(c).   Calculate the inter collision time at room temperature and drift velocity in a field of   10
        $100\ Vm^{-1}$ in sodium. whose conductivity is $2.16 \times 10^7\ \Omega^{-1}m^{-1}$.

5(a). What is photoelectric effect? Establish Einstein's photoelectric equation and then describe (i)Work function, (ii)Plank's constant   13

5(b). Find the relation between phase velocity and group velocity.   12

5(c). The stopping potential for electrons emitted from a metal due to photoelectric effect is found to be 1 V for light for 2500 Å. Calculate the work function of the metal in eV.   10

6(a). What are meant by space quantization and spin quantization?   10

6(b). Explain correspondence principle.   10

6(c). Write down two sets of quantum numbers of electron for $n = 2$.   06

6(d). Calculate the smallest and longest wavelengths for Paschen series.   09

7(a). Define mass defect, packing fraction, and binding energy.   10

7(b). State the radioactive decay law and show that,   15
$$N = N_0 e^{-\lambda t}$$
Also show that, mean-life is inversely proportional to the decay constant.

7(c). How much time will it take for a 8 mc source to reduce 1 mc source (half-life of source is 10 years)?   10

8(a). What is radioactivity? Write down the basic difference among α, β, and γ decay.   10

8(b). Define fission and fusion. Distinguish between them.   05

8(c). What is meant by biological effects of radiation? Define Acute effect, Latent effect, Somatic effect, and Genetic effect.   10

8(d). Calculate the energy released by 1 gm of uranium in kilowatt hour.   10