

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 2nd Year Backlog Examination, 2018

EE 2113

(Electrical Machines)

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). Explain flux density, permeability, reluctance, and hysteresis. 12
- 1(b). What is magnetizing force? Explain hysteresis curve of magnetic material. 10
- 1(c). Describe the procedure of determining flux in a series parallel magnetic circuit. 13
- 2(a). Deduce the equation of induced voltage in a conductor moving in a magnetic field. How can the derivation of induced voltage be determined? 12
- 2(b). How dc generator can produce unidirection current from alternating current? 12
- 2(c). Describe the no-load magnetizing curve of a separately excited dc generator. What is field resistance line? 11
- 3(a). Compare the external characteristics of compound generator with shunt generator. What is degree of compounding? 12
- 3(b). What is armature reaction? Describe two methods for minimizing the effect of armature reaction in dc generator. 15
- 3(c). How load is divided between two shunt generators connected in parallel? Assume both generator has equal no-load terminal voltage. 08
- 4(a). Deduce the equation for force on a current carrying conductor in a magnetic field. How can the direction of force be determined? 12
- 4(b). Explain the torque Vs armature current characteristics of shunt motor and different compound motors. 13
- 4(c). Describe the operating principle of a three point starter for starting a dc motor. 10

SECTION – B

- 5(a). Describe the elementary theory of an ideal transformer. Deduce the E.M.F. equation of a transformer. 10
- 5(b). Explain the working principle of a single phase transformer with different kinds of load. 10
- 5(c). What is transformer voltage regulation? Why is the transformer rating in KVA? 05
- 5(d). The primary and secondary windings of a 30 KVA, 76000/230 V, 1-phase transformer have resistance of 10 Ω and 0.016 Ω respectively. The reactance of the transformer referred to the primary is 34 Ω . Calculate the primary voltage required to circulate full-load current when the secondary is short circuited. What is the power factor on short circuit? 10

- 6(a). Write short notes on: (i) star/star connection and (ii) delta/delta connection of a 3-phase transformer. 15
 What are the disadvantages of star/star connection?
- 6(b). Describe construction of induction motor. 10
- 6(c). A 3 ϕ induction motor is wound for 4 poles and is supplied from 50 Hz system. Calculate 10
 (i) the synchronous speed, (ii) the rotor speed when slip is 4%, and (iii) rotor frequency when rotor runs at 600 rpm.
- 7(a). Deduce the equation of starting torque of an induction motor. What is slip? 11
- 7(b). Why does the rotor rotate in an induction motor? Explain complete torque/speed curve of a three-phase machine. 12
- 7(c). The power input to the rotor of 440 V, 50 Hz, 6 pole, 3-phase induction motor is 80 kW. 12
 The rotor electromotive force is observed to make 100 complete alternations per minute. Calculate (i) the slip, (ii) the rotor speed, and (iii) rotor copper losses per phase.
- 8(a). Describe the basic principle and construction of an alternator. 11
- 8(b). What is armature reaction? Explain the effect of armature reaction in an alternator for different loads. 12
- 8(c). In a 50 KVA, star-connected, 440 V, 3-phase, 50 Hz alternator, the effective armature resistance is 0.25 Ω per phase. The synchronous reactance is 3.2 Ω per phase and leakage reactance is 0.5 Ω per phase. Determine at rated load and unity power factor: (i) internal e.m.f. E_a , (ii) no-load e.m.f. E_o , (iii) percentage regulation on full-load, (iv) value of synchronous reactance which replaces armature reaction. 12

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 2nd Year 1st Term Backlog Examination, 2018

Math 2113

(Linear Algebra & Vector Analysis)

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 consistent and inconsistent system of linear equations. If possible, find the solutions of the followings system of linear equations:

$$\begin{aligned}x_1 + x_2 + 2x_3 + x_4 &= 5 \\2x_1 + 3x_2 - x_3 - 2x_4 &= 2 \\4x_1 + 5x_2 + 3x_3 &= 7\end{aligned}$$

- 1(b). Reduce the matrix A into normal form by the elementary transformations and hence

find its rank. $A = \begin{pmatrix} 0 & 2 & 3 & 4 \\ 2 & 3 & 5 & 4 \\ 4 & 8 & 13 & 12 \end{pmatrix}$

- 1(c). Show that any square matrix can be expressed as the sum of a symmetric and skew-symmetric matrix.

- 2(a). Examine the following vectors for linear dependence and find the relationship if it exists. $x_1 = (1, 2, 4)$, $x_2 = (2, -1, 3)$, $x_3 = (0, 1, 2)$ and $x_4 = (-3, 7, 2)$

- 2(b). Define column space. Find the basis and dimension of column space of following matrix.

$$B = \begin{bmatrix} 2 & 4 & -1 & 6 \\ -1 & -2 & 2 & -3 \\ 1 & 2 & -2 & 3 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

- 2(c). Find all the eigenvalues and an eigen vector corresponding to lowest eigenvalue of the

following matrix: $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ -2 & -1 & 3 \end{bmatrix}$

- 3(a). Use matrix multiplication to find the image of vector $(2, -1, 2)$ if it rotated 30° clockwise about the positive X axis and then followed by a 45° counterclockwise about the positive Z axis

- 3(b). Let R^2 have the Euclidean inner product. Use the Gram Schmidt orthogonalization process to transform the basis $\{\underline{u}_1, \underline{u}_2\}$ into an orthonormal basis, where $\underline{u}_1 = (1, -3)$ and $\underline{u}_2 = (2, 2)$

- 3(c). Define basis of the vector space. Find a subset of vector $\underline{v}_1 = (1, 0, 1, 1)$, $\underline{v}_2 = (-3, 3, 7, 1)$, $\underline{v}_3 = (-1, 3, 9, 3)$ and $\underline{v}_4 = (-5, 3, 5, -1)$ that forms a basis for the space spanned by those vectors. Also express the vector that is not in the basis as a linear combination of the basis vectors.

- 4(a). For the inner product $\langle f, g \rangle = \int_0^{2\pi} f(x)g(x)dx, c[0,2\pi]$, show that the set $S = \{1, \sin x, \cos x, \sin 2x, \cos 2x \dots \dots \sin nx, \cos nx\}$ is orthogonal. 12
- 4(b). Define subspace of a vector space. If $S = \{(x, y, z): x + y = z\}$. Is S a subspace of \mathbb{R}^3 ? If so then find its dimension. 13
- 4(c). Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be the linear mapping defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$. Find the rank and nullity of T 10

SECTION - B

- 5(a). Define vector valued function. Given the space curve $x = t, y = t^2, z = \frac{2}{3}t^3$, find unit tangent vector, unit normal vector and unit binomial vector, i. e; $\underline{T}, \underline{N}, \underline{B}$ 15
- 5(b). Find an equation for the tangent plane and normal line to the surface $2xz^2 - 3xy - 4x = 7$ at the point $(1, -1, 2)$ 10
- 5(c). Find the ^{directional} ~~dimensional~~ derivative of $x^2y^2z^2$ at the point $(1, 1, -1)$ in the direction of the tangent to the curve $x = e^t, y = \sin(2t+1), z = 1 - \cos t$ at $t = 0$ 10
 $y = 1 + \sin 2t$
- 6(a). A particle moves along the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$, where t is the time. Find the components of its velocity and acceleration at time $t = 1$ in the direction $\underline{i} - 3\underline{j} + 2\underline{k}$ 12
- 6(b). Determine whether $\vec{F} = (2xy + z^3)\underline{i} + x^2\underline{j} + 3xz^2\underline{k}$ conservative force field or not. Also find the scalar potential and hence find the work done in moving an object in this field from $(1, -2, 1)$ to $(3, 1, 4)$ 15
- 6(c). Show that $\nabla r^n = nr^{n-2}\underline{r}$, where $r = |\underline{r}|$ 08
- 7(a). Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point $(2, -1, 2)$ 10
- 7(b). Write physical interpretation of divergence. Find the value of n for which the vector $r^n \underline{r}$ is solenoidal, where $\underline{r} = x\underline{i} + y\underline{j} + z\underline{k}$ 13
- 7(c). If $\underline{F} = 3xy\underline{i} - y^2\underline{j}$, evaluate $\int_c \underline{F} \cdot d\underline{r}$ where c is the curve in the xy plane, $y = 2x^2$ from $(0, 0)$ to $(1, 2)$. 12
- 8(a). Let $\underline{F} = 2xz\underline{i} - x\underline{j} + y^2\underline{k}$, evaluate $\int_v \int \int \underline{F} \cdot d\underline{v}$ where v is the region bounded by the surfaces $x = 0, y = 0, y = 6, z = x^2, z = 4$ 11
- 8(b). Using Green's theorem $\oint_c (2xy - x^2)dx + (x + y^2)dy$, where c is the closed curve of the region bounded by $y = x^2$ & $y^2 = x$ 10
- 8(c). Verify Stokes's theorem for $\vec{F} = (2y + z)\underline{i} + (x - z)\underline{j} + (y - z)\underline{k}$ taken over the triangle ABC cut from the plane $x + y + z = 1$ by the coordinate planes 14

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year Backlog Examination, 2018

Course No Ch. 1213

(Chemistry II)

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 about the collision theory of the reaction rate. Represent graphically about the exothermic and endothermic reaction mentioning energy of activation E_a . 11
- 1(b). What is elementary reaction? Derive rate equation for the chemical reaction $2A \rightarrow \text{Products}$. 10
- 1(c). Why high molecularity reaction are rare? Explain with diagram. 07
- 1(d). For a certain first order reaction $t_{0.5}$ is 100 sec. How long will it take for the reaction to be completed 75%? 07
- 2(a). Deduce the relation $I = I_0 e^{-ax}$, where symbols have their usual meanings. 10
- 2(b). Explain photosynthesis in the light of photochemical reaction. 10
- 2(c). Discuss briefly fluorescence and chemiluminescence. 08
- 2(d). A certain substance absorbs 2.01×10^{16} quanta of light per second. At the end of 10 minutes, it is observed that 0.0015 mole of the irradiated substance has reacted. What is the quantum yield of the substance? 07
- 3(a). Explain the following terms with examples: 09
i) Electrophiles ii) Nucleophiles iii) Free radicals .
- 3(b). What do you mean by homogeneous and heterogeneous catalytic reactions? 06
- 3(c). How does a catalyst accelerate the speed of a reaction? Explain with proper energy profile diagram. 12
- 3(d). Write note on "enzyme catalysis". 08
- 4(a). Discuss the mechanism of enzyme catalyzed reaction. 10
- 4(b). Illustrate briefly the addition and condensation polymerization process with examples. 10
- 4(c). What is microorganism? Write down the various uses of microorganism in industry. 10
- 4(d). How does rate of a reaction vary with temperature? 05

SECTION – B

- 5(a). Define the term frequency and wave-number. 08
- 5(b). Why atomic spectrum appears as sharp line spectrum? 08
- 5(c). The spectrum arising from electronic transition occurs as a broad band. Justify. 08
- 5(d). Give the different types of electronic transition that can occur in an organic molecule. 11
- 6(a). Discuss the electrochemical theory of corrosion of a metal in aqueous solution with reference to rusting. 12
- 6(b). Discuss the various factors that affect corrosion. 12
- 6(c). Illustrate various methods of controlling corrosion. 11
- 7(a). What is an adsorption isotherm? Show under what conditions the Langmuir adsorption isotherm equation becomes identical with the Freundlich adsorption isotherm equation. 12
- 7(b). How is chemisorption distinguished from physisorption? 08
- 7(c). Discuss about the applications of adsorption. 11
- 7(d). Define fractional coverage (θ). 04
- 8(a). Derive Langmuir adsorption isotherm equation in the form $y = \frac{ap}{1+bp}$. How is this equation verified? 12
- 8(b). Distinguish between the terms adsorption and absorption. 08
- 8(c). Discuss the behavior of adsorption with increasing temperature. 08
- 8(d). Draw the typical adsorption isotherms obtained in the case of unimolecular and multimolecular adsorption. 07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year Backlog 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). A function $f(x)$ is defined as follows: 15
$$f(x) = \begin{cases} -x + 2 & \text{for } x < 2 \\ x - 2 & \text{for } x \geq 2 \end{cases}$$

Discuss the continuity and differentiability of $f(x)$ at $x = 2$.
- 1(b). Find the domain and range of $f(x) = \frac{x+1}{5-x}$. 10
Sketch the graph of the function $y = |x + 1| + 2$.
- 1(c). If $y = x^x + \sin x \log x$, then find $\frac{dy}{dx}$. 10
- 2(a). State mean value theorem and verify it for $f(x) = (x - 1)(x - 2)(x - 3)$ in $0 \leq x \leq 4$. 10
- 2(b). Define maxima and minima of a function at a given point. Show that $f(x) = x^3 - 6x^2 + 24x + 4$ has neither a maximum nor a minimum. 15
- 2(c). Use chain rule to find $\frac{\partial z}{\partial u}$ and $\frac{\partial z}{\partial v}$ where $z = e^{xy}$, $x = 2u + v$, $y = \frac{u}{v}$. 10
- 3(a). Expand $\log x$ in powers of $(x - 2)$. 10
- 3(b). State Rolle's theorem. 12
Expand $5x^2 + 7x + 3$ in powers of $(x - 3)$.
- 3(c). If $u = f(x^2 + 2yz, y^2 + 2zx)$, then find the value of 13
 $(y^2 - zx) \frac{\partial u}{\partial x} + (x^2 - yz) \frac{\partial u}{\partial y} + (z^2 - xy) \frac{\partial u}{\partial z}$.
- 4(a). Use implicit differentiation to find $\frac{dy}{dx}$ if $x^3 + y^3 = 3xy$. 07
- 4(b). Find the equation of the tangent plane to the surface $z = 4x^3y^2 + 2y$ at the point 08
 $(1, -2, 12)$.
- 4(c). If $V = z \tan^{-1}\left(\frac{y}{x}\right)$, then find $\frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2}$. 08
- 4(d). Determine the radius of curvature and center of curvature of the curve $y = x^3 + 2x^2 + x + 1$ at $(0, 1)$. 12

SECTION – B

- 5(a). Integrate $\int (3x - 1)\sqrt{x^2 - x + 1} dx$ 12
- 5(b). Integrate $\int \frac{dx}{(x^2+2)\sqrt{x^2+3}}$ 13
- 5(c). Integrate $\int \frac{e^x}{x} (1 + x \log x) dx$ 10
- 6(a). Evaluate 11
 $\int_2^3 \frac{dx}{(x-1)\sqrt{x^2-2x}}$
- 6(b). Evaluate 12
 $\int_0^{\pi/2} \log(\cos x) dx$
- 6(c). Evaluate 12
 $\int_0^2 x \sqrt[3]{8-x^3} dx$
- 7(a). Deduce a reduction formula for $\int \tan^n x dx$, hence evaluate $\int \tan^5 x dx$ 11
- 7(b). Define Gamma and Beta functions. Prove that, 14
$$\int_0^{\pi/2} \sin^p \theta \cos^q \theta d\theta = \frac{\Gamma(p + 1/2)\Gamma(q + 1/2)}{2\Gamma(p + q + 2/2)}$$
- 7(c). Determine the average value of the function $f(x) = 2x$ over the interval $[0, 4]$ and find all 10
points in the interval at which the value of $f(x)$ is the same as the average.
- 8(a). Find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$. 12
- 8(b). Find the entire length of the curve $x^{2/3} + y^{2/3} = 2^{2/3}$. 13
- 8(c). Find the volume of the solid that is obtained when the region under the curve $y = \sqrt{x}$ over 10
the interval $[1, 4]$ is revolved about the x-axis.

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year Backlog 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). “Sociology is the science of human behavior and groups.” Explain it. — 10
1(b). Explain different types of society with their distinct character. 10
1(c). What is social stratification? Why are human society stratified? 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 socialization? How does socialization contribute in constructing reality? Explain with example. 15
3(b). “Role of family is lost or modified”-what do you think? Give reason in favor of your opinion. 15
3(c). Describe functions of marriage. 05
4(a). What is urbanization? What are the consequence of urban living? 15
4(b). What is social control? Explain the role of social control to prevent deviant behavior. 10
4(c). What is social structure? What are the basic elements of social structure? 10

SECTION – B

- 5(a). What is meant by behavioral science? Explain role of behavioral science in achieving organizational goal. 15
5(b). Describe key elements of organizational behavior. 10
5(c). Explain relation between training, education and development. 10
6(a). What do you mean by training? Explain importance of training in any organization. 15
6(b). Critically explain the steps of training evaluation with example from real world. 20
7(a). What is motivation? Discuss the motivational theories. 15
7(b). What is employee relation? Explain elements of good employee relation. 15
7(c). What do you mean by training need assessment? Explain importance of training need assessment. 05
8(a). Explain causes and consequences of stress in workplace. Describe importance of counselling in reducing stress. 15
8(b). Discuss in brief organizational designs. 05
8(c). What is leadership skills? Discuss the leadership styles. 15

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year 2nd Backlog Examination, 2017

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). What is simple harmonic motion? Derive an expression for average kinetic energy and average potential energy of a simple harmonic motion. 13
- 1(b). Explain interference phenomena of sound wave. 12
- 1(c). A wave along a string is given by the relation $y = 0.02 \sin(30t - 4.0x)$, where x is in meters and t is in seconds. Find its amplitude, frequency, speed and wavelength? 10
- 2(a). What are free, damped, and forced vibration? 09
- 2(b). Obtain the differential equation for the particle that vibrating with forced harmonic oscillation, and hence show that the solution of differential equation can be written as
$$y = \frac{f_0}{\sqrt{(\omega^2 - p^2)^2 + 4\lambda^2 p^2}} \sin \left[pt - \tan^{-1} \left\{ \frac{2\lambda p}{(\omega^2 - p^2)} \right\} \right]$$
 16
- 2(c). Find whether the discharge of a condenser for the following inductive circuit is oscillatory. $C = 0.1 \mu F$, $L = 10 \text{ mH}$, $R = 200 \text{ ohms}$. If the circuit is oscillatory, calculate its frequency. 10
- 3(a). Define Primitive cell and Atomic Packing fraction. Show that, for FCC structure, atomic packing fraction is 74%. 10
- 3(b). What is Miller indices? Show that, for a cubic lattice, if (hkl) are corresponding Miller indices, then, interplanar spacing can be written as
$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$
 15
where the symbols have their usual meaning.
- 3(c). Draw the following planes in a cubic crystal – 10
(111), (100), (011), (210), (110)
- 4(a). What is Hall effect? Explain quantitatively why the Hall constant R_H is inversely proportional to the electron concentration N . 13
- 4(b). Derive an expression for velocity of electron according to Band theory. 12
- 4(c). A Cu strip 2.0 cm wide and 1.0 mm thick is placed in a magnetic field with $B = 1.5 \text{ wb/m}^2$ perpendicular to the strip. If a current of 200 A is set up in the strip, what Hall potential difference appears across the strip? $n = 8.5 \times 10^{28} \text{ electrons/m}^3$. 10

SECTION – B

- 5(a). What is quantum theory of light? What is meant by Phase velocity and Group velocity? Find a relation between them. 15
- 5(b). Explain Bohr's correspondence principle. 10
- 5(c). Write down two sets of quantum numbers of electron for $n = 2$. 10
- 6(a). Describe the Vector atom model and explain the differential quantum numbers associated with it. 15
- 6(b). Write short notes on – 10
- (i) De-Broglie hypothesis
 - (ii) Space quantization
- 6(c). Calculate the limiting value of wavelengths for Paschen series and Pfund series. 10
- 7(a). Define Binding energy. Draw the Binding energy versus Mass number graph. 07
- 7(b). What is Isotope, Isobar, and Isotones? Show examples. 09
- 7(c). Write down the basic difference among α , β and γ decay.. 09
- 7(d). Calculate the mass defect and binding energy for a deuteron. Given that – 10
 ${}^1_0n = 1.008665 \text{ amu}$; ${}^1_1H = 1.007825 \text{ amu}$ and mass of deuteron ${}^2_1H = 2.01403 \text{ amu}$.
- 8(a). What is meant by biological effects of Radiation? Discuss Somatic effect and Genetic effect. 10
- 8(b). Define half-life and mean life. Find a relation between them. 10
- 8(c). Mention some application of radioactivity. 05
- 8(d). Half-life of Radium is 1672 years. Calculate the time in which 1 gm of Radium is reduced by 2.1 mg. 10

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year 2nd Backlog 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). What is electrode potential? Derive Nerust theory of electrode potential. 10
- 1(b). Define Gibb's free energy and electrical double layer. Draw and explain an electrochemical cell with three electrode system. 10
- 1(c). Calculate the value of 'C' from the following cell at 33 °C, if the *emf* of the cell is 0.0152 volts – 07
- $$Al/AlCl_3(0.15M) || AlCl_3(C)/Al$$
- 1(d). Write short notes on 'future trend of using fuel cell in Bangladesh'. 08
- 2(a). Define following terms – 10
- (i) Packing fraction
 - (ii) Radiochemistry
 - (iii) Artificial Radioactivity
 - (iv) Nuclear Binding Energy.
- 2(b). 'Half-life of a radioelement is independent of its total mass' – explain. 10
- 2(c). The radioactive decay constant of Radium is 1.36×10^{-11} . How many disintegration per second occurs in 100 g of Radium. 07
- 2(d). Complete the following reactions – 08
- (i) ${}_{13}Al^{27} + _ \rightarrow {}_{15}P^{30} + {}_0n^1 \rightarrow _ + e^+$
 - (ii) ${}_{5}B^{10} + _ \rightarrow {}_7N^{13} + {}_0n^1 \rightarrow _ + e^+$
- 3(a). What is 'Local action cell' in electrochemical corrosion? Write down the mechanism of environmental corrosion. 10
- 3(b). What is specific conductance? 0.5 N solution of a salt placed between two Platinum electrodes, 20 cm apart and area of cross-section 4 cm² has a resistance of 25 ohm. Calculate the equivalent conductance of the solution. 09
- 3(c). 'Li ion battery is rechargeable, whereas Li battery is not' – explain. 09
- 3(d). What is electroplating? How pure gold can be separated from impure gold with the help of electrolysis? 07
- 4(a). Define fuel. 'Coal is an unrenewable source of fuel' – explain. 10
- 4(b). What is a co-generation system? Write down merits and demerits of co-generation system in our daily life. 10
- 4(c). What is LNG? Write down the roles of Natural Gas in country's development. 08
- 4(d). Write short notes on – 'Oil distillation process' 07

SECTION – B

5(a).	What is meant by homopolymer and co-polymer?	06
5(b).	Discuss the mechanism of ionic polymerization.	12
5(c).	Differentiate between thermosetting and thermoplastic polymer.	12
5(d).	What is conducting polymer? Give examples.	05
6(a).	Establish a relation between K_p and K_c .	08
6(b).	What is L�chatelier's principle? Discuss its application for the synthesis of ammonia.	11
6(c).	Write short notes on 'criteria for spontaneity of processes'.	10
6(d).	The equilibrium constant (K_c) at 700 K for the dissociation of HI is 0.134. calculate the amount of HI of still remaining at equilibrium, when started with 12.8 g of HI.	06
7(a).	Write down the difference between chain polymerization and step polymerization.	10
7(b).	Explain the terms – (i) Glass transition temperature (ii) Optical fiber	10
7(c).	Distinguish between plastic and rubber.	08
7(d).	Discuss the effect of hydrocarbon pollutants on human health.	07
8(a).	Define DO, BOD, and COD; and write down the impact of its variation from the acceptable range in drinking water.	11
8(b).	What are the sources of NO_x ? Discuss the harmful effect of NO_x on human health.	09
8(c).	Explain the causes of depletion of ozone layer. Why is the ozone layer important for us?	10
8(d).	What is free available Chlorine?	05

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year Backlog 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 $f(x) = \frac{x-3}{2x+1}$. Sketch the graph of the function $y = (x-3)^2 + 1$. 11
- 1(b). A function $f(x)$ is defined as follows – 15
- $$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2-x & \text{for } 1 \leq x \leq 2 \end{cases}$$
- Discuss the continuity and differentiability of $f(x)$ at $x = 1$.
- 1(c). Find $\frac{dy}{dx}$, when $\log(xy) = x^2 + y^2$. 09
- 2(a). At a certain instant the edge of a cube is 5 cm, and the volume is increasing at a rate of $2 \text{ cm}^3/\text{minute}$. At what rate is the area of surface is increasing? 13
- 2(b). Find the local linear approximation of the function $f(x) = \sin x$ at $x_0 = 0$, and use it to approximate $\sin 2^\circ$, also compare your approximation to the result directly by your calculator. 10
- 2(c). Define error propagation. Suppose that the side of a square is measured with a ruler to be 5 inches with a measurement error of at most $\pm \frac{1}{16}$ inch. Estimate the error in the computed area of the square. 12
- 3(a). State Rolle's Theorem. Expand $x^3 + 2x^2 - 2$ in powers of $(x - 2)$. 12
- 3(b). Discuss the maxima and minima of $12(\log x + 1) + x^2 - 10x + 3$. 12
- 3(c). If $u = x^2 - y^2 - 2xy + y + z$, then find the value of the following – 11
- $$(x + y) \frac{\partial u}{\partial x} + (x - y) \frac{\partial u}{\partial y} + (y - x) \frac{\partial u}{\partial z}$$
- 4(a). Suppose that $w = e^{xyz}$, $x = 3u + v$, $y = 3u - v$, $z = u^2v$. Find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$ by using the chain rule. 12
- 4(b). Find the radius of curvature and center of curvature at the point (3,1) on the curve $y = x^2 - 6x + 10$. 12
- 4(c). Evaluate the value of $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$ when $u = (x^2 + y^2 + z^2)^{\frac{1}{2}}$. 11

SECTION - B

5. Evaluate any THREE of the followings -- 35
- (a) $\int \frac{dx}{x^3 + 1}$
- (b) $\int \frac{dx}{3 + 2 \cos x + 2 \sin x}$
- (c) $\int \frac{dx}{x^{1/2}(1+x)^{5/2}}$
- (d) $\int e^x \left(\frac{1-x}{1+x^2} \right) dx$
6. Evaluate the followings:
- (a) $\int_0^1 \frac{x \sin^{-1} x}{\sqrt{1-x^2}} dx$ 11
- (b) $\int_0^{\pi/2} \frac{dx}{1 + \sqrt{\tan x}}$ 11
- (c) $\int_0^{\pi/2} \ln(\sin x) dx$ 13
- 7(a). Obtain reduction formula for $\int \sin^n x dx$, hence find $\int \sin^5 x dx$. 10
- 7(b). Define Beta function and Gamma function. Establish the relation between Beta function and Gamma function. 14
- 7(c). Find the average value of the function $f(x) = x$ over the interval $[2,4]$ and find all points in the interval at which the value of $f(x)$ is the same as the average. 11
- 8(a). Find the area bounded by the parabola $y^2 = 4ax$ and its latus rectum. 11
- 8(b). Find the arc length of the cardioid $r = a(1 - \cos \theta)$. 12
- 8(c). Find the volume of the solid generated by the revolution of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about x -axis. 12

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Energy Science and Engineering

B. Sc. Engineering 1st Year 2nd Backlog Examination, 2017

ESE 1101

(Fundamentals of Energy Resources)

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? Briefly explain the advantages and disadvantages of non-conventional energy sources. 14
- 1(b). Briefly explain the following energies – 06
(i) Primary Energy
(ii) Secondary Energy
(iii) Commercial Energy
- 1(c). What is meant by energy cycle? Briefly explain the flow of energy in earth-energy cycle with neat sketch. 15
- 2(a). Define nuclear energy. Explain the principle of nuclear power plant with schematic diagram. 14
- 2(b). Differentiate between nuclear fission and nuclear fusion. How does energy get liberated in nuclear reaction? 11
- 2(c). Write a brief note on sources, reserve, and classification of natural gas. 10
- 3(a). What is coal and how it is formed? Describe in details the process of metamorphosis of peat to coal. 13
- 3(b). Describe the several stages in the conversion of wood to coal with schematic diagram. 10
- 3(c). How coal is classified according to ASTM? Explain in brief. 12
- 4(a). What is petroleum oil? Write down the composition of natural gas. 07
- 4(b). Illustrate the origin and formation of petroleum along with organic and inorganic theories. 15
- 4(c). Distinguish between LPG and LNG. 05
- 4(d). Define natural gas. How was natural gas formed in nature? 08

SECTION – B

- 5(a). What is solar energy? Why solar radiation is less on the earth surface than that on the extraterrestrial region? Explain. 10
- 5(b). How solar radiation data can be obtained for a location where there is no radiation measuring facility? Explain. 07
- 5(c). With a schematic diagram describe the construction of a solar hot water collector. 10
- 5(d). How does a PV cell work? Describe with neat sketch. 08
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- 6(a). Define biomass and bio-energy. What are the disadvantages of using biomass in row form? 12
- 6(b). Why do we need biomass conversion? Explain the process of getting liquid fuel from biomass. 12
- 6(c). What is meant by anaerobic digestion process? Explain how biogas is obtained through this process. 11
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- 7(a). Describe the classification of hydro electric power plants. 09
- 7(b). Describe how pumped storage power plant works. 09
- 7(c). What are the different types of water turbines used in hydro power plants? Explain. 07
- 7(d). How does wind energy conversion take place? Show that an hour with an average velocity must produce more power than an hour with a constant wind speed. 10
-
- 8(a). Write down the fields of application of geothermal energy. 09
- 8(b). What are the environmental effects of geothermal energy? Explain in brief. 07
- 8(c). What is meant by OTEC? With neat sketch describe closed cycle OTEC system. 10
- 8(d). Describe with neat sketch how single basin tidal cycle system works. 09