Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2017
IPE 1101
Manufacturing Process-I

Full Marks: 210   Time: 03 hrs

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 missing any.

SECTION–A

1. (a) What is meant by manufacturing process? Name five different manufacturing processes and give example in each case. — 12
   (b) Briefly discuss the seven main stages of sand casting process cycle. — 13
   (c) What is casting defect? Explain the following casting defects with their causes and remedies- — 10
       i)   Hot Spot   ii)   Cold Spot   iii)   Mis-run

2. (a) Explain the precision investment casting process with neat sketch. — 16
   (b) Write down the step by step procedure of shell mold casting with necessary sketches. — 10
   (c) Write down the differences between hot chamber and cold chamber die casting. — 09

3. (a) Briefly describe the squeeze casting process and write down its advantages and limitations. — 15
   (b) Write down the essential properties of a good core. — 08
   (c) Write down the working principle of extrusion process for plastic product manufacturing with necessary sketches. — 12

4. (a) What is blow molding? Briefly discuss the injection blow molding and stretch blow molding process. — 15
   (b) What is welding? What are the requirements of a high quality weld? — 10
   (c) Write down the types of welding joint. — 05
   (d) What is the main difference between extrusion and injection molding process? — 05

SECTION–B

5. (a) Write down the advantages and disadvantages of submerged arc welding. — 12
   (b) Describe the types of flames obtained in gas welding process with mentioning their applications. — 12
   (c) Differentiate between TIG and MIG. What is resistance welding process? — 11

6. (a) State the important functions of flux used in metal arc-welding process. — 08
   (b) Describe various types of forging operations. — 12
   (c) Explain different types of sheet-metal forming process. — 15

7. (a) What are the basic differences among welding, soldering and brazing? — 10
   (b) Explain different types of rolling defects and various methods to overcome them. — 15
   (c) Differentiate between tube drawing and wire drawing. — 10

8. (a) A solid cylindrical slug made of 304 stainless steel is 150 mm in diameter and 100 mm high. It is reduced in height by 50% at room temperature, by open die-forging with flat dies. Assuming that the co-efficient of friction is 0.2 and the absolute value of the true strain is 0.69; calculate the forging force at the end of the stroke. — 15
   (b) Write short notes on: — 12
       i)   Electron-beam welding   ii)   Laser-beam welding
   (c) Differentiate between hot extrusion and cold extrusion. — 08

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B.Sc. Engineering 1st Year 1st Term Examination, 2017
CHEM 1111
Chemistry

Full Marks: 210   Time: 03 hrs

N.B: i) *Answer any THREE questions from each section in separate scripts.*
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SECTION–A

1. (a) Write down the main feature of valance bond theory of complex compound formation. Discuss about the success of this theory.   13

     (b) Write down the co-ordination number and hybridization of tetrahedral, octahedral, square planar, trigonal bi-pyramidal and square pyramidal shapes.   05

     (c) Discuss Sidjurck's theory of complex compound formation with examples.   13

     (d) Draw possible isomers of ML_5X and ML_4X_2 complexes. [Here M represents central metal atom and $L\&X$ represents ligand]   04

2. (a) Explain rate of reaction and rate constant with examples. Write down their significance.   10

     (b) Describe Lindemann-Hinshelwood unimolecular reaction mechanism. In what conditions it shows first order or second order reaction mechanism?   13

     (c) What is chain reaction? Write down the name of reaction steps with example.   05

     (d) Compound A decomposes to B and C and reaction is first order. At 25^0 C the rate constant for the reaction is 0.450 s^{-1}. What is the half-life of A at 25^0 C?   07

3. (a) What is equivalent conductance? How does it vary with $\sqrt{concentration}$ for strong and weak electrolytes?   10

     (b) What is electrophoretic effect? Describe Kholrausch's law of independent migration of ions.   12

     (c) What is glass electrode? What are the merits and demerits of glass electrode?   08

     (d) Does $Zn + CuSO_4 = ZnSO_4 + Cu$ reaction spontaneous? Give a potential proof. [Given $E^0_{Cu^{2+}|Cu} = +0.34V$ and $E^0_{Zn^{2+}|Zn} = -0.76V$]   05

4. (a) What is transport number? Describe moving boundary method of determining transport number.   12

     (b) Derive Nernst's theory of determining electromotive force of a cell.   10

     (c) What is liquid junction potential?   05

     (d) Discuss about H-bonding?   08

SECTION–B

5. (a) Explain the terms   09
         i)   Congruent melting point   ii)   Eutectic point   iii)   CST

     (b) Determine how many components are present in the following systems: 06
         i)   Only NH_4Cl is heated in a closed vessel.
         ii) $KCl + water \rightleftharpoons KCl \text{ hydrate}$.

     (c) Derive Gibb's phase rule.   10

     (d) Describe the phase diagram of water-phenol system   10

6. (a) *"Adsorption is a surface phenomena"*-explain.   06

     (b) Discuss Langmuir theory of adsorption and derive an expression for Langmuir monolayer adsorption isotherm.   15

6. (c) What signs of ΔH and ΔS in case of physical adsorption are expected? Justify your answer.   06

    (d) 100 ml of 0.3 M acetic acid (CH_3COOH) is shaken with 0.8 g of wood charcoal. The final concentration of the solution after adsorption is 0.125 M. Calculate the weight of acetic acid adsorbed per gram of carbon?   08

7. (a) Explain the terms: 09
    　　　　　　　i) Emulsion ii) Gel iii) Peptization
    (b) Describe the electrodialysis method for the purification of colloids.   08
    (c) What are meant by electrical double layer and zeta potential? Explain the formation of electrical double layer by Stern theory.   13
    (d) What is micelle?   05

8. (a) Explain sedimentation potential and dorn effect of colloids?   10
    (b) Write down the application of colloid in our daily life.   10
    (c) Show that Freundlich adsorption isotherm is a special case of Langmuir isotherm.   10
    (d) Explain why does colloid exhibit Tyndall effect?   05

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2017
HUM 1111
Economics

Full Marks: 210   Time: 03 hrs

N.B: i) *Answer any THREE questions from each section in separate scripts.*
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iii) *Assume reasonable data if missing any.*

SECTION–A

1. (a) Define Economics and distinguish carefully between positive and normative economics.   15
   (b) "Multiplicity of wants and scarcity of means are the two foundations."-Discuss.   10
   (c) Explain production possibilities frontier on the basis of scarcity, choice and opportunity cost.   10

2. (a) How does technology and government policy affect the supply of any goods and services?   05
   (b) Enumerate the factors which cause a change in the demand for a commodity.   10
   (c) The R.J Smith Corporation is a publisher of romance novel- just stories of common people. The corporation hires an economist to determine the demand for its novel. After month of hard work the economist informed that the demand for the firm's novel (θ_x) is given by the following equation-   20
   $$\theta_x = 10,000 - 3000P_x + 4I + 500P_c$$
   Assume that the initial values of P_x, I and P_c are \$5, \$10,000 and \$6 respectively. Using the above information being a company's manager how would you
   i) Determine the effect of a price increase would have on total revenues.
   ii) Evaluate how sale of the novels would change during a period of rising incomes.
   iii) Assess the probable impact of completing publishers would raise their prices.

3. (a) What is price elasticity of demand? Illustrate how elasticity of demand varies from different incomes and different range of prices.   15
   (b) Define income elasticity of demand. When Rahim's income was \$300, he bought 20 liters of milk per month, when his income increased to \$ 350, he purchased 24 liters of milk per month. Assuming to change in the price of milk. What was Rahim's income elasticity of demand for milk?   10
   (c) What factors govern the size of the co-efficient of price elasticity of demand?   10

4. (a) Define market. Write the forms of market.   05
   (b) What is short-run? How does a competitive firm reach in equilibrium in the short-run?   20
   (c) Explain the shut-down condition of a firm in the short-run with diagram.   10

SECTION–B

5. (a) Distinguish between demand-pull and cost-push inflation.   10
   (b) What are the causes of inflation? Discuss.   20
   (c) "True inflation begins only after the level of full inflation."-Explain.   05

6. (a) What is credit control?   05
   (b) Briefly explain the methods by which the central bank controls the volume and creation of credit.   20
   (c) Distinguish between fixed investment and induced investment.   10

7. (a) What are the determinants of investment? Discuss.   10
   (b) Explain the following terms:-   09
         i) National Income   ii) GNP   iii) Personal Income
   (c) Discuss the various methods of estimating national income.   16

8. (a) What is savings? Draw a savings curve with a hypothetical savings function.   15
   (b) Prove that $MPC + MPS = 1$.   10
   (c) What are the prime problems of executing planning in Bangladesh? Discuss.   10

SECTION-A

1. (a) Define limit of a function. A function $f(x)$ is defined by   13
$$f(x) = \begin{cases} x^2 + x + 1, & for\ 0 \le x < 1 \\ 2x + 1, & for\ 1 \le x < 2 \end{cases}$$
Examine the continuity and differentiability of the function $f(x)$ at $x = 1$.

(b) If $\sin y = x \sin(a + y)$, then prove that $\frac{dy}{dx} = \frac{\sin^2(a+y)}{\sin a}$ 08

(c) Find the differential co-efficient of the following: 14
   i) x^{e^x}

   ii) $\sin\left\{2 \tan^{-1} \sqrt{\frac{1-x}{1+x}}\right\}$

2. (a) State Leibnitz's theorem. If $x = \sin\left(\frac{\ln y}{m}\right)$, then prove that,   13
$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$$

(b) State Rolle's theorem. If $f(x) = \tan x$, then $f(0) = 0$ and $f(\pi) = 0$. Is Rolle's   10
theorem applicable to $f(x)$ in $(0, \pi)$?

(c) A cylindrical tin can closed at the both ends, of a given capacity, has to be   12
constructed. Show that the amount of the tin required will be a minimum when the
height is equal to the diameter.

3. (a) Find the values of limits: 10
   i) $\lim_{x\to0} \frac{(e^x-1)\tan^2 x}{x^3}$

   ii) $\lim_{x\to0} \frac{e^x - e^{-x} + 2\sin x - 4x}{x^5}$

(b) If $u = x^n F\left(\frac{y}{x}, \frac{z}{x}\right)$, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = nu$ 14

(c) Find the asymptotes of the cubic: $x^3 - 2y^3 + xy(2x - y) + y(x - y) + 1 = 0$.   11

4. (a) Find the tangent and the normal to the curve $y(x - 2)(x - 3) - x + 3 = 0$ at the   12
point where it cuts the x-axis.

(b) Show that the pedal equation of the parabola $y^2 = 4a(x + a)$ is $p^2 = ar$.   12

(c) Find the circle of curvature of the curve $y = x^3 + 2x^2 + x + 1$ at $(0,1)$.   11

SECTION-B

5.   Integrate any three of the following: 35
   i) $\int \frac{x\,dx}{(x^2+16)\sqrt{x^2+7}}$

   ii) $\int \sqrt{\frac{x}{a+x}}\,dx$

   iii) $\int \frac{x}{(x+2)(x-1)}\,dx$

   iv) $\int \frac{dx}{4+5\sin x}$

6.   Evaluate any three of the followings: 35

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

b) $\int_0^\pi \frac{x}{a^2 \sin^2 x + b^2 \cos^2 x}\, dx$

c) $\int_0^1 \frac{x^7}{\sqrt{1-x^4}}\, dx$

d) $\int_0^{\pi/2} \frac{\sin^4 x}{\cos^4 x + \sin^4 x}\, dx$

7. (a) Define Gamma and Beta function. Show that $\int_0^1 x^2 (1-x^3)^{3/2}\, dx = \frac{2}{15}$.   12

(b) Obtain a reduction formula for $\int \sin^n x\, dx$ and hence evaluate $\int \sin^7 x\, dx$ 10

(c) Show that the entire arc length of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ is $6a$ 13

8. (a) Find the area of the cardioid $r = c(1 - \sin\theta)$ 12

(b) Find the volume of the solid formed by revolving the ellipse $b^2 x^2 + a^2 y^2 = a^2 b^2$ 13
     about the x axis.

(c) Evaluate $\lim_{n\to\infty}\{(2+\frac{1}{n^2})^{1/n^2}(2+\frac{2^2}{n^2})^{2/n^2} \dots \dots \dots \dots (3)^{1/n}\}$ 10

Khulna University of Engineering & Technology
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B.Sc. Engineering 1st Year 1st Term Examination, 2017
PHY 1111
Modern and Solid State Physics

Full Marks: 210   Time: 03 hrs

N.B: i) Answer any THREE questions from each section in separate scripts.
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SECTION–A

1. (a) Derive the Lorentz transformation equations and the inverse Lorentz transformation equations.   12
   (b) Derive Einstein's mass energy relationship. Explain physical significance of this relation.   13
   (c) A man has mass of 100 Kg on the ground. When he is in a rocket ship in flight, his mass is 101 Kg as determined by an observer on the ground. What is the speed of the rocket ship?   10

2. (a) What is the necessity of quantum theory to explain photoelectric effect? Write down Einstein's hypothesis about photoelectric effect.   12
   (b) What is Compton effect? Derive the expression for Compton shift,
   $\Delta\lambda = \frac{h}{m_0 c}(1 - \cos\phi)$, Where the symbols have their usual meaning.   13
   (c) The photoelectric threshold frequency of silver is 1.086×10^{15} Hz. Calculate the maximum velocity of the ejected electrons. When the silver surface is illuminated by ultraviolet light of frequency 1.5×10^{15} Hz.   10

3. (a) What is wave packet? Prove that the de-Broglie wave group associated with a moving body travel with the same velocity as the body.   13
   (b) Show that electron cannot stay in the nucleus but it can stay within the atom.   12
   (c) Compute the de-Broglie wavelength of a photon whose kinetic energy is equal to the rest energy of an electron. Mass of a proton is 1836 times that of the electron.   10

4. (a) Give an account of various quantum numbers used to specify completely the state of an atom.   10
   (b) Derive the expressions for radius and energy of an electron orbit of the hydrogen atom.   15
   (c) Write down the quantum numbers of the electrons for n=3.   10

SECTION–B

5. (a) Define Miller indices. Show that for a cubic lattice the interplaner distance between a set of $(h\ k\ l)$ plane is given by $d_{hkl} = \frac{a}{\sqrt{(h^2+k^2+l^2)}}$.   13
   (b) What is atomic packing factor? Determine the atomic packing factor for simple, face centered and body centered cubic structures.   12
   (c) The density of KCl crystal is 1.98×10^3 Kg/m^3. Calculate the lattice constant and the distance between two adjacent atoms of the crystal KCl has fcc lattice structure.   10

6. (a) Write down the outstanding properties of metals. Explain Wiedemann-Franz relation.   10
   (b) Derive an expression of the lattice heat capacity of the solid following Einstein model.   15

6. (c) Calculate the highest possible frequencies for lead, aluminum and silicon if their respective Debye temperatures are 80 K, 300 K and 570 K.   10

7. (a) Discuss hall effect. What are the importance's of the hall effect?   10
   (b) Show that the density of states of the free electron is given by   15

   $D(E) = \frac{v}{2\pi^2} \left(\frac{2m}{\hbar^2}\right)^{\frac{3}{2}} E^{\frac{1}{2}}$, Where the symbols have their usual meaning.

   (c) The atomic radius of sodium is 1.86 Å. Calculate the Fermi energy of sodium at absolute zero.   10

8. (a) Explain population inversion and stimulated emission. Mention some applications of LASER.   12
   (b) Describe briefly the principle, construction and working of Helium-Neon laser. What are the advantages of gas lasers compared to solid state lasers?   13
   (c) A laser beam has a power of 50 mW. It has an aperture of 5×10^{-3} m and it emits light of wavelength 7200 Å. The beam is focused with a less of focal length 0.1 m. Calculate the area and intensity of the image.   10