Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2016
IPE-1101
(Manufacturing Process - I)

Full Marks: 210   Time: 3 hrs

N.B: i) *Answer any THREE questions from each section in separate scripts.*
ii) *Figures in the right margin indicate full marks.*

SECTION-A

1. (a) What is manufacturing process? Name five different manufacturing processes and give one example in each case. 07
   (b) What is meant by casting? Briefly explain the process for sand casting process. 12
   (c) What is pattern? List the name of different pattern allowance and briefly describe any two of them. 12
   (d) Briefly explain the loose piece pattern. 04

2. (a) What is meant by mold? Briefly describe the properties of molding sand. 13
   (b) Why core is used in casting? Write down the essential properties of core. 08
   (c) What is casting defect? Mention the causes and remedies of the following sand casting defects: 14
       i) Blow holes;   ii) Hot tears;   iii) Mis-runs;   iv) Mold-shift

3. (a) Write down the 'step by step procedure' of shell molding and investment casting process with necessary sketches. 15
   (b) Distinguish between centrifugal, semi centrifugal and centrifuging casting process. 08
   (c) Explain the hot chamber and cold chamber die casting. 12

4. (a) Explain the working principle of injection molding process with proper sketches. 15
   (b) How do thermoplastic differ from thermosetting plastics? 05
   (c) Briefly describe the squeeze casting process and write down its advantages and limitations. 15

SECTION-B

5. (a) What is welding? Why is welding widely used in manufacturing? 11
   (b) Briefly explain three types of welding flames and their applications. 12
   (c) What is resistance welding process? Differentiate between TIG and MIG welding process. 12

6. (a) Explain the working principles of submerged arc welding process with its advantages and limitations. 15
   (b) What are the defects generally found in welding? Write down the main causes of cracks and incomplete penetration. 10
   (c) Discuss the friction welding process in brief. 10

7. (a) What is spot welding? Explain the basic working procedures of resistance spot welding. 13
   (b) What are the main advantages of soldering as a joining process? How does soldering differ from brazing? 10
   (c) Write short notes on the following processes: 12
       i) Hot extrusion;   ii) Deep drawing

8. (a) Illustrate various roll arrangements in rolling mills. 10
   (b) Briefly describe different types of cold extrusion process. Why is cold extrusion process more applicable than hot extrusion process? 13
   (c) Define: i) Piercing   ii) Blanking   iii) Deburring   iv) Coining 12

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2016
CHEM 1111
(Chemistry)

Full Marks: 210   Time: 3 hrs

N.B: *i) Answer any THREE questions from each section in separate scripts.*
ii) Figures in the right margin indicate full marks.

SECTION–A

1. (a) What do you mean by standard electrode potential, ionic mobility and ECE? 09
    (b) Deduce thermodynamically the relation between the emf and heat of reaction in a galvanic cell. 12
    (c) What is ampere? Discuss the emf method for the measurement of pH of a solution. 10
    (d) Why glass electrode is used as an electrode in pH meter? 04

2. (a) What is energy of activation? How can energy of activation be determined with help of Arrhenius equation? 09
    (b) What is activated complex? Discuss the collision theory of reaction rate. 09
    (c) The initial concentration of 'B' is 1 gm.mole per litre. Calculate the time for 70% completion of the following reaction, if 50% completed in 30 minutes. 08
    $$3B \longrightarrow Product$$
    (d) Define molecularity of a chemical reaction. Derive first order rate law of chemical reaction. 09

3. (a) What is lithium-ion battery? Discuss the drawbacks of the present lithium-ion battery. 09
    (b) What is equivalent conductance? Discuss how can pure gold be separated from impure gold with the help of electrolysis? 10
    (c) Calculate the value of 'C' from the following cell at 42°C, if the emf of the cell is 0.9112 volts. 10
    $$Al|AlCl_3\ (0.35\ M) \parallel ZnCl_2(c)\ |\ Zn$$
    [The standard electrode potential of Aluminum and Zinc are 1.622 and 0.758 volts respectively]
    (d) What is calomel electrode? Write its cell reaction. 06

4. (a) What are the importance of pH in fish cultivation and human body? 10
    (b) What do you mean by transport number? Describe the Hittorf's method for the measurement of transport number of Ag^+ and NO_3^- in $AgNO_3$ solution. 13
    (c) Draw a complete diagram of an electrochemical cell. Write down the sign convention and types of reaction of Galvanic cell and electrolyte cell. 07
    (d) Write short note on cell constant. 05

SECTION–B

5. (a) What is meant by Co-ordination complexes? Explain "Effective Atomic Number" and show how this idea explains the stability of complexes compounds. 10
    (b) Define isomerism. The behavior of Ni^{2+} and Cu^{2+} can not be explained by Valance Bound Theory, why? 10
    (c) Explain the distortions of the geometry of metal complexes. 08
    (d) Make drawing to represent the structure of the following complex ions: 07

        i) $K_3[Fe(CN)]_6$ ii) $K_3[Fe(F_6)]$

        iii) $Cis, Cis, Cis[Co(NH_3)_3Cl_3]$

6. (a) Explain the term component. How many components are present in the following systems? 08

        1) Water ⇌ water-vapour

        2) KCL + Water ⇌ KCL hydrate.

    (b) Explain what do you understand by the following 10

        i)   Congruent melting point

        ii)   Eutectic point

        iii)   Metastable equilibrium.

    (c) Draw and explain a phase diagram when two components form a solid compound. 10

    (d) Give the limitations and advantages of phase rule. 07

7. (a) Draw the crystal structure of Si. Write down the difference between Si and Ge – Physical 12
         and Chemical properties.

    (b) Explain why diamond is a heat conductor but not electricity? 06

    (c) Write short notes on 10

        i)   Metallic bond

        ii)   H-bond

    (d) Discuss about the different types of silicates. 07

8. (a) What are colloids? How are they classified? 08

    (b) Write down the differences between lyophobic and lyophilic of colloids. 10

    (c) What is electrolysis? Discuss about the applications of colloids. 10

    (d) What do you mean by Gold Number and Micelle? 07

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2016
HUM-1111
(Economics)

Full Marks: 210   Time: 3 hrs

N.B: i) *Answer any THREE questions from each section in separate scripts.*
ii) *Figures in the right margin indicate full marks.*

SECTION-A

1. (a) Explain Robleins definition of Economics.   05
    (b) What is scarcity and choice? Explain the key problems of an economic organization.   15
    (c) What is production possibilities frontier? Describe various economic systems to solve the key 15
         problems of an economy.

2. (a) Define price-elasticity of demand. Calculate price-elasticity of demand with extreme cases.   20
    (b) What are the determinants of price-elasticity of demand? Explain.   15

3. (a) Explain the determinants of demand.   15
    (b) Solve the problems: 20
         There are 10,000 identical individuals in the market for commodity x, each with a demand
         function is given by $Q_{dx} = 12 - 2px$ and 1,000 identical producers of commodity x, each with a
         supply function is given by $Q_{sx} = 20P_x$.
         i)   Obtain equilibrium price and quantity.
         Now if the government decides to collect a sales tax of $2 per unit sold from each of the 1,000
         identical sellers of commodity x-
         ii) What effect does this have on the equilibrium price and quantity of commodity x?
         iii) Who actually pays the tax?
         iv) What is the amount of tax collected by the government?

4. (a) Why the average cost curves are 'U'-shaped?   10
    (b) Write the main characteristics of perfect competition.   05
    (c) Describe short-run equilibrium of a firm under perfect competition.   20

SECTION-B

5. (a) Explain the idea of Real GDP and Nominal GDP. Explain why an economy's income must equal   15
         its expenditure.
    (b) In year 2011, the economy produces 1000 units of pen that sell 5TK each. In year 2012 the   20
         economy produces 1500 units of pen that sell of TK. 6 each and in 2013 the economy produces
         2000 units of pen that sell for TK 7 each year. (Use 2011 as the base year). Calculate nominal
         GDP, Real GDP and the GDP deflator. By that percentage does each of these three statistics rise
         from one year to the next?

6. (a) What is the role of the financial system? Name and describe two markets that are the part of the 15
         financial system in our economy.
    (b) Suppose GDP is $8 trillion, taxes are $1.5 trillion, private savings is $0.5 trillion and the public 20
         savings is $0.2 trillion. Assuming this economy is closed. Calculate consumption, government
         purchases, national savings and investment. Explain.

7. (a) What do you mean by the word "Productivity" in Economics? List and describe four   15
         determinants of productivity.
    (b) Explain how higher saving leads to a higher standard of living?   10
    (c) What might deter a policymaker from trying to raise the rate of savings?   10

8. (a) What is demand-pull inflation and cost-push inflation?   10
    (b) List and describe four components of GDP.   10
    (c) ABC Artworks, Inc. is a firm that speculates in modern paintings. The manager is thinking of   15
         buying an original Picasso for $400000 with the intention of selling it at the end of the one year
         and the worth will be $480000. Suppose the guaranteed interest rates granted by banks are 10
         percent. There might be a risk of 15 percent. Should the firm purchase the painting? Explain.

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st term Examination, 2016
Math 1111
(Mathematics I)

Full Marks: 210   Time: 3 hrs

N.B: i) *Answer any THREE questions from each section in separate scripts.*
      ii) *Figures in the right margin indicate full marks.*

SECTION–A

1. (a) Define implicit function with example. A function $f(x)$ is defined as follows: 10

$$f(x) = \begin{cases} x^2 + 1 & when\ x \leq 0 \\ x & when\ 0 < x < 1 \\ \dfrac{1}{x} & when\ x \geq 1 \end{cases}$$

Discuss the continuity of $f(x)$ at $x = 0$ and differentiability at $x = 1$.

 (b) State Rolle's theorem. Expand $x^3 + 2x^2 - 1$ in powers of $(x - 2)$.   15

 (c) State L'Hospital's theorem. Evaluate $\lim_{x \to \frac{\pi}{2}} (sinx)^{tanx}$ 10

2. (a) State leibnitz's theorem. If $y = a\,sin^{-1}x + b\,cos^{-1}x$, then prove that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - n^2 y_n = 0$.   15

 (b) Differentiate $tan^{-1}\dfrac{x}{\sqrt{1-x^2}}$ with respect to $sec^{-1}\dfrac{1}{2x^2-1}$.   10

 (c) If $u = 3(ax + by + cz)^2 - (x^2 + y^2 + z^2)$ and $a^2 + b^2 + c^2 = 1$ then find the value of $\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} + \dfrac{\partial^2 u}{\partial z^2}$ 10

3. (a) Find the equation of tangent and normal to the curve $x^3 + xy^2 - 3x^2 + 4x + 5y + 2 = 0$ at the point $(1, -1)$.   12

 (b) If $f(x,y) = \dfrac{(x^2+y^2)^p}{2p(2p-1)} + x\emptyset(y/x) + \Psi(y/x)$ then using Euler's theorem on homogeneous function, show that $x^2 \dfrac{\partial^2 f}{\partial x^2} + 2xy \dfrac{\partial^2 f}{\partial x \partial y} + y^2 \dfrac{\partial^2 f}{\partial y^2} = (x^2 + y^2)^p$.   13

 (c) State Mean-Value – Theorem. Is Rolle's theorem applicable to the function $f(x) = 2 + (x - 1)^{2/3}$ in the interval $[0, 2]$?   10

4. (a) Find the radius of curvature of the curve $(x^2 + y^2)^2 = a^2(y^2 - x^2)$ at the point $(0, a)$.   12

 (b) Find all the asymptotes of the curve $x^3 - 4xy^2 - 3x^2 + 12yx - 12y^2 + 8x + 2y + 4 = 0$ 10

 (c) If $\propto$ and β are the intercepts on the axes of x and y cut off by the equation of tangent to the curve $(x/a)^n + (y/b)^n = 1$, then show that $(a/\propto)^{n/_{n-1}} + (b/\beta)^{n/_{n-1}} = 1$ 13

SECTION–B

5.   Integrate any three of the followings: 35

    a) $\int (x + 1)\sqrt{2x^2 + 3}\ dx$

    b) $\int \dfrac{dx}{(1+x)\sqrt{1+x^2}}$

    c) $\int \dfrac{2sinx + 3cosx}{3sinx + 4cosx}\ dx$

    d) $\int \dfrac{dx}{2+3cosx+sinx}$

6. (a) Evaluate any three of the followings 35

    a) $\int_0^1 \frac{\log x}{\sqrt{1-x^2}} dx$

    b) $\int_0^{\frac{\pi}{2}} \frac{\cos x \, dx}{(\sin x + 1)(\sin x + 2)}$

    c) $\int_0^\pi \frac{x \tan x}{\sec x + \tan x} dx$

    d) $\int_0^1 \cot^{-1}(1 - x + x^2) \, dx$

7. (a) Define Beta function and Gamma functions. Prove that $\Gamma m \, \Gamma(m + \frac{1}{2}) = \frac{\sqrt{\pi}\sqrt{2m}}{2^{2m-1}}$ 13

   (b) Obtain a reduction formula for $\int \frac{\sin^m x}{\cos^n x} dx \ (n \neq 1)$ 09

   (c) Find the area inside the circle $r = \sin\theta$ and outside the cardioide $r = 1 - \cos\theta$.   13

8. (a) Prove that $\int_0^\infty \frac{\tan^{-1} ax}{x(1+x^2)} dx = \frac{\pi}{2} \log(1 + a)$ 15

   (b) Find the volume of the solid generated by revolving the loop of the curve $2ay^2 = x(x - a)^2$ about x-axis.   10

   (c) Find the length of the arc of the parabola $y^2 = 4ax$ cut off by the line $y = 2x$.   10

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2016
PHY 1111
(Modern and Solid State Physics)

Full Marks: 210   Time: 3 hrs

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

1. (a) What is invariant under space-time coordinate transformation? Show that the speed of light is the same for all observers regardless of their state of motion. **10**

    (b) Establish mathematically Einstein's mass-energy relationship. Explain physical significance of this relationship. **15**

    (c) A man has a 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 Compton effect? Explain and derive an expression for Compton shift on the basis of quantum theory. **15**

    (b) Discuss the origin of X-ray. Show that the productions of X-ray and photoelectric effect are always opposite to one another. **10**

    (c) An X-ray Photon of initial frequency 3×10^{19} Sec^{-1} collides with an electron and is scattered through $90°$. Find its new frequency. **10**

3. (a) What do you mean by phase velocity and group velocity? Establish a relation between phase velocity and group velocity. **12**

    (b) What are the basic postulates of Bohr Atom model? Derive an expression for the different spectral series of Hydrogen Atom. **13**

    (c) Find the wavelength of the photon emitted when a hydrogen atom goes from the n = 10 state to its ground state. **10**

4. (a) Discuss vector atom model. Write down the names of all quantum number associated with vector atom model. **13**

    (b) Show that in a privileged orbit, the magnetic moment of the electron must be $-(e/2m)\bar{L}$, where $\bar{L}$ is angular momentum. **12**

    (c) A typical atomic nucleus is about 5.0×10^{-15} m in radius. Use the uncertainty principle to place a lower limit on the energy an electron must have if it is to be part of a nucleus. **10**

SECTION-B

5. (a) In practice how many crystal system are possible? Give the names starting the relationship between crystallography axes and the angle between them. **13**

    (b) What is density of packing? Calculate the relative density of packing of i) simple cubic ii) body centered cubic and iii) face centered cubic structure atom. **12**

    (c) In a unit cell of a simple cubic structure, find the angle between the normal to pair of planes whose Miller indices are i) [100] and [010], ii) [121] and [111]. **10**

6. (a) Distinguish between metals, semiconductors and insulators on the basis of band theory of solids. **10**

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

    (c) Calculate maximum phonon frequency generated by scattering of visible light of wavelength $\lambda= 4920$ Å. Given that velocity of sound in medium is 3.32×10^5 cm/s and refraction index is 1.51. **10**

7. (a) Obtain expression for thermal conductivity of a metal on the basis of free electron.   10

   (b) Explain the concept of density of states for free electron. Show that the density of states of   15
   free electron is given by $D(E) = \frac{v}{2\pi^2}(\frac{2m}{h^2})^{3/2}E^{1/2}$. use this expression to discuss number of
   filled states between electronic energy levels.

   (c) Show that the average kinetic energy of an electron at absolute zero is $< E_0 > = \frac{3}{5}E_f$, where   10
   E_f is Fermi energy.

8. (a) Discuss in detail the concept of directionality, monochromaticity, intensity and coherence of   12
   LASER light.

   (b) Give brief outlines of generation of coherent radiation. Explain the terms i) induced   13
   absorption ii) spontaneous emission and iii) stimulated emission.

   (c) A LASER beam has a power of 66 mW. It has an aperture of 5 x 10^{-3} m and it emits light of   10
   wavelength 6000 Å. The beam is focused with a lens of focal length 0.15 m. Calculate the
   area and the intensity of the image.