Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1th Year 1st Term Examination, 2019
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) Define manufacturing process. Name five different manufacturing processes and give example in each case. — 10
   (b) What is casting? Draw a typical sand mold and write down the function of various parts of it. — 15
   (c) What are chaplets? What are the essential properties of good core? — 10

2. (a) What is pattern? Briefly explain the factors that influence the selection of a specific type of pattern. — 10
   (b) Write short notes on split pattern and gated pattern. — 12
   (c) Why pattern allowance is necessary? Briefly describe the draft allowance and chambered allowance. — 13

3. (a) Briefly describe the properties of molding sands. — 13
   (b) Briefly describe the step by step procedure of investment casting process. — 12
   (c) Write down the differences between hot chamber and cold chamber die casting process. — 10

4. (a) Write down the working principle of extrusion process for plastic product manufacturing. — 13
   (b) Briefly describe the injection blow molding process. — 10
   (c) Mention the causes and remedies of following casting defects: — 12
   (i) Misrun (ii) Blow holes (iii) Mould shift.

SECTION-B

5. (a) Define welding. Write down the factors on which joining process depends on. — 10
   (b) What is mechanical fastening? Describe in brief about its importance in manufacturing. — 10
   (c) Define joint. Sketch the joints: (i) Butt joint (ii) Corner joint (iii) T joint (iv) Lap joint and (v) Edge joint — 15

6. (a) What is thermit welding? — 05
   (b) Describe the reactions that take place in an oxyfuel gas torch. What is the level of temperature generated? — 10
   (c) Explain the basic principles of arc welding processes. — 10
   (d) Explain why so many different welding processes have been developed. — 10

7. (a) Classify electrode with example. Write down the major functions of electrode. — 15
   (b) Define extrusion process. Classify this process with brief discussion and proper examples. — 10
   (c) What is Gas Metal-Arc welding (GMAW)? Describe the working principle of this welding process. — 10

8. (a) Briefly describe blanking and punching. — 05
   (b) What are the differences between Electron Beam Welding (EBW) and Laser Beam Welding (LBW)? Describe the working principle of EBW. — 15
   (c) Why is tungsten the preferred material for non-consumable electrodes? — 05
   (d) Write down the basic differences between forging and extrusion process. Describe the impression die forging. — 10

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2019
MATH 1111
Mathematics-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) Define limit of a function. Discuss the continuity and differentiability of the function $f(x)$ at $x = 1$, where $f(x)$ is defined as   13
$$f(x) = \begin{cases} 5x - 4 & when\ 0 < x \le 1 \\ 4x^2 - 3x & when\ 1 < x < 2 \\ 3x - 4 & when\ x \ge 2 \end{cases}$$

   (b) Find $\frac{dy}{dx}$ where $(\sin x)^y = (\cos y)^x$ 10

   (c) State Rolle's theorem. Is the Rolle's theorem applicable to the function $f(x) = \sin x$ in the interval $(0, \pi)$? Justify your answer.   12

2. (a) State Leibnitz's theorem.   13
   If $y = (\sin^{-1} x)^2$ then find a relation connecting y_n, y_{n+1} and y_{n+2}.

   (b) Find the maxima and minima of $y = 1 + 2\sin x + 3\cos^2 x\ \left(0 \le x \le {}^\pi/_2\right)$. Also find the maximum and minimum value.   12

   (c) Evaluate $\lim\limits_{x \to 1} \left\{\frac{2}{x^2-1} - \frac{1}{x-1}\right\}$ 10

3. (a) If $u = \sin ax + \cos ax$, show that $u_n = a^n\{1 + (-1)^n \sin 2ax\}^{1/2}$ 12

   (b) State Euler's theorem on homogeneous function. If $u = f(x^2 + 2yz, y^2 + 2zx)$, find $(y^2 - zx)\frac{\partial u}{\partial x} + (x^2 - yz)\frac{\partial u}{\partial y} + (z^2 - xy)\frac{\partial u}{\partial z}$ 12

   (c) Find the radius of curvature of the curve $x^2 + 4y^2 = 25$ at the point $(3,2)$ 11

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

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

   (c) If $x \cos a + y \sin a = P$ touch the curve $\frac{x^m}{a^m} + \frac{y^m}{b^m} = 1$ show that $(a \cos a)^{\frac{m}{m-1}} + (b \sin a)^{\frac{m}{m-1}} = P^{\frac{m}{m-1}}$ 11

SECTION–B

5.   Evaluate any three of the followings: 35

   (a) $\int \frac{x + 3}{\sqrt{4x^2 - 4x + 3}} dx$

   (b) $\int \frac{dx}{(x^2 - 1)\sqrt{x^2 - 3}}$

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

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

6.   Evaluate any three of the followings: 35

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

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

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

(d) $\int_0^{\frac{\pi}{2}} \log(\sin x)\, dx$

7. (a) Obtain reduction formula for $\int \tan^n x\, dx$ and hence find $\int_0^{\pi/4} \tan^6 x\, dx$ 12

(b) Define Gamma function and Beta function. Use Gamma function to evaluate   12

$$\int_0^\infty \dfrac{x^4}{(1 + x^2)^4}\, dx$$

(c) Evaluate $\int_0^\infty \dfrac{e^{-ax} \sin bx}{x}\, dx$ 11

8. (a) Find the area bounded by the parabola $y^2 = 4x$ and the straight line   12
         $y - 2x + 4 = 0$

(b) Show the entire arc length of the curve $x^{2/3} + y^{2/3} = c^{2/3}$ is $6c$.   11

(c) Find the volume of the solid obtained by revolving the area bounded by the   12
     cycloid $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ and $\theta = 0$, $\theta = 2\pi$ about x-axis.

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1ᵗʰ Year 1ˢᵗ Term Examination, 2019
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) Discuss about coordination number and hybridization of tetrahedral, octahedral, square planer, trigonal bipyramidal shape of complexes compound. — 08

    (b) *"Magnetic moment of $[FeF_6]^{3-}$ is 5.6BM but that of $[Fe(CN)_6]^{3-}$ is 1.1 BM"*-explain. — 10

    (c) Write down the principle of valence bond theory of complex compound formation. What is effective atomic number (EAN) rule? Calculate EAN of the following: — 17
    $[Cr(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$, $[Ni(CN)_4]^{2-}$, $[Fe(CN)_6]^{4-}$ and $[Mn(H_2O)_6]^{2+}$
    [Atomi number of Cr, Co, Ni, Fe and Mn are 24, 27, 28, 26 and 25 respectively]

2. (a) How can energy of activation be determined with the help of Arrhenius Model of reaction rate? — 08

    (b) *"Boiling point of H_2O is 100^0C but that for H_2S is -60^0C "*-explain with the help of H-bonding. — 08

    (c) Mention the various steps of chain reaction with examples. — 08

    (d) Discuss the Lindeman unimolecular reaction mechanism. How did Hinshelwood corrected Lindeman's theory? — 11

3. (a) Write down the differences between order and molecularity. — 08

    (b) Derive an expression for the rate equation of second order reaction when the reactants are same. Write down the characteristic properties of second order reaction. Prove that the half-life of second order reaction depends on initial concentration of the reactants. — 17

    (c) Derive a relation between pH and E_{cell} (EMF of the cell) for determining pH of the solution. — 10

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

    (b) What is salt-bridge? How can it be constructed? How does it work? — 04

    (c) Discuss Kohlrausch's law of independent migration of ions at infinite dilution. — 05

    (d) Construct a Li-ion ion battery. Discuss its charging-discharging process with reaction. Write down the advantages and disadvantages of Li-ion battery. — 14

SECTION–B

5. (a) Draw and explain the phase diagram of the binary system of Magnesium and Zinc. — 12

    (b) How will you distinguish the eutectic point and melting points by cooling curve? — 07

    (c) Draw a neat phase diagram of one component water system and explain the curves, areas and point with reference to the phase rule. — 10

    (d) Determine how many components are present in the following systems: — 06
    i)   Only NH_4Cl is heated closed vessel.
    ii) $KCl + H_2O \rightleftharpoons KCl$ Hydrate.

6. (a) Explain Freundlich adsorption isotherm. — 08

    (b) Discuss the factors which affect the adsorption of a gas or liquid on a solid adsorbent. — 08

    (c) *"Adsorption is an exothermic process"*-explain. — 07

    (d) Deduce Langmuir adsorption isotherm and discuss this equation for the limiting condition of very low and very high pressure. — 12

7. (a) Discuss the origin of charge on the colloidal particle.
   (b) Write down the differences between lyophilic and lyophobic colloids.
   (c) What is electrophoresis? How does the phenomenon provide information about the   0͡
       sign of charge on particles?
   (d) What is colloid? How can you obtain pure sol by dialysis and ultrafiltration method?   10

8. (a) Explain the followings: (i) Gold number (ii) Tyndal effect   08
   (b) What is emulsion? How can it be prepared? Write down the application of emulsion.   10
   (c) What is zeta potential? What are the effects of electrolyte's concentration on zeta   10
       potential?
   (d) "River water is turbid but sea water is clear"-explain with help of coagulation.   07

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1st Year 1st Term Examination, 2019
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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iii) *Assume reasonable data if missing any.*

SECTION–A

1. (a) What are meant by length contraction and time dilation? What are proper length and proper interval of time? **10**

   (b) What are the two postulates of special theory of relativity? Derive the equation of Lorentz transformation. **15**

   (c) A photon is travelling east and another photon is travelling west. Find the relative velocity of the two photons. **10**

2. (a) Explain and derive an expression for Compton shift on the basis of quantum theory. **15**

   (b) Show that the de Broglie wave graph associated with a moving body travels with the same velocity as that of the body. **10**

   (c) X-rays of wavelength 4.5×10^{-11} m are scattered by free electrons in a block of carbon through 90^0. Find the momentum of (i) incident photons (ii) scattered photons (iii) recoil electrons and (iv) the energy of the recoil electrons. **10**

3. (a) What is the origin of X-rays? State Moseley's law. Mention some applications of X-rays. **12**

   (b) State and prove Heisenberg's uncertainty principle. Using uncertainty principle, prove that electron cannot stay in the nucleus but it can stay within the atom. **13**

   (c) X-rays of wavelength 0.35Å are diffracted in first order at angle of 4.9^0 in Bragg's crystal spectrometer. Find the effective spacing of atomic layers in the crystal. **10**

4. (a) Explain Vector Atom Model with the help of quantum numbers associated with this model. **13**

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

   (c) If the Rydberg constant is 1.097×10^7 m^{-1}, what are the wavelengths of the first three lines of the Paschem series? **10**

SECTION–B

5. (a) Discuss seven crystal systems by giving one example of each and describe the various types of Bravais Lattices in case of three dimensions with the help of neat and clear diagrams. **15**

   (b) What is density of packing? Calculate the relative density of simple cubic, body centered cubic and face centered cubic structure atom. Give some example. **10**

   (c) In a unit cell of simple cubic structures find the angle between the normal to pair of planes whose Miller indices are (i) [1 1 2] & [0 1 1] and (ii) [2 1 2] & [1 0 1]. **10**

6. (a) Describe the formation of energy band in solids. Explain how it helps classify the materials into metal, insulators and semiconductors. **10**

   (b) What are the assumptions of Debye model for the Lattice specific heat? Calculate the lattice specific heat according to the Debye theory. **15**

6. (c) Compare the frequencies of sound waves of wavelength $\lambda = 10^{-7}$ cm for (i) a   10
homogeneous line (ii) acoustic waves on a linear lattice containing two identical
atoms per primitive cell of inter-atomic spacing 2.5Å and (iii) light waves of the
same wavelength, given that $U_0 = 10^5 cm/sec$.

7. (a) What are the static and transport properties in the case of free electron model?   13
Obtain an expression for the electrical conductivity of a metal on the basis of free
electron theory.

   (b) Derive the value of Hall voltage and show that Hall co-efficient $R_H \frac{1}{ne}$ in e.m.u.   12

   (c) Show that average kinetic energy of a free electron at 0K is $\frac{3}{5}E_f$, where E_f is Fermi   10
energy and average speed is $\frac{3}{4}v_f$ where v_f is the velocity at Fermi surface.

8. (a) Give the brief outlines of the form of input energy of a LASER. Give some   12
characteristics properties of a LASER light.

   (b) Explain the terms stimulated and spontaneous emission. State the action and   13
construction of Ruby LASER.

   (c) A LASER beam has a power of 75 mW. It has an aperture of 5×10^{-3} m and it   10
emits light of wavelength 6000Å. The beam is focused with a lens of focal length
0.16 m. Calculate the area and the intensity of the image.

Khulna University of Engineering & Technology
Department of Industrial Engineering and Management
B.Sc. Engineering 1ᵗʰ Year 1ˢᵗ Term Examination, 2019
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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SECTION–A

1. (a) What is the relationship between need and demand? 05
   (b) Distinguish between increase-decrease in demand and extension-contraction in demand. 10
   (c) X is a commodity which market demand function given by $Qd_x = 10 - 3p_x$ and supply function given by $Qs_x = -5 + 2p_x$ 20
      i) Find the market demand schedule and supply schedule of commodity X and from them find the equilibrium price and the equilibrium quantity.
      ii) Plot on one set of axes, the market demand curve and market supply curve for commodity X and show equilibrium point.

2. (a) Explain consumer's surplus. 05
   (b) Explain the idea of *"Law of diminishing returns"*. 10
   (c) An individual MU_x and MU_y schedule is given below where x and y are only two commodities available and $p_x = \$2$ while $p_y = \$1$, the individuals income is \$12 per time and is all spent. 20

Q	1	2	3	4	5	6	7	8
MU_x	16	14	12	10	8	6	4	2
MU_y	11	10	9	8	7	6	5	4

   (i) From the above information find out maximum total utility of a consumer.
   (ii) How two conditions for consumer equilibrium are simultaneously satisfied?

3. (a) Discuss the characteristics of an indifference curve. 10
   (b) Prove that price effect is a summation of income effect and substitution effect. 15
   (c) What is land capital? Explain the idea of *"Marginal production"* with appropriate example. 10

4. (a) What is market? What are the properties of a competitive market? Discuss. 15
   (b) How normal, supernormal profits and losses of a firm are shown under perfect competition in short run. 20

SECTION–B

5. (a) Explain the idea of real GDP and nominal GDP. List and explain the four components of GDP. Give an example of each. 20
   (b) *"True inflation begins only after the level of full employment."* Explain. 15

(a) What is role of financial system of a country? Name and describe the two markets that are the part of financial system. 20
   (b) What is national savings, public savings and private savings? Describe a change in tax-code that might increase private savings. 15

(a) What is worker's productivity? Explain the factors that determine the worker's productivity? 20
   (b) What is government budget deficit? How does it affect interest rates, investment and economic growth? 15

(a) Write short notes of the followings:
      i) Natural rate of unemployment. 15
      ii) The goals of Sustainable Development Goals (SGD's). 10
   (b) What are the essential conditions for success of planning? Discuss. 10

6. Evaluate any three of the followings:

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

(b) $\displaystyle\int_0^{\frac{\pi}{2}} \frac{\tan^2 x}{\tan^2 x + 1} dx$

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

(d) $\displaystyle\int_0^{\frac{\pi}{2}} \log(\sin x) \, dx$

7. (a) Obtain reduction formula for $\int \tan^n x \, dx$ and hence find $\int_0^{\pi/4} \tan^6 x \, dx$ — 12

(b) Define Gamma function and Beta function. Use Gamma function to evaluate — 12
$$\int_0^\infty \frac{x^4}{(1 + x^2)^4} dx$$

(c) Evaluate $\int_0^\infty \frac{e^{-ax} \sin bx}{x} dx$ — 11

8. (a) Find the area bounded by the parabola $y^2 = 4x$ and the straight line — 12 $y - 2x + 4 = 0$

(b) Show the entire arc length of the curve $x^{2/3} + y^{2/3} = c^{2/3}$ is $6c$. — 11·

(c) Find the volume of the solid obtained by revolving the area bounded by the — 12 cycloid $x = a(\theta - \sin\theta), y = a(1 - \cos\theta)$ and $\theta = 0, \theta = 2\pi$ about x-axis.