KHULNA UNIVERSITY OF ENGINEERING &TECHNOLOGY
Department of Textile Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
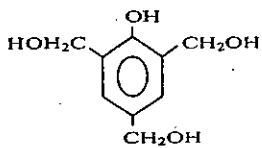**TE-1123**
(Polymer Engineering)
Time: 3 Hours   Total Marks: 210
N.B.: i) Answer any THREE questions from each section in separate scripts.
     ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.

SECTION-A

1(a) Define: i) Homopolymer ii) Co-polymer iii) Atactic polymer.   06

1(b) Classify polymer on the basis of chemical structure and behavior towards heat.   14

1(c) Differentiate between monomer and polymer.   06

1(d) Write down monomer and repeating unit of the following items: 09

      i) Polythene ii) PVC iii) Polyether

2(a) What is Nylon 6:6? How this is formed?   07

2(b) Describe cationic polymerization process with example.   15

2(c) Classify polycondensation type of step polymerization.   05

2(d) What is functionality? Write down the number of functional groups of the followings: 08

    i) $HOOC-(CH_2)_4-COOH$

    ii)

$$CH_2-OH$$
$$|$$
$$CH-OH$$
$$|$$
$$CH_2-OH$$

    iii)

3(a) What is polymer degradation? When and why polymers suffer degradation?   10

3(b) How degradation of polymer can be controlled?   05

3(c) Describe the photo-degradation process of polymer.   15

3(d) Write shot note on Hydrolytic.   05

4(a) Describe co-ordination polymerization with example.   12

4(b) What is softening point temperature? Describe in brief the measuring process   12
    temperature for polymer.

4(c) What is glassy solid? Describe this with relevant figure.   06

4(d) Is it possible to produce fully crystalline polymeric material? Explain with valid   05
    reason.

SECTION-B

5(a) What is copolymer? Write down the classification of copolymer according to arrangement and bonding of monomer. 08

5(b) Mention the names of different polymerization techniques. What are the reasons for choosing different polymerization techniques? 05

5(c) Describe the suspension polymerization with advantages and disadvantages. 12

5(d) State the different steps of emulsion polymerization. 10

6(a) What is weight average molecular weight? Derive the following expression for weight average molecular weight $\overline{M_w} = \frac{\sum n_i M_i^2}{\sum n_i M_i}$. 12

6(b) What is tacticity? "Tecticity has significant influence on molecular weight of polymer"- Explain the statement. 08

6(c) What is Polydispersity Index (PDI)? What can be inferred from PDI? 05

6(d) Calculate the number average and weight average molecular weight of a polymer sample comprising of 10 moles of polymer molecules having molecular weight of 60,000 gm/mol and 9 moles of polymer molecules having molecular weight of 20,000 gm/mol. 10

7(a) What is meant by liquid crystal phase? 05

7(b) Discuss the adjacent reentry chain-folded model for smooth and rough surface with sketch. 10

7(c) Why some polymers are highly crystalline and some are highly amorphous? Explain. 12

7(d) Write short note on spherulite structure. 08

8(a) Write down the functions of different zones in extruder machine with proper sketch. 12

8(b) Describe the exhaustion molding process of thermoplastic polymer with proper sketch. 12

8(c) Derive the following expression for degree of polymerization in step growth polymerization: 11
$$< N >= 1 + K + [A]_o$$

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KHULNA UNIVERSITY OF ENGINEERING &TECHNOLOGY
Department of Textile Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
TE-1121
(Textile Fibers)

Time: 3 Hours   Total 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 missing any.

SECTION-A

1(a)	What is Textile Fibers? Classify Textile Fibers with example.	10
1(b)	What is ginning? Distinguish between Saw gin and Roller gin.	10
1(c)	Discuss fiber structure and formation of cotton fibers with schematic diagram.	15
2(a)	Compare the chemical properties of cotton and jute fibers.	15
2(b)	Write down the chemical compositions of jute fibers. How and why retting could be done?	10
2(c)	What are allied fibers? Why are they so called? Describe their properties.	10
3(a)	Briefly explain the manufacturing process of wool into yarn.	13
3(b)	Distinguish between two categories of woolen fabrics.	08
3(c)	Why does wool show good range of flexibility and absorbency?	07
3(d)	"Bamboo fiber is used as hygiene materials"- Why? State the special features of Bamboo fibers.	07
4(a)	Describe the chemical composition and chemical structure of wool fiber.	10
4(b)	What is sericulture? State the silk manufacturing process briefly.	15
4(c)	Point out the extra ordinary features of pineapple, banana and coir fibers.	10

SECTION-B

5(a)	State the general principles of synthetic fiber spinning with sketches.	10
5(b)	Compare among melt, wet and dry spinning processes.	10
5(c)	State the physical, chemical and biological properties of acetate and triacetate.	08
5(d)	How chemical fibers are influenced by the spinneret in spinning head?	07
6(a)	What is polyamide fiber?	04
6(b)	Describe the manufacturing process of Nylon 6.6.	12
6(c)	Differentiate between Nylon 6 and Nylon 66.	07
6(d)	Write short notes on:	12
	i) Carbon fiber ii) Kevlar fiber iii) Glass fiber	
7(a)	State the various steps involved in viscose process.	12
7(b)	Describe the manufacturing process of polyester fiber.	12
7(c)	Why rayon is called regenerated fiber?	05
7(d)	Compare the physical properties of Nylon and Polyester.	06
8(a)	What is elastomeric fiber? Show the production process of Spandex.	12
8(b)	What are acrylic and modacrylic? State the physical structure of acrylic fiber.	10
8(c)	Write down the trade name with country of origin of the following fibers:	10
	i) Carbon fiber ii) Polyester fiber iii) Nylon fiber iv) Glass fiber	
8(d)	What is casein fiber?	03

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SECTION-A

1(a) What is meant by specific heat? How does a system is said to be in thermodynamic   06
equilibrium?

1(b) Define second law of thermodynamics. Briefly explain 'PMM-II' violates the 2nd law   08
of thermodynamics but does not 1st law of thermodynamics.

1(c) Prove that the difference between two specific heats (C_p and C_v) is equal to   11
characteristic gas constant (R).

1(d) A mass of 2.25 kg of nitrogen occupying 1.5 m^3 is heated from 30°C to 250°C at a   10
constant volume. Calculate the initial and final pressures of the gas. Take universal gas
constant as 8314 J/kg mol K. The molecular mass of nitrogen is 28.

2(a) What is meant by reversible process? Explain the phenomena of general laws for   07
expansion and compression with the help of curves for various values of index number
(n).

2(b) What is polytropic process? Deduce the relations of workdone for adiabatic process.   10

2(c) State and explain the term: 06
i)Zeroth law of thermodynamics ii) Quasi static process

2(d) A quantity of gas has a volume of 0.15 m^3, pressure 1.5 bar and a temperature 110°C. If   12
the gas is compressed at a constant pressure, until its volume become 0.112 m^3,
determine:
    i)   The temperature at the end of compression
    ii)   Work done in compressing the gas, and
    iii) Decrease in internal energy

3(a) Classify IC engine. Write down the function of i) Connecting rod ii) Piston iii) Crank   10
shaft.

3(b) Describe the working principle of four-stroke SI engine.   08

3(c) What are the major differences of 2-stroke and 4-stroke engine?   05

3(d) During the test on single cylinder oil engine, working on the four stroke cycle and 12
fitted with a rope brake, the followings readings are taken:
Effective diameter of brake wheel = 630 mm; Dead load on brake = 200 N; Spring
balance reading = 30 N; Speed = 450 rpm; Mean effective pressure = 7.7 bar;
Diameter of cylinder = 100 mm; Stroke = 150 mm; Quantity of oil used = 0.815 kg/h;
Calorific value of oil = 42000 KJ/kg.
Calculate brake power, indicated power, mechanical efficiency and brake thermal
efficiency.

4(a) Draw P-V and T-S diagram of following cycles: 06
i) Carnot cycle ii) Brayton cycle iii) Otto cycle.

4(b) Differentiate between open cycle and closed cycle gas turbine.   08

4(c) What are the differences among fan, blower and compressor?   06

4(d) Classify compressor. Write down the working principle of centrifugal compressor with 15
neat sketch.

SECTION-B

5(a) What is meant by steam boiler? Draw the schematic diagram of a boiler plant with 07
boiler accessories.

5(b) Describe the working principle of a high pressure water tube steam boiler with neat 10
sketch.

5(c) Write down the function of the following in a steam boiler: i) Economiser ii) Blow off 08
cork iii) Fusible plug iv) Superheater.

5(d) A boiler produces 9000 kg of steam while 1 tonne of coal is burnt. The steam is 10
produced at 10 bar from water at a 15°C. The dryness fraction of steam is 0.9.
Determine the efficiency of boiler when the calorific value of the coal is 32000 KJ/kg.

6(a) What is COP? Draw the p-h diagram and label it clearly showing various regimes.   07

6(b) Briefly explain the working principle of vapor absorption refrigeration system.   10

6(c) What are differences in between actual VCR cycle and standard VCR cycle?   08

6(d) A R-134a refrigerant based vapor compression system operating at a condenser   10
temperature of 40°C and an evaporation temperature -5°C develops 15 tons of
refrigeration using the properties of following table, draw the p-h diagram and also
determine i) the mass flow rate, ii) COP and iii) Compressor Power Consumption.

Specific Volume (m³/kg)	V_2	0.07
Enthalpy (KJ/kg)	h_1	190
	h_2	208
	$h_3=h_4$	75

7(a) What are the basic elements of an air conditioning unit? Why does the use of air 07
conditioner increase day by day recently?

7(b) What is meant by human comfort? Describe the working principle of 'Year-Round' 10
Air-conditioning system with neat sketch.

7(c) What is the difference between central air-conditioning and unitary air-conditioning 09
system? Why does exhausted air recirculate in the system of an air-conditioner?

7(d) What is condensation? Distinguish between film wise condensation and drop wise 09
condensation. Which one is faster for the same condition and why?

8(a) What are the modes of heat transfer and explain their mechanism. 10

8(b) Define pool boiling. Draw the pool boiling curve of water with mentioning its regimes 06
with a clear sketch.

8(c) Explain the terms i) Gray body ii) Solid angle iii) Emissivity 06

8(d) Consider slab of thickness L. The boundary surface at X = 0 and X = L are maintained 13
at constant but different temperature T_1 and T_2 respectively. There is no energy
generation in the solid and the thermal conductivity K is constant. Develop an
expression for the temperature distribution $T_{(x)}$ in the slab and the thermal resistance of
the slab for the heat flow through an area A.

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KHULNA UNIVERSITY OF ENGINEERING &TECHNOLOGY
Department of Textile Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
Math-1121
(Mathematics-I)
Time: 3 Hours   Total 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 missing any.

SECTION-A

1(a) Define continuity of a function. A function $f(x)$ is defined as follows: 15

$$f(x) = \begin{cases} x \text{ when } 0 < x < 1 \\ 2 - x \text{ when } 1 \leq x \leq 2 \\ x - \dfrac{x^2}{2} \text{ when } x > 2 \end{cases}$$

Discuss the continuity and differentiability of $f(x)$ at $x = 2$.

1(b) Find $\dfrac{dy}{dx}$ if $\ln(xy) = x^2 + y^2$ 08

1(c) If the area of a circle increases at a uniform rate, show that the rate of increase of the   10
perimeter varies inversely as the radius.

1(d) What is the physical significance of $\dfrac{dy}{dx} = Lt_{\Delta x \to 0} \dfrac{\Delta y}{\Delta x}$?   02

2(a) Find the nth derivatives of $\dfrac{1}{x^2+16}$.   10

2(b) State the Leibnitz's theorem. Use this theorem to find the value of   13

$x^2 y_{n+2} + (2n + 1)xy_{n+1} + (n^2 + 1)y_n$ if $y = a\cos(lnx) + b\sin(lnx)$.

2(c) If $v = \sqrt{x^2 + y^2 + z^2}$, then show that $v_{xx} + v_{yy} + v_{zz} = \dfrac{2}{v}$.   12

3(a) Evaluate $\lim_{x \to 0} \left(\dfrac{\tan x}{x}\right)^{\frac{1}{x}}$ 10

3(b) A garments company has examined its cost structure, revenue structure and profit   15
structure and has determined that C is the total cost, R total revenue, P total profit and x
is the number of units produced are related as:

$C(x) = 100 + 0.015x^2, R(x) = 3x$ and $P(x) = R(x) - C(x)$. Find the production
rate x that that will maximize profits of the company. Find that profit. Also determine
the profit, when $x = 120$.

3(c) Differentiate $\tan^{-1} \dfrac{2x}{1-x^2}$ with respect to $\sin^{-1} \dfrac{2x}{1+x^2}$.   10

4(a) Find the tangent to the curve $xy^2 = 4(4 - x)$ at the point where it is cut by the line   10
$y = x$.

4(b) The curves $y = x^2$ and $y^2 = x$ pass through the point $(1,1)$. Find their angle of   06
intersection at this point.

4(c) Expand $f(x) = \ln(1 + x)$ in a Talyer series about $x = 0$.   10

4(d) Find the equation of the circle of curvature at the point (3,1) on the curve   09

$$y = x^2 - 6x + 10.$$

SECTION-B

5   Evaluate any three of the followings: 35

  a) $\int \frac{(4x+3)}{3x^2+3x+1} dx$

  b) $\int \frac{dx}{x^3+8}$

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

  d) $\int \frac{dx}{x^{\frac{1}{2}}(1+x)^{\frac{5}{2}}}$

6   Evaluate the integrals (Any three):   35

  a) $\int_0^1 \tan^{-1} x \, dx$

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

  c) $\int_0^1 x^3(1-x^2)^{\frac{5}{2}} dx$

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

7(a) Evaluate $\lim_{n\to\infty}[\frac{n^2}{(n+1)^3} + \frac{n^2}{(n+2)^3} + \frac{n^2}{(n+3)^3} + \cdots + \frac{1}{8n}]$ 10

7(b) Obtain reduction formula for $\int \tan^n x$, hence find $\int \tan^5 x \, dx$.   13

7(c) Test whether the vectors $v_1 = (2,-1,4), v_2 = (3,6,2) and \ v_3 = (2,10,-4)$ are linearly   12
      dependent or independent?

8(a) Find the rank of the matrix A by the help of elementary row transformations.   10

      Where $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 2 & 1 & 2 \end{bmatrix}$

8(b)   12
      Find the inverse of $A = \begin{pmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{pmatrix}$ by using row transformations only.

8(c) Solve the following system of equations by using the matrix method: 13

      $2x - y + 3z = 9$
      $x + y + z = 6$
      $x - y + z = 2$

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KHULNA UNIVERSITY OF ENGINEERING &TECHNOLOGY
Department of Textile Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
HUM-1121
(Sociology and Economics)

Time: 3 Hours   Total Marks: 210

N.B.: i) Answer any THREE questions from each sectionin separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.

SECTION-A

1(a)	Define sociology and society.	10
1(b)	Discuss the importance of studying sociology for the students of engineering.	10
1(c)	What is community? What are the vital role of community and association for the nation?	15
2(a)	What is social structure? What are the basic elements of social structure of Bangladesh?	15
2(b)	What is culture? Why is culture so important to human being?	10
2(c)	Discuss the relationship among the Industrialization, Urbanization, and Urban ecology.	10
3(a)	What is socialization? What is the relationship between socialization and personality development?	15
3(b)	What is social stratification? Why are human society stratified?	10
3(c)	What are the relationships between society and community?	10
4(a)	What is meant by urbanization? What are the impacts of urbanization on society?	20
4(b)	What are the social problems in Bangladesh? Discuss them briefly.	15

SECTION-B

5(a)	Define Economics. Explain the concept of Micro and Macro Economics.	10
5(b)	What are the basic problems of an economic system? Explain.	10
5(c)	What are the different ways that a society can answer the basic economic questions?	15
6(a)	Define the law of demand. Explain the determinants of demand.	10
6(b)	On a supply-and-demand diagram, show equilibrium price, equilibrium quantity, and the total revenue received by producer.	15
6(c)	If demand is elastic, how will an increase in price change total revenue? Explain.	10
7(a)	What is indifference curve? State the characteristics of indifference curve.	15
7(b)	"High price traditionally cause expansion in an industry, eventually bringing an end to high prices and manufacturer's prosperity"- Explain, using appropriate diagrams.	20
8(a)	Define GDP. List four components of GDP. Give an example of each.	15
8(b)	What are national savings, private savings, and public savings? Describe a tax code that might increase private savings. If this policy was implemented, how would it affect the market for loanable fund?	20

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Textile Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2018
Ch-1121
(Chemistry-I)

Time: 3 Hours   Total 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 missing any.

SECTION-A

1(a) Define thermal and photochemical reactions with examples.   08

1(b) State and explain the laws of photochemistry.   12

1(c) A photochemical reaction gives one mole products with a quantum yield one. Calculate   08
      the energy associated with the reaction.

1(d) Explain photosensitized reaction with example.   07

2(a) Define different types of hydrogen bonds with examples.   08

2(b) Ice floats on water. Why?   07

2(c) What is metallic bond? Discuss the electron sea model of metallic bond.   10

2(d) What is bond order? Predict about bond order and magnetic nature of H_2^+ and H_2 10
      species.

3(a) Define different types of buffer solutions with examples.   08

3(b) Discuss the Arrhenius and Lewis theory of acids and bases.   12

3(c) Water can act both as acid and base. Explain.   08

3(d) Calculate the pH of 0.02 M $Ba(OH)_2$ solution.   07

4(a) Define lyophilic and lyophobic sols with examples.   08

4(b) Mention two important methods of sol preparation.   10

4(c) What is gold number? Explain.   07

4(d) Discuss the work function of artificial kidney machine.   10

SECTION-B

5(a) How does Zn electrode and Cu electrode potential measured by using standard   10
      hydrogen electrode?

5(b) What is glass electrode? How can it be used in measuring pH of a solution?   10

5(c) What is the cell potential of a half-cell consisting of zinc electrode in 0.01M $ZnSO_4$ 07
      solution at 25° C, $E° = 0.763$ V.

5(d) How a redox reaction can produce an electrical current?   08

6(a) Classify atmosphere on the basis of differences in corrosion. 07

6(b) Explain that the fully exposed metal surface is more beneficial than the partially 10
exposed metal surface from the corrosion point of view.

6(c) Define with applications of the followings: 10
     i)   Inductive effect
     ii)   Hyperconjugation effect

6(d) What is catalysis? Write down the characteristics of catalytic reactions. 08

7(a) State Rault's law. How is the molecular mass of a solute determined from vapour 10
pressure lowering?

7(b) What are the colligative properties? Why does the addition of a solute lower vapour 07
pressure?

7(c) The elevation of boiling point is directly proportional to the lowering of vapour 09
pressure- Explain this statement with the help of diagram.

7(d) 18.2 g of urea is dissolved in 100 g of water at 50° C. The lowering of vapour pressure 09
produced is 5 mm Hg. Claculate the molecular mass of urea. The vapour pressure of
water at 50° C is 92 mm Hg.

8(a) Write down name of the following complexes: 07
     i) $Ni(CO)_4$ ii) $[Co(NH_3)_4Cl_2]^+$

8(b) Draw the primary and secondary valencies of the central metal on the following 10
complex compounds:
     i) $[Co(NH_3)_6]Cl_3$ ii) $[Co(NH_3)_4Cl_2]Cl$

8(c) Write a short note fac-mer isomerism. 08

8(d) Explain the colour of transition metal complexes according to crystal field theory. 10

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