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.

SECTION – A

1(a) Make sentence with the following structures using the words given in brackets. 14
(i) Subj., + modifier, + Intransitive Verb + Adv. of Manner. (Sleep as verb)
(ii) Subj., + Transitive Verb + Object. (Prepare as verb)
(iii) Why + Subj., + Verb, + Adv. of place + Verb + Adj. Complement. (Go and is as verb)
(iv) Before + Subj. + Verb. + Adv. of place, Subj. + Verb + Adv. of place. (Come and attend as verb)
(v) Subj. + Verb + Obj. + as + Subj. + Verb + Obj. (Perform and teach as verb)
(vi) If + Subj. + Verb + Obj., Subj. + Verb + Obj. (Read and learn as verb)
(vii) Subj. + Verb + not only + Adv. of place + but also + Adv. of place. (Work as verb)

1(b) Change the following words as asked in brackets and use the changed forms in sentence. 12
Chastity (into adj.), Month (into adj.), Elegancy (into adj.), Divert (into noun) Conception (into verb), Fortification (into verb).

1(c) Make new words with the following suffix, prefix and use them in sentence: 09
Hypo−,   Be−,   −ion,   −al,   −ance,   Fore−.

2(a) Transform the following sentences as per instruction. 14
(i) Being a cripple, he cannot ride a horse. (Compound)
(ii) His silence proves his guilt. (Complex)
(iii) Does he know the consequences if he refuse? (Simple)
(iv) He is rich but honest. (Complex)
(v) Everybody longs for happiness. (Interrogative)
(vi) Old fools surpass all the other fools in folly. (Negative)
(vii) If you are not Bangladeshi you cannot be admitted. (Simple)

2(b) Complete the following sentences with suitable phrases. 12
(i) She wishes ………. (Adj. phrase)
(ii) We all hope ……… (Noun phrase)
(iii) My mother hates ……… (Noun phrase)
(iv) He has behaved ……… (Adv. phrase)
(v) The sailor climbed ……… (Adv. phrase)
(vi) The leaves ……… are glossy. (Adj. phrase)

2(c) Make sentence using one synonym for each of the word below. 09
Beautiful, carry, weight, quite, down, right.

3(a) Make WH question with the underlined word/words of the following sentences: 14
(i) He returned <u>safe</u> home.
(ii) We met V. C. <u>to discuss the issue of ethics in students.</u>
(iii) He travelling <u>at a speed of 60 mph.</u>
(iv) The nearest town is <u>ten miles away.</u>
(v) The works of K. Nazrul are <u>revolutionary in nature.</u>
(vi) The building is <u>20 feet high and 10 feet wide.</u>
(vii) He has been living peacefully in this village <u>for ten years.</u>

3(b) Complete the following sentences with clauses as asked in brackets. 12
(i) ……… touches our depth of heart. (Noun clause)
(ii) In ………, we can understand very easily. (Noun clause)
(iii) ………, he could sing well. (Adv. clause of condition)
(iv) ………, he can't expend hugely. (Adv. clause of reason)
(v) Rani, ………, is brilliant. (Adj. clause)
(vi) Shoma studies sincerely ……… (Adv. clause of purpose)

3(c) Make sentence with the following idioms and phrases. 09
Pull the last straw, that ship has sailed, have one's head in the clouds, on the ice, once bitten twice shy, when it rains it pours.

4(a) Correct the mistakes of the following sentences.   14
     (i) Lazy Liza go on shopping.
     (ii) It was the best of times, to do the chores.
     (iii) Donot got lost in the darkness.
     (iv) Cakes cooks quickly bakes.
     (v) Who teach you grammar?
     (vi) Burning bridges have become his speciality.
     (vii) He is a M.A.

4(b) Express the following notions/function in sentence.   12
     (i) Shame, (ii) Hatred, (iii) Hope, (iv) Determination, (v) Sympathy, (vi) Wish.

4(c) Make use of the following modals in sentence as asked in brackets.   09
     (i) Can. (To express a polite request)
     (ii) Can. (To express an offer to somebody else)
     (iii) Could. (To express a past ability)
     (iv) Would rather. (To express a preference)
     (v) Had better. (To express a duty at present)
     (vi) Should. (To express propriety)

SECTION – B

5(a) Read the following passage and answer the questions.   25

Ajanta and Ellora Caves come to mind when we think of places that fill us with wonder. The Ajanta and Ellora Caves, located in Aurangabad, Maharashtra, are beyond impressive, thanks to their exceptional rock-cut architecture, intricate sculptures, and historical importance. We often speak of Ajanta and Ellora Caves together, but there's a distance of approximately 100 km between the two. Distance aside, there are a ton of similarities between the two cave complexes and they never fail to amaze us. These two caves, also UNESCO World Heritage Sites, offer a remarkable window into ancient India's artistic and spiritual past. If only rocks could talk, they would tell us stories we now only imagine. These caves date back to the 2nd century BCE and were used as Buddhist monastic complexes. Ellora Caves date back to the 6th to 10th centuries CE, and include Buddhist, Hindu, and Jain structures. These caves are carved into the rock faces, exhibiting incredible craftsmanship. Both cave complexes consist of intricately caves. The sculptures are elaborate and the frescoes impressive.

Questions:
(i) What is the above mentioned passage about?
(ii) Are Ajanta-Ellora the same cave complexes? How are they different? What is its significance?
(iii) Have you ever been to any ancient artifact? Would you compare the experience of visiting ancient artifacts with a "window"? Explain why?

5(b) Write a precis of the above mentioned passage [Q 5(a)] with a suitable title.   10

6(a) Amplify the idea- "Fear is not in the habit of speaking truth".   20

6(b) Write an argumentative paragraph on "Is technology too isolating?"   15

7(a) Write a CV for the post of an engineer at Tesla.   20

7(b) Write a report on Hall life.   15

8   Write a free composition on: "The Impact of Technology on Ethics and Values".   35

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2023
Ch 1105
(Engineering Chemistry)

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 any missing.

SECTION – A

1(a) What is the concept of an "electrical double layer"? Discuss the effect of electrolyte concentration on zeta potential.   10

1(b) What is Tyndall effect? Write an essay on the shape and size of colloids.   10

1(c) Differentiate between lyophilie and lyophobie colloids.   08

1(d) Explain the principle of dialysis.   07

2(a) Explain the Pilling-Bedworth rule.   10

2(b) Bolts and nuts made of the same metal are preferred in practice. Why?   09

2(c) Zinc is more readily corroded when coupled with copper than with lead, why?   09

2(d) What happens when metals like gold, aluminum and iron are exposed to moist atmosphere?   07

3(a) What is cement? What are the criteria of the Portland cement raw materials?   10

3(b) Briefly describe the dry and wet process for manufacturing cement clinkers.   13

3(c) Draw and explain the flow diagram involving various steps for manufacturing powdered sugar from raw sugar.   12

4(a) What are silicates? Draw the structural pattern of (i) single chain, (ii) double chain, and (iii) ring silicate structure.   11

4(b) What is glass? Write about the raw materials used in the manufacture of glass.   09

4(c) Write short notes on: 08
(i) Coloured glass,   (ii) Safety glass.

4(d) Mention the underlying properties of clay for use in ceramics.   07

SECTION – B

5(a) Define with examples of the followings: 09
(i) Repeating unit, (ii) Telechelic polymer, and (iii) Network polymer.

5(b) "All polymers are macromolecules but all macromolecules are not polymer" – why?   08

5(c) "Polymers are generally covalent compounds but, sometimes they conduct electricity". Explain.   10

5(d) What are the differences between thermoplastic polymer and thermosetting polymer?   08

6(a) How HDPE is prepared using Ziegler-Natta catalyst?   10

6(b) What are the ingredients used in polymer processing? Briefly discuss with their functions.   10

6(c) Classify fibers into different classes and give examples of each class.   07

6(d) Write short notes on: 08
(i) Melamine   (ii) Saran

7(a) How will you establish the following facts: 11
(i) Natural rubber is purely hydrocarbon, and (ii) Natural rubber is a polymer of isoprene unit.

7(b) What is vulcanization? Why is it so important for natural rubber?   08

7(c) Describe the manufacturing process of styrene-butadiene rubber.   10

7(d) Mention some uses and properties of silicone rubber.   06

8(a) "The rate determining step of urea synthesis is endothermic, but it is not synthesized at 200°C or higher" – why?   08

8(b) Narrate the Prilling method for the production of ammonium nitrate.   11

8(c) What is pulp? Briefly discuss the kraft pulping process.   11

8(d) What is the term "calendering" refers to in paper industries?   05

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B.Sc. Engineering 1st Year 1st Term Examination, 2023
Math 1105
(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 any missing.

SECTION – A

1(a) Define continuity and differentiability of $f(x)$ at $x = a$. A function $f(x)$ is defined as follows: 12
$$f(x) = \begin{cases} x \sin(1/x) & \text{for } x \neq 0 \\ 0 & \text{for } x = 0 \end{cases}$$
Check the continuity and differentiability of $f(x)$ at $x = 0$.

1(b) Find a, b such that $\lim\limits_{x \to 0} \dfrac{x(1 + a\cos x) - b\sin x}{x^3} = 1$. 12

1(c) If $u = x^n F(\frac{y}{x}, \frac{z}{x})$, then find the value of $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z}$. 11

2(a) Write the statement of Euler's theorem on homogeneous function. 13

2(b) Find the differential coefficients of (i) x^{x^x} and (ii) $(sinx)^{cosx} + (cosx)^{sinx}$ 12

2(c) If $J^{1/m} + J^{-1/m} = 2x$, then find the relations between J_{n+2}, J_{n+1} and J_n. 10

3(a) Expand e^x in powers of $(x - 1)$. 10

3(b) Find the maximum or minimum value of $x^3 + 3x^2 + 4xy + y^2$. 12

3(c) Find the condition that the line $lx + my = 1$ touches the curve $(ax)^n + (by)^n = 1$. 13

4(a) Find the length of tangent, normal, subtangent and subnormal of the curve 10
$x = a(\theta + sin\theta), y = a(1 - cos\theta)$ at θ.

4(b) Find the asymptotes of $2x(y - 5)^2 = 3(y - 2)(x - 1)^2$. 12

4(c) Find the radius of curvature at origin for the curve 13
$y^2 - 2xy - 3x^2 - 4x^3 - x^2y^2 = 0$.

SECTION – B

5(a) Integrate the followings: 15
(i) $\int \sqrt{(x - \alpha)(\beta - x)} \, dx$, (ii) $\int \dfrac{dx}{13 + 3cosx + 4sinx}$.

5(b) Explain antiderivative and rectangle method for finding area. Find area function $A(x)$ 10
between the graph of $f(x) = 2x + 3$ and the interval $[a, x] = [-1, x]$ by antiderivative method.

5(c) Evaluate $\lim\limits_{n \to \infty} \left[\dfrac{1}{n} + \dfrac{n^2}{(n+1)^3} + \dfrac{n^2}{(n+2)^3} + \cdots + \dfrac{1}{8n}\right]$. 10

6(a) Prove that $\int_0^a f(x)dx = \int_0^a f(a-x)dx$. Apply this formula to prove that $\int_0^{\pi/2} \frac{dx}{(a^2 cos^2 x + b^2 sin^2 x)^2} = \frac{\pi}{4}\frac{a^2+b^2}{a^3 b^3}$. 15

6(b) Obtain a reduction formula form of $\int tan^n x\, dx$ and evaluate $\int_0^{\pi/4} tan^4 x\, dx$. 10

6(c) State different kinds of improper integrals. Draw the graphs of $\frac{1}{x}$, $\frac{1}{x^2}$ and $\frac{1}{x^3}$ in the same axes and find for what values $\int_1^\infty \frac{dx}{x^p}$ converge? 10

7(a) State beta and gamma functions. Prove that $\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$ and also find the value of $\int_{-\infty}^\infty e^{-x^2} dx$. 15

7(b) Evaluate $\int_0^{\pi/2} sin^p x\, cos^q x\, dx$ where $p, q > -1$ and hence find the value of $\int_0^{\pi/2} sin^3 x\, cos^2 x\, dx$. 10

7(c) Draw the graph of $r = a\, cos2\theta$ and find the area of all the loops of the curve. 10

8(a) Find the length of the arc of the parabola $y^2 = 4ax$ cut off by the line $3y = 8x$. 12

8(b) Find the area of the region bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. 11

8(c) Find the volume of the solid that is obtained when the region under the curve $y = \sqrt{x}$ over the interval $[1, 4]$ is revolved about the x-axis. 12

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2023
ME 1107
(Manufacturing Process)

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 any missing.

SECTION – A

1(a) Define manufacturing process. Describe different production systems in terms of output variety and production volume. 07

1(b) Write down the necessity of sand testing. Enlist the factors affecting permeability of a moulding sand. 08

1(c) Why are pattern allowances considered? Describe taper allowance and machining allowance. 10

1(d) Describe the cause, effect, and remedies of the following casting defects: 10
(i) Minrun, (ii) Blow holes, (iii) Porosity, (iv) Slag inclusion, and (v) Cold shut.

2(a) Interpret the different types of casting. Illustrate and explain shell mould casting with its applications. 12

2(b) Which centrifugal casting process would you choose to manufacture a motorcycle rim? Justify your answer. 08

2(c) Describe continuous casting for rod making process. 07

2(d) Explain various welding terminology and zones in a weld joint with necessary sketches. 08

3(a) Interpret different flames produced in oxy-acetylene gas welding. 08

3(b) Describe thermit welding with applications. How does TIG welding differ from MIG welding processes? 12

3(c) Briefly describe submerged arc welding with neat sketches. 07

3(d) Write down the names of different types of welding defects. How welding defects can be tested and inspected? Explain. 08

4(a) Write short notes on the following: 08
(i) Forging, (ii) Extrusion, (iii) Bulging, and (iv) Coining.

4(b) State the purposes of metal forming process. Also, write down the significance of recrystallization temperature in metal forming process. 10

4(c) Describe how a toothpaste tube can be manufactured. 07

4(d) Illustrate various rolling arrangements used in rolling mills. 10

5(a) Draw a single point cutting tool and show its different angles and elements. What is 12 meant by tool signature $(10, 20, 7, 6, 8, 15, \frac{1}{32})$?

5(b) Identify the mechanism of chip formation. Explain the terms orthogonal cutting and 12 oblique cutting.

5(c) Define chip. Describe different types of chips formed in metal cutting. Why chip 11 breaker is used?

6(a) How is lathe machine specified? Write down the differences between 3-jaw universal 10 chuck and 4-jaw universal chuck.

6(b) Is drilling operation possible in a lathe machine? If yes, describe the procedures with 10 necessary illustration.

6(c) Explain the quick return mechanism of a shaper machine with the help of a neat 09 sketch.

6(d) Differentiate between shaper and planar machine operations. 06

7(a) Enlist different operations that can be performed in a drilling machine. 05

7(b) Define tool life. Explain the factors that affect tool life. 08

7(c) Describe centerless grinding method with its advantages and limitations. 10

7(d) Define indexing. What are the common methods of indexing? Describe any one of 12 them.

8(a) Explain the need for the use of modern manufacturing processes compared to 13 conventional ones. Also, explain the principle of EDM process.

8(b) Describe USM and ECM with figures. 12

8(c) Illustrate and explain the working procedure of PAM with mentioning its advantages 10 and disadvantages.

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 1st Year 1st Term Examination, 2023
ME 1105
(Thermal 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) Steam table, Mollier diagram and Psychromatic chart may be supplied on request.
iv) Assume reasonable data if any missing.

SECTION – A

1(a) Why is an elevation difference established between the reservoir and downstream area in harvesting hydropower? 07

1(b) "Even though biomass releases energy through combustion, it is considered a renewable energy source"- justify the statement. 08

1(c) Write down the differences between a heat engine, heat pump and refrigerator. 08

1(d) Describe the working principle of a simple vaour absorption refrigeration system. 12

2(a) How is the melting temperature influenced by the change in pressure? Is there any difference between water and typical substances in this regard? Support your explanation with a P-T diagram. 08

2(b) What advantages are obtained if superheated steam is used in steam prime movers? 08

2(c) Define the following terms: 06
(i) Internal energy of steam, (ii) Triple point, and (iii) Dryness fraction of steam.

2(d) Given a dry steam with a mass of 3 kg at 20 bar. If now 2400 kJ of heat is added to the system at constant pressure, (i) determine the work done under constant pressure condition, (ii) find the change in internal energy at constant pressure, and (iii) if now volume is kept constant after adding 2400 kJ of heat at constant pressure, find how much heat must be extracted to reduce the pressure to 14 bar. 13

3(a) Explain the reason for higher efficiency of water tube boilers in comparison to fire tube boilers. 07

3(b) Describe the steam generation process in a Benson boiler along with a neat sketch and discuss the advantages that make it superior to the Lamont boiler. 14

3(c) When designing a boiler which type of valve would you choose to ensure safety against both high steam pressure and low water level? Explain its operation principle for safety against high steam pressure and low water levels. 14

4(a) Using a schematic diagram of a boiler, explain how boiler accessories contribute to the enhancement of boiler efficiency. 10

4(b) Describe the significance of equivalent evaporation as a crucial parameter for ensuring a fair comparison of evaporative capacity and overall performance. 06

4(c) When assigned to design a boiler, which device would you employ to protect the heating surface from overheating in the event of a drop in water level below the recommended limit? Where in the boiler system would you install this protective device? 05

4(d) A steam generator plant produces steam at 100 bar and 500°C. The feed water enters the economizer at 160°C. The steam generation rate is 100,000 kg/h, and the boiler plant efficiency is 88%. Assuming saturated water enters the boiler and exits with a steam quality of 0.92, determine: (i) The fuel consumption rate in kg/h, given a calorific value of 21 MJ/kg; (ii) Equivalent evaporation from and at 100°C; (iii) The percentage of total heat absorbed in the economizer, evaporator and superheater. 14

5(a) What is meant by the term 'fuel'? Explain the different types of solid fuel mentioning their calorific values. 11

5(b) What is meant by HCV and LCV? Explain briefly the method used to determine the higher calorific value of the liquid fuel. 12

5(c) A bomb calorimeter is used to determine the calorific value of a sample of coal and the following results are obtained: 12
Mass of coal burnt = 1 gm, Mass of water in calorimeter = 2.6 kg, Water equivalent of the apparatus = 0.75 kg, Initial temperature of water = 18°C, Max. observed temperature of water = 22°C, Cooling correction = +0.017°C. If the fuel contains 4% of hydrogen, calculate its lower calorific value of the fuel.

6(a) For the combustion of fuel, write down the equations of combustion by mass for the followings: 10
(i) Complete combustion of Carbon (C) to Carbon dioxide (CO_2)
(ii) Burning of Sulphur (S) to Sulphur dioxide (SO_2)
(iii) Burning of Marsh gas (CH_4)

6(b) What is meant by stoichiometric air-fuel ratio? How will you make the conversion of volumetric analysis to gravimetric analysis for flue gas? 10

6(c) During a boiler trial, the dry flue gas analysis by volume was reported as: 15
CO_2 11%, CO 0.5%, O_2 7%, N_2 81.5%.
The coal analysis by mass was reported as:
C 63.5%, H_2 4%, O_2 4.5%, moisture 14%, ash 14%. Calculate:
(i) Minimum air required to burn 1 kg of coal.
(ii) Mass of air actually supplied per kg of coal.
(iii) The amount of excess air per kg of coal burnt.

7(a) Write short notes on: (i) Knocking, (ii) Scavenging process, and (iii) Supercharging process. 09

7(b) Write down the cooling requirement of an IC engine. 05

7(c) What is meant by octane and cetane number rating of a fuel? 10

7(d) Why the fuel pump and fuel atomizer are used in a CI engine? Discuss the lubrication system of an IC engine. 11

8(a) Draw a T-h diagram of an actual vapour compression cycle and provide a brief explanation for the deviations observed from the ideal vapour compression cycle. 06

8(b) How the gas turbines are classified? Describe the working principle of a simple open cycle gas turbine. 08

8(c) "Summer air conditioning systems dehumidify air, while winter air conditioning systems humidify air" – justify the reason. Also, discuss the factors that influence human comfort. 08

8(d) A vapour compression refrigeration uses R-12 as a refrigerant and the liquid evaporates in the evaporator at -15°C. The temperature of this refrigerant at the delivery from the compressor is 15°C when the vapour is condensed at 10°C. Refrigerant leaves the evaporator before being saturated. Find the coefficient of performance if (i) there is no undercooling, and (ii) the liquid is cooled by 5°C before expansion by throttling. Take specific heat for the saturated vapour as 0.64 kJ/kg K and for liquid as 0.94 kJ/kg K. Also, compare the COPs of two systems and provide the reason for the higher COP in one compared to another. The properties of the refrigerant are given in the table below. 13

Temperature in °C	Enthalpy in kJ/kg		Entropy in kJ/kg K	
	Liquid	Vapour	Liquid	Vapour
-15	22.3	180.88	0.0904	0.7051
+10	45.4	191.76	0.1750	0.6921

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