

4. Answer **any three** of the following questions :

$$10 \times 3 = 30$$

তলত দিয়া প্রশ্নসমূহৰ যিকোনো তিনিটা প্রশ্নৰ উত্তৰ লিখা :

(a) What is the importance of cost accounting in a chemical industry? What are the *two* main types in which costs are divided? Discuss each of them.

$$2+2+6=10$$

ৰাসায়নিক উদ্যোগৰ ক্ষেত্ৰত খৰচ খতিয়ানৰ প্ৰয়োজনীয়তা কি ? ইয়াক কি কি দুটা প্ৰধান ভাগত কৰা হৈছে ? দুয়োবিধৰ বিষয়ে আলোচনা কৰা।

(b) What are various types of job training methods used in industries? Explain them.

উদ্যোগ ক্ষেত্ৰত ব্যৱহাৰ হোৱা চাকৰি প্ৰশিক্ষণ পদ্ধতিসমূহ কি কি ? ব্যাখ্যা কৰা।

(c) Discuss the principles of motivation which are to be followed for successful running of a business.

ব্যৱসায়ৰ সঠিক পৰিচালনাৰ বাবে লবলগীয়া অনুপ্ৰেৰণা নীতিসমূহৰ বিষয়ে আলোচনা কৰা।

(d) What is copyright? Name *four* items on which copyright can be issued.

What happens to the patent when its validity period is expired? Discuss the difference between patent and copyright.

কপিৰাইট কি ? কপিৰাইট প্ৰযোজ্য হোৱা চাৰিবিধ বস্তুৰ নাম লিখা। পেটেণ্টৰ ম্যাদকাল উত্তীৰ্ণ হোৱাৰ পিছত পেটেণ্টৰ কি হয় ? কপিৰাইট আৰু পেটেণ্টৰ মাজত পাৰ্থক্য লিখা।

(e) Discuss the role of chemistry in the following industrial sectors: 5+5=10

তলত উল্লেখ কৰা ঔদ্যোগিক খণ্ডদুটাত ৰসায়ণৰ ভূমিকা আলোচনা কৰা :

(i) Agriculture  
কৃষি

(ii) Medicine  
ঔষধি

(f) Write short notes on: 5+5=10  
চমু টোকা লিখা :

(i) Human resource management  
মানৱ সম্পদ পৰিচালনা

(ii) Importance of marketing management  
বিপণন পৰিচালনাৰ গুৰুত্ব

## OPTION - F

Paper : CHE-SE- 3074

### [Intellectual Property Rights (IPR)]

1. Answer the following :

তলত দিয়াবোৰৰ উত্তৰ লিখা :

1×4=4

(a) What was the subject matter of Berne Convention ?

বাৰ্ন চুক্তিৰ বিষয়বস্তু কি আছিল ?

(b) What is commercial exploitation according to SICLD ?

SICLD অনুসৰি বাণিজ্যিক শোষণ কি ?

(c) What is the difference between MFN treatment and National treatment ?

ৰাষ্ট্ৰীয় চিকিৎসা আৰু MFN চিকিৎসা মাজত কি পাৰ্থক্য আছে ?

(d) What is the mission of UPOV ?

UPOV ৰ উদ্দেশ্য কি ?

2. Answer the following :

তলত দিয়াবোৰৰ উত্তৰ দিয়া :

2×3=6

(a) "The Registration of GI is not granted to any individual." State whether it is true **or** false. Explain.

1+1=2

"GI ৰ পঞ্জীয়ন কোনো ব্যক্তিক প্রদান কৰা নহয়" এইটো সঁচা নে মিছা উল্লেখ কৰা আৰু কাৰণ ব্যাখ্যা কৰা।

(b) What are the key features of trademark ?

ট্ৰেডমাৰ্কৰ মুখ্য বৈশিষ্ট্যসমূহ কি ?

(c) What is Hague Agreement ? How is it useful for users ?

1+1=2

হেগ চুক্তি কি ? ব্যৱহাৰকাৰীৰ বাবে ই কিদৰে উপযোগী ?

3. Answer **any two** of the following questions :

5×2=10

তলৰ যিকোনো দুটা প্ৰশ্নৰ উত্তৰ লিখা :

(i) (a) What is WIPO ? What are its objectives ?

1+1=2

WIPO কি ? ইয়াৰ উদ্দেশ্যসমূহ কি কি ?

(b) Give **three** differences between geographical indication and trademark.

3

ভৌগোলিক চিহ্ন আৰু ট্ৰেডমাৰ্কৰ মাজত তিনিটা পাৰ্থক্য উল্লেখ কৰা।

(ii) What is the tenure of design protection ? What are advantages of registration of design ?

1+4=5

ডিজাইন সুৰক্ষাৰ ম্যাদ কি ? ডিজাইন পঞ্জীয়নৰ সুবিধাসমূহ কি কি ?

(iii) (a) What is PCT in patent? What is its advantages? 1+2=3

পেটেন্টত PCT কি? ইয়াৰ নাভালাভবোৰ কি কি?

(b) "Right of the patent holder in his invention is a monopoly right." Explain. 2

"পেটেন্টধাৰক তেঁওৰ আৱিষ্কাৰৰ একচেটিয়া অধিকাৰক।" ব্যাখ্যা কৰা।

(iv) (a) Justify the following statement: "Government may use the invention for which the patent is filed." 3

তলৰ উক্তিটোৰ সত্যাসত্য ব্যাখ্যা কৰা:

পেটেন্টৰ বাবে আবেদন কৰা উদ্ভাৱনটো চৰকাৰে ব্যৱহাৰ কৰিব পাৰে।"

(b) What is IP infringement? What is watermarking in the context of IPR infringement? 1+1=2

IP উলংঘা কি? IPR উলংঘাৰ প্ৰসংগত বাটাৰমাৰ্কিং কি?

4. Answer the following questions: (any three)

10×3=30

তলত দিয়া যিকোনো তিনিটা প্ৰশ্নৰ উত্তৰ লিখা:

(a) (i) What are the main features of Budapest Treaty? 3

বুদাপেষ্ট সন্ধিৰ মূল বৈশিষ্ট্যসমূহ কি কি?

(ii) Differentiate between GATT and GATS. 2

GATT আৰু GATS-ৰ মাজত পাৰ্থক্য লিখা।

(iii) When did India join World Trade Organisation as a member? Discuss the functions of WTO. 1+4=5

ভাৰত কেতিয়া বিশ্ব বাণিজ্য সংস্থাৰ সদস্য হয়? বিশ্ব বাণিজ্য সংস্থাৰ কাৰ্যসমূহ আলোচনা কৰা।

(b) (i) Who are the beneficiaries of patent? 3

পেটেন্টৰ হিতাধিকাৰী কোন কোন হয় লিখা?

(ii) What is the criteria for patentability? 3

পেটেন্টযোগ্যতাৰ মানদণ্ড কি?

(iii) Which Act governs the patent system in India? 1

কোনখন আইনে ভাৰতত পেটেণ্ট ব্যৱস্থা নিয়ন্ত্ৰণ কৰে ?

(iv) Mention any three reasons due to which a patent filed may be rejected. 3

আবেদন কৰা পেটেণ্ট প্ৰত্যাখ্যান কৰাৰ যিকোনো তিনিটা কাৰণ উল্লেখ কৰা।

(c) (i) Give two examples of traditional knowledge. Discuss on the systems of traditional knowledge protection. 2+5=7

পৰম্পৰাগত জ্ঞানৰ দুটা উদাহৰণ দিয়া।  
পৰম্পৰাগত জ্ঞান সুৰক্ষাৰ ব্যৱস্থাৰ ওপৰত আলোচনা কৰা।

(ii) What are the three criteria for a software patent? 3

ছ'ফটৱেৰ পেটেণ্টৰ তিনিটা মানদণ্ড কি কি ?

(d) (i) What is the GI Tag in India? 1

ভাৰতৰ প্ৰথমতে GI টেগ কি আছিল ?

(ii) What are the goals of Convention on Biological Diversity (CBD)? Which countries are not members of CBD? 2+1=3

জৈবিক বৈচিত্ৰতাৰ ওপৰত সন্মিলনৰ (CBD) লক্ষ্যসমূহ কি কি ? কোনবোৰ দেশ CBDৰ সদস্য নহয় ?

(iii) What are the criteria for registering as industrial design? Mention any four advantages of registration of design. 2+4=6

ঔদ্যোগিক ডিজাইন পঞ্জীয়নৰ বাবে কি কি মানদণ্ড আছে ? ডিজাইন পঞ্জীয়নৰ চাৰিটা সুবিধা উল্লেখ কৰা।

(e) (i) What is arbitrary trademark? Give one example. 2

স্বৈৰাচাৰী ট্ৰেডমাৰ্ক কি ? উদাহৰণ দিয়া।

(ii) How is certification trademark useful for consumers? Give example. 2

প্ৰমাণীকৰণ ট্ৰেডমাৰ্ক কিদৰে উপভোক্তাৰ বাবে উপযোগী ? উদাহৰণ দিয়া।

(iii) What happens when a copyright expires? Give example. 2+1=3

কপিৰাইটৰ ম্যাদ শেষ হ'লে কি হ'ব ? উদাহৰণ  
দিয়া।

(iv) What does copyright protect? 3  
কপিৰাইটৰ দ্বাৰা কি সুৰক্ষিত হয় ?

(f) (i) What is the term of copyright in  
case of joint authors? 1

যৌগ লেখকৰ ক্ষেত্ৰত কপিৰাইটৰ ম্যাদ কি ?

(ii) What is IDA? How is it helpful for  
the patent system? 1+2=3

IDA মানে কি ? পেটেণ্ট ব্যৱস্থাৰ বাবে ই  
কেনেকৈ সহায়ক ?

(iii) What are the issues covered by  
TRIPS Agreement? 3

TRIPS ৰ অধীনত কি কি বিষয় সামৰি লোৱা  
হৈছে ?

(iv) What remedies are available to  
redress IP infringement? 3

IP উলংঘনৰ বাবে কি কি ব্যৱস্থা আছে ?

Total number of printed pages-4

**3 (Sem-3/CBCS) BOT HC 1**

**2023**

**BOTANY**

(Honours Core)

Paper : BOT-HC-3016

**(Morphology and Anatomy of Angiosperm)**

Full Marks : 60

Time : Three hours

***The figures in the margin indicate full marks for the questions.***

1. Answer the following : 1×7=7

(a) Which tissue of the leaf contains chloroplast?

(b) What is laticifer?

(c) What is quiescent centre?

(d) Write the name of flattened petiole of Australian *Acacia*.

Contd.

(e) Write the types of vascular bundle in dicot root.

(f) When anthers are united but the filaments remain free the condition is called \_\_\_\_\_. (Fill up the gap)

(g) The only living element in xylem tissue is \_\_\_\_\_. (Fill up the gap)

2. Answer the following very shortly :  $2 \times 4 = 8$

(a) Schizocarpic fruits.

(b) Tyloses and Tylosoid.

(c) Distinguish between Tracheid and Vessels.

(d) Spikelet.

3. Answer **any three** of the following :

$5 \times 3 = 15$

(a) Distinguish between internal structure of Dicot and Monocot stem.

(b) Cohesion of stamen.

(c) Anatomical and physiological adaptations of Xerophytes.

(d) Distinguish between cambium and Cork cambium.

(e) Distinguish between Racemose and Cymose inflorescences.

4. Answer the following questions : (**any three**)

$10 \times 3 = 30$

(a) What is Secondary Growth? Describe in detail about Secondary Growth in dicotyledonous stem with neat diagram.

$2 + 8 = 10$

(b) What is the difference between tissue and tissue system? Describe the epidermal tissue system with special reference to epidermal outgrowths.

$1 + 9 = 10$

(c) Define permanent tissues. How are they classified? Describe different types of simple tissues with neat diagram.

$2 + 2 + 6 = 10$

(d) Describe briefly about the role of anatomy in solving the problems of plant systematics.

- (e) Write briefly the principal changes that occur in the sapwood during its progression into heartwood? How would you differentiate the former from the latter? Which of these two is economically more important?

5+4+1=10

- (f) What do you mean by Phyllode? Describe briefly about the Phyllode theory, and its significance.

2+7+1=10

Total number of printed pages-11

3 (Sem-3/CBCS) CHE HG/RC

2023

**CHEMISTRY**

(Honours Generic/Regular)

Paper : CHE-HG/RC-3016

**(Chemical Energetics, Equilibrium  
and Functional Organic Chemistry-I)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate  
full marks for the questions.**

Answer **either** in English **or** in Assamese.

1. Write the answers of the following questions :  
1×7=7

তলৰ প্ৰশ্নৰ উত্তৰ লিখা :

- (i) A system absorbs 701 J heat and does 394 J work. What will be the change in internal energy of the system ?

এটা তন্ত্ৰই 701 J তাপ শোষণ কৰাৰ ফলত 394 J কাৰ্য্য সম্পন্ন কৰে। তন্ত্ৰটোৰ আন্তঃশক্তিৰ কিমান পৰিৱৰ্তন হ'ল?

Contd.

(ii) The ionic product of water at 310K is  $2.7 \times 10^{-14}$ . What is the pH of neutral water at 310K?

310K উষ্ণতাত পানীৰ আয়নীয় গুণফল  $2.7 \times 10^{-14}$  হয়। 310K উষ্ণতাত পানীৰ pH কিমান হ'ব?

(iii) How does a change in temperature affect the pH of a neutral solution?

এটা প্রশম দ্ৰৱৰ pH ৰ ওপৰত উষ্ণতাৰ প্ৰভাৱে কেনেদৰে পৰিৱৰ্তন আনে?

(iv) What will be value of  $\Delta G$  when liquid water is vaporized at 373K and 1 atm pressure?

373K উষ্ণতা আৰু 1 atm চাপত যেতিয়া পানী বাষ্পলৈ পৰিৱৰ্তন হয়,  $\Delta G$  ৰ মান কিমান হ'ব?

(v) What happens when acetylene is heated in red hot iron tube at 873K temperature?

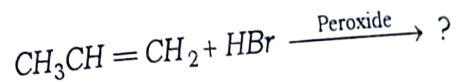
873K উষ্ণতাত এচিটাইলিনক লোহিত তপ্ত আইৰন নলীত উত্তপ্ত কৰিলে কি সংঘটিত হ'ব?

(vi) What is the use of iodoform test?

আয়ড'ফৰ্ম পৰীক্ষাৰ এটা ব্যৱহাৰ লিখা।

(vii) Complete the following reaction :

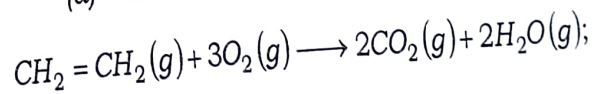
তলত দিয়া বিক্ৰিয়াটো সম্পূৰ্ণ কৰা :



2. Answer the following questions :  $2 \times 4 = 8$

তলত দিয়া প্ৰশ্নসমূহৰ উত্তৰ কৰা :

(a) Calculate  $\Delta_r H^\circ$  for the reaction,

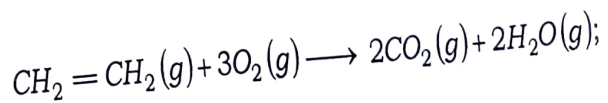


Given that,

$$\epsilon_{\text{C-H}} = 414.0 \text{ kJ mol}^{-1}$$

$$\epsilon_{\text{O-O}} = 499.0 \text{ kJ mol}^{-1} \text{ and}$$

$$\epsilon_{\text{C-O}} = 724.0 \text{ kJ mol}^{-1}$$



Contd.

এই বিক্রিয়াটোৰ বাবে  $\Delta_r H^\circ$  ৰ মান গণনা কৰা।

দিয়া আছে যে,

$$\varepsilon_{C-H} = 414.0 \text{ kJ mol}^{-1}$$

$$\varepsilon_{O-O} = 499.0 \text{ kJ mol}^{-1} \text{ আৰু}$$

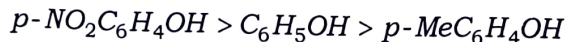
$$\varepsilon_{C-O} = 724.0 \text{ kJ mol}^{-1}$$

(b) The pH of 0.1 M HCN solution is 5.2. What is the value of  $K_a$  for the acid?

0.1 M HCN দ্ৰৱৰ pH ৰ মান 5.2। HCN ৰ বাবে  $K_a$  ৰ মান কিমান হব?

(c) Explain why the acidity of the given phenols are in the following order :

তলত উল্লেখ কৰা ফিনলসমূহৰ এচিডীয়কৰণৰ ক্ৰমটো ব্যাখ্যা কৰা :



(d) How can you distinguish between 1°, 2° and 3° alcohols with the help of Lucas test?

লুকাছ পৰীক্ষাৰ সহায়ত 1°, 2° আৰু 3° এলকহলৰ চিনাক্তকৰণ কেনেকৈ কৰিব?

3. Answer **any three** of the following : 5×3=15

তলৰ যিকোনো তিনিটা প্ৰশ্নৰ উত্তৰ লিখা :

(a) What do you understand by buffer action? Explain mechanism of buffer action with the help of suitable example. Define buffer capacity. 1+2+2=5

বাফাৰ ক্ৰিয়া মানে কি বুজা? উপযুক্ত উদাহৰণসহ বাফাৰ ক্ৰিয়া বৰ্ণনা কৰা। বাফাৰ ক্ষমতা মানে কি বৰ্ণনা কৰা।

(b) Show that : 2½×2=5

$$(i) \left( \frac{\partial A}{\partial V} \right)_T = -V \text{ and } (ii) \left( \frac{\partial A}{\partial T} \right)_V = -S$$

Where A is work function and other symbol have their usual meaning.

দেখুওৱা যে :

$$(i) \left( \frac{\partial A}{\partial V} \right)_T = -V \text{ আৰু } (ii) \left( \frac{\partial A}{\partial T} \right)_V = -S$$

য'ত A হ'ল কাৰ্য্য ফলন আৰু বাকী চিহ্নবোৰে সচৰাচৰ অৰ্থ সূচায়।

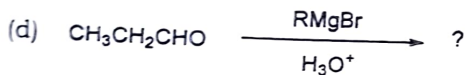
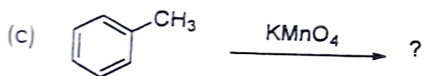
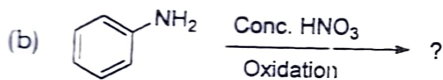
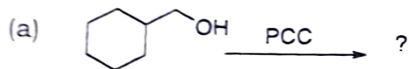
- (c) State Hess's law and explain it with example. Show that Hess's law is another form of the first law of thermodynamics.  $2+3=5$

হেছৰ সূত্ৰটো উদাহৰণসহ উপস্থাপন কৰা। বৰ্ণনা কৰা যে হেছৰ সূত্ৰটো তাপগতিবিজ্ঞানৰ প্ৰথম সূত্ৰৰ অন্য এটা প্ৰকাশ হৈ হয়।

- (d) Complete the following reactions :

$1 \times 5 = 5$

তলত দিয়াবোৰ সম্পূৰ্ণ কৰা :



- (e) (i) Why  $\text{S}_{\text{N}}1$  reaction is preferred more than  $\text{S}_{\text{N}}2$  reaction in case of tertiary alkyl halide?  $2$

টাৰ্ছিয়েৰী এলকাইল হেলাইডে  $\text{S}_{\text{N}}2$  বিক্ৰিয়াৰ পৰিবৰ্তে  $\text{S}_{\text{N}}1$  বিক্ৰিয়াৰ প্ৰতি সক্ৰিয়তা দেখুৱায় কিয়?

- (ii) Discuss the factors that affect  $\text{S}_{\text{N}}2$  reaction.  $3$

$\text{S}_{\text{N}}2$  বিক্ৰিয়াক প্ৰভাৱিত কৰা কাৰকসমূহ আলোচনা কৰা।

4. Answer **any three** :  $10 \times 3 = 30$

যিকোনো তিনিটাৰ উত্তৰ কৰা :

- (a) Derive the relation between the equilibrium constant  $K_p$ ,  $K_c$  and  $K_x$ . Under what conditions  $K_p = K_c = K_x$ ? ( $p$ ,  $c$  and  $x$ , stands for partial pressure, molar concentration and mole fraction) Why equilibrium constant is important?

সাম্য ধ্রুবক  $K_p$ ,  $K_c$  আৰু  $K_x$  ৰ মাজৰ সম্পৰ্কটো উপস্থাপন কৰা। কি চৰ্ত সাপেক্ষে  $K_p = K_c = K_x$  হ'ব? ( $p$ ,  $c$  আৰু  $x$ , ক্ৰমে আংশিক চাপ, ম'লাৰ গাঢ়তা আৰু ম'ল ভগ্নাংশ।)

সাম্য ধ্রুবক কিয় প্ৰয়োজনীয়?

- (b) Define the terms hydrolysis constant and degree of hydrolysis. Find the mathematical expressions of these quantities for following :  $2+3+3+2=10$

জল বিয়োজন ধ্রুবক আৰু জল বিয়োজন মাত্ৰা বুলিলে কি বুজা? তলত উল্লেখ কৰা পৰিমাণসমূহৰ বাবে গাণিতীয় প্ৰকাশ বাশি উলিওৱা :

- (i) An aqueous solution of a salt of strong acid and weak base.

তীব্ৰ এচিড আৰু মৃদু ক্ষাৰৰ লৰণৰ জলীয় দ্ৰৱণ।

- (ii) An aqueous solution of a salt of weak acid and strong base.

মৃদু এচিড আৰু তীব্ৰ ক্ষাৰৰ লৰণৰ জলীয় দ্ৰৱণ।

- (iii) Also find the expression for pH of the solution in each case.

উভয় ক্ষেত্ৰত pH ৰ প্ৰকাশ বাশি উপস্থাপন কৰা।

- (c) State and Explain the terms heat capacity of a system, molar heat capacity at constant volume and constant pressure. Show that for one mole an ideal gas  $C_p - C_v = R$ .

6+4=10

তলত উল্লেখ কৰা বাশিসমূহ ব্যাখ্যা কৰা :

তন্ত্ৰ এটাৰ তাপ গ্ৰাহিতা, স্থিৰ আয়তনত ম'লাৰ তাপ গ্ৰাহিতা, আৰু স্থিৰ চাপত ম'লাৰ তাপ গ্ৰাহিতা।

দেখুওৱা যে এক ম'ল আদৰ্শ গেছৰ বাবে  $C_p - C_v = R$

- (d) Write the following reactions :

(any four)

$2\frac{1}{2} \times 4 = 10$

যিকোনো চাৰিটাৰ বিক্ৰিয়া লিখা :

- (i) Sandmeyer reaction

ছেণ্ডমায়াৰ বিক্ৰিয়া

- (ii) Williamson's synthesis

উইলিয়ামছনৰ পদ্ধতি

- (iii) Wittig reaction

উইটিগ বিক্ৰিয়া

(iv) Meerwein-Ponndorf-Verley  
reduction

মিৰউইন-প'নডৰ্ফ ভ'লে' বিজ্ঞাপণ

(v) Benzoin condensation

বেনজয়ইন ঘনীভৱন

(e) How can you prepare ?  $2 \times 5 = 10$

কিদৰে প্ৰস্তুত কৰিবা ?

(i) Benzene to Benzaldehyde

বেনজিন ৰ পৰা বেনজেলডিহাইড

(ii) Chlorobenzene to Aniline

ক্ল'ৰ'বেনজিন ৰ পৰা এনিলিন

(iii) Phenol to Salicylaldehyde

ফিনল ৰ পৰা চেলিচাইলেলডিহাইড

(iv) Cumene to Phenol

কিউমিন ৰ পৰা ফিনল

(v) diethylether to ethanol

ডাইইথাইল ইথাৰ ৰ পৰা ইথানল

(f) State and explain Le Chatelier's principle. Describe the effect of change of concentration, pressure and temperature on the equilibrium of reaction.

লা চেটেলিয়াৰ সূত্ৰ লিখি বৰ্ণনা কৰা। বিক্ৰিয়াৰ সাম্য অৱস্থাৰ ওপৰত গাঢ়তা, চাপ আৰু উষ্ণতাৰ পৰিৱৰ্তনৰ প্ৰভাৱ বৰ্ণনা কৰা।

Total number of printed pages-8

**3 (Sem - 3/CBCS) PHY HC 3**

**2023**

**PHYSICS**

(Honours Core)

Paper : PHY-HC-3036

**(Digital Systems and Applications)**

Full Marks : 60

Time : Three hours

**The figures in the margin indicate  
full marks for the questions.**

1. Answer the following questions :  $1 \times 7 = 7$

(a) What is the function of the trigger circuit in a CRO ?

(A) To control the vertical deflection.

(B) To adjust the horizontal position of the trace.

(C) To stabilize the waveform display.

(D) To change the time/division setting.

Contd.

(b) Which of the following statement is not true ?

(A) Analog ICs are more suitable for applications that involve precise control of voltage and current.

(B) A flip-flop is a component of digital IC commonly used for data storage and sequential logic operations.

(C) Digital ICs are typically more resistant to noise and interference compared to analog ICs.

(D) Operational amplifiers (op-amps) are commonly found in digital ICs for performing arithmetic and logic operations.

(c) What is the BCD representation of the decimal number 7 ?

(d) In a 3-variable Boolean expression, how many Minterms, and Maxterms can be obtained ?

(e) What are the *two* outputs produced by a half adder ?

(f) How many operational modes does the IC555 timer have ?

(g) What is the size of the data bus in the 8085 microprocessors ?

2. Give answer to the following questions :  $2 \times 4 = 8$

(a) What do you mean by deflection sensitivity of a CRO ?

(b) Mention *two* differences between active and passive components of an IC.

(c) Draw the external circuit diagram of an IC555 used as an astable multivibrator.

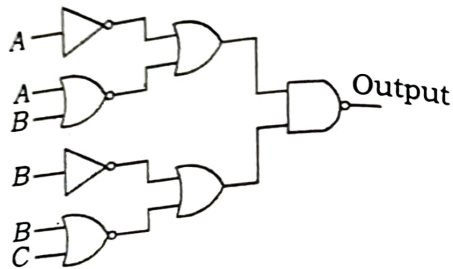
(d) Draw the logic diagram of a 4-bit parallel-in-serial-out shift register.

3. Answer **any three** questions from the following :  $5 \times 3 = 15$

(a) Mention the names of the logic gates known as Universal gate. Describe how AND gate and OR gate can be realised using *any one* of the Universal gates.  $1+2+2=5$

(b) Describe the working of NAND gate using Transistor logic.

(c) Draw the simplest possible logic diagram to provide the output of the following logic diagram :



(d) What do you mean by 'minterm' in a Boolean expression? Expand the following Boolean expression into minterms : 1+4=5

$$A + B\bar{C} + AB\bar{D} + ABCD$$

(e) Draw the circuit diagram of a 1 to 4 demultiplexer and give its truth table. Mention *two* applications of demultiplexer. 3+2=5

4. Answer **any three** questions from the following : 10×3=30

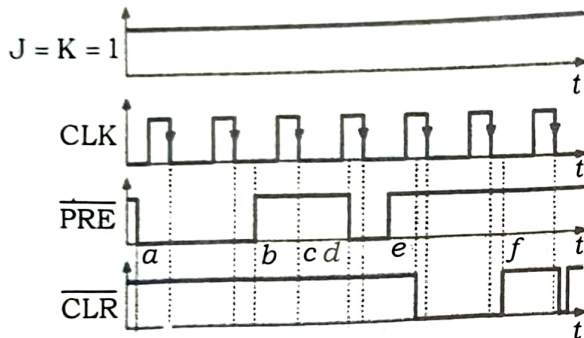
(a) (i) Perform the addition and subtraction of the following 8-bit numbers expressed in 2's complement representation. Verify your answer using decimal addition and subtraction. 4

$$N1 = 00110010 \text{ and } N2 = 11111101$$

(ii) Explain the PRESET and CLEAR operations in a clocked JK flip-flop using logic diagram and truth table. 6

(b) (i) Describe the basic components of a 4-bit binary adder circuit. How does it handle the addition of two binary numbers, including carry propagation? 4

- (ii) The waveforms shown in the following figure are applied to a NGT clocked JK flip-flop having active low Preset and Clear inputs. Draw the output waveform explaining its behaviour at the indicated time steps (a, b, c, d, e, f). Consider the flip-flop is initially at RESET condition. 6



- (c) (i) Mention *two* basic differences between synchronous and asynchronous counters. Draw the logic diagram of a decade counter. 2+3=5
- (ii) What do you mean by the modulus of a counter? Design a three-bit asynchronous up counter using negative edge triggered flip-flops. 1+4=5

- (d) (i) Discuss various levels of memory used in computer system and their characteristics. 5

- (ii) Give *two* examples of output device of a computer system. What do you mean by the term 'bus' in computer? Discuss about the two types of buses used in CPU of a computer. 1+1+3=5

- (e) (i) What do you mean by flag registers? Describe briefly the function of various flag registers. 1+5=6

**Or**

With neat diagram explain the working of various buses in a microprocessor based system. 6

- (ii) Differentiate between the 2-byte instructions and 3-byte instruction code in case of 8085 microprocessor. Write an Assembly Language Program to transfer data from register B to C. 2+2=4

**Or**

Write an 8085 Assembly Language Program to add two 8-bit hexadecimal numbers stored in memory using direct addressing mode. 4

(f) (i) Write two differences between Analog and Digital circuits. 2

(ii) Using truth tables, prove the following : 6

1.  $\overline{A.B} = \overline{A} + \overline{B}$

2.  $\overline{A+B} = \overline{A}. \overline{B}$

(iii) Mention the truth table of XNOR gate. 2

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Total number of printed pages-4

3 (Sem-3/CBCS) CHE HC 1

2023

**CHEMISTRY**

(Honours Core)

Paper : CHE-HC-3016

**(Inorganic Chemistry-II)**

Full Marks : 60

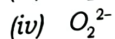
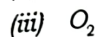
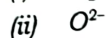
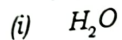
Time : Three hours

***The figures in the margin indicate full marks for the questions.***

1. Answer the following as directed:  $1 \times 7 = 7$ 
  - (a) Name the graph of Gibbs Energy ( $\Delta G$ ) versus Temperature (T) for the formation of oxide of metal.
  - (b) "Group-I elements gets oxidized easily" – State whether *True* or *False*.
  - (c) Write the structural formula of borazine.
  - (d) What is "basicity of an acid"?

Contd.

(e) Which one of the following species is conjugate base of  $\text{OH}^-$ ?



(f) "The name inert gas is improper" - Explain the statement.

(g) Calculate the hardness of  $\text{Al}^{3+}$  for the ionization energy, 119.99 eV and electron affinity 28.45 eV.

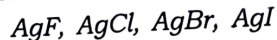
2. Answer the following :  $2 \times 4 = 8$

(a) Describe the structure of boric acid.

(b) What is inert pair effect? Arrange the stability of +1 oxidation states of  $\text{Ca}^+$ ,  $\text{Al}^+$ ,  $\text{In}^+$  and  $\text{Tl}^+$  in their increasing order.

(c) Applying Wade's rule, predict and draw the structure of  $\text{CB}_5\text{H}_9$ .

(d) Arrange the following compounds in ascending order of their solubility in water.



Give explanation.

3. Answer **any three** of the following :

$5 \times 3 = 15$

(a) Briefly discuss the bonding and structure of diborane. 5

(b) What is diagonal relationship? Write **any four** similar properties of Be and Al. 1+4=5

(c) Discuss the Mond's process used in metal refining.

(d) What are polyhalides? Give example. How they are different from Interhalogen Compounds? 1+1+3=5

(e) Write constructing properties of the borazine and benzene.

4. Answer **any three** of the following :

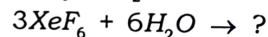
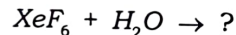
$10 \times 3 = 30$

(a) What is Allotropism? Name Different allotropes of carbon. Discuss bonding in graphite. Explain the high thermal and electrical conductivity of graphite. What is intercalation compounds? Give examples. 2+2+2+2+1+1=10

(b) (i) What happens when Xenon is heated in presence of fluorine? How the amount of fluorine affect the nature of product? 2+2=4

(ii) Discuss the bonding in  $\text{XeF}_6$ . 4

(iii) Complete the following reaction



- (c) (i) Give the formula, structure and method of preparation of basic beryllium acetate.  $1+2+2=5$
- (ii) How are poly siloxanes formed? Distinguish between silicon fluids and silicon rubbers.  $2+3=5$
- (d) Write notes on : **(any two)**  $5+5=10$
- (i) Pseudohalogens
- (ii) Pasting process
- (iii) Catenation
- (e) (i) State the Pauling's rules for determination of strength of mononuclear oxoacids.  $3$
- (ii) Arrange the following in order of descending acid strengths in aqueous solution -  
 $HClO_4$  ,  $HOCl$ ,  $HClO_3$ ,  $HClO_2$   
 Give explanation.  $3$
- (iii) Pauling's rule is useful in detecting structural anomalies, explain.  $2$
- (iv) What is symbiosis? Explain.  $2$
- (f) What is silicates? Explain the bonding and structure of  $SiO_4^{4-}$  unit using hybridization. What are different types of silicates? Give their structure.  
 $1+4+3+2=10$

Total number of printed pages-7

**3 (Sem-3/CBCS) MAT HC 1**

**2023**

**MATHEMATICS**

(Honours Core)

Paper : MAT-HC-3016

**(Theory of Real Functions)**

Full Marks : 80

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following questions:  $1 \times 10 = 10$
- (a) Is 0 a cluster point of  $(0,1)$  ?
- (b) "If the limit of a function  $f$  at a point  $C$  of its domain does not exist, then  $f$  diverges at  $C$ ." (Write True or False)
- (c) Define  $\lim_{x \rightarrow c} f(x) = \infty$ , where  $A \subseteq \mathbb{R}$  and  $f : A \rightarrow \mathbb{R}$  and  $C \in \mathbb{R}$  is a cluster point of  $A$ .

Contd.

- (d) Write sequential criterion for continuity.
- (e) What do you mean by an unbounded function on a set ?
- (f) Let  $A, B \subseteq \mathbb{R}$  and let  $f: A \rightarrow \mathbb{R}$  be continuous on  $A$  and let  $g: B \rightarrow \mathbb{R}$  be continuous on  $B$ . Under what condition  $g \circ f: A \rightarrow \mathbb{R}$  is continuous on  $A$  ?
- (g) "If a function is continuous then it is uniformly continuous."  
(Write True or False)
- (h) If functions  $f_1, f_2, \dots, f_n$  are differentiable at  $c$ , write the expression for  $(f_1, f_2, \dots, f_n)'(c)$ .
- (i) The function  $f(x) = x$  is defined on the interval  $I = [0, 1]$ . Is 0 a relative maximum of  $f$  ?
- (j) Define Taylor's polynomial for a function  $f$  at a point  $x_0$ , supposing  $f$  has an  $n$ th derivative at  $x_0$ .

2. Answer the following questions:  $2 \times 5 = 10$

(a) Use  $\varepsilon - \delta$  definition of limit to show

$$\text{that } \lim_{x \rightarrow 0} \frac{x^2}{|x|} = 0.$$

(b) Show that the absolute value function  $f(x) = |x|$  is continuous at every point  $c \in \mathbb{R}$ .

(c) Give an example of a function  $f: [0, 1] \rightarrow \mathbb{R}$  that is discontinuous at every point of  $[0, 1]$ , but  $|f|$  is continuous on  $[0, 1]$ .

(d) "Continuity at a point is not a sufficient condition for the derivative to exist at that point." Justify your answer.

(e) Show that  $\lim_{x \rightarrow 0^+} \frac{\sin x}{\sqrt{x}} = 0$ .

3. Answer **any four** parts:  $5 \times 4 = 20$

(a) Prove that a number  $c \in \mathbb{R}$  is a cluster point of a subset  $A$  of  $\mathbb{R}$  if and only if there exists a sequence  $\{a_n\}$  in  $A$  such that  $\lim a_n = c$  and  $a_n \neq c$  for all  $n \in \mathbb{N}$ .

- (b) Show that (using  $\epsilon$ - $\delta$  definition of limit)

$$\lim_{x \rightarrow 2} \frac{x^3 - 4}{x^2 + 1} = \frac{4}{5}$$

- (c) Prove that if  $I = [a, b]$  is a closed bounded interval and if  $f: I \rightarrow \mathbb{R}$  is continuous on  $I$  then  $f$  is bounded on  $I$ .
- (d) Show that if  $f$  and  $g$  are uniformly continuous on a subset  $A$  of  $\mathbb{R}$  then  $f+g$  is uniformly continuous on  $A$ .
- (e) Suppose that  $f$  is continuous on a closed interval  $I = [a, b]$  and that  $f$  has a derivative in the open interval  $(a, b)$ . Then there exists *at least one* point  $c$  in  $(a, b)$  such that
- $$f(b) - f(a) = f'(c)(b - a).$$
- (f) Let  $f: I \rightarrow \mathbb{R}$  be differentiable on the interval  $I$ . Then prove that  $f$  is increasing if and only if  $f'(x) \geq 0$  for all  $x \in I$ .

4. Answer **any four** parts : 10×4=40

- (a) Prove that a real valued function  $f$  is continuous at  $c \in \mathbb{R}$  if and only if whenever every sequence  $\{c_n\}$ , converging to  $c$ , then corresponding sequence  $\{f(c_n)\}$  converges to  $f(c)$ .
- (b) (i) Show that every infinite bounded subset of  $\mathbb{R}$  has *at least one* limit point. 5
- (ii) Let  $A \subseteq \mathbb{R}$ , let  $f: A \rightarrow \mathbb{R}$  and let  $c \in \mathbb{R}$  be a cluster point of  $A$ . If  $a \leq f(x) \leq b$  for all  $x \in A$ ,  $x \neq c$  and if  $\lim_{x \rightarrow c} f(x)$  exist then prove that
- $$a \leq \lim_{x \rightarrow c} f \leq b. \quad 5$$
- (c) (i) Let  $I = [a, b]$  be a closed bounded interval. Let  $f: I \rightarrow \mathbb{R}$  be such that  $f$  is continuous. Prove that  $f$  is uniformly continuous on  $[a, b]$ .

5