2022
BIOLOGY
(Theory)
Full Marks – 70
Time – 3 Hours

General Instructions:
(i) All questions are compulsory.
(ii) Please write down the serial number of the question before attempting it.
(iii) Marks for each question are indicated against it.

SECTION – A

1. Choose the correct answer: 9×1=9

(a) The protective and nutritive layer of the blastocyst is –
   (i) trophoblast               (ii) embryonic disc
   (iii) inner cell mass         (iv) mesoderm

(b) When pollen grains of a flower are transferred to the stigma of another flower on the same plant, it is known as –
   (i) autogamy                  (ii) geitonogamy
   (iii) allogamy                (iv) xenogamy

(c) Which of these is not a secondary sex organ?
   (i) Oviduct                  (ii) Ova
   (iii) Vas deferens            (iv) Penis

(d) If a double stranded DNA has 20% cytosine, the percentage of adenine in DNA would be –
   (i) 30%                      (ii) 20%
   (iii) 40%                    (iv) 60%

(e) If Tall (T) is dominant over dwarf (t) and round seed (R) is dominant over wrinkled seed (r), the genotype of a true breeding tall plant with wrinkled seed would be –
   (i) TtRr                     (ii) TtRR
   (iii) TtIr                    (iv) TtRr

P.T.O.
(f) Which of the following are known as psychedelic or mind expanding drugs?
   (i) stimulants  (ii) hallucinogens
   (iii) cannabinoids  (iv) opioids

(g) An orchid attaches itself to a mango tree for support. It is not getting any food from it and the tree is not harmed either. What type of interaction are they having?
   (i) commensalism  (ii) mutualism
   (iii) parasitism  (iv) predation

(h) The relationship of sea anemone and hermit crab is called—
   (i) predation  (ii) commensalism
   (iii) protocooperation  (iv) competition

(i) Which of the following is an association of fungi and algae?
   (i) co-evolution  (ii) mycorrhizae
   (iii) lichen  (iv) commensalism

2. Fill in the blanks:
   (a) _________ is the genetic expression of an organism.
   (b) _________ refers to many embryo in the same seed.
   (c) The process of nutrient enrichment of water and consequent loss of species diversity is called _________.

   (d) The transgenic crop, golden rice is rich in vitamin _________.

   (e) The cell that grows into unorganised mass of cell is called _________.

SECTION — B

   1+\frac{1}{2}+\frac{1}{2}=2

4. (a) How are amino acids activated during protein synthesis?  
   2

   OR

(b) How is sex determined in insects and birds?  
   1+1=2
5. Differentiate between Humoral and Cell mediated immune response. 1+1=2
6. What are the effects of alcohol on the liver? 2
7. Define transgenic crops. Give two advantages of transgenic crops. 1+½+½=2
8. Explain Brood parasitism with example. 2
9. List any four important ecosystem services derived from biodiversity. 2

SECTION – C

10. What is population explosion? Write the causes and effects of population explosion. 1+2=3
11. (a) What is speciation? Explain the types of speciation. 1+2=3
    
    OR

    (b) Explain Oparin Haldane theory. 3
12. Can a couple both having blood group ‘A’ have a child having blood group ‘O’? Give reasons and make suitable crosses. 1+1+1=3
13. What is vaccination? Briefly explain what happens when vaccine is introduced into the body. 1+2=3
14. There is a need to develop food that have higher level of nutritive value. Why is it so? Explain the desired nutritional qualities in crops. 1+2=3
15. What is palindromic nucleotide sequence? Mention two important consequences that arise from palindromic nucleotide sequence. 1+2=3
16. What is a transgenic animal? Mention four applications of transgenic animals. 1+2=3
17. Write notes on micro-habitat, habitat and ecological niche. 1+1+1=3
18. Define water pollution? Explain the important resources of water pollutants. 1+2=3

SECTION – D

19. (a) Explain various stages of ovarian cycle or menstrual cycle with a well labelled diagram. 4+1=5
    
    OR

    (b) Where does microsporogenesis occur? Explain microsporogenesis and draw the diagram of the development of a mature pollen grain. ½+3+1½=5
20. (a) How did Hershey and Chase prove that DNA is the genetic material? Explain their experiment with suitable diagrams. Write down the results and conclusion. 3 + 2 = 5

OR

(b) With diagram, describe Meselson and Stahl’s experiment to explain the semi-conservative mode of DNA replication. Write down the results and interpretation. 3 + 2 = 5

21. (a) What is recombinant DNA technology? Explain the various steps of recombinant DNA (rDNA) technique. 1 + 4 = 5

OR

(b) What are bioreactors? What are the important aspects of a bioreactor? Name the commonly used types of bioreactors. Describe their common features. 1 + 1 + 1 + 2 = 5
General Instructions:

(i) All questions are compulsory.
(ii) Marks for each question are indicated against it.
(iii) Use log tables if necessary.
(iv) Use of calculator is not allowed.

1. Normality of 0.3M phosphorus acid ($H_3PO_3$) is —
   (a) 0.5  
   (b) 0.6  
   (c) 0.9  
   (d) 0.1

2. Constant boiling point mixtures are called —
   (a) Ideal solution  
   (b) Azeotropes  
   (c) Isotonic solution  
   (d) Buffers

3. The units of cell constant are —
   (a) ohm$^{-1}$cm$^{-1}$  
   (b) cm  
   (c) ohm$^{-1}$cm  
   (d) cm$^{-1}$

4. For a gaseous reaction, the units of rate of reaction are —
   (a) Latm s$^{-1}$  
   (b) atm s$^{-1}$  
   (c) atm mol$^{-1}$s$^{-1}$  
   (d) mol s$^{-1}$

5. The number of reacting species which collide simultaneously to bring about a chemical reaction is —
   (a) molecularity of a reaction  
   (b) order of a reaction  
   (c) rate of reaction  
   (d) unit of reaction

P.T.O.
6. The process of separation of colloids by passing through semi-permeable membrane is called—
   (a) Filtration (b) Electrophoresis
   (c) Dialysis (d) Ultrafiltration
7. Which of the following is the strongest acid?
   (a) H₂O (b) H₂S
   (c) H₂Se (d) H₂Te
8. Largest number of oxidation states is shown by—
   (a) Mn (b) Fe
   (c) Cr (d) Zn
9. Transition elements form alloys easily because they have—
   (a) nearly same atomic size (b) same electronic configuration
   (c) same atomic number (d) same oxidation state
10. Which of the following gives positive Fehling’s solution test?
    (a) Sucrose (b) Glucose
    (c) Fats (d) Protein
11. Tollen’s reagent is used to identify—
    (a) aldehydes (b) ketones
    (c) carboxylic acids (d) alcohols
12. Ethylamine and anilines can be distinguished by—
    (a) Azo dye Test (b) Lucas Test
    (c) Hinsberg’s Test (d) Victor Meyer’s Test
13. The IUPAC name of \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CHO} \) is—
    (a) 3-Aminobutanal (b) 4-Oxobut-2-amine
    (c) 2-Amino propanal (d) 4-Oxo but-3-amine

Contd.
14. The IUPAC name of $\text{C}_2\text{H}_5-\text{N}-\text{CH}_2\text{CH}_2\text{CH}_3$ is $\text{C}_2\text{H}_5$.
   
   (a) $\text{N, N-Diethylpropanamine}$
   (b) $\text{N, N-Diethylheptan-1-amine}$
   (c) $\text{N, N-Diethylpropan-2-amine}$
   (d) $\text{N, N-Diethylpropan-3-amine}$

15. Define F-Centre. Which property is influenced by the presence of it in a solid.

16. Explain that $\text{NF}_3$ does not have donor properties like ammonia.

17. (a) Write the reaction mechanism for the formation of diethyl ether from ethanol at 413K.

   OR

   (b) Write the reaction mechanism for acid catalysed dehydration of ethanol to form alkene.

18. Why are phenols more acidic than alcohols?

19. Which is the stronger acid between acetic acid and chloroacetic acid and why? $1+1=2$

20. Why are the boiling points of amines lower than alcohols and carboxylic acids?

21. Write the chemical reaction for the conversion of bromoethane to diethyl ether.

22. Write the chemical reaction for the conversion of benzaldehyde to benzalaniline.

23. Write a short note on Finkelstein reaction and give suitable chemical equation.

24. Write short notes on Friedal Crafts alkylation in phenol and give suitable chemical equation.

25. Write a short note on Rosenmund reaction and give suitable chemical equation.

26. An element with atomic mass 40 g mol$^{-1}$ has fcc structure and its unit cell edge length is 400 pm. Calculate the density of the element.

27. Osmotic pressure of a solution containing 7g of a protein per 100cm$^3$ of solution is $3.3 \times 10^{-2}$ bar at 37°C. Calculate the molar mass of protein. ($R=0.083$ L Bar K$^{-1}$ mol$^{-1}$) $3$

28. (a) The rate constant for a first order reaction is 80 s$^{-1}$. How much time will it take to reduce the concentration of the reactant to $\frac{1}{18}$ of its initial value.

   OR

   (b) A first order reaction is 15% complete in 20 minutes. How long will it take to complete 60% of the reaction.
29. Explain Freundlich adsorption isotherm at –
   (a) low pressure
   (b) high pressure
   (c) intermediate pressure

30. Why do transition metals act as a good catalyst for various reactions?

31. What is crystal field splitting? Draw and explain the splitting of d-orbitals in an octahedral complex.

32. Explain the following terms –
   (a) Ambidentate ligand
   (b) Chelation
   (c) Coordination number

33. What are nucleic acids? Write two differences between RNA and DNA.

34. (a) (i) Why does the conductivity of an electrolytic solution decrease with dilution?
   (ii) Zinc rod is dipped in 0.1 M solution of ZnSO₄. The salt is 95% dissociated at this dilution at 298K. Calculate the electrode potential given that E°(Zn²⁺/Zn) = -0.76V.

   OR

   (b) (i) Why on dilution the $\Delta_m$ of CH₃COOH increases drastically while that of CH₃COONa increases gradually?
   (ii) Represent the cell in which the following reaction takes place.
        $$\text{Mg}_6 + 2\text{Ag}^+ (0.0001M) \rightarrow \text{Mg}^{2+} (0.130M) + 2\text{Ag}_6$$
        Calculate its $E$ if $E^\circ$ is 3.17 V.

35. (a) (i) Ammonia is a good complexing agent. Explain.
   (ii) Write the molecular structure of XeOF₄ and XeO₃.

   OR

   (b) (i) Why are the melting and boiling points of noble gases very low?
   (ii) What are interhalogen compounds? Why are they more reactive than halogens?
2022
COMPUTER SCIENCE
(Theory)
Full Marks – 70
Time : 3 hours

General instructions:
(i) All questions are compulsory.
(ii) Please write down the number of the question before attempting it.
(iii) Figures in the margin indicate marks.
(iv) Programming Language: Python

1. Choose the correct answer: 5×1=5
   (a) How would you write \( x^y \) in Python as an expression?
      (i) \( x^y \)    (ii) \( x*y \)
      (iii) \( x^y \)    (iv) None of these
   (b) A Python module has ______ extension.
      (i) .mod    (ii) .imp
      (iii) .mpy    (iv) .py
   (c) Which transmission media is capable of having a much higher bandwidth (data capacity)?
      (i) coaxial    (ii) twisted pair cable
      (iii) fibre optic    (iv) untwisted cable
   (d) Which command is used for removing a table and all its data from the database?
      (i) create table command    (ii) drop table command
      (iii) alter table command    (iv) delete table command
   (e) A relational database consists of a collection of—
      (i) Tables    (ii) Fields
      (iii) Records    (iv) Keys

2. Fill in the blanks: 5×1=5
   (a) A ______ is a word having special meaning reserved by programming language. (token / keyword / identifiers)
(b) _____ is a variable defined outside all the functions. (A global variable / A static variable / A local variable)

(c) To read all the file contents in the form of a list, _____ method is used. (readlines() / close() / flush())

(d) _____ network topology requires a central controller or hub. (Bus / Tree / Star)

(e) By default, ORDER BY clause lists the results in _____ order. (descending / ascending / same)

3. State whether the following statements are True or False:

(a) A Dictionary is an unordered set of key : value pairs.
(b) A Python function may return multiple values.
(c) A Router can be replaced with a bridge.
(d) A Primary key can store empty values in it.

4. Answer the following questions:

(a) What are data types? What are Python’s built-in core data types?
(b) What is indexing in context to Python strings? Why is it also called two way indexing?
   OR
   (ii) What is a string slice? How is it useful?
(c) What are the different kinds of loops provided by Python?
(d) Write the output of the following Python code:

   ```python
def update(x=10):
    x += 15
    print('x =', x)

x = 20
update()
print('x =', x)
```

(c) What is the difference between a text file and a binary file?
   OR
   (ii) What is the difference between ‘w’ and ‘a’ file mode?

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(f) What is recursion?

(g) (i) Differentiate between LAN and PAN.

OR

(ii) Differentiate between Hackers and Crackers.

(h) What is a protocol? Give two examples of protocol.

(i) What is database system? What is its need?

(j) (ii) Differentiate between Primary key and Foreign key.

OR

(ii) Define any two aggregate functions of SQL with example.

(k) Define INSERT INTO command with an example.

(l) Differentiate between CHAR and VARCHAR datatypes.

(m) Write a SQL command to create a student table whose schema is as follows:

student (name, roll, age)

5. Answer the following questions: 10×3=30

(a) Explain mutable and imutable types with examples.

(b) What is a nested IF statement? Rewrite the following code in Python after removing all syntax error(s). Underline each correction done in the code.

```python
value = 30
for val in range (0, value)
    if val % 4 == 0:
        print (val *4)
    Else if val % 5 == 0:
        print (val+3)
    else
        print (val + 10)
```

(c) (i) What is meant by the term iteration? Write a python program to print a multiplication table of a number using range() function.

OR

(ii) What is the difference between the break statement and the continue statement.

(d) Differentiate between an actual parameter and a formal parameter with a suitable example for each.
(e) (i) What is a module, a package and a library?

OR

(ii) Write the procedure to create a library/package in Python.

(f) Write a program to get the empid, name and salary of the employees of a department and store these details in a file called “salary.txt”

(g) State the advantages and the disadvantages of using recursion over iteration.

(h) (i) Explain the different types of network topologies.

OR

(ii) What are the differences between Hub and switch.

(i) Differentiate between the DROP TABLE and the ALTER TABLE command.

(j) Write SQL commands for the following on the basis of the given table sports:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Class</th>
<th>Name</th>
<th>Game</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>7</td>
<td>John</td>
<td>Cricket</td>
<td>B</td>
</tr>
<tr>
<td>102</td>
<td>8</td>
<td>Robert</td>
<td>Tennis</td>
<td>A</td>
</tr>
<tr>
<td>103</td>
<td>7</td>
<td>William</td>
<td>Swimming</td>
<td>B</td>
</tr>
<tr>
<td>104</td>
<td>7</td>
<td>Grace</td>
<td>Tennis</td>
<td>C</td>
</tr>
<tr>
<td>105</td>
<td>9</td>
<td>Archana</td>
<td>Basketball</td>
<td>A</td>
</tr>
<tr>
<td>106</td>
<td>10</td>
<td>Andrew</td>
<td>Cricket</td>
<td>A</td>
</tr>
</tbody>
</table>

(i) To display the name of the students who are getting grade ‘C’ in the table.

(ii) To display the games taken up by the students whose name starts with ‘A’.

(iii) To display the table in the ascending order of name.
Punctuality is a necessary habit in all public affairs of a civilised society. Without it, nothing could ever be brought to a conclusion, everything would be in a state of chaos. Only in a sparsely populated rural community, is it possible to disregard it. In ordinary living, there can be some tolerance of punctuality. The intellectual who is working on some abstruse problem has everything coordinated and organised for the matter in hand. He is therefore, forgiven, if late for the dinner party.

But people are often reproached for the unpunctuality when their only fault is cutting things fine. It is hard for energetic, quick-minded people to waste time, so they are often tempted to finish a job before sitting out to keep an appointment. If no accidents occur on the way, like punctured tyres, diversion of traffic, sudden descent of fog, they will be on time. They are often more industrious useful citizens than those who are always late. The over punctual can as much be a trial to others as the unpunctual. The guest who arrives half an hour too soon is the greatest nuisance. Some friends of my family had this irritating habit. The only thing to do was to ask them to come half an hour later than the other guests. Then they arrived just when we wanted them.

P.T.O.
If you are catching a train, it is always better to be comfortably early than even a fraction of a minute too late. Although being early may mean wasting a little time, this will be less than if you miss the train and have to wait an hour or so for the next one. Also, you avoid the frustration of arriving at the very moment when the train is drawing out of the station and being unable to get on it. An even harder situation is to be on the platform in good time for a train and to still see it go off without you. Such an experience befell a certain young girl the first time she was travelling alone.

She entered the station twenty minutes before the train was due, since her parents had impressed upon her that it would be unforgivable to miss and cause the friends with which she was going to stay to make two journeys to meet her. She gave her luggage to a porter and showed him her ticket. To her horror, he said that she was two hours too soon. She felt in the handbag for the piece of paper on which her father had written down the details of the journey and gave it to the porter. He agreed that a train did come into the station at the time on the paper and that it did stop, but only to take on water, not passengers. The girl asked to see a timetable, feeling sure that her father could not have made a mistake. The porter went to fetch one and arrived back with the station master, who produced it with a flourish and pointed out a microscopic ‘0’ beside the time of the arrival of the train at his station. This little 0 indicated that the train only stopped for water. Just at that moment, the train came into the station. The girl with tears streaming down her face, begged to be allowed to slip into the guards van. But the station master was adamant: rules could not be broken. And she had to watch that train disappear towards her destination while she was left behind.

A. Based on your understanding of the passage, answer the following questions briefly: \(2 \times 2 = 4\)

(a) Why is punctuality necessary in a civilised society?

(b) The over-punctual can be as much a trial to others as the un-punctual. Why?

B. Select the appropriate answer from the given options: \(2 \times 1 = 2\)

(a) Reason why punctuality is necessary in a society –

(i) for emotional reasons

(ii) for environmental factors

(iii) to avoid chaos

(iv) to avoid suffocation

HSS/001 Contd.
(b) Pick out the odd word from the following words:
   (i) energetic
   (ii) quick-minded
   (iii) irritating
   (iv) industrious

C. Choose the correct word from the given options which convey similar meaning to the following:
   \[2 \times 1 = 2\]

(a) thinly
   (i) comfortably
   (ii) horribly
   (iii) ordinarily
   (iv) sparsely

(b) hard working
   (i) frustrating
   (ii) unpunctuality
   (iii) chivalrous
   (iv) industrious

2. Read the following passage and answer the questions that follow:

Conversation is indeed the most easily teachable of all arts. All you need to do in order to become a good conversationalist is to find a subject that interests you and your listeners. There are, for example, numberless hobbies to talk about. But the important things are that you must talk about other fellow’s hobbies rather than your own. Therein lies the secret of your popularity. Talk to your friends about the things that interest them, and you will get a reputation for good fellowship, charming wit and a brilliant mind. There is nothing that pleases people so much as your interest in their interests.

It is just as important to know what subjects to avoid as subject to select for good conversation. If you don’t want to be set as a wet blanket or a bore, be careful to avoid certain unpleasant
topics. Avoid talking about yourself; unless you are asked to do so. People are interested in their own problems, and not in yours. Sickness or death bores everybody. The only one who willingly listens to such talk is the doctor, but he gets paid for it.

To be a good conversationalist, you must know not only what to say but how to say it. Be civil and modest. Don't overemphasize your own importance. Be mentally quick and witty, but don't hurt others with your wit. Finally try to avoid mannerism in your conversation.

(a) On the basis of your reading of the passage make notes on it using recognisable abbreviations wherever necessary. Supply a suitable title to it.

(b) Write a summary of the above passage in about 80 words.

SECTION – B: Writing (25 marks)

3. You are Zara of Ramhhun South, Aizawl. You want to rent out your newly constructed flat in the heart of the city. Prepare an advertisement in not more than 50 words for publication in a newspaper giving location of the building, nature of accommodation, rent expected, etc.

4. You are a student of Class XII, studying at St. Mary's H.S.S. You have lost your Titan wristwatch somewhere in the school premises. Draft a notice in not more than 50 words to be placed on your school notice board.

5. (a) You are Lali/Lala of A-17, Chaltlang Lily Veng, Aizawl. You are disturbed by the way people throw their garbage and rubbish in polythene bags by the roadside in your locality. Write a letter to the Editor of 'Mizoram Daily' to create awareness about the harmful effects of polythene bags and also suggest measures to clear garbage.

(b) You are James/Mary. You have seen an advertisement for the post of Education teacher in ABC Public School, Mamit. Write a letter in response to the advertisement applying for the post. Give your detailed bio-data also.

6. (a) You are Lalrinmawia/Lalrinmawii of Aizawl Public School. You have witnessed a road accident near your school. Write a report in not more than 120 words to be published in your school news-letter.

(b) You are Lalthazuala/Lalthazualli of Aizawl Public School. As a representative of your school, you have attended a campaign on 'Say No to Polythene Bags'. Write a report in not more than 120 words.
SECTION – C : Literature (40 marks)

7. Read the following extract and answer the questions that follow:

I. And show the children to green fields, and make their world
Run azure on gold sands, and let their tongues
Run naked into books the white and green leaves open
History theirs whose language is the sun.

(a) The title of the poem is —
   (i) A Roadside Stand
   (ii) A Thing of Beauty
   (iii) Keeping Quiet
   (iv) An Elementary School Classroom in a Slum

(b) The ‘Children’ here refers to —
   (i) The children who were running out of their homes joyously
   (ii) The children who had everything in their lives
   (iii) The children who go to school in a slum
   (iv) The children who are retarded

(c) The white leaves refer to —
   (i) the leaves of books
   (ii) the leaves of plants
   (iii) the tender leaves of trees
   (iv) the leaves of new season

(d) The poet wants to take the children to a place —
   (i) where they can play in a safe environment
   (ii) where they can enjoy a good meal
   (iii) where they can play in open fields and golden sands
   (iv) where they can play without worries

OR

II. A thing of beauty is a joy forever
   Its loveliness increases, it will never
   Pass into nothingness, but will keep
   A bower quiet for us, and a sleep
   Full of sweet dreams, and health and quiet breathing

HSS/001

5

P.T.O.
(a) The name of the poet is —
   (i) Pablo Neruda
   (ii) Kamala Das
   (iii) John Keats
   (iv) Stephen Spender

(b) A thing of beauty never passes into —
   (i) something
   (ii) imagination
   (iii) nothingness
   (iv) dreams

(c) A thing of beauty can be measured by —
   (i) its colour
   (ii) its fragrance
   (iii) its appearance
   (iv) its performance

(d) Pick out what is not true about ‘a thing of beauty’—
   (i) its a joy forever
   (ii) provides us peace of mind
   (iii) increases its loneliness
   (iv) it befools us

8. Answer the following questions in about 30 words:
   3 × 2 = 6
   (a) Why has the poet brought in the image of merry children ‘spilling out of their homes’ in the poem ‘My Mother at Sixty-Six’?
   (b) What idea does Pablo Neruda want to convey in his poem ‘Keeping Quiet’?
   (c) How does the poet describe the faces of the children in the classroom?

9. Answer the following questions in about 30 words:
   4 × 2 = 8
   (a) Why did the ironmaster speak kindly to the peddler and invite him home?
   (b) How did Franz’s feeling about M. Hamel and school change?
   (c) Why did Gandhi go to Lucknow in 1916? Who met him there and why?
   (d) How did Douglas’ misadventure affect him?
10. Choose the correct answer from the given options:
   2\times1=2
   (a) Mukesh's father was born in a family of bangle makers, but his first profession was a—
      (i) carpenter  (ii) teacher
      (iii) tailor  (iv) plumber
   (b) The name of the ironmaster’s daughter was—
      (i) Mary Jones  (ii) Emily Dickinson
      (iii) Selma Lagerlof  (iv) Edla Willmansson

11. Answer any one of the following questions in about 100 – 120 words each:
   5
   (a) What forces conspire to keep the workers in the bangle industry of Firozabad in poverty?
   (b) Why do you think Gandhi considered the Champaran episode to be a turning point in his life?

12. Answer the following questions in about 30 words:
   2\times2=4
   (a) What does Zitkala Sa remember about her first day in the land of apples?
   (b) Who was Sam in the lesson, “The Third Level”?

13. Choose the correct answer from the given options:
   6\times1=6
   (a) Why did Mother Skunk want her son to retain his identity?
      (i) She disliked the wizard
      (ii) She did not like roses
      (iii) She wanted her son to be accepted as he was
      (iv) All of these
   (b) What did Charley find in his stamp collection?
      (i) Old addresses  (ii) Hairstyles
      (iii) Old letters  (iv) First day cover
   (c) The chief concern for Sadao’s father was—
      (i) Sadao’s wedding  (ii) Sadao’s education
      (iii) Sadao’s migration  (iv) Sadao’s treatment
(d) Which words of Annan made a deep impression on Bama?
   (i) To leave their house to have better education
   (ii) They were not supposed to touch the upper caste people
   (iii) She should never bow low before the upper caste
   (iv) To study hard and progress, to rise above all shackles of indignity

(e) Derry entered Mr. Lamb's garden by—
   (i) climbing over the wall
   (ii) climbing through the window
   (iii) walking in through the open gate
   (iv) walking in stealthily

(f) Jo wanted the ______ in the story the next day.
   (i) skunk to smell of roses  (ii) skunk mommy to relent
   (iii) wizard to hit mommy  (iv) animals to love skunk

14. Answer any one of the following questions in about 100–120 words:
   (a) There are moments in life when we have to make hard choices between our roles as private individuals and as citizens with a sense of national loyalty. Discuss with reference to the story “The Enemy”. 5

   OR

   (b) Will Derry get back to his old seclusion or will Mr. Lamb’s brief association affect a change in the kind of life he will lead in the future? 5
2022
GEOLOGY
(Theory)
Full Marks – 70
Time – 3 Hours

General Instructions:
(i) All questions are compulsory.
(ii) Marks for each question are indicated against it.
(iii) Please write down the question number before attempting it.

1. Choose the correct answer: 14×1=14

(a) A large anticline with secondary folds of smaller size developed in it is called –
   (i) Monocline
   (ii) Anticlinorium
   (iii) Synclinorium
   (iv) Homocline

(b) A series of parallel joints is termed as –
   (i) Joint set
   (ii) Master joint
   (iii) Joint system
   (iv) Dip set

(c) If you walk towards the direction of a dip, you will encounter –
   (i) Same rocks
   (ii) Younger rocks
   (iii) Folded rocks
   (iv) Older rocks

(d) The sum of angle of Hade and Dip is –
   (i) 180°
   (ii) 45°
   (iii) 90°
   (iv) 50°

(e) Pitch and Plunge coincide in case of –
   (i) Symmetrical fold
   (ii) Assymetrical fold
   (iii) Recumbent fold
   (iv) Overturned fold

P.T.O.
(f) The word 'fossil' is derived from –
   (i) Greek
   (ii) English
   (iii) Latin
   (iv) French

(g) In bivalves when two adductor impressions are present, it is called –
   (i) Monomyarian shell
   (ii) Isomyarian shell
   (iii) Bimyarian shell
   (iv) Dimyarian shell

(h) The formation temperature of different magmatic deposits varies from –
   (i) 1500°C – 700°C
   (ii) 1500°C – 500°C
   (iii) 1500°C – 300°C
   (iv) 1500°C – 100°C

(i) If the cavity filling deposits consist of only one mineral, it is called –
   (i) Massive
   (ii) Crustification
   (iii) Horses
   (iv) Vugs

(j) Earthquake is caused by –
   (i) Unconformity
   (ii) Faults
   (iii) Sedimentation
   (iv) Metamorphism

(k) Strength of rock to resist the movement of one part of rock with respect to the other is –
   (i) Crushing strength
   (ii) Tensitional strength
   (iii) Shearing strength
   (iv) Lithostatic strength

(l) Artesian Well occurs in –
   (i) Confined aquifers
   (ii) Perched aquifers
   (iii) Aquicludes
   (iv) Unconfined aquifers

(m) Which dam requires strong abutment rocks?
   (i) Gravity Dam
   (ii) Arch Dam
   (iii) Buttress Dam
   (iv) Earth Dam
(n) Very light rain smaller than 0.5mm in diameter is –
   (i) Freezing rain
   (ii) Sleet
   (iii) Drizzle
   (iv) Sun shower

2. Answer the following questions:  
   (a) What is a clinometer compass?
   (b) What is spiral angle of gastropods?
   (c) Define tenor.
   (d) What is injection deposit?
   (e) Write down the non-metallic minerals formed by metamorphic mineral deposits.
   (f) What is global warming?
   (g) (i) What is an earthquake?

   OR

   (ii) What is a Tsunami?

3. Explain with diagram the difference between thrust faults and strike slip faults.  \(1 \frac{1}{2} + 1 \frac{1}{2} = 3\)

4. Describe the nature and mode of preservation of fossils.  3

5. What are the uses of fossils?  3

6. What is meant by residual concentration? What are the deposits formed by residual concentration?  2 + 1 = 3

7. Differentiate between Immiscible liquid segregation and Immiscible liquid injection deposits.  \(1 \frac{1}{2} + 1 \frac{1}{2} = 3\)

8. (a) What are the different types of Placer deposits?  3

   OR

   (b) What are the four essential factors which are important for the formation of placer deposits?  3

9. Differentiate between Primary and Secondary mineral deposits.  3

   HSS/028

   P.T.O.
10. Why do greenhouse gas trap infrared radiation as compared to other gases in the atmosphere? 3

11. Describe the *three* zones of occurrence of groundwater. 3

12. (a) Explain with a diagram the different parts of a fold. 2+3=5

(b) Classify the types of fault on the basis of attitude of fault with a suitable diagram. 3+2=5

13. What are fossils? What are the *three* processes in which the altered hard parts are preserved? Write a neat diagram of gastropods fossils. 1+3+1=5

14. (a) What are the different types of landslides? What are the various ways in which we can prevent landslides? 3+2=5

(b) What is hydrological cycle? What are the *two* types of openings present in rocks? 3+2=5
2022
HINDI
Full Marks – 80
Time – 3 Hours

General Instructions:
(i) All questions are compulsory.
(ii) Figures in the margin indicate marks.
(iii) Write your answers neatly and legibly.
(iv) While attempting a question, write the question number as given in the question paper.

खण्ड – 'ए'

1. निम्नलिखित काल्पनिक प्रश्नों को ध्यान से पढ़ें और पूछे गए प्रश्नों के उत्तर दीजिए:
हवा है, हवा में बसती हवा है।
सुनो बात मेरी – अनोखी हवा है।
बड़ी बाबती है, बड़ी मस्तगीला।
नहीं कुछ निकल है, बड़ी ही निंद्र है।
जिघर चाहती हूँ उधर गुलामी है।
पुसाफ़िर अजब हैं, न घर-चार मेरा।
न उद्रेक मेरा, न हच्छा किसी की,
न आशा किसी की, न प्रेमी न हृदयन,
जिघर चाहती हूँ, उधर गुलामी है।
हवा है, हवा में बसती हवा है।
2. निम्नलिखित गद्यांश को ध्यानपूर्वक पढ़िए और पूछे गए प्रश्नों के उत्तर दीजिए:

मनोरंजन का जीवन में विशेष महत्व है। दिन भर की दिशयाँ से थकाना मनुष्य रात की आराम का साधन छोजता है। यह साधन है—मनोरंजन। मनोरंजन मानव-जीवन में संजीवनी-बूटी का काम करता है। यह मनुष्य के धरे धरे शरीर को आराम की सुविधा प्रदान करता है। यदि आज के मानव के पास मनोरंजन के साधन न होते तो उसका जीवन नीरस जन कर रहा जाता। यह नीरसता मानव-जीवन को चक्की की तरह भी तीसरी अंग नहीं रहा पाता।

(क) मनोरंजन क्या है?
(ख) यदि मनुष्य के पास मनोरंजन के साधन न होते तो उसका जीवन कैसा होता?
(ग) नीरस मानव जीवन का सबसे बड़ा नुकसान क्या होता है?

खण्ड—‘ख’

3. निम्नलिखित विषयों में से किसी एक पर निर्माण लिखिए:

(क) जीवन में खेलों का महत्व
(ख) क्रमशुद—आज की आकार्यक्ता
(ग) महान समस्या
(घ) आनंदावस्था व्यक्ति के फायदे और नुकसान
4. सड़कों पर दिन-प्रतिदिन होने वाली दुरुस्तियों के कारणों पर एक रिपोर्ट तैयार कीजिए।

5. ‘मेरे विदालय का पुलबालाब’ विषय पर एक प्रतिबद्ध तैयार कीजिए।

6. ‘भीड भरी बस के अनुभव’ विषय पर एक कीचर तैयार कीजिए।

7. निम्नलिखित पाठांश से सांबंधित प्रश्नों के उत्तर दीजिए:

   (अ) में जन-जीवन का भार लिए फिरता हूँ,
   फिर भी जीवन में चार लिए फिरता हूँ
   कर किसी ने ज्ञात किसी चुकाता
   में सीधे के दो तार लिए फिरता हूँ

   (ब) इस पाठांश के कवि तथा कविता का नाम लिखिए।

   (ह) जन-जीवन के भार से कवि का व्या आशय है?

   (ग) ‘फिर भी’ के द्वारा कवि क्या कहना चाहता है?

   (घ) कवि क्या चाहता है? वह किसलिए आमीर है?

   (ड) कवि की मनोदर्शन पर टिप्पणी कीजिए।

अध्या

(अ) ‘पतंगों के साथ-साथ वे भी उड़ रहे हैं

अपने संगी के सहारे

अगर वे कभी मिलते हैं छाया के खतरनाक किनारों से

और वह जाते हैं तब तो

और भी निकट होकर सुनहले सूरज के सामने आते हैं

पृथ्वी और भी तेज धूसली हुई आती है

उनके बैठने दैर्घ्य के पास।’

(क) इस पाठांश के कवि तथा कविता का नाम लिखिए।

(ख) कोन है जो पतंगों के सहारे उड़ रहे हैं और कैसे उड़ रहे हैं?
8. निम्नलिखित पद्यांश से सीन्द्ररूप संबंधित प्रश्नों के उत्तर दीजिएः

(अ) जाने क्या रिता है, जाने क्या नाता है
     जितना मी उड़ैलता हूँ भर-भर फिर आता है
     दिल में क्या हरणा है?
     मीठे पानी का सोता है
     भीतर वह, ऊपर तुम
     मुख्तारा चौंद ज्यों धरती पर रंग-भर
     मुख पर ज्यों हुमारा ही खिलता वह चेहरा है।

(ब) यह पद्यांश कित् शैली में लिखि गई है?

(ब) भाषा की विशेषता लिखिए।

(ग) 'भर-भर फिर' में कौन सा अलंकार है?

(घ) भाव-शैली स्पष्ट कीजिए।

अथवा

(आ) नम में पौंटी-बैंठे बैगुलों के पंख,
     चुराए लिए जाती वे मेरी औखँ।
     कबरे बालकों की कैसी नम खाया,
     तैती सम्राट की सतेज स्वेत काया।
     हौले हौले जाती दुखों बांध निज गाया से।
     उसी कोई तनिक रोक रखा।
     वह तो सुराग लिए जाती मेरी औखँ।
     नम में पौंटी-बैंठी बैगुलों की चौख़े।
(क) काव्यांश की पाठ्य पर टिप्पणी कीजिए।
(ख) काव्यांश से मानवीकरण का एक उदाहरण छोटीकर लिखिए।
(ग) काव्यांश में प्रयोग एक मुहावरा छोटीकर लिखिए।
(घ) काव्यांश में सिंहित प्रकृति-सीद्धांत का विवरण अपने शब्दों में कीजिए।

9. निम्नानुसार प्रश्नों में से किन्हीं दो के उत्तर दीजिए:

(क) कविता और बच्चे को समानांतर धार्मिक का कैसे बना हो सकता है?
(ख) कैसे में बच्चों अपनी कल्याण के मुख्यों में दिखी हुस्ता की कविता है - क्यों?
(ग) बालकों के आममण से प्रकृति में होने वाले फिक-फिक परिवर्तनों को कबिता रेखांकित करती है?

10. निम्नानुसार गद्यांश को पढ़िए और पूछे गए प्रश्नों के उत्तर दीजिए:

(अ) भक्ति का दुर्भाग्य भी उससे कम ही नहीं था, इसी के चिंताओं से युक्त होते ही बड़ी लड़की भी विधवा हो गई। भाई के पार ना पाए जाते बच्छों और काफी की प्रस्ता करने के लिए कहने जिती है आशा को एक किरण देख पाई। विधवा बहिन के गठ-चंपन के लिए बड़ा जिती अपने वीर लड़ते वाले स्त्री को बुता लाए, श्वेती उसका हो जाने पर सब कुछ उन्हीं के अधिकार में जाता। भक्ति की लड़की भी भी भी से कम समझदार नहीं थी, इसी से उसने बाच को ना-पंख कर दिया। बाहर के बहुआई का आना चढ़े भाई के लिए सुविधाजनक नहीं था, विशेष यह प्रस्ताव जहाँ-कहाँ रह गया। तब वे दोनों भी-बेटी खुद मान समझकर अपनी संतति की देख-भाल करने लगीं और 'मान न मान में तेज शेषमान' की क्रियात्मक चरित्र बनाने वाले कर के उपस्थित उसे बीस - बीस प्रकार पात्र की पद्धति पर अभिलक्षित करने का उपाय सीखने लगे।

(क) भक्ति का दुर्भाग्य किससे अधिक होती थी और क्यों?
(ख) जेठ भांजू से पार क्यों नहीं पा रहे थे? वे क्या बाहर थे?
(ग) भक्ति के जितियों को आशा की कौन-सी किरण दिखाई दें रही थी?
(घ) बड़ा जिती अपने सालों के अपने पर किस तरह बुला लाया?
(ह) भक्ति की लड़की ने क्या समझदारी दिखाई?
अन्वय

(आ) अपने जीवन के अधिकांश हिस्सों में हम चाली के दिली ही होती हैं जिसके रोमांस हमेशा पंक्त्वर होते रहते हैं।

हमारे महानत्म क्षणों में कोई भी हमें चिढ़कर या लात मारकर भाग सकता है। अपने चालों के शूरीर क्षणों में हम कलेंद्र और पताखन के शिकार हो सकते हैं। कभी-कभार ताज़ा होते हुए जीत भी सकते हैं। मूलतः हम तब चाली हैं क्योंकि हम सुपरमेंट नहीं हो सकते। सत्य, यत्न, निर्धिमता, प्रेम और पैरे के चरमोतक्षण में जब हम आईना देखते हैं तो चेहरा चाली-चाली हो जाता है।

(क) चाली के दिली होने का क्या आशय है?

(ख) चाली के चरित्रों के साथ प्रायः कैसी घटनाएं घटित होती हैं?

(ग) ‘चेहरा चाली-चाली हो जाता है’ का आशय स्पष्ट कीजिए।

(घ) चाली अपने चरित्रों के माध्यम से क्या कहना चाहते हैं?

(ङ) सुपरमेंट और चाली के व्यक्तित्व में क्या आन्तर है?

11. निम्नलिखित में से किन्हीं चार प्रश्नों के उत्तर दीजिए: 4×3=12

(क) बाजार का जदू चढ़ने और उतरने पर मनुष्य पर क्या-क्या असर पड़ता है?

(ख) गाँव में महामारी फैलने और अपने बेटों के देहांत के बावजूद लूटन पहलवान होल व्यंग्य बजाता रहता?

(ग) ‘बाजारपन’ से क्या तात्पर्य है?

(घ) लेखक ने शिरिस को कालाजी के अवधूत (संतवाली) की तरह क्यों माना है?

(ङ) हरदूध की कौन्सल्ट को बताने के लिए व्यवहार की कठोरता भी कभी-कभी जरूरी हो जाती है – ‘शिरिस के पूल’ पाद के आधार पर स्पष्ट करो।
12. निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर दोजिए:

(क) ‘जून’ कहानी में चित्रित प्रामाण्य जीवन का संबंध वर्णन अपने शब्दों में लिखिए।

(ख) मुआमजे-दूहे के आदिम राज की आवश्यकता की आवश्यकता की है?

(ग) ऐन फ्रैंक जीन थी? उसकी जानकारी कथा प्रसिद्ध है?

13. (क) सिम्बु घाटी सम्पत्ति की कला का वर्णन कीजिए।

अथवा

(ख) ऐन फ्रैंक ने अपनी डायरी ‘किंड्री’ को संबोधित विषय के रूप में कैसी सिद्ध होगी?

HSS/002
2×3=6

4

4
2022
MATHEMATICS
Full Marks – 80
Time – 3 hours

General Instructions:
(i) All questions are compulsory.
(ii) Marks for each question are indicated against it.
(iii) Use of calculator is not permitted; however, you may ask for logarithmic tables if required.
(iv) Please write down the serial number of the questions before attempting it.

1. Choose the correct answer from the following: \[16 \times 1 = 16\]

(a) If \(f(x) = \frac{1}{1-x^2}\), then the domain of \(f(x)\) is -

(i) \(\mathbb{R}\) \hspace{1cm} (ii) \(\mathbb{R} \setminus \{-1, 1\}\)
(iii) \(-1, 1\) \hspace{1cm} (iv) \(\mathbb{R} \setminus \{1\}\)

(b) Let \(R\) be the relation in the set \(\mathbb{N}\) given by \(R = \{(a, b) : a = b - 2 > 6\}\). Choose the correct option -

(i) \((2,4) \in R\) \hspace{1cm} (ii) \((3,8) \in R\)
(iii) \((6,8) \in R\) \hspace{1cm} (iv) \((8,7) \in R\)

(c) If \(A\) is a singular matrix, then \(A(adjA)\) is -

(i) a unit matrix \hspace{1cm} (ii) a null matrix
(iii) a symmetric matrix \hspace{1cm} (iv) a scalar matrix

(d) If \(\begin{bmatrix} 2x & 4 \\ 4 & -8 \end{bmatrix} = 0\), then the positive value of \(x\) is -

(i) 1 \hspace{1cm} (ii) 2
(iii) 4 \hspace{1cm} (iv) 6

P.T.O.
(e) If \( y = \tan^{-1}(\log x) \), then \( \frac{dy}{dx} \) is –

(i) \( \frac{1}{1+(\log x)^2} \)  
(ii) \( \frac{1}{x(1+\log x)^2} \)  
(iii) \( \frac{1}{x\left(1+(\log x)^2\right)} \)  
(iv) None of these

(f) The function \( f(x) = x^3 - 6x^2 + 15x - 12 \) is –

(i) strictly decreasing on \( \mathbb{R} \)  
(ii) strictly increasing on \( \mathbb{R} \)  
(iii) increasing in \((-\infty, 2]\) and decreasing in \((2, \infty)\)  
(iv) decreasing in \((-\infty, 2]\) and increasing in \((2, \infty)\)

(g) \( \int \frac{1+2\sin x}{\cos^2 x} \, dx \) is –

(i) \( \sec x + \tan x + C \)  
(ii) \( \tan x + 2 \sec x + C \)  
(iii) \( \sec x + 2 \tan x + C \)  
(iv) \( \tan^2 x + 2 \cot x + C \)

(h) \( \int \frac{\sin^7 x}{x} \, dx \) is –

(i) \(-1\)  
(ii) \(0\)  
(iii) \(1\)  
(iv) \(\frac{1}{2}\)

(i) The solution of the differential equation \( \frac{dy}{dx} = e^{x+y} \) is –

(i) \( e^x + e^y = C \)  
(ii) \( e^x - e^y = C \)  
(iii) \( e^x + e^y = C \)  
(iv) \( e^x - e^y = C \)
(j) The value of $k$ for which $f(x) = \begin{cases} \frac{\sin 2x}{5x}, & \text{when } x \neq 0 \\ k, & \text{when } x = 0 \end{cases}$

is continuous at $x = 0$, is –

(i) $\frac{5}{2}$

(ii) $\frac{2}{5}$

(iii) $\frac{4}{25}$

(iv) 5

(k) If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}| = |\vec{b}| = \sqrt{2}$ and $\vec{a} \cdot \vec{b} = -1$, then the angle between $\vec{a}$ and $\vec{b}$ is –

(i) $\frac{\pi}{6}$

(ii) $\frac{\pi}{4}$

(iii) $\frac{\pi}{3}$

(iv) $\frac{2\pi}{3}$

(l) The vectors $\vec{a} = 2\hat{i} + \lambda \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 3\hat{k}$ are orthogonal, if $\lambda$ is equal to –

(i) 0

(ii) $\frac{5\pi}{2}$

(iii) $-\frac{5\pi}{2}$

(iv) $\frac{3\pi}{5}$

(m) The vector equation of the line passing through the points A (2, -1, 4) and B (1, 1, -2) is –

(i) $\vec{r} = (2\hat{i} - \hat{j} + 4\hat{k}) + \lambda(\hat{i} + \hat{j} - 2\hat{k})$

(ii) $\vec{r} = (2\hat{i} - \hat{j} + 4\hat{k}) + \lambda(-\hat{i} + 2\hat{j} - 6\hat{k})$

(iii) $\vec{r} = (\hat{i} + \hat{j} - 2\hat{k}) + \lambda(2\hat{i} - \hat{j} + 4\hat{k})$

(iv) $\vec{r} = (\hat{i} + \hat{j} - 2\hat{k}) + \lambda(3\hat{i} + 2\hat{k})$

(n) The vector equation of the x-axis is given by –

(i) $\vec{r} = \hat{i}$

(ii) $\vec{r} = \hat{j} + \hat{k}$

(iii) $\vec{r} = \lambda \hat{i}$

(iv) $\vec{r} = \lambda (\hat{j} + \hat{k})$
(o) If $2P(A) = P(B) = \frac{6}{13}$ and $P(A \mid B) = \frac{1}{3}$, then, $P(A \cap B)$ is ~

(i) $\frac{2}{13}$

(ii) $\frac{7}{13}$

(iii) $\frac{5}{13}$

(iv) $\frac{8}{39}$

(p) A coin is tossed and then a die is tossed. The probability of obtaining a 6 (six) given that a head came up is ~

(i) $\frac{5}{6}$

(ii) $\frac{1}{2}$

(iii) $\frac{1}{12}$

(iv) $\frac{1}{6}$

2. Let $A = R - \{3\}$ and $B = R - \{1\}$. Let $f : A \to B : f(x) = \frac{x - 2}{x - 3}$ for all values of $x \in A$. Show that $f$ is one-one and onto.

3. Let $y = e^{x} \log(\sin 2x)$, find $\frac{dy}{dx}$.

4. Evaluate: $\int \frac{dx}{x(x + 2)}$.

5. A can solve 90% of the problems given in a book and B can solve 70%. What is the probability that at least one of them will solve a problem selected at random from the book?

6. Express the matrix $A = \begin{bmatrix} 3 & -1 & 0 \\ 2 & 0 & 3 \\ 1 & -1 & 2 \end{bmatrix}$ as the sum of a symmetric and a skew-symmetric matrix.

HSS/020
7. Using matrix, solve the following system of linear equations:

\[
\begin{align*}
2x + 3y + 3z &= 5 \\
x - 2y + z &= -4 \\
3x - y - 2z &= 3
\end{align*}
\]

8. Let \( Z \) be the set of all integers and let \( R \) be a relation in \( Z \) defined by

\[ R = \{(a, b) | a, b \in Z \text{ and } a - b \text{ is even}\} \]. Show that \( R \) is an equivalence relation.

9. (a) If \( y = (\sin x)^{\cos x} + (\cos x)^{\sin x} \), find \( \frac{dy}{dx} \).

OR

(b) Find the equation of the tangent to the curve \( x^2 + 3y = 3 \), which is parallel to the line \( y - 4x + 5 = 0 \).

10. (a) Evaluate: \( \int \frac{2x+1}{(x+2)(x-3)} \, dx \).

OR

(b) Evaluate: \( \int \frac{x^2}{x^4 - 1} \, dx \).

11. (a) Solve the differential equation: \( 3e^x \tan y \, dx + (1 - e^x) \sec^2 y \, dy = 0 \).

OR

(b) Show that the differential equation \( (x^2 + 3xy + y^2) \, dx - x^2 \, dy = 0 \) is homogeneous and solve it.

12. Find the coordinates of the image of the point \( P(1, 3, 4) \) in the plane \( 2x - y + z + 3 = 0 \).

13. There are 3 bags, each containing 5 white and 3 black balls. Also, there are 2 bags each containing 2 white and 4 black balls. A white ball is drawn at random. Find the probability that this ball is from a bag of the second group.
14. (a) Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius $R$ is $\frac{2R}{\sqrt{3}}$. Find the volume of the largest cylinder inscribed in a sphere of radius $R$.

OR

(b) Show that the perimeter of a right angled triangle of given hypotenuse is maximum when the triangle is isosceles.

15. (a) Find the area of the region bounded by the line $y = x$ and the curve $y = x^3$.

OR

(b) Using integration, find the area of $\triangle ABC$, the equation of whose sides $AB$, $BC$ and $AC$ are given by $y = 4x + 5$, $x + y = 5$ and $4y = x + 5$ respectively.

16. Show that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z$ intersect each other. Also, find the point of their intersection.

17. A firm manufactures two types of products $A$ and $B$, and sell them at a profit of Rs. 5 per unit of type $A$ and Rs. 3 per unit of type $B$. Each product is processed on two machines $M_1$ and $M_2$. One unit of type $A$ requires one minute of processing time on $M_1$ and two minutes of processing time on $M_2$, whereas one unit of type $B$ requires one minute of processing time on $M_1$ and one minute on $M_2$. Machines $M_1$ and $M_2$ are respectively available for at most 5 hours and 6 hours in a day. Find out how many units of each type of product should the firm produce a day in order to maximise the profit. Solve the problem graphically.
2022

MIZO

Full Marks – 80
Time – 3 Hours

Hriat turte:
(i) Zawhna zawng zawng hi chhan ngei ngei tur a ni.
(ii) Zawhna tin mark put zat chu a zawnah tarlan zel a ni.
(iii) Chhan dawnin zawhna nambar ziah zel tur a ni.

THEN KHATNA : HLA

1. Kuakhung chhunga thute hi a dik ber thlang chhuak la, a kar awlte hi dah khat rawh : $4 \times 1 = 4$
   (a) Sem sem dam dam ______ hawhhawm tlawnmgaihna nen. (ei bil thi thi / lian te thlelo / aia upa zah)
   (b) ______ lailen tlunhnam zawhna. (Sirvate / Savate / Thuvate)
   (c) An suhnu lei ______ hian. (awmharah / khawharah / hreahmah)
   (d) Zan khua tlaia run sang ______. (belin / kaiin / mawin)

2. Hausiampa Zai-a, “Duh leh mual lianpui chu ṭulrawh se” tih hi eng nge a amnzia?


4. Phengphe nunmem tih hla phuahtu hian theih nise engfia awm nge a duh sawi la, eng vangin nge hringnun hi a ṭahpui ṭhin sawi bawk rawh.

5. I tan ka ding zel ang tih hla phuahtu T. Zorampela’n ‘Ka tan chunnu’ a tih hi eng nge sawi la. Mizorama chengte dinchhuah nana thil pawimawh a sawi hrang hrangte kha a hla thu tlawnhchhain n han ziak teh.

2+2=4

1+5=6

P.T.O.
THEN HNIHNA : THU

6. A dik ber thlang chhuak rawh:
   (a) R.L. Thanmawia'n zirlai tam takin an tlakchham nia a sawi chu –
       (Dawthheihi / Hmangaihi / Ngilneihna)
   (b) British-in Mizoram a awp kum chu –
       (1880 / 1890 / 1900)
   (c) Mizo Tawnga Bible bu kim kan neih kum chu –
       (1957 / 1958 / 1959)
   (d) H. Lallungmuana' khawhar aia tuar har a tih chu–
       (sum tlakchham / riltam / khawsik)

7. I thinrim elo ? tih ziaktuin thinrimna hneh dan tha ber a tih kha eng nge ? Han sawi zau teh.  

8. C. Lalsiamthanga'n literature tehfung dik tak a tih kha eng nge ni ?

   1+1=2

10. 'Ka han chhut ka han chhut hian, pawi ber maia ka hriat tak chu kan nun khuarei an chang tur hi a ni'. C. Thuamluaia'n kan nun khuarei an chang tur pawi a tih dan kim takin han sawi teh.  

THEN THUMNA : LEMCHAN

11. A dik ber thlang chhuak rawh:
   (a) Thangzawra'n nang zawngin min lainat e', a tih kha tunge? 
       (Lalhniangi / Khuaia / A nu)
   (b) Thangzawra'n 'phivawk rimchhe pahnih' a tihte kha tute nge ?
       (Chawnghrima leh Kanglova / Thanghrima leh Kanglova / Khuaia leh Kanglova)

12. Kalkhama'n pui tham deuh hleka vai run a tum chhan kha eng nge ni ?

13. Lalhniangi pain a fānu man atana a ngen kha sawi la, a ngen chhan chiang takin han sawi bawk teh.  
   1+3=4

14. Lalhniangi leh Thangzawra te inneh thei lohna tura Chawnghrima hma lak dante kha han sawi teh.  

HSS/003  

Contd.
THEN LINA : GRAMMAR AND COMPOSITION

15. A hnuai a rinte hi eng adverb nge an nih ?
   (a) A zuang thoh thoh mai.
       (Adjectival Adverb / Double Adverb / Emphatic Adverb)
   (b) Tlan vak vak suh.
       (Adjectival Adverb / Double Adverb / Emphatic Adverb)

16. A hnuai tawng upa hi hrilhsiah la, a tifiah turin thu phuah rawh :
    Rotejawla se pa ang
    1+1=2

17. A dik zawk thlang chhuak rawh :
    2×1=2
    (a) Chhungkhant laina hnae nei lo hi (Zuntei nu siam ang / vanlaia tla ang) an ti.
    (b) Munanga thil hmuh a taka lo thleng dik leh hi (kelchal mang man / zawng mang chhia ang) an ti.

18. Lalenga, Bawngkawn, Aizawl i ni a. In bialtu SDO, Power & Electricity Department, Bawngkawn hnenah in electric bill dik lo chungchang sawiselna (complaint) han ziak teh.

19. A hnuai a thupui i duh ber hmang hian thumal 250 velin Essay ziak rawh :
    (a) COVID-19 leh Mizote
    (b) Zirleite leh Mobile Phone
    (c) Nungcha Humhalh
    6

THEN NGANA : RAPID READER

20. A dik ber thlang chhuak rawh :
    2×1=2
    (a) ‘E Chawngpuii pa zah ngai, zah ngai, a tawk e, a tawk e’ ti tu chu _____ a ni:
        (Hrangmuana / Kapzawna / Aitama)
    (b) Zawlbuka riak tlangval mutthilh hnuai Hrangehhuana tui petu chu _____ a ni.
        (Kapphunga / Kapzawna / Hrangmuana)
21. “A hun thlen hma chuan kan sawi tak leh kan sawi zel turte pawh a hrectu pathum chauh kan ni tlat reng tur a ni.” He thu hi tu sawi nge? A hun lo thleng tur chu eng nge ni?  

22. Tlangchhina’n Hrangtinluasia kha hmeifa a tih mai theihna chhan han sawi teh.  

23. Khaw thenawm invelh tawn nan fei pawh a ban a la sei lutuk tih hi-eng nge a awmzia?  

24. Chawngmawii leh Hrangchhuana te inhmangaihna thuk takin a thlen leh a rahchhuah pahnih te kha han sawi teh.  

25. Chawngmawii te khua leh Hrangchhuana te khua ann tuaithu chhiai chhiai kha tawi fel takin han sawi teh.
2022
Nepali
Full Marks – 80
Time – 3 Hours

General Instructions:
(i) All questions are compulsory.
(ii) Figures in the margin indicate marks.
(iii) Write your answers neatly and legibly.
(iv) While attempting a question, write the question number as given in the question paper.

खण्ड ‘क’ (पटन : 10 अंक)

1. तल्लो दिखाई गदांशा पढ्दै सोचिएका प्रस्तुति को उत्तर सत्ता भाषामा लेखन:

भारतवर्षमा आए भोजन, लेखिने नयाँ भारतीय आर्थ-भाषाहरू (हिंदी, बांग्ला, असमी, पंजाबी, कन्नडी आदि) तथा जन्म संस्कृत भाषाहरू भएको हो। नेपाली भाषाको जन्म पनि संस्कृत भाषाहरू भएको हो। तर भारतीय आर्थ-भाषाहरू जन्म सोह्रै संस्कृतबाट भएको भने होइन। संस्कृतबाट पक्को सात प्राकृत भाषा भए, शैवसेनी, मागधी आदि। सात प्राकृतबाट पक्को उसी नै सात अपर्याय भाषाहरू भए। प्राकृत र अपर्याय भाषाहरूलाई संभव भारतीय भाषा भनिएको。

प्रायापक गुप्तीको अनुसन्धान अनुसार बाह्य सतायीमत्ता खसरहुले पश्चिम नेपालमा आर्थमण भनी खसान राज्य बसाइँदै किछू भने सेन्ज्मा आफ्नो राज्यमा व्यापारी परीक्षा लिए। सेन्ज्मा एक खस राजा पुस्थमलाई ताम्रपत्र सन् 1337 र चौथा तिनी निर्माणको बारे मार्गमण भनेर पुस्थमलाई पंजाबी पाउने र गौरवात पुस्थमलाई भन्ने गर्ने तिनीहरूलाई लेखा गरेको थिए। यी खसरहुले खस प्राकृत भाषा बोल्ने भने भर दीवसन र सुनिनीकुमा चट्टानलाई अनुमान गरे यी नेपाली भाषाको जन्म खस प्राकृतबाट भएको हुने अवस्था भनाई छ।

(क) भारतवर्षमा भोजन भाषाहरूको मूल श्रोत कुन भाषा हो ।

(ख) नयाँ (नया) भारतीय भाषाहरू के हुन ।

(ग) संस्कृतबाट प्राकृत र अपर्याय भाषाहरूको अधिक भन्ने ।

P.T.O.
(8) खसाहल्को राज्यको राजधानीको नाम के थियो?

(9) नेपाली भाषामा लेखिएको सबैभन्दा पुरानो तानापत्र कुन हो?

(10) खसाहल्को कहिले नेपालमा राज्य बसाएका थिए?

(11) के नयो भाषाको आर्य भाषाहल्को जन्म सोई संस्कृतान्त मध्ये हो? यदि होइँ भन्ने यो भाषाहल्को जन्म कसै भयो?

(12) खस मानको तानापत्र कहिले, किन लेखीएको थियो?

खण्ड — ‘ख’ (व्याकरण और रचना: 25 अंक)

2. (क) छात्रावासमा बन्ने आफ्नो भाईलाई दूरीको विद्रोह घर नहाएको कारण सोबैदेउटा व्यक्तित्व पत्र लेख।

(अ) मान कि तिमी कम्युटर नेटवर्क, आइजोलेटको मालिक मदन हो। तत्क्षण विज्ञापन क्रियापद तथा इनै दुहो पढाउँदै मान्ने गर्ने र अनि सो विज्ञापनले लागि र 5,00,000.00 उनीहाउनको बैंक खातामा हालिदिको त्याँहाँ विज्ञापन प्रबन्धक कम्प्युटर हाउस, चांदीकोट, दिहिलाई व्यापारिक पत्र लेख।

3. कुनै एक विषयमा लगभग 250 शब्दको निर्मम लेख गरिएको छ?

(क) कोविड-19 महामारी

(ख) मोबाइल फोन — लाम र हानी

(ग) टोकियो ओलिम्पिक — 2020

4. खाटलै दूर भेरे उत्कार्य पूरा गरिएको छ कुनै दुई?

(क) आफ्नो ___________ जगात भए।

(ख) तै रानी मै रुमी कसैले ___________ कुमालो पानी।

(ग) कि रौम ___________ आफ्नो दुई हाल्के।

5. कुनै दुई शब्दहल्पुँ दुई-दुईकटा पर्यवेक्षकी शब्द लेख:

(क) ___________

(ख) ___________

(ग) ___________
6. कुने दुई शब्द—समूहको सार शब्द लेखः
   (क) जो मासू खाएँ
   (ख) जो काहिल्ये मर्दैः
   (ग) जसले इँसार माखः

7. तलका कुने दुई अनेकार्थक शब्दहरूको बेगला-बेगले अर्थ निस्कने गरी तिनीहरूलाई चलाएः दुई-दुईबटा वाक्य रचना गरः
   (१) हार
   (२) रान
   (३) वर

8. कुने दुई सिन्यार्थक शब्दहरूका बेगला-बेगले अर्थ दुआउन तिनीहरूको प्रयोगद्वारा वाक्य रचना गरः
   (क) दियो, दीयो
   (ख) चित, चीन
   (ग) दुल्ल, दूल्ल

9. कुने दुई वाम्पारको अर्थ खोल्न तिनीहरूलाई चलाएः वाक्य रचना गरः
   (क) मुख लामु
   (ख) नाक राखुः
   (ग) मन मानुः

खण्ड — 'ग' (साधित्य : 45 अंक)

10. बहादुर हिजो-आज के पर्व बाढ़ छन्?

11. तुला के मा धुमिएँको छ?

12. उक्तन गर्दा-पत्थर जलमाहाँ फसाईः
    अब तिमि नस्ताङ्क दुड़ीही फन्खियाईः
    गर्दा किव भन तिनभ्रो जानिभ्या अनुमत
    गदाहु रात निन्ति ताड़ियी हे निरादः
    उठक पदार्थ कृन कवितामात्र लिखिएँको हो?

13. भिखारी कविता का कवित रो हुन?

14. 'हमी बहादुर' कवितामा युवाहरूलाई कस्ता चुनौती दिएका छौँ?
15. जानिए क्या छात्र शिक्षार्थीका कस्ता विनियम पोखरेका छन्?

16. कविले भिखारीबारे कस्ता कल्पना गरेको छन्?

17. कृपया एक प्रश्नको उत्तर देइँ:
   (क) बिजाको सुरक्षा कस्ता दुःख भोगि रहेको छ?
   (ख) हामी बहादुर गीतितारो कवि ले बहादुर गीतिका को कस्तो अवस्था दर्शाइन्छ भएको छ?

18. संक्षेपमा क्षण देइँ:
   (क) चामे गुड्रो ओकलामा कस्ता कर्यो?
   (ख) स्वास्थ्य निवेशको लेखक को हुन?
   (ग) ऐतिहासिक कवि नेपाली गुरु को तिराम?
   (घ) नौमती बाजा विवेक अनुसार प्रत्येक नेपाली को कर्मवर्ध र दानवित्व के हो?
   (डॉ) हाम्रो मातृभाषाका हो?
   (ढ) मानसको जीवकलाई रचनालाई बनाउने के हो?

19. सन 1828 तिरे नेपाल राज्यमा कस्ता परिवर्तन के के बोली बोलिन्याउ?

20. "तपाई लाई कर्तमयि शहका हुन्?
    यो कसाले, कसलाई मनेको हो?

21. स्वास्थ्य भनेको हो?

22. तृत्यरे छैन लेख।

23. कस्ती खस भाषा नेपालको राजभाषा बन्यो?

24. "बाहुल जनताका कालो होस् तपासको भित्र चौरंटी जस्तो सेतो हुन्। यो कसलाई मान स्पष्ट गर।"

25. कृष्णारामको चित्रकथा चित्रण गर।
2022
PHYSICS
(Theory)
Full Marks − 70
Time − 3 Hours

General Instructions:
(i) All questions are compulsory.
(ii) Marks for each question are indicated against it.
(iii) Use log table, if necessary.
(iv) Use of calculator is not allowed.

1. An uncharged insulated conductor A is brought near a charged insulated conductor B. Which one is the correct statement for the conductor B?
   (a) Charge remains same but potential decreases
   (b) Both charge and potential decrease
   (c) Charge decreases but potential remains same
   (d) Both charge and potential increase

2. If the electric field is given by \(6\hat{i} + 3\hat{j} + 4\hat{k}\), what is the electric flux through a surface of area 20 units lying in YZ plane?
   (a) 120 units
   (b) 60 units
   (c) 80 units
   (d) 260 units

3. Of the two bulbs in a house, one glows brighter than the other. Which of the two has a larger resistance?
   (a) The brighter bulb
   (b) The dim bulb
   (c) Both have same resistance
   (d) The brightness does not depend upon the resistance

P.T.O.
4. In the figure given below, if B is the magnetic field produced by individual wire, current in each wire being the same, then the resultant magnetic field at O in the two cases will be—

(a) zero in both cases
(b) $2B$ in both cases
(c) zero in case-I and $2B$ in case-II
(d) zero in case -II and $2B$ in case-I

Case-I Case-II

5. A charged particle is moving through magnetic field. Then the magnetic field—

(a) always exerts a force on the particle
(b) never exerts a force on the particle
(c) exerts a force, if the particle is moving at right angle to the field
(d) exerts a force, if the particle is moving along the field

6. Identify the correct statement—

(a) $\alpha$-rays have highest penetrating power
(b) $\beta$-rays have highest penetrating power
(c) $\gamma$-rays have highest penetrating power
(d) All three are equally penetrating

7. The electromagnetic waves used in telecommunications are—

(a) ultraviolet
(b) infrared
(c) visible
(d) microwaves

8. The power of a lens of focal length 50 cm is—

(a) +5D
(b) +2D
(c) −5D
(d) −2D

9. Which of the following equations is true for de-Broglie wavelength ‘$\lambda$’ of a particle of mass ‘m’ moving with velocity ‘$\nu$’?

(a) $\lambda \propto \frac{m}{\nu}$
(b) $\lambda \propto \frac{1}{\nu \nu}$
(c) $\lambda \propto \frac{\nu}{m}$
(d) $\lambda \propto \frac{m}{\nu^2}$
10. Light of wavelength 5000 Å falls on a photo-sensitive plate with photoelectric work function of 1.9 eV. The kinetic energy of the photoelectrons emitted will be -

(a) 0.58 eV  
(b) 2.48 eV  
(c) 1.24 eV  
(d) 1.16 eV

11. The nuclear force between the two nucleons is the result of the exchange of -

(a) neutrino  
(b) π - meson  
(c) photon  
(d) μ - meson

12. When the hydrogen atom is in first excited level, its radius is -

(a) four times its ground state radius  
(b) twice as its ground state radius  
(c) same as its ground state radius  
(d) half of its ground state radius

13. Number of holes are equal to number of electrons in -

(a) p-type semiconductor  
(b) n-type semiconductor  
(c) intrinsic semiconductor  
(d) All of these

14. In the following figures, which one of the diodes is reverse biased?

(a) ![Diode Circuit A](image)  
(b) ![Diode Circuit B](image)  
(c) ![Diode Circuit C](image)  
(d) ![Diode Circuit D](image)

15. State Ohm's law. Write the SI unit of conductance.
16. Define the following terms:
   (a) Magnetic declination
   (b) Magnetic inclination

17. Why does a capacitor block DC whereas an inductor allows easy path to it?  

18. Write two properties of electromagnetic waves.  

19. (a) Calculate the refractive index of the material of equilateral prism for which the angle of minimum deviation is 60°.  

OR  

(b) In Young's double slit experiment, interference fringes were produced on a screen placed at 1.5 m from the two slits 0.3 mm apart and illuminated by light of 6400 Å. Find the width of the fringe.

20. A ray of light of frequency $5 \times 10^{14}$ Hz is passed through a liquid. The wavelength of light measured inside the liquid is found to be $450 \times 10^{-9}$ m. Calculate the refractive index of the liquid.

21. (a) What is Light Emitting Diode (LED)? State the factor which controls the wavelength of light emitted by a LED and how?  

OR  

(b) What is donor energy level? Explain.

22. Two point charges equal to $+10 \, \mu C$ and $+20 \, \mu C$ are 1 m apart. What is the amount of work done to bring them closer by 50 cm?  

23. The electrical resistance of a 5 m long wire is 3 $\Omega$. Calculate the electrical resistivity and conductivity, if its cross-sectional area is 0.03 mm$^2$.  

24. With the help of a circuit diagram, explain how a potentiometer can be used to compare emfs of two cells.
25. (a) Using Ampere's circuital law, derive the expression for magnetic field at a point due to an infinitely long wire carrying current I. OR

(b) What is a galvanometer? With the help of a schematic diagram, explain how it can be converted into a voltmeter.

26. (a) The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\phi = (4t^3 + 5t^2 + 8t + 5)$ Weber. Calculate the induced current through the coil at $t=2$ s, if the resistance of the coil is $3.1 \Omega$.

OR

(b) Find the virtual value of current through a capacitor of capacitance $10 \mu F$, when connected to a source of 110 volt at 50 cycles supply. What is its reactance?

27. The focal length of a glass convex lens in air is $15$ cm. Calculate its focal length, when it is completely immersed in water. Given: $\mu_w = \frac{4}{3}$ and $\mu_s = 1.5$.

28. Derive the relation $\delta = A(\mu - 1)$, for a small angled prism, where the symbols have their usual meanings.

29. Distinguish between nuclear fission and nuclear fusion.

30. What is photoelectric effect? Write the laws of photoelectric effect.

31. (a) Define capacitance. Write its S.I Unit. Derive an expression for the electrostatic energy stored in a charged capacitor.

OR

(b) Is electric field intensity a scalar or vector quantity? Give its SI Unit. Derive the expression for electric field intensity at any far point due to an electric dipole.

32. (a) Define instantaneous power of an a.c. circuit. Derive an expression between true power and virtual power of an a.c. circuit.
(b) What is meant by self-induction and co-efficient of self induction? Derive an expression for the co-efficient of self-induction for a long air-cored solenoid.

33. (a) Define magnifying power of an astronomical telescope. With the help of a ray diagram, derive the expression for the magnifying power of a telescope for its normal adjustment.

(b) State Huygen's principle and prove the laws of refraction on the basis of wave theory.

OR

OR
Physical constants:

\[
\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{Nm}^2\text{C}^{-2}
\]

\[\varepsilon_0 = 8.854 \times 10^{-12} \text{C}^2 \text{N}^{-1}\text{m}^{-2}\]

\[c = 3 \times 10^8 \text{ms}^{-1}\]

\[e = 1.6 \times 10^{-19}\text{C}\]

\[m_e = 9.1 \times 10^{-31}\text{Kg}\]

\[m_p = 1.67 \times 10^{-27}\text{Kg}\]

\[h = 6.6 \times 10^{-34}\text{Js}\]

\[G = 6.67 \times 10^{-11}\text{Nm}^2\text{Kg}^{-2}\]

\[g = 9.8 \text{ms}^{-2}\]

\[\text{1\AA} = 10^{-10}\text{m}\]

\[\text{1 amu} = 931\text{MeV}\]

\[\mu_0 = 4\pi \times 10^{-7}\text{TAm}^{-1}\text{m}\]