Chhatrapati Shahu Ji Maharaj
University, Kanpur

Answer Script Details
Barcode 11621057

Roll No. 24080022030
Total Mark 56/75.00

Exam M.SC-III_ODD_EXAM_NOV_2025
Subject B050909T - Environmental Biology (Elective)

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	4/5						
1B	4/5						
1C	4/5						
1D	3/5						
1E	3/5						
1F	3/5						
1G	4/5						
1H	4/5						
1I	3/5						
2	0/15						
3	0/15						
4	12/15						
5	0/15						
6	12/15						
7	0/15						
8	0/15						
9	0/15						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-II

Date of Exam: 10/12/2025 Shift: 3rd Room No. 04
Paper Code: B050909T Subject: Zoology Paper IV Year/Sem.: 3rd
Name of Candidate: ALSHIFA ALAM
Roll No.: 2408002030

MARKS OBTAINED										
Q.	1	2	3	4	5	6	7	8	9	10
(a)										
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Total										
Total Marks in Figures									Max. Marks	
Total Marks in Words										

B050909T
Paper Code

Signature of Evaluator

Course: M.Sc. Final Zoology
Session: 2025-26 Year/Semester: 3rd
Subject: Zoology Paper IV
Paper Code: B050909T
Exam Date: 10/12/2025
Name of Candidate: ALSHIFA ALAM
Father's Name: MOHD ALAM

College Code: KN04
Exam Centre Code: KN04

Type of Exam: Regular ● Ex. Student ○ Private ○ Back paper Exam ○

ANSWER BOOKLET NO.: 11621057

B050909T
Paper Code

Enrollment Number: CSJMA240000013789

Candidate's Roll Number: 2408002030

Paper Code: B050909T

Signature of Candidate: Alshifa Alam

Signature of Invigilator: 10.12.25

C.S Facsimile

COE Facsimile

नोट : 1. परीक्षार्थी को निर्देशित किया जाता है कि आवरण पृष्ठ के मुख्य भाग पर अंकित सभी निर्देशों को सावधानी पूर्वक पढ़ें।
2. प्रश्न में पूछी जाने वाली प्रविष्टियाँ काली स्याही से शुरू की जायें। 3. गोलों को काले या नीले बॉलपेन से भरा जायें।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-III

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2. Carefully study the example before you start marking.
3. As shown in the example below blacken the circles completely.

Correct method	Incorrect method
① ● ③ ④	✓ ✗ ◉ ⊘

4. Make no Stray marks on this sheet.
5. **DO NOT WRITE OR MARK ON THE BAR CODE.**

परीक्षार्थी के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र कोड सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में (1–24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उ पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. B कोपी या अतिरिक्त ग्राफ नहीं दिया जायेगा।

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/ electronic watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

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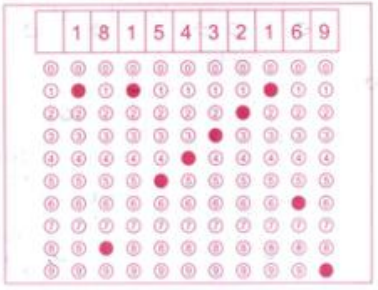
1. Read the instructions carefully given on the Question Pa Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-32) or any other kind of dam in your answer script, if found than change the answer s immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy Subject Code. Subject Name and Question of the Ques Paper during first THIRTY MINUTES of the commencemer the exam, so that it can be corrected in TIME. After that corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over pa should fill in status as Carry Over. Those appearing as Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provide

अनुचित साधन से बचने हेतु:

1. उत्तर पुस्तिका के निर्दिष्ट स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कही और न लिखे तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ करने पर अनुचित साधन प्रयोग माना जावेगा।
3. परीक्षा कक्ष में निम्न वस्तुऐं साथ न लाये, जैसे लिखे हुए कागज के टुकड़े, मोबाईल, डिजिटल डायरी, कोपी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल संबंधित प्रश्नपत्र में ही नेगेटिव लैस साइटफिक कैल्कुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रूपये न रखें न ही उत्तर पुस्तिका में विपकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-

1. Use blue or black ball point pen for writing alphabets & number in ☐ Boxes.
2. Use blue or black ball point pen for filling the circles.



Note - If your Roll No. is of 10 digits. Please leave first three colur

Paper Code B 0 5 0 9 0 9 T 01

(SEC - A)
Short Answers
Ans. 1.(A)

Define Biome

Biome is a large geographical area defined by its climate, soil type and vegetation.

Types of Biome

Tropical Rainforest :- Tropical rainforest is the large evergreen forest with dense vegetation. It is located near the equator. It has a humid, hot climate throughout the year. Rainfall = 2000 - 4000 mm/year.

Temperate forest → Temperate forest experience seasonal changes in daylight length. It is located in Europe, East Asia, Eastern etc. Temperature is moderate with four distant seasons.

Desert → Characterise by low rainfall, high evaporation and sparse vegetation.
Temperature → Daytime upto 45°C
Night hours below 10°C.

④ Tundra Biome ⇒ One of the coldest and least productive biome on the Earth.

- Characterize by low temperature, short growing season and permafrost.
- Two main types —
  (i) Alpine tundra ⇒ At high mountain tops.
  (ii) Arctic tundra ⇒ At north pole.

⑤ Taiga Biome ⇒ Located in North Canada, Siberia.

Temperature ⇒ Long cold winters and short mild summers.

Effect :- Slow decomposition, low productivity.

Ans. 1 (B)

Ectotherms ⇒ Ectotherms ~~regulate~~ depends on external sources of heat to regulate their body temperature. Ex. Fishes, Amphibians, reptiles etc.

Adaptations to extreme temperature

① Behavioural thermoregulation.

They bask in the sun to warm up or seek shade to cool down.

② Supercooling :- To avoid freezing, they allow their body fluids to go down below freezing temperature without forming ice. Ex - Frog, insect.

③ Freeze tolerance :- Certain species tolerate the actual freezing of body tissues by producing protectant such as glycerol, glucose.

④ Aestivation :- They show dormancy in hot, dry period.

Endotherms :-

They regulate their internal temperature through metabolism. Ex - Birds, Mammals

Adaptations to cold :-

① Insulation :- Thick fur, feathers or fat layers to reduce heat lost.

② Hibernation :- Undergo dormancy during cold period.

③ Counter current exchange :- Blood vessels conserve heat by passing blood (warm) next to the cold blood coming from extremities

Ans. 1 (c)

Biodiversity hotspots :—

Biodiversity hotspot is a region rich in—
- endemic species
- under threat from human activities such as deforestation, urbanization, pollution etc.

According to Conservation International a region must meet two criteria to be biodiversity hotspot :—

(i) At least 1,500 species of vascular plants as endemics.

(ii) Lost at least 70% of its original natural vegetation.

In India there are 4 biodiversity hotspots :—

(i) Himalayan hotspot

(ii) Western Ghats hotspot

(iii) Indo-Burma hotspot

(iv) Sundaland hotspot.

Global Distribution:-

There are 36 biodiversity hotspots in the world, covering about 2.4% of the Earth's surface.

Importance of hotspots:-

(i) Conservation of species.
(ii) Provide ecosystem services.
(iii) Have economic benefits.
(iv) Scientific and educational benefits.
(v) Cultural and social value

Ans. 1 (B)

Natality (Birth rate)

Natality refers to the rate at which new individuals are added to the population through reproduction over a specified period of time.

Types :-

Maximum natality:-

- Maximum number of birth rate that occur under ideal environmental conditions

- Not influenced by limiting factors.
- Rarely occur in natural conditions.

Physiological natality.

- The actual ~~birth~~ birth rate under real environmental conditions.
- Influenced by limiting factors such as climate, food availability, disease, competition etc.

Expression of Natality

Natality = $\frac{\text{No. of births per unit time}}{\text{Total population or 1000 individual}}$

Factors affecting natality.

1. Environmental conditions.
2. Reproductive biology of the species
3. Age structure of the population
4. Sexual structure and mating behaviour.
5. Survival of offsprings.

Importance of Natality :—

1. Population growth → Natality contributes to population increase. through exponential or logistic growth.

Paper Code B 0 5 0 9 0 9 T 07

Ans. 1 (E)

Nitrogen cycle.

Nitrogen cycle is the movement of nitrogen through biotic and abiotic components of the environment.

Steps:

① **Nitrogen fixation:-** Anabena, Azobacter, Rhizobium fix nitrogen.

$N_2 = NH_4^+$

② **Assimilation:-** Plants absorb nitrogen as NH_4^+ / NO_3^- from the soil to form amino acids and proteins. Animals get nitrogen by feeding on plants.

③ **Mineralization / Ammonification**

Decomposers convert organic N to NH_4^+.

④ **Nitrification**

Nitrosomonas $NH_4^+ \longrightarrow NO_2^-$

Nitrobacter $NO_2^- \longrightarrow NO_3^-$

(5) ~~Denif~~ Denitrification

NO_3^- is converted back to N_2 and release in the atmosphere. Bacillus and pseudomonas do the denifrication process.

$ND_3^- \rightarrow N_2$ (gas).

Ans. 1(F)

Trophical Levels :—

Each stage in a food chain is called a trophic level.

Producers :— These are usually green plants, algae that convert sunlight into chemical energy through photosynthesis.
Ex— Phytoplanktons, algae, Grasses.

Consumers →

(i) Primary consumers (Herbivores) → They feed on producers. Ex— Rabbit, grasshopper, zooplanktons.

(ii) Secondary consumers (Carnivores)

these are carnivores that feed on the primary consumers.
Ex- frog, small, fishes, fox etc.

(iii) Tertiary consumers (Top carnivores) → These are carnivores that eat other carnivores
Ex- Lion, Hawk. etc.

(iv) Decomposers → Bacteria, fungi or various invertebrates that decompose dead organic matter and release nutrients back into the environment. These are detrivores

Ans. 1 (G)

Exponential growth curves.

- It is J- shaped.
- Exponential growth occurs under ideal environmental conditions.
- This curve shows three phase —

① Lag phase :- It is the intial phase of growth, show very slow growth.

② Exponential growth phase :- In this phase, rapid growth occurs. till environmental

conditions are favourable.

(iii) **Decline phase** :- The sudden decrease in the population growth due to limited environmental condition. This phase is known as population crash.

Logistic Growth curve.

1. It is S-shaped or sigmoid curve.
2. The habitat in nature are ~~habitat~~ species specific and have resources that can support maximum no. of individuals to growth and reproduce, beyond which no growth occurs. This property of habitat is known as Carrying capacity

It has 5 phase :-

1. Lag phase.
2. Positive accerelation phase
3. Exponential phase
4. Negative accerelation phase
5. Stabilization phase.

It stabilizes the population in an area.

Equation of logistic growth:-

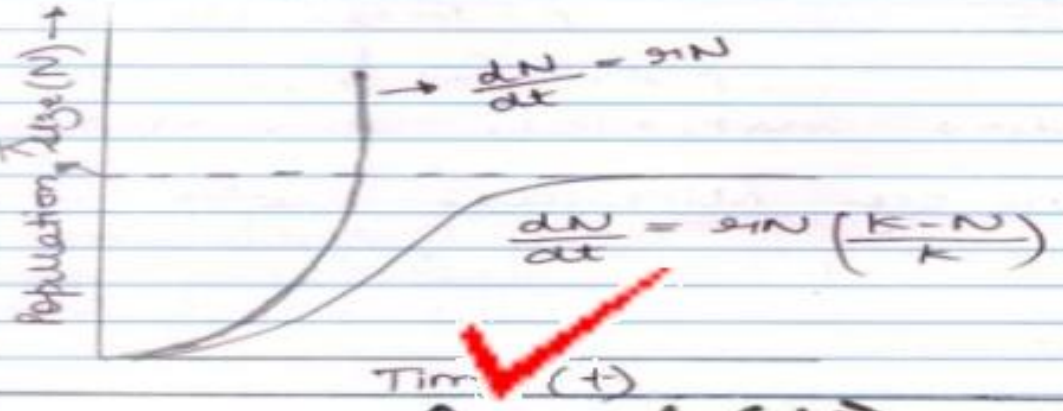
$$\frac{dN}{dt} = rN\left(\frac{K-N}{K}\right)$$

Equation for exponential growth :—

$$\frac{dN}{dt} = rN.$$

Where,

N = population size
r = intrinsic rate of natural increase.



Ans. 1 (H)

Mineral resources

Mineral resources are natural resources. They hold immense important as they form the backbone of industrial, agricultural and technological advancements.

Types of Minerals :-

① Metallic minerals :- These are metals in their natural form such as iron, copper, aluminium, gold etc. These are good conductors of heat and electricity. These are used in industries and constructions.

② Non-metallic minerals :- These do not contain metals. These are limestone, gypsum, mica, phosphate. These are used in agriculture, building materials and manufacturing.

③ Energy Minerals :- Include coal, petroleum and natural gas. They provide energy for industrial & domestic use.

Significance :-

Industries

① Many minerals serve as raw materials for industries such as steel, cement etc.

② Agriculture :- Many minerals such as phosphate and nitrates are components of fertilizers.

Ans. 1 (I)

Silent Valley Movement

Silent valley movement occur in 1970. The focus is on Silent Valley, which is a tropical forest.
This movement is against for the hydroelectric power generation on silent valley.
Hydroelectric power generation can cause serveal damage to the Silent Valley. Therefore protests was done by sicntists environmentalistics and publics to stop the hydroelectric power establishment on the Palakadi river of Kerela.
Lion-tailed macque which is an endagered species found in Western Ghats is the symbol of the movement.
In 1980, Government appoint a committe to check the environmental hazards of the hydrowelectric power generation through dams.
The report gives the positive result of harming the environment.
In 1983, India Gandhi (PM of India) stop this development.
In 1984, Silent Valley becomes the national park.

(SEC - B)

(Ans. 4)

Productivity

- It is the rate of at which energy is produced and stored in the organisms.
- It represents the conversion of solar energy into chemical energy by autotrophs and then the movement of the energy through various trophic levels.
- It is usually expressed in :—

Biomass ⇒ g/m²/ year
Energy ⇒ MJ/m²/ year or kcal/m²/ year.

Energy per unit area per unit time.

Types of Productivity

(1) Primary Productivity:- It is the rate which energy is captured by the autotrophs from sunlight through photosynthesis.

It is the foundation of the food chain.

Primary Productivity is of two types

(i) Gross primary productivity (GPP):-

It is the total amount of energy or biomass produced by the autotrophs.
It includes the energy used in plant's respiration and growth.

$$GPP = NPP + R$$

(ii) Net primary productivity (NPP):-

It is the amount of energy available for consumers.
It represents the actual rate of energy stored in plant tissues after respiration losses.
NPP is different for different ecosystems.
Ex - Tropical rainforests have high NPP than deserts and tundra.

$$NPP = GPP - R$$

(3) Secondary Productivity.

- It is the rate at which consumers / herbivores convert the chemical energy of food into their own biomass.
- It includes growth, reproduction

and maintainance of animal tissues.
- It is lower than NPP because of some energy is lost as heat through metabolism and respiration

③ **Community Productivity :-** It refers to all productivity of all trophic levels in a food chains. It represents the combined production of producers, consumers and decomposers.

Factors affecting productivity :-

① **Light :-** Light intensity, duration and availability affects the photosynthesis rate so the productivity also.

High productivity occurs in region with high solar radiations.

② **Temperature**

Productivity is high in warm tropical rainforest and low in polar areas.

③ **Water availability.**

Water is essential for photosynthesis and transfer of nutrients.
Productivity declines in water stress.

④ Nutrient availability

Certain nutrients such as nitrogen, phosphorus and potasium limits plants productivity.

⑤ CO_2 concentration :- High CO_2 concentration can increase photosynthesis and productivity upto a certain limit.

⑥ Biotic factors :- Herbivores, competition and disease decrease productivity.

⑦ Human activity :- Human activities such as deforestation, pollution, land use change can reduce productivity, while, agriculture and irrigation enhance it.

Productivity of Some Biomes:-

① Tropical rainforest → 2000 - 4000 g/m²/year
② Temperate forest → 1200 - 1500 g/m²/year
③ Grassland → 600 - 1500 g/m²/year
④ Desert → 90 - 250 g/m²/year
⑤ Tundra → 100 - 400 g/m²/year

(SEC - C)
(Ans. 6)

Water pollution

Water pollution refers occurs when harmful substances are introduced into the water bodies, such as - lakes, ponds, rivers, oceans and groundwater + causing deterioration of water quality and making it unfit for the human use.

Sources of water pollution

① Point sources :- These are identified sources from the pollutants enter into the water bodies.
Ex - industrial effluents, oil spills etc.

② Non-point sources :- These are diffused sources that do not have common origin.
Ex - Agriculture run-off, Atmospheric deposition.

Type of water pollutants

① Organic pollutants :- These include

domestic sewage, animal waste, pesticides and industrial organic chemicals that consume dissolve oxygen causing eutrophication.

④ Inorganic pollutants :- These are heavy metals such as lead, mercury, cadmium, arsenic that are toxic to aquatic life and human health

③ Pathogens :- bacteria, Viruses, protozoans from the sewage or animal waste can cause waterborne diseases such as Cholera, typhoid, hepatitis, dysentery, diarrohea etc.

② Thermal pollutants :- Heated water discharged from the industries, power plants deplete oxygen causing biodiversity ↓.

⑤ Nutrients :- Excess nitrogen and sulphur from fertilizers cause algal bloom.

Effects of water pollution

① Human health :- Contaminated water cause several diseases such as typhoid, Cholera, diarrohea, etc.

② Ecological effects :- Water pollution cause biodiversity loss. Fish and aquatic plants die due to lack of oxygen of toxic exposures.

③ Economic cost :- The cost of waste water treatment is high. Water pollution reduces the productivity of agriculture and fisheries.

④ Aesthetic and social effect :-

Dirty, dark coloured, foul-smelling water bodies degrade the natural and cultural value of water bodies.

Control of Water Pollution

① Source control

① Waste - water treatment

- Primary treatment :- Removes large solids and materials through sedimentation and filteration.
- Secondary treatment :- It is a biological degradation of organic matter through

microorganisms.

- Tertiary treatment :- Advanced treatment to remove nutrients, pathogens and metals.

② Industrial control

- Use of clean production technologies.
- Treatment of effluents before discharge.

③ Agricultural practices

- Use of organic fertilizers called bio-fertilizers
- Use of organic farming.
- Proper application of pesticides and fertilizers to reduce run-off.

④ Legislative Measures

- The Water (Prevention and control) Act, 1974 (India) ⇒ • Established by CPCB and SPCB.
  • Monitor water quality.
- Environmental Protection Act, 1986.

⑤ Public awareness and education

- Educating public about the benefits of water conservation.

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