

SET – 2**Series : GBM/1**

कोड नं.

Code No.

57/1/2

रोल नं.

Roll No.

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परीक्षार्थी कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।

Candidates must write the Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **11** हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए कोड नम्बर को छात्र उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **26** प्रश्न हैं ।
- कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, प्रश्न का क्रमांक अवश्य लिखें ।
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जायेगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains **11** printed pages.
- Code number given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **26** questions.
- **Please write down the Serial Number of the question before attempting it.**
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

जीव विज्ञान (सैद्धांतिक)

BIOLOGY (Theory)

निर्धारित समय : 3 घंटे

अधिकतम अंक : 70

Time allowed : 3 hours

Maximum Marks : 70

सामान्य निर्देश :

- प्रश्न-पत्र में पाँच खण्डों में 26 प्रश्न दिए गए हैं । सभी प्रश्न अनिवार्य हैं ।
- खण्ड – क में प्रश्न संख्या 1 से 5 अति लघु-उत्तरीय प्रश्न हैं । प्रत्येक प्रश्न एक अंक का है ।
- खण्ड – ख में प्रश्न संख्या 6 से 10 लघु-उत्तरीय प्रश्न प्रकार I के हैं, प्रत्येक प्रश्न दो अंकों का है ।
- खण्ड – ग में प्रश्न संख्या 11 से 22 लघु-उत्तरीय प्रश्न प्रकार II के हैं, प्रत्येक प्रश्न तीन अंकों का है ।
- खण्ड – घ में प्रश्न संख्या 23 मूल्य आधारित प्रश्न चार अंकों का है ।
- खण्ड – ङ में प्रश्न संख्या 24 से 26 दीर्घ-उत्तरीय प्रश्न हैं, प्रत्येक प्रश्न पाँच अंकों का है ।
- प्रश्न-पत्र में समग्र पर कोई विकल्प नहीं है, फिर भी दो अंकों वाले एक प्रश्न में, तीन अंकों वाले एक प्रश्न में और पाँच अंकों वाले सभी तीनों प्रश्नों में भीतरी चयन-विकल्प दिए गए हैं । प्रत्येक परीक्षार्थी को ऐसे प्रश्नों के दो विकल्पों में से कोई एक प्रश्न हल करना है ।

57/1/2

1

[P.T.O.]

General Instructions :

- (i) There are total **26** questions in **five** sections in the question paper. **All** questions are compulsory.
- (ii) Section **A** contains questions number **1** to **5**, Very Short Answer type questions of **one** mark each.
- (iii) Section **B** contains questions number **6** to **10**, Short Answer type-**I** questions of **two** marks each.
- (iv) Section **C** contains questions number **11** to **22**, Short Answer type-**II** questions of **three** marks each.
- (v) Section **D** contains question number **23**, Value Based Question of **four** marks.
- (vi) Section **E** contains questions number **24** to **26**, Long Answer type questions of **five** marks each.
- (vii) There is no overall choice in the question paper, however, an internal choice is provided in **one** question of **two** marks, **one** question of **three** marks and all **three** questions of **five** marks. An examinee is to attempt any **one** question out of the **two** given in the question paper with the same question number.

खण्ड – क

SECTION – A

1. डार्विन के अनुसार “व्यष्टि की क्षमता” (fitness) क्या होती है ? 1

What is “fitness of an individual” according to Darwin ?

2. जैव अवैध नकल क्या होती है ? 1

What is biopiracy ?

3. मानवों में अनुस्मरण अनुक्रिया को सुनिश्चित करने के लिए एक विधि का सुझाव दीजिए । 1

Suggest a method to ensure an anamnestic response in humans.

4. युग्मक निर्माण के दौरान एक जोड़ी अलिंगसूत्री गुणसूत्रों की नियति क्या होती है ? 1

State the fate of a pair of autosomes during gamete formation.

5. हमारी सरकार ने हमारे देश में M.T.P. के लिए जानबूझकर सख्त शर्तें लगा दी हैं । कारण बताते हुए इसकी पुष्टि कीजिए ।

1

Our government has intentionally imposed strict conditions for M.T.P. in our country.
Justify giving a reason.

खण्ड – ख

SECTION – B

6. दो उदाहरणों की सहायता से जैव-प्रबलीकरण की व्याख्या कीजिए जिससे खाद्य-गुणवत्ता को बेहतर बनाने में सहायता मिली ।

2

By taking two examples explain how has bio-fortification helped in improving food quality.

7. आपके इलाके के किसी तालाब में बड़े पैमाने पर शैवाल प्रस्फुटन दिखायी देता है ।

(a) यह प्रस्फुटन किस कारण उत्पन्न हुआ है और जल की गुणवत्ता पर इसका क्या प्रभाव पड़ेगा ?

(b) इस प्रस्फुटन की रोकथाम के उपाय का सुझाव दीजिए ।

2

Plenty of algal bloom is observed in a pond in your locality.

(a) Write what has caused this bloom and how does it affect the quality of water.

(b) Suggest a preventive measure.

8. सायनोबैक्टीरिया के अनुप्रयोग से कृषि क्षेत्र की उपज (पैदावार) में किस प्रकार मदद मिली ?

2

How does the application of cyanobacteria help improve agriculture output ?

9. एक पुष्पी पौधे में एक लघुबीजाणु जनक कोशिका चार नर युग्मकोद्भिद उत्पन्न करती है जबकि एक गुरुबीजाणु जनक कोशिका केवल एक मादा युग्मकोद्भिद उत्पन्न करती है। व्याख्या कीजिए। 2

In a flowering plant a microspore mother cell produce four male gametophytes while a megaspore mother cell form only one female gametophyte. Explain.

10. न्यूक्लियोसोम की संरचना का वर्णन कीजिए। 2

अथवा

निम्नलिखित जीवों के विकासीय महत्त्व की चर्चा कीजिए : 2

- (a) छछूंदर
- (b) लोबफ़िन
- (c) होमो हैबिलिस
- (d) होमो इरेक्टस

Describe the structure of a nucleosome.

OR

Mention the evolutionary significance of the following organisms :

- (a) Shrews
- (b) Lobefins
- (c) *Homo habilis*
- (d) *Homo erectus*

खण्ड-ग

SECTION – C

11. डॉक्टरी जाँच के दौरान पता लगा कि एक नवजात शिशु में एक 21वाँ गुणसूत्र अधिक है। इस बच्चे में बड़े होकर क्या रोग लक्षण प्रकट होने की संभावना है ? 3

During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life.

12. 'स्वस्थाने' संरक्षण से संकटापन्न स्पीशीजों को मदद मिल सकती है । इस कथन की पुष्टि कीजिए । 3

अथवा

- जैव-विविधता "हानियों" के किन्हीं तीन कारणों के नाम बताइए तथा उनका वर्णन कीजिए । 3

'*in-situ*' conservation can help endangered/threatened species. Justify the statement.

OR

Name and describe any three causes of biodiversity losses.

13. वार्षिक और द्विवार्षिक पौधों में अंतर बताइए । प्रत्येक का एक-एक उदाहरण दीजिए । 3

Differentiate between an annual and a biennial plant. Provide one example of each.

14. मानव शुक्रजनक नलिका की आरेखी नामांकित काट के दृश्य बनाइए । 3

Draw a labelled diagrammatic sectional view of a human seminiferous tubule.

15. पुलिस द्वारा पीछा किए जाने पर एक अपराधी ने स्थानीय बाज़ार में अपने आपको फूँक डाला । उसका चेहरा पहचाने योग्य नहीं रह गया था । एक आधुनिक तकनीक का सुझाव दीजिए तथा वर्णन कीजिए जिसकी मदद से उसकी पहचान की जा सके । 3

A criminal blew himself up in a local market when was chased by cops. His face was beyond recognition. Suggest and describe a modern technique that can help establish his identity.

16. $p^2 + 2pq + q^2 = 1$ हार्डी वाइनबर्ग के नियम के आधार पर इस बीजगणितीय समीकरण की व्याख्या कीजिए । 3

$p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg's principle.

17. जैव-प्रौद्योगिकी में निम्नलिखित की भूमिकाओं की व्याख्या कीजिए :

- (a) प्रतिबंधन एंडोन्यूक्लिऐज़
- (b) जेल-विद्युतकण संचलन
- (c) pBR322 में वरणात्मक चिह्नक

3

Explain the role(s) of the following in Biotechnology :

- (a) Restriction endonuclease
- (b) Gel – electrophoresis
- (c) Selectable markers in pBR322.

18. Bt कपास के पौधों पर भरण-पोषण करने वाले लेपिडोप्टेरा-कीट क्यों मर जाते हैं ? समझाकर बताइए कि ऐसा क्यों होता है ।

3

Why do lepidopterans die when they feed on Bt cotton plant ? Explain how does it happen.

19. विदेशी-जीन-उत्पाद को प्राप्त करने के लिए लिये जाने वाले चरणों का सुझाव दीजिए ।

3

Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

20. वाहित मल-उपचार में फ्लॉक्स (उर्णिक) तथा सक्रियित स्लज किस प्रकार सहायता करते हैं, वर्णन कीजिए ।

3

Describe how do 'flocs' and 'activated sludge' help in Sewage Treatment.

21. (a) अंतःप्रजनन अवसाद क्या होता है ?

(b) पशुओं के अंतःप्रजनन के दौरान “वरण” के महत्त्व की व्याख्या कीजिए ।

3

(a) What is inbreeding depression ?

(b) Explain the importance of “selection” during inbreeding in cattle.

22. नौजवानों की एक टोली किसी एकाकी जगह पर “हल्ला-गुल्ला” पार्टी कर रहे थे जहाँ पुलिस ने छापा मारा ।

स्मैक और सुईयों सहित सिरिंजें भी वहाँ पर बिखरी पड़ी थीं ।

(a) स्मैक के सेवन को एक बुरी आदत क्यों माना जाता है ?

(b) स्मैक का रासायनिक नाम लिखिए तथा उसके स्रोत-पौधे का नाम भी लिखिए ।

(c) नशीले पदार्थ को लेने के लिए सिरिंजों और सुईयों का प्रयोग करना बहुत घातक भी हो सकता है । क्यों ? 3

A group of youth were having a ‘rave party’ in an isolated area and was raided by police. Packets of ‘smack’ and syringes with needles were found littered around.

(a) Why is taking ‘smack’ considered an abuse ?

(b) Write the chemical name of ‘smack’ and the name of its source plant.

(c) Syringes and needles used by the youth for taking the drug could prove to be very fatal. Why ?

खण्ड – घ

SECTION – D

23. संपूर्ण भारत की जनता उत्तरी भारत के बड़े भाग की वायु की बिगड़ती हुयी गुणवत्ता को लेकर बहुत अधिक चिंतित है । इस स्थिति से संतुष्ट होकर आपके इलाके की रिहायशी कल्याण संस्था ने “दफ़नाइए, जलाइए मत” जागरूकता कार्यक्रम का आयोजन किया । जीव-विज्ञान के विद्यार्थी होने के नाते संस्था ने इसमें भाग लेने के लिए आमंत्रित किया है ।

(a) दफ़नाने को बढ़ावा देने तथा जलाने को निरुत्साहित करने के आपके तर्क की पुष्टि किस प्रकार करेंगे ?
(कोई दो कारण दीजिए) ।

(b) प्रवाह-चाटों, प्रत्येक कार्रवाही के लिए एक-एक, की सहायता से, कार्रवाही के पश्चात् होने वाली परिघटनाओं की शृंखला की चर्चा कीजिए ।

4

Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled “Bury not burn”. They invited you, being a biology student to participate.

(a) How would you justify your arguments that promote burying and discourage burning ? (Give two reasons)

(b) With the help of flow charts, one for each practice depict the chain of events that follow.

खण्ड – ङ

SECTION – E

24. (a) आयु का पिरैमिड क्या होता है ?

(b) मानव जनसंख्या के आयु-पिरैमिड के तीन निरूपक प्रकारों के नाम बताइए और प्रत्येक की लाक्षणिकता की सूची बनाइए ।

(1 + 4) = 5

अथवा

आर्थिक, पर्यावरणीय तथा सौन्दर्यपरक वस्तुओं तथा सेवाओं के व्यापक परिसर के लिए पूर्वपेक्षित स्वस्थ पारितंत्रीय सेवाओं की भूमिका की चर्चा कीजिए ।

5

- (a) What is an age-pyramid ?
- (b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

25. नीचे दिए गए कथन को पढ़िए तथा पूछे गए प्रश्नों के उत्तर दीजिए :

बैंगन के एक फूल के अंडाशय में 520 बीजांड हैं । फिर भी, वह उससे जो फल बनता है उसमें केवल 480 जननक्षम बीज हैं ।

- (a) परिपक्व हो रहे बीजों में से 40 बीजांड जननक्षम बीज क्यों नहीं बन पाए ? व्याख्या कीजिए ।
- (b) एक जीवनक्षम बीज में द्विबीजपत्री भ्रूण के परिवर्धन का वर्णन कीजिए ।
- (c) क्यों निश्चित आवृतबीजी बीज ऐल्ब्यूमिनी जबकि दूसरे ऐल्ब्यूमीनहीन होते हैं ? समझाइए । $(1 + 2 + 2) = 5$

अथवा

- (a) निम्नलिखित द्वारा स्रावित हार्मोनों के नाम लिखिए तथा उनके कार्य भी बताइए :
- (i) कॉर्पस ल्यूटियम और अपरा (कोई दो)
- (ii) पुटक प्रावस्था तथा प्रसव के दौरान (2 + 2)
- (b) एक स्त्री में उन अवस्थाओं के नाम बताइए जहाँ :
- (i) कॉर्पस ल्यूटियम और अपरा साथ-साथ होते हैं ।
- (ii) कॉर्पस ल्यूटियम स्थायी तौर पर विद्यमान नहीं रहता । (1)

Read the statement and answer the questions that follow.

A flower of brinjal has 520 ovules in its ovary. However, it produces a fruit with only 480 viable seeds.

- (a) What could have prevented the rest of the 40 ovules from maturing into viable seeds ? Explain giving a reason.
- (b) Describe the development of a dicot embryo in a viable seed.
- (c) Why certain angiospermic seed are albuminous while others are exalbuminous ? Explain.

OR

- (a) Name the hormones secreted and write their functions :
 - (i) by corpus luteum and placenta (any **two**).
 - (ii) during Follicular phase and parturition.
- (b) Name the stages in a human female where :
 - (i) Corpus luteum and placenta co-exist.
 - (ii) Corpus luteum temporarily ceases to exist.

26. एक प्ररूपी मेन्डेलीय द्विसंकर क्रॉस में “स्वतंत्र अपव्यूहन के नियम” की चर्चा कीजिए तथा उसकी व्याख्या कीजिए ।

5

अथवा

- (a) इंग्लैंड में औद्योगीकरण से पहले और बाद में शलभ-एकत्रीकरण के दौरान किए गए प्रेक्षणों से प्राकृतिक वरण द्वारा विकास के विचार को पुष्टि किस प्रकार मिलती है ?
- (b) उस परिघटना की व्याख्या कीजिए जो, प्राकृतिक वरण के अतिरिक्त, डार्विन फिचों (पक्षियों) द्वारा भलीभाँति प्रदर्शित करती है ।

(4 + 1) = 5

State and explain the “law of independent assortment” in a typical Mendelian dihybrid cross.

OR

- (a) How do the observations made during moth collection in pre- and post-industrialized era in England support evolution by Natural Selection ?
- (b) Explain the phenomenon that is well represented by Darwin’s finches other than natural selection.

अथवा

इंग्लैंड में औद्योगीकरण से पहले और बाद में शलभ-एकत्रीकरण के दौरान किए गए प्रेक्षणों से प्राकृतिक वरण द्वारा विकास के विचार को पुष्टि किस प्रकार मिलती है ?

5

OR

How does the observations during pre- and post – industrialized moth collection in England support evolution by Natural Selection ?

Question Paper Code 57/1/2

SECTION – A

Q. Nos. 1 - 5 are of one mark each

1. **What is “fitness of an individual” according to Darwin ?**

Ans. Individual with reproductive fitness passes on the useful gene to the next generation

[1 mark]

2. **What is biopiracy ?**

Ans. Use of bioresources by MNC/organizations / individuals , without proper authorization / legal permission / without compensatory payment from the countries and people concerned = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

3. **Suggest a method to ensure an anamnestic response in humans.**

Ans. Vaccination / Immunization (Active / passive) / weakened or inactive microbes or pathogens or proteins or antibodies introduced into the host body

[1 mark]

4. **State the fate of a pair of autosomes during gamete formation.**

Ans. Segregate / separate

[1 mark]

5. **Our government has intentionally imposed strict conditions for M.T.P. in our country. Justify giving a reason.**

Ans. To prevent female foeticide / to maintain sex ratio / to avoid any danger for (young) mother (and foetus)

[1 mark]

SECTION -B

Q. Nos. 6 - 10 are of two marks each

6. **By taking two examples explain how has bio-fortification helped in improving food quality.**

Ans. A maize hybrid was developed that had twice the amount of amino acid / lysine and tryptophan / Atlas 66 wheat variety having high protein content used as donor for improving cultivated wheat / Iron fortified rice /

(IARI has released)

Vitamin A enriched carrots / spinach / pumpkin

Vitamin C enriched bitter melon / bathua / mustard / tomato

Iron & calcium enriched spinach / bathua

Protein enriched beans-broad / french peas / garden peas

(Any two examples)= 1 + 1

[2 marks]

7. **Plenty of algal bloom is observed in a pond in your locality.**

(a) **Write what has caused this bloom and how does it affect the quality of water.**

(b) **Suggest a preventive measure.**

Ans. (a) Presence of large amounts of nutrients / Nitrogen / Phosphorus in water causes excessive growth of algae, depletes dissolved oxygen / imparts distinct colour to the water bodies / bloom forming algae are extremely toxic / deteriorates water quality / fish mortality = $\frac{1}{2} + \frac{1}{2}$

(b) Treatment of waste water before it reaches the pond / Integrated waste water treatment / avoiding using NPK fertilizers / use of organic or biodegradable manure / resort to organic farming = 1

[1 + 1 = 2 marks]

8. **How does the application of cyanobacteria help improve agriculture output ?**

Ans. Fixes atmospheric N_2 / adds organic matter / increases soil fertility / replenish soil nutrients / acts as bio fertiliser / reduce dependence on chemical fertilisers

(Any two) = 1 + 1

[2 marks]

9. **In a flowering plant a microspore mother cell produce four male gametophytes while a megaspore mother cell form only one female gametophyte. Explain.**

Ans. A microspore mother cell / PMC on meiosis forms 4 functional pollen grains / male gametophyte = 1

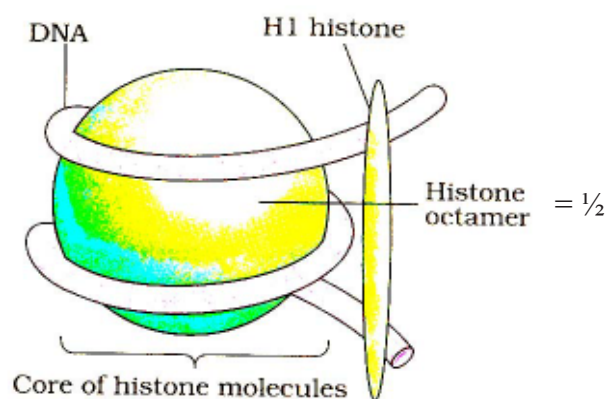
A megaspore mother cell / MMC on meiosis also forms four megaspores but out of it only one is functional and other three degenerate = 1

[2 marks]

10. **Describe the structure of a nucleosome.**

Ans. A unit of eight molecules of positively charged histones, negatively charged DNA, wrapped around the histones octamer, contains 200 bp of DNA helix = $\frac{1}{2} \times 4$

// In lieu of the above explanation the following diagram alongwith the following statement can be considered



DNA is negatively charged , histone is positively charged , 200 bp of DNA helix = $\frac{1}{2} \times 3$,
Diagram = $\frac{1}{2}$

[2 marks]

OR

Mention the evolutionary significance of the following organisms :

- (a) Shrews
- (b) Lobefins
- (c) *Homo habilis*
- (d) *Homo erectus*

Ans. (a) first mammals = $\frac{1}{2}$

(b) first amphibians (lived both on land and in water) / fish with stout and strong fins which could move on land and go back to water = $\frac{1}{2}$

(c) first human like being / hominid / brain capacity from 650 - 800 cc / did not eat meat = $\frac{1}{2}$

(d) brain around 900 cc / ate meat = $\frac{1}{2}$

[$\frac{1}{2} \times 4 = 2$ marks]

SECTION-C

Q. Nos. 11 - 22 are of three marks each

11. During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life.

Ans. Short statured , small round head , furrowed tongue , partially open mouth , broad palm with characteristic palm crease , physical psychomotor & mental development retarded , big and wrinkled tongue , broad flat face , flat back of head , many 'loops' on finger tips

(Any three) = 1×3

[3 marks]

12 'In-situ' conservation can help endangered/threatened species. Justify the statement.

OR

Ans. Threatened organisms are conserved in their natural habitat / eco system , and such regions are legally protected = $1 + 1$

As hotspots / biosphere reserves / national parks / sanctuaries / sacred groves / ramsar sites

(Any two names) = $\frac{1}{2} + \frac{1}{2}$

[3 marks]

OR

Name and describe any three causes of biodiversity losses.

Ans. Habitat loss and fragmentation = $\frac{1}{2}$, Habitat loss from tropical rainforest / The Amazon rain forest is being cut and cleared / for raising cattle / for conversion to grass lands / for cultivating soyabeans / large habitats are broken up into small fragments due to human activities / mammals and birds requiring large territories are badly affected leading to decline in population = $\frac{1}{2}$

Over exploitation = $\frac{1}{2}$, when 'need' turns 'greed' lead to over exploitation of natural resources / steller's sea cow / passenger pigeon were over exploited / marine fish populations around the world

are over exploited / endangering existence of commercially important species = $\frac{1}{2}$

Alien species invasions = $\frac{1}{2}$, when introduced unintentionally or deliberately for any purpose some of them turn invasive and decline indigenous species / carrot grass / parthenium / African cat fish / *Clarias gariepinus* poses threat to indigenous cat fishes of our river = $\frac{1}{2}$

Co-extinctions = $\frac{1}{2}$, when a species becomes extinct the plant or animal species associated with it (an obligate way) become extinct / when a host species becomes extinct (its unique assemblage of) parasites meets the same fate / extinction of any member in plant pollinator mutualism leads to extinction of other = $\frac{1}{2}$

(Any three explained) = 1×3

[3 marks]

13. Differentiate between an annual and a biennial plant. Provide one example of each.

Ans. Annual - complete their life cycle in one season / normally planted in spring and produce grain before end of growing season / planted in autumn and harvested around mid summer e.g. wheat / barley / rye / rice

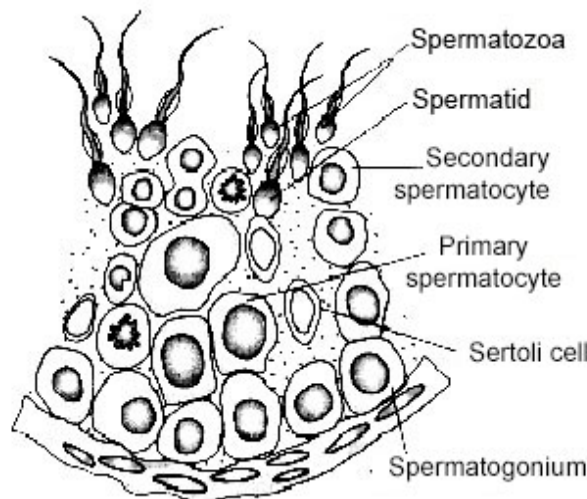
Biennial - they are (monocarpic) plants flower and die in the second season / complete their life cycle in two seasons / show vegetative growth in one season and reproductive growth in second season.

e.g. sugarbeet / cabbage / carrot / radish

Any one difference = 2 marks

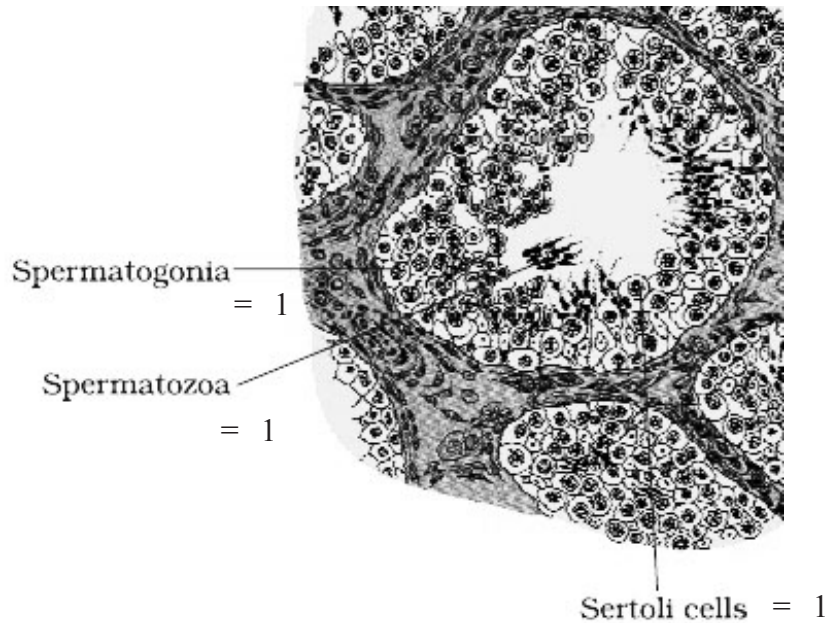
Any one correct example of annual and biennial = $\frac{1}{2} + \frac{1}{2}$ mark

14. Draw a labelled diagrammatic sectional view of a human seminiferous tubule.



(Any three correct labellings) = $(1 \times 3 = 3)$

//



$$(1 \times 3 = 3)$$

[3 marks]

15. A criminal blew himself up in a local market when was chased by cops. His face was beyond recognition. Suggest and describe a modern technique that can help establish his identity.

Ans. DNA finger printing = 1

Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon, hybridization using VNTR probe and detection of hybridised DNA fragments by autoradiography, matching the banding pattern so obtained with that of relative = $\frac{1}{2} \times 4$

[3 marks]

16. $p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg's principle.

Ans. If p represents the frequency of allele A , q represent the allele frequency of a , then frequency of $AA = p^2$, $aa = q^2$, $Aa = 2pq$

Total genes and their alleles in a population or gene pool remains constant (called as genetic equilibrium)

Sum total of all the allelic frequencies is 1 / $[p + q = 1 / (p + q)^2 = 1]$

(Any six) = $\frac{1}{2} \times 6$

[3 marks]

17. Explain the role(s) of the following in Biotechnology:

- (a) Restriction endonuclease
- (b) Gel - electrophoresis
- (c) Selectable markers in pBR322.

- Ans. (a) Cuts at specific position within the DNA / cuts DNA at specific nucleotide / cuts at palindromic nucleotide sequence = 1
- (b) Separation of DNA fragments (under the influence of electric field) = 1
- (c) Helps in identifying and eliminating non-transformants from transformants / selection of transformants = 1

[1 + 1 + 1 = 3 marks]

18. Why do lepidopterans die when they feed on Bt cotton plant ? Explain how does it happen.

- Ans. Bt cotton contains inactive toxin protein / protoxin / insecticidal protein / crystal protein, once the insect ingests it the inactive protoxins converted into active form due to alkaline pH in gut, which solubilise the crystals, activated toxins binds to surface of midgut (epithelial cells), create pores causes cell swelling, lysis eventually leading the death of the insect pest = $\frac{1}{2} \times 6$

[3 marks]

19. Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

- Ans. Insert a piece of alien or desired or foreign DNA into a cloning vector, transfer it into a bacterial / plant / animal cell, the alien DNA gets multiplied, optimised condition (temperature pH, substrate, salts, vitamins, O_2 provided to the culture / culture in bioreactor / in continuous culture system to induce the expression of the target product, extracting the desired product, purifying it by using different separation techniques = $\frac{1}{2} \times 6$

[3 marks]

20. Describe how do 'flocs' and 'activated sludge' help in Sewage Treatment.

- Ans. Flocs - Aerobic microbes consume the major part of the organic matter in the effluent, significantly reduces BOD = 1 + 1

Activated sludge - Small part of activated sludge is used as inoculum and pumped back to aeration tank / pumped into anaerobic sludge digesters where microbes or bacteria grow anaerobically to produce CH_4 or H_2S or CO_2 or biogas = 1

[2 + 1 = 3 marks]

21. (a) What is inbreeding depression ?

- (b) Explain the importance of "selection" during inbreeding in cattle.

- Ans. (a) Continuous inbreeding especially close inbreeding usually reduces fertility, and even productivity / yield = $\frac{1}{2} + \frac{1}{2}$
- (b) Helps in accumulation of superior genes / elimination of less desirable genes, increases homozygosity, pure lines, true breeding, helps to restore fertility, helps to increase yield / productivity, produces more milk per lactation, produces superior progeny, produces disease resistant breeds
- (Any two) = 1 + 1

[1 + 2 = 3 marks]

22. A group of youth were having a 'rave party' in an isolated area and was raided by police. Packets of 'smack' and syringes with needles were found littered around.

- (a) Why is taking 'smack' considered an abuse ?
- (b) Write the chemical name of 'smack' and the name of its source plant.

- (c) Syringes and needles used by the youth for taking the drug could prove to be very fatal. Why?

Ans. (a) An addictive substance / causes drug dependence / affects nervous system / used in amounts or frequencies that impairs one's physical and physiological or psychological functions = 1

- (b) Diacetyl-morphine = $\frac{1}{2}$

Papaver somniferum / poppy plant / opium poppy = $\frac{1}{2}$

- (c) They can acquire serious infections / transmission of HIV infections / AIDS / Hepatitis = 1

[3 marks]

SECTION-D

Q. Nos. 23 is of four marks

23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled "Bury not burn". They invited you, being a biology student to participate.

- (a) How would you justify your arguments that promote burying and discourage burning? (Give two reasons)

- (b) With the help of flow charts, one for each practice depict the chain of events that follow.

Ans. (a) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in the pit / landfill and should be covered with soil leading to the decomposition of organic matter / which enrich soil / increase soil fertility (*Any two points*) = $\frac{1}{2} + \frac{1}{2}$

- If these things are burnt it will lead to formation of harmful gases / smoke / particulate matter which causes air pollution / global warming / respiratory diseases (*Any two points*) = $\frac{1}{2} + \frac{1}{2}$

- (b) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in pit / landfill → decomposition → compost → increase soil fertility / recycling of nutrients

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : fragmentation → leaching → catabolism → humification → mineralisation

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : Detritus → decompositions

(*Any one flow chart*) = 1

- If these things are burnt : air pollution / global warming → respiratory disease

//

If these things are burnt : release of $\text{CO}_2 \rightarrow$ global warming

(Any one flow chart) = 1

[2 + 2 = 4 marks]

SECTION-E

Q. Nos. 24 - 26 are of five marks each

24. (a) What is an age-pyramid ?

(b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.

Ans. (a) If the age distribution (per cent individuals of a given age or age group) is plotted for the population the resulting structure is called the age pyramid = 2

(b) Expanding = $\frac{1}{2}$: pre reproductive population is greater than reproductive or post reproductive population / growing with maximum no. of individuals in pre reproductive phase and least no. in post reproductive phase = $\frac{1}{2}$

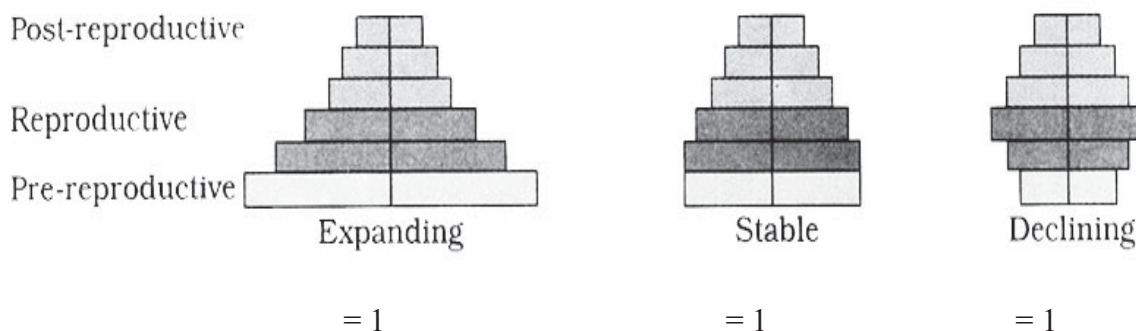
Stable = $\frac{1}{2}$: Pre-reproductive & reproductive population are almost similar / ideal for population / maintains balanced continuity / no. of individuals in reproductive and pre reproductive phase is almost same and less no. of individuals in post reproductive phase = $\frac{1}{2}$

Declining = $\frac{1}{2}$: Pre-reproductive population is less than reproductive population / less no. of individuals in pre reproductive phase than reproduction \rightarrow phase = $\frac{1}{2}$

($\frac{1}{2} \times 6$)

// (b part)

In lieu of the above explanation the following diagram can be considered



[2 + 3 = 5 marks]

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

Ans. Purify air and water / mitigate droughts and floods / cycle nutrients / generate fertile soils / provide wild life - habitat / maintain biodiversity / pollinate crops / provide storage site for carbon / provide aesthetic cultural and spiritual value recreation / climate regulation

[$\frac{1}{2} \times 10 = 5$]

25. A flower of brinjal has 520 ovules in its ovary. However, it produces a fruit with only 480 viable seeds.

- (a) What could have prevented the rest of the 40 ovules from maturing into viable seeds ? Explain giving a reason.
- (b) Describe the development of a dicot embryo in a viable seed.
- (c) Why certain angiospermic seed are albuminous while others are exalbuminous ? Explain.

Ans. (a) Less number of pollen grains / less number of male gametes were available / all pollen grains did not germinate / all pollen grains did not form pollen tubes / many pollen were not compatible / 40 ovules did not get fertilised / only 480 ovules were fertilised = 1

(b) Zygote divides (mitotically) to give rise to pro embryo , globular , heart shaped , mature embryo (give marks if all stages shown correct diagrammatically) = $\frac{1}{2} \times 4 = 2$

(c) Albuminous - Endosperm is not completely used up during embryo development / residual endosperm found in the seed = 1

Exalbuminous - Endosperm is completely consumed / no residual endosperm is left in seed = 1

[1 + 2 + 2 = 5 marks]

OR

(a) Name the hormones secreted and write their functions :

- (i) by corpus luteum and placenta (any two).
- (ii) during Follicular phase and parturition.

(b) Name the stages in a human female where :

- (i) Corpus luteum and placenta co-exist.
- (ii) Corpus luteum temporarily ceases to exist.

Ans. (a) (i) Corpus luteum - progesterone, essential for maintenance of the endometrium = $\frac{1}{2} + \frac{1}{2}$
Placenta - hCG / human chorionic gonadotropin , produced during pregnancy / stimulates and maintains the corpus luteum / to secrete progestogens / growth of mammary glands

hPL / human placental lactogen , produced during pregnancy

Estrogen , maintenance of pregnancy / supporting foetal growth / metabolic changes in mother

Progestogens , maintenance of pregnancy / supporting foetal growth / metabolic changes in mother (*Any two*) = $\frac{1}{2} \times 4$

(ii) Follicular phase : LH / FSH , stimulates follicular development / secretion of estrogen by growing follicles = $\frac{1}{2} + \frac{1}{2}$

Parturition : oxytocin , causes stronger uterine contraction /

relaxin , secreted during (later stage) of pregnancy / softens symphysis pubis = $\frac{1}{2} + \frac{1}{2}$

(b) (i) pregnancy / gestation = $\frac{1}{2}$

(ii) menstruation / proliferative phase / ovulatory phase / follicular phase = $\frac{1}{2}$

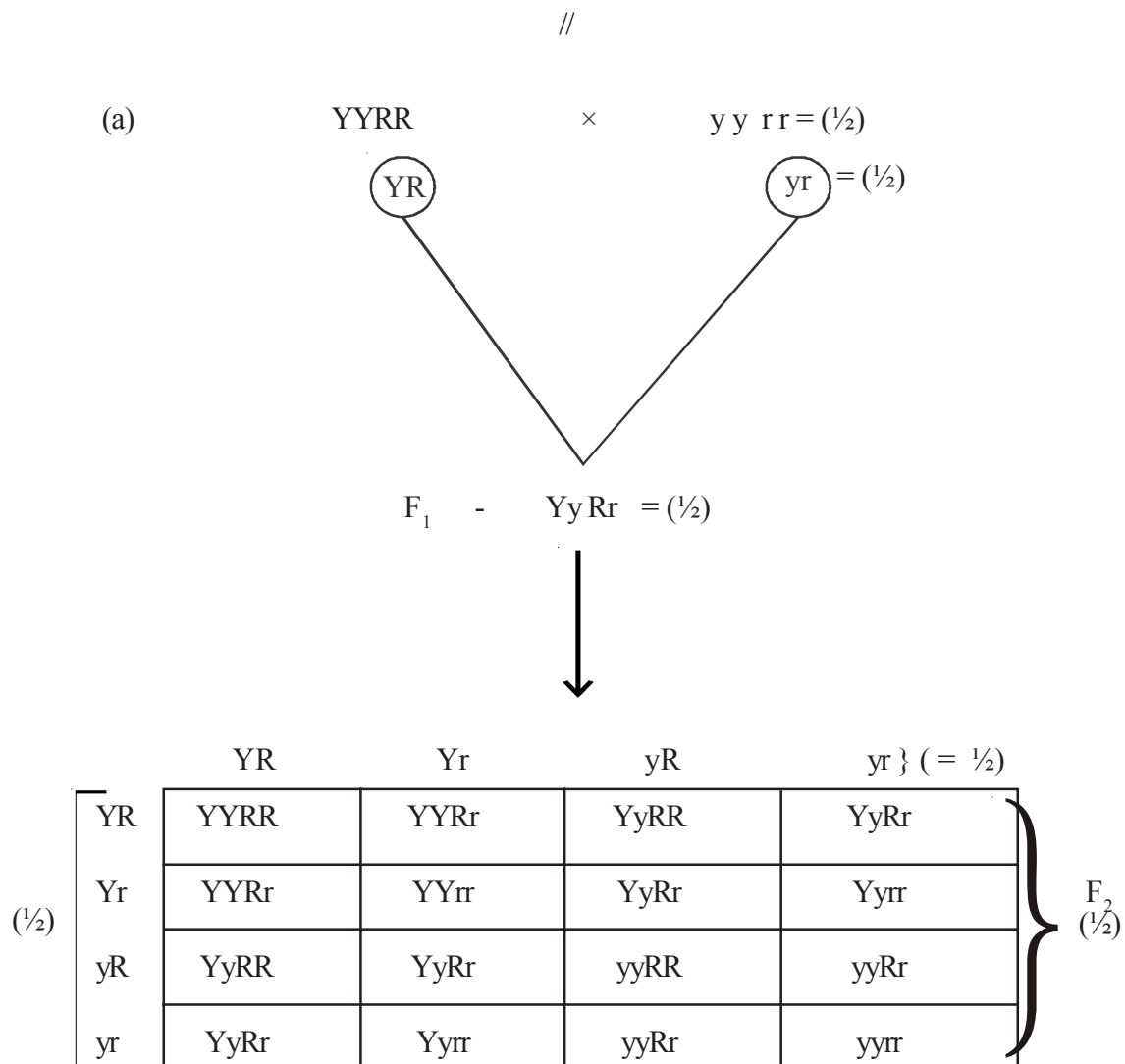
[3 + 1 + 1 = 5 marks]

26. State and explain the “law of independent assortment” in a typical Mendelian dihybrid cross.

OR

Ans. Law of Independent Assortment : when two pair of traits are combined in a hybrid , inheritance of one pair of characters is independent of the other pair of characters / when two pairs of contrasting characters or genes or traits are inherited together in a dihybrid cross (in a pea plant) the inheritance of one pair of character is independent of inheritance of the other character in the progeny = 1

Explanation : Mendel took homozygous pea plant producing yellow and round seeds and crossed them with homozygous pea plant producing green and wrinkled seeds / shown in a flow chart of a dihybrid cross given



Phenotypes – Yellow round : Yellow wrinkled : Green round : Green wrinkled

Phenotype ratio – 9 : 3 : 3 : 1

(Four different types of phenotypes in correct ratio) = $\frac{1}{2} + \frac{1}{2}$

(Formation of new phenotypes along with parental phenotypes is possible because inheritance of two pairs of contrasting traits or genes in the progeny is independent of each other)

[4 + 1 = 5 marks]

OR

- (a) **How do the observations made during moth collection in pre- and post-industrialized era in England support evolution by Natural Selection ?**
- (b) **Explain the phenomenon that is well represented by Darwin's finches other than natural selection.**

- Ans. (a)
- Before industrialisation white coloured lichen covered the trees in which white winged moths camouflaged themselves from predators ,
 - More white winged moths existed on trees than dark winged or melanised moths ,
 - After industrialisation there were more dark winged moths in the same area i.e. proportion was reversed ,
 - Predators would spot a moth easily against a contrasting background ,
 - During post industrialisation tree trunks became dark due to industrial smoke and soot ,
 - White winged moth did not survive due to detection by predators whereas dark winged survived = $\frac{1}{2} \times 6$
- (b) The process of evolution of different species in a given geographical area starting from a point , radiating to other areas of geography (habitats) is called adaptive radiation , finches evolved in the same island from original seed eating features , many other altered beaks arose enabling them to become insectivorous and vegetarian finches = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]