SAMPLE QUESTION PAPER

BLUE PRINT

Time Allowed : 3 hours **Maximum Marks :** 70

S. No.		Chapter	VSA /Case based/ AR (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total	
1.	Unit-VI	Sexual Reproduction in Flowering Plants	2(2)	–	–	–	**2(2)**	**14**
2.		Human Reproduction	2(2)	–	1(3)	1+1*(5)	**4(10)**	
3.		Reproductive Health	–	1(2)	–	–	**1(2)**	
4.	Unit-VII	Principles of Inheritance and Variation	2(2)	1(2)	1+1*(3)	–	**4(7)**	**18**
5.		Molecular Basis of Inheritance	2+1*(2)	2+1*(4)	–	1+1*(5)	**5(11)**	
6.	Unit-VIII	Human Health and Diseases	1(4)	1(2)	1(3)	–	**3(9)**	**14**
7.		Microbes in Human Welfare	–	–	–	1+1*(5)	**1(5)**	
8.	Unit-IX	Biotechnology : Principles and Processes	2(2)	2+1*(4)	–	–	**4(6)**	**12**
9.		Biotechnology and Its Applications	1(1)	1(2)	1(3)	–	**3(6)**	
10.	Unit-X	Organisms and Populations	2(5)	1(2)	1(3)	–	**4(10)**	**12**
11.		Biodiversity and Conservation	2(2)	–	–	–	**2(2)**	
		Total	**16(22)**	**9(18)**	**5(15)**	**3(15)**	**33(70)**	

*It is a choice based question.

Subject Code : 044

BIOLOGY

Time allowed : 3 hours ***Maximum marks : 70***

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.

(iii) Section-A has 14 questions of 1 mark each and 02 case-based questions. Section-B has 9 questions of 2 marks each. Section-C has 5 questions of 3 marks each and Section-D has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

1. Give reasons why groundnut seeds are exalbuminous and castor seeds are albuminous?

2. Explain the function of germ pores.

3. Write the location and functions of Leydig's cells in human testes.

4. Name any two hormones which are secreted by placenta and are also present in a non-pregnant woman.

5. Name the phenomenon in which a single gene may express more than one effect.

6. Name the type of cross that would help to find the genotype of a pea plant bearing violet flowers.

7. Mention the contribution of genetic maps in human genome project.

8. Name any two techniques that serve the purpose of early diagnosis of some bacterial/viral disease.

9. Why are transgenic animals so called?

10. Write one method of *ex-situ* conservation.

11. **Assertion :** *m*RNA is called informational or genetic RNA.
Reason : *m*RNA brings instructions from the DNA for the formation of a particular type of polypeptide.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

OR

Assertion : The mechanism of DNA replication is semi- conservative.
Reason : One strand of the daughter DNA duplex is derived from the parent while the other strand is formed a new.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

12. **Assertion :** Restriction enzymes *Hin* and *Hae* are produced from two different genera of bacteria.
Reason : *Hin* is produced from *Haemophilus* while *Hae* is produced from *Hematococcus*.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

13. **Assertion :** One of the most important traditional uses of sacred groves was that they acted as a repository for various ayurvedic medicines.
Reason : In modern times, sacred groves have become biodiversity rich areas, as they provide refuge to various plant and animal species of conservation significance.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

14. **Assertion :** The epiphytes use the trees only for attachment and manufacture their own food by photosynthesis.
Reason : Commensalism results in negative effects on the growth and survival of one or both of the populations.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

15. Read the following and answer any four questions from 15(i) to 15(v) given below:
Atriplex and *Rhizophora* are plants adapted to saline environment. They have the ability to tolerate high salt concentration and obtain water from the same. These plants excrete salts through glands. They grown in saline soils – mangroves, coastal dunes. Mangrove plants possess different types of roots– stilt, prop roots, horizontal roots.

(i) Plants adapted to saline environment are called
(a) heliophytes (b) hydrophytes
(c) halophytes (d) sciophytes.

(ii) What is the function of chalk glands in *Atriplex*?
(a) To secrete salt (b) To facilitate gaseous exchange
(c) To absorb water (d) Both (a) and (b)

(iii) Which of the following is not an adaptation of *Rhizophora*?
(a) Presence of pneumatophores (b) Sunken stomata
(c) Presence of mycorrhizae (d) Thick cuticle

(iv) Solute(s) responsible for osmoregulation in plants is/are _____.
(a) proline (b) sorbitol
(c) chaperonin (d) both (a) and (b)

(v) **Assertion :** Seed germination is difficult in mangrove plants.
Reason : Mangrove areas have excess salts and anaerobic conditions.
(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

16. Read the following and answer any four questions from 16(i) to 16(v) given below:
A group of teenagers got involved in drugs. They took various mood altering (phychotropic) drugs which effect their behaviour and mental activities. Observe the given table and answer the following questions.

	Source of the drug	**Product obtained**	**Effect**
(A)	*Cannabis sativa*	P	Raise blood sugar level, feeling of euphoria
(B)	*Papaver somniferum*	Opium	Q
(C)	*Coffea arabica*	Caffeine	R
(D)	S	Lysergic acid diethylamide	Hallucinations

(i) Which of the following could be the product P?
(a) Ganja (b) Smack
(c) Morphine (d) Heroin

(ii) Opium in our body shows
(a) analgesic effect (b) insomnia
(c) hallucination (d) aggressiveness.

(iii) Which of the following is correct for R?
(a) Slows down body functions (b) Acts as CNS stimulant and increases BMR
(c) Produce skeletal muscle relaxation (d) Results in emotional outbursts, chronic psychosis

(iv) Identify S.
(a) *Psilocybe mexicana* (b) *Thea sinensis*
(c) *Erythroxylon coca* (d) *Claviceps purpurea*

(v) Name two more drugs that have same source as P?
(a) Bhang and Charas (b) Charas and Cocaine
(c) Marijuana and Smack (d) Smack and Codeine

SECTION - B

17. When is sterilisation advised to married couples? How is it carried out in a human male and a female, respectively.

18. What is aminoacylation? State its significance.

OR

State the functions of the following in a prokaryote:
(i) *t*RNA
(ii) *r*RNA

19. State and explain the law of segregation as proposed by Mendel in a monohybrid cross?

20. What is proinsulin? How is mature insulin different from proinsulin?

21. Name the process that can help in developing large number of copies of a specific gene of interest. Explain the working mechanism of this process.

OR

To obtain a foreign-gene-product by recombinant DNA technology, what steps should be followed?

22. Mention the role of selectable markers in the cloning vector pBR322.

23. State the dual role of deoxyribonucleoside triphosphates during DNA replication.

24. Write how parasites have evolved with adaptation to co-exist with their host in an ecosystem.

25. Explain 'addiction' and 'dependence' in respect of drug/alcohol abuse in youth.

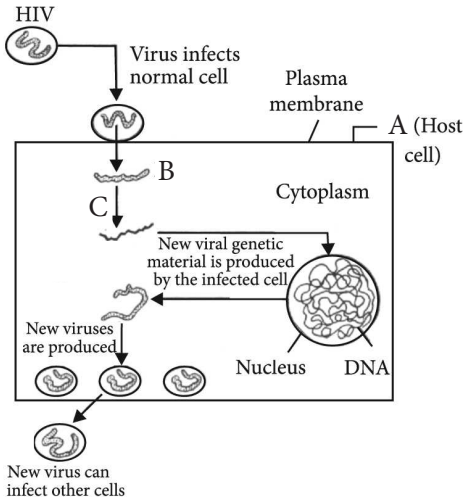
SECTION - C

26. 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.

OR

Explain the mechanism of 'sex determination' in birds. How does it differ from that of human beings?

27. Study the diagram showing the entry of HIV into the human body and the process that are followed:



(i) Name the human cells A, HIV enters into.

(ii) Mention the genetic material B HIV releases into the cell.

(iii) Identify enzyme 'C'.

28. Write down the applications of given transgenic plants.

(i) Bt cotton (ii) Wheat (iii) Tobacco

(iv) Flavr Savr tomato (v) Golden rice (vi) Potato

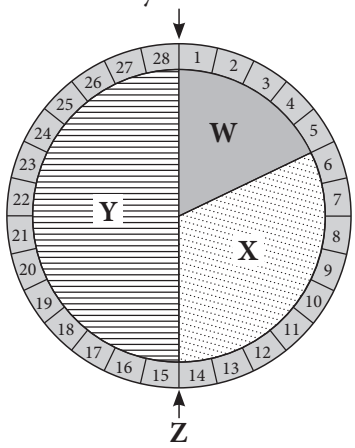
29. Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

30. **(a)** State how the constant internal environment is beneficial to organisms.

(b) Explain any two alternatives by which organisms can overcome stressful external conditions.

SECTION - D

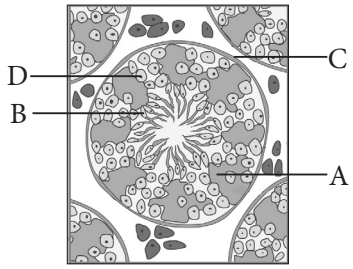
31. Study the schematic representation of menstrual cycle and answer the following questions.



(i) Identify W, X, Y and Z in the given figure.
(ii) What events take place during the phase X and Y?
(iii) In which phase does the concentration of estrogen in the blood attain peak?

OR

Study the given diagram and answer the following questions.



(i) Identify the labelled parts A, B, C and D.
(ii) Briefly explain the labelled part A.
(iii) Write briefly about the labelled part B?

32. **(a)** State the arrangement of different genes that in bacteria is referred to as 'operon'.
(b) Draw a schematic labelled illustration of *lac* operon in a 'switched on' state.
(c) Describe the role of lactose in *lac* operon.

OR

How do *m*RNA, *t*RNA and ribosomes help in the process of translation?

33. **(a)** Mention a product of human welfare obtained with the help of each one of the following microbes :
(i) LAB
(ii) *Saccharomyces cerevisiae*
(iii) *Propionibacterium shermanii*
(iv) *Aspergillus niger*
(b) State the medicinal value and the bioactive molecules produced by *Penicillium notatum*, *Monascus purpureus* and *Trichoderma polysporum*.

OR

(a) Name two groups of organisms which constitute 'flocs'. Write their influence on the level on BOD during biological treatment of sewage.
(b) Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen.
Mycorrhiza*; Monascus; Anabaena; Rhizobium; Methanobacterium; Trichoderma*.

SOLUTIONS

1. Groundnut seeds are exalbuminous as the seeds usually store food materials in cotyledons and the endosperm is used up by the developing embryo. Castor seeds are albuminous as they, have copious amounts of endosperm tissue to provide nutrition to the developing embryo.

2. Germ pores are prominent apertures of pollen grain where exine is thin or absent hence, sporopollenin is absent and intine is thickened. These are the regions where intine comes out to form a pollen tube after pollination.

3. Leydig's cells are present between the seminiferous tubules. They synthesise and secrete testicular hormones called androgens.

4. Estrogen and progesterone are hormones secreted by placenta and they are present in non-pregnant woman also.

5. In pleiotropy single gene may express more than one effect.

6. To find the genotype of a pea plant bearing violet flowers, test cross must be performed.

7. Genetic maps have helped in gene sequencing, DNA fingerprinting, tracing human history, etc.

8. Polymerase chain reaction (PCR) and enzyme linked immunosorbent assay (ELISA) are the some of the techniques that serve the purpose of early diagnosis of bacterial/viral diseases, *e.g.,* tuberculosis, HIV, etc.

9. Transgenic animals are those animals which contain in their genome, a foreign gene introduced by recombinant DNA technology. Such gene is called transgene. Examples of transgenic animals are transgenic mice, transgenic rabbit, etc.

10. Seed banks are one of the methods of *ex-situ* conservation. Seeds are of two types - Orthodox seeds and recalcitrant seeds. Orthodox seeds can tolerate reduction in moisture content (upto 5%), anaerobic conditions and low temperature (–10°C to –20°C), *e.g.*, cereals, legumes. Recalcitrant seeds get killed on reduction of moisture and exposure to low temperature, *e.g.,* tea, cocoa, etc.

11. (a) : Messenger RNA (*m*RNA) is a single stranded RNA molecule that is complementary to one of the DNA strands of a gene. It carries codes from the DNA in the nucleus to the sites of protein synthesis in the cytoplasm.

OR

(a) : DNA replication is said to be semi-conservative because of the process of replication, where the resulting double helix is composed of both an old strand and a new strand. Each strand of the double helix DNA would serve as a template for synthesis of a new strand.

12. (d) : *Hin* and *Hae*, both are produced from a single genus *Haemophilus* but from two different species, *i.e.*, *H. influenzae* and *H. aegyptius* respectively.

13. (b)

14. (c) : Epiphytes which grow on the branches and in the forks of some trees, cite an example of commensalism. Commensalism is a type of positive interaction in which, two organisms (of different species) live together without any physiological dependence between them, and one gets the benefit from the association while the other is neither benefitted nor harmed.

15. (i) (c) : Halophytes are plants adapted to saline environment.
(ii) (a) : Many halophytes secrete salts through chalk or salt glands.
(iii) (c) : Presence of mycorrhizae is an adaptation of tropical plants.
(iv) (d)
(v) (a)

16. (i) (a)
(ii) (a) : Opioid narcotic relieves pain by acting on CNS, they work as analgesic
(iii) (b) : Caffeine is a stimulant, which make person more wakeful, alert and active.
(iv) (d)
(v) (a)

17. Surgical methods of birth control or sterilisation advised to human males and females are vasectomy and tubectomy respectively. In vasectomy a small part of the vas deferens is removed or tied up through a small cut on the scrotum while in tubectomy a small part of the Fallopain tube is removed or tied up through a small cut in the abdomen or through

vagina. Both vasectomy and tubectomy are permanent birth control methods with no side effects but one disadvantage of this procedure is that their reversibility is very poor. So, it is advised to those married couples who already have children and do not wish to have any more.

18. Aminoacylation or charging of the *t*RNA is the process during which the amino-acyl-adenylate-enzyme complex reacts with *t*RNA specific for the amino acid to form aminoacyl-*t*RNA complex. Enzyme and AMP are released. *t*RNA complexed with amino acid is sometimes called charged tRNA. The amino acid is linked to 3-OH-end of tRNA through its -COOH group,

AA ~ AMP — E + *t*RNA → AA -*t*RNA + AMP + E

Aminoacyl adenylate enzyme

The aminoacyl-*t*RNA complex specific for the initiation codon reaches the P-site to initiate the process of protein synthesis.

OR

(i) *t*RNA helps in transferring amino acids to ribosome for synthesis of polypeptide chain. *t*RNA reads the genetic codes, carries amino acids to the site of protein synthesis and acts as an adapter molecule.

(ii) *r*RNA is the most abundant RNA. Prokaryotic ribosomes are of three types 23S, 16S and 5S. 23S and 5S occur in large subunit of ribosome while 16S is found in smaller subunit. It plays structural and catalytic role during translation.

19. Principle of segregation states that, "when a pair of contrasting factor or gene are brought together in a hybrid; these factors do not blend or mix up but simply associate themselves and remain together and separate at the time of gamete formation", *i.e*, allele pairs segregate during gamete formation and the paired condition is restored by random fusion of gametes during fertilisation. The above law is also known as "law of purity of gametes" because each gamete is pure in itself.

20. Proinsulin is the prohormone which needs to be processed before it becomes a fully mature and functional hormone. Proinsulin contains an extra stretch called the C peptide. This C peptide is not present in the mature insulin as it is removed during maturation into insulin.

21. Polymerase chain reaction (PCR) is a technique of synthesising multiple copies of the desired gene (DNA segment) *in vitro*. The basic requirements of PCR are DNA template, two oligonucleotide primers usually 20 nucleotides long, dNTPs and DNA polymerase which is stable at high temperature (usually *Taq* polymerase). Working mechanism of PCR is as follows :

(i) Denaturation : the target DNA (DNA segment to be amplified) is heated to high temperature (94°C). Heating results in the separation of two strands of DNA. Each of the two strands of the target DNA now act as template for synthesis of new DNA strand.

(ii) Annealing : During this step, two oligonucleotide primers hybridise to each of single stranded template DNA in presence of excess of synthetic oligonucleotides.

(iii) Extension : During this step, the enzyme DNA polymerase synthesises the DNA segment between the primers. *Taq* DNA polymerase, isolated from a thermophilic bacterium *Thermus aquaticus,* is used in most of the cases. This step requires presence of deoxynucleotide triphosphates (dNTPs) and Mg^{2+} and occurs at 72°C.

OR

Recombinant DNA technology can be used to obtain foreign-gene-products. It involves following steps :

(i) Isolation of genetic material (DNA) using enzymes.

(ii) Identification and cutting of DNA from specific location using restriction enzymes and separating the fragments of DNA using gel electrophoresis to obtain gene of interest.

(iii) Amplification of gene of interest using PCR.

(iv) Adding or ligation of gene of interest into suitable vector using ligase enzymes. This produces a recombinant DNA molecule.

(v) Insertion of recombinant DNA into the host cell or organism.

(vi) Selection of recombinants from non-recombinant cells.

(vii) Culturing recombinant cell under suitable conditions and obtaining the desired foreign-gene-product.

22. Plasmid pBR322 is a most widely used cloning vector. It has two resistance genes ampicillin resistance (amp^R) and tetracycline resistance (tet^R) which are considered useful as selectable markers. Selectable markers are antibiotic resistance gene that help in identifying and eliminating non-transformants and selectively permitting the growth of transformants.

23. Deoxyribonucleoside triphosphates (or phosphorylated nucleotides) *i.e*., deATP, deCTP,

deGTP and deTTP serve dual purpose during DNA replication. They act as substrates for the replication process as well as provide energy for the polymerisation of nucleotides.

24. Parasitism is a negative interaction wherein parasite depends on its host organism partially or completely for survival and perpetuation. Accordingly, parasites are classified as partial or hemiparasites and complete or holoparasites. Also they could be ectoparasites (on host's body) or endoparasites (inside host's body). Parasites are adapted vividly on the basis of their dependability on host.
In accordance with their life styles, parasites evolved special adaptations such as:
(i) anaerobic respiration in internal parasites
(ii) loss of unnecessary sense organs
(iii) presence of adhesive organs (*e.g.,* suckers in tapeworm) to cling on to the host
(iv) loss of certain organs (*e.g.*, bedbugs lack wings, *Taenia* loses digestive system)
(v) excessive multiplication
(vi) resistant cysts and eggs for safe transfer of their progeny to new hosts
(vii) high reproductive capacity.

25. The prolonged use of drugs/alcohol may lead to the dependence of body upon them. Addiction is the habitual, physiological and psychological dependence on substance or practice which is beyond voluntary control. Addiction is a chronic, progressive and sometimes fatal disorder with both genetic and environmental roots. It manifests as a compulsion that drives an individual to continue to behave in a way that is harmful to self and loved ones, despite an intense desire to halt that behaviour. Medically, addiction is of three types: tobacco addiction, alcohol addiction and drug addiction.
Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drug or alcohol is abruptly discontinued.

26. The infant is suffering from Down's syndrome that is caused by the presence of an extra chromosome number 21. It is an autosomal aneuploidy. Both the chromosomes of the pair 21 pass into a single egg due to non-disjunction during oogenesis. Thus, the egg possesses 24 chromosomes instead of 23. The child will have short stature and a small rounded head. Palms of the child will be broad with characteristic palmer crease and his physical and mental development will be retarded.

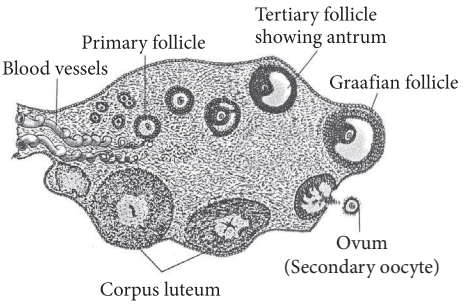
OR

In case of birds, the type of sex determination is ZW-ZZ type. Female has two different sex chromosomes (AA + ZW) whereas male has a pair of same chromosomes (AA + ZZ). As the female has heteromorphic sex chromosomes, the female is heterogametic and produces two types of eggs, (A + Z) and (A + W). The male gametes or sperms are of one type (A + Z). Therefore, in birds, sex is determined by female. Chromosomal determination of sex in human beings is of XX-XY type. Human beings have 22 pairs of autosomes and one pair of sex chromosomes. The females possess two homomorphic sex chromosomes, named XX while. The males have two heteromorphic sex chromosomes, *i.e.*, XY. All the ova formed by female are similar in their chromosome type (22 + X). Therefore, females are homogametic. The male gametes or sperms produced by human males are of two types, gynosperms (22 + X) and androsperms (22 + Y). Human males are therefore, heterogametic. Thus, the genetic makeup of the sperm determines the sex of the child in case of humans.

27. (i) HIV enters into macrophages (A).
(ii) B is viral RNA.
(iii) Enzyme C is reverse transcriptase.

28. Applications of the given transgenic plants are as follows:
(i) Bt cotton - Pest resistance, herbicide tolerance, high yield and resistant to bollworm infestation
(ii) Wheat - Resistant against the herbicide
(iii) Tobacco - CPTI gene introduced to show pest resistance
(iv) Flavr Savr tomato - Delayed ripening, better tomato nutrient quality
(v) Golden rice - Vitamin A rich
(vi) Potato - Higher protein content

29. Diagrammatic sectional view of human ovary showing the development of follicles, corpus luteum and ovulation is as follows:



30. (a) Constant internal environment is beneficial to organisms as it permits all biochemical reactions and physiological functions to proceed with maximal efficiency thereby enhancing the overall efficiency of organism.

(b) Organisms can overcome stressful external conditions by following adaptation :

(i) Migration - Birds of colder areas of northern hemisphere begin their southward migration as the day length begins to shorten.

(ii) Aestivation - Ground squirrels undergo aestivation to avoid heat by spending dry hot period in burrows.

31. (i) In the given figure of menstrual cycle, W is menstrual phase, X is proliferative phase, Y is secretory phase and Z is ovulatory phase.

(ii) Proliferative phase (X), takes place between 6^{th} to 13^{th} in a 28 days cycle. In this phase primary follicle changes into Graafian follicle and 2-3 mm thick endometrium rebuilds. The FSH secreted by the anterior lobe of pituitary gland stimulates the ovarian follicle to secrete estrogens.

Secretory or luteal phase (Y) takes place from days 15 to 18 in a 28 days cycle. LH secreted by anterior lobe of pituitary causes ovulation. Empty Graafian follicle changes into corpus luteum that secretes large amount of progesterone.

(iii) In the ovulatory phase (Z), both LH and FSH attain a peak level. FSH secretes estrogens and hence the concentration of estrogen in the blood is high and reaches its peak.

OR

(i) In the given figure of the sectional view of testes, A, B, C and D are Sertoli cell, spermatid, seminiferous tubule and primary spermatocyte respectively.

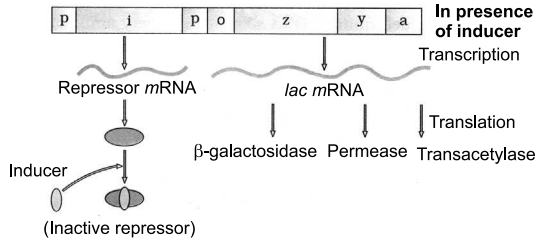
(ii) Sertoli cell (A) provides nourishment to the developing spermatozoa. Sertoli cells secrete androgen binding protein that concentrates testosterone in the seminiferous tubules. These cells also secrete another protein, inhibin which suppresses FSH synthesis.

(iii) Spermatids (B) are haploid cells formed from secondary spermatocytes undergoing second maturation (mitotic) division. Each primary spermatocyte form 2 secondary spermatocytes, which then form 4 spermatids.

32. (a) The arrangement of different genes in the operon of bacteria is as follows:

Regulator gene, Promoter gene, Operator gene and Structural genes.

(b) Schematic diagram of lac operon in 'switched on' position is as follows:



(c) Inducer is a chemical (substrate, hormone or some other metabolite) which after coming in contact with the repressor, changes the latter into non-DNA binding state so as to free the operator gene.

The inducer for *lac* operon of *Escherichia coli* is lactose (actually allolactose, or metabolite of lactose). In the presence of inducer (lactose), the repressor gets inactivated due to its interaction with it. This allows RNA polymerase to access the promoter and transcription proceeds. Hence, the *lac* operon is switched on.

When lactose is digested, glucose and galactose are formed. Then, the *lac* operon will stop due to the accumulation of glucose and galactose in the cell as they cannot be used as an inducer for *lac* operon.

OR

(i) *m*RNA - Messenger RNA bring coded information from DNA and takes part in its translation by bringing amino acids in a particular sequence during the synthesis of polypeptide. However, the codons of *m*RNA are not recognised by amino acids but by anticodons of their adapter molecules (*t*RNAs → aa-*t*RNAs). Translation occurs over the ribosomes. The same *m*RNA may be reused time and again. In the form of polysome, it can help synthesise a number of copies simultaneously.

(ii) *t*RNAs -They are transfer or soluble RNAs which pick up particular amino acids (at CCA or 3′ end) in the process called charging. The charged *t*RNAs take the same to *m*RNA over particular codons corresponding to their anticodons. A *t*RNA can pickup only a specific amino acid though an amino acid can be specified by 2-6 *t*RNAs. Each *t*RNA has an area for coming in contact with ribosome (T ψ C) and the enzyme amino acyl *t*RNA synthetase (DHU).

(iii) Ribosomes - Protein synthesis occurs over the ribosomes, Ribosomes are, therefore, also

called protein factories. Each ribosome has two unequal parts, small and large. The larger subunit of ribosome has a groove for pushing out newly formed polypeptide and protecting the same from cellular enzymes. The smaller subunit fits over the larger one like a cap but leaves a tunnel for *m*RNA. The two subunits come together only at the time of protein formation. Mg^{2+} is essential for it. Soon after the completion of protein synthesis, the subunits separate.

33. (a) (i) LAB (Lactic acid bacteria) - Curd
(ii) *Saccharomyces cerevisiae* - Bread
(iii) *Propionibacterium shermanii* - Swiss cheese
(iv) *Aspergillus niger* - Citric acid

(b) Penicillin is an antibiotic obtained from *Penicillium notatum*. It helps in curing rheumatic fever, tonsillitis, sore throat, gonorrhoea and some pneumonia types.

Statin obtained from *Monascus purpureus*, inhibits cholesterol synthesis and is therefore used in lowering blood cholesterol, *e.g.*, lovastatin, pravastatin, simvastatin.

Cyclosporin A is obtained from *Trichoderma polysporum*. This chemical has antifungal, anti-inflammatory and immunosuppressive properties. It inhibits activation of T-cells and therefore, prevents rejection reactions in organ transplantation.

OR

(a) Aerobic bacteria and fungi constitute 'flocs'. Flocs are masses of aerobic bacteria held together by slime and fungal filaments to form mesh like structures. These microbes digest a lot of organic matter converting it into microbial biomass and releasing a lot of minerals. This reduces biochemical oxygen demand or BOD.

In anaerobic sludge digesters, aerobic microbes present in the sludge get killed. Anaerobic microbes digest the organic mass as well as aerobic microbes of the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas which can be used as source of energy as it is inflammable. The spent sludge of anaerobic sludge digester can be used as manure or part of compost.

(b) Among the given microbes, the ones which are in great demand for organic farming are: Mycorrhiza, *Anabaena* and *Rhizobium*.

Mycorrhiza is a mutually beneficial or symbiotic association of a fungus with the roots of a higher plant. Mycorrhizal roots show a sparse or dense wooly growth of fungal hyphae on their surface. Plants having mycorrhizal associations show resistance to root-borne pathogens.

Anabaena is free living and symbiotic nitrogen fixing cyanobacteria. Cyanobacteria are photosynthetic and have the property of nitrogen fixation. They add organic matter as well as extra nitrogen to the soil. Cyanobacteria are an extremely low cost biofertilisers.

Rhizobium is symbiotic nitrogen fixing bacteria. They form a mutually beneficial association with the plants. The bacteria obtain food and shelter from plants. In return, they give a part of their fixed nitrogen to the plants, thus enhancing the availability of nutrient to crops. It forms nodules on the roots of legume plants. They develop the ability to fix nitrogen only when they are present inside the root nodules.

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