

SECTION – A

1. ‘Cry’ protein coded by gene Cry IAb controls

- (A) Cotton bollworm
- (B) Corn borer
- (C) Tobacco budworm
- (D) Mosquito

Ans (B) / Corn borer

[ 1 Mark]

2. Meselson and Stahl carried out centrifugation in  $\text{CsCl}_2$  density gradient to separate :

- (A) DNA from RNA
- (B) DNA from protein
- (C) The normal DNA from  $^{15}\text{N}$ -DNA
- (D) DNA from tRNA

Ans C / The normal DNA from  $^{15}\text{N}$ -DNA

[1 Mark]

3. Self-pollination is fully ensured if

- (A) the flower is bisexual.
- (B) the style is longer than the filament.
- (C) the flower is cleistogamous.
- (D) the time of pistil and anther maturity is different.

Ans C / Flower is Cleistogamous

OR

Zoospores are the reproductive units to carry asexual reproduction in

- (A) *Chlamydomonas*
- (B) *Spirogyra*
- (C) Yeast
- (D) *Rhizopus*

Ans A / Chlamydomonas

[1 Mark]

4. Micropropagation can be achieved by

- (A) Self-pollination

- (B) Asexual reproduction
- (C) Tissue culture
- (D) Vegetative propagation

Ans C / Tissue Culture

**OR**

**The microbes commonly used in kitchens are**

- (A) Lactobacillus and Yeast
- (B) Penicillium and Yeast
- (C) Microspora and E. coli
- (D) Rhizopus and Lactobacillus

Ans A / Lactobacillus and Yeast

[1 Mark]

**5. The main barrier that prevents the entry of micro-organisms into our body is**

- (A) Antibodies
- (B) Macrophages
- (C) Monocytes
- (D) Skin

Ans D / Skin

[1 Mark]

### **SECTION – B**

**6. Name the genus of baculovirus that acts as a biological control agent in spite of being a pathogen. Justify by giving three reasons that make it an excellent candidate for the job.**

Ans Genus -*Nucleopolyhedrovirus*, species-specific , Narrow spectrum , No negative impact on (plants /mammals/ birds /fish ) non-target organisms =  $\frac{1}{2} \times 4=2$

[2 Marks]

**OR**

**“Micro-organisms play an important role for the biological treatment of sewage.”  
Justify**

Ans Primary effluent passed into aeration tanks, constantly agitated and air is pumped in , allows growth of useful aerobic microbes into flocs / (masses of bacteria and fungal filaments), these microbes consume organic matter and reduce Biochemical oxygen demand (BOD) of effluent. =  $\frac{1}{2} \times 4$

[2 Marks]

**7. It is often observed that the chances of a person suffering from measles in his or her lifetime are low if he or she has suffered from the disease in their early childhood. Justify the statement.**

Ans. Memory cells develop during measles in early childhood, subsequent encounters with the same pathogen elicits a highly intensified secondary / anamnestic response. = 1 + 1

[2 Marks]

**8. Wings of birds and wings of butterflies contribute to locomotion. Explain the type of evolution such organs are a result of.**

Ans They are not anatomically similar in structure but perform same function , hence these are analogous structure =  $\frac{1}{2} + \frac{1}{2}$

type of evolution is convergent evolution = 1

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similar habitat of birds and butterflies has resulted in selection of similar adaptive features (wings) in different groups of organisms , but towards the same function =  $\frac{1}{2} + \frac{1}{2}$

convergent evolution = 1

[2 Marks]

**9. Name and mention the events that occur in the cells when HIV gets into blood after gaining entry into the human body.**

Ans Virus/viral RNA enters into macrophages , where RNA genome of virus replicate to form viral DNA with the help of reverse transcriptase , This viral DNA gets incorporated into host cell's DNA, and direct infected cells to produce virus particles =  $\frac{1}{2} \times 4$

[ 2 Marks]

**10. List the four different human male accessory ducts.**

Ans rete testis , vasa efferentia , epididymis , vas deferens =  $\frac{1}{2} \times 4$

[ 2 Marks]

**11. State what is out-crossing type of breeding. Mention on what type of cattle this is practised.**

Ans Practice of mating animals within the same breed, but having no common ancestors on either side of ( their pedigree) upto 4-6 generations. =  $\frac{1}{2} + \frac{1}{2}$

Animals that are below average, in milk production / growth rate in beef cattle.  $\frac{1}{2} + \frac{1}{2}$

[ 2 Marks]

**12. Given below is one of the strands of a DNA segment :**



(a) Write its complementary strand.

(b) Write a possible RNA strand that can be transcribed from the above DNA molecule formed.

Ans (a) 5' ATGCATGCATGCATGC → 3' (polarity =  $\frac{1}{2}$ , nucleotide sequence =  $\frac{1}{2}$ )

(b) 5' AUGCAUGCAUGCAUGC → 3' (polarity =  $\frac{1}{2}$ , nucleotide sequence =  $\frac{1}{2}$ )

[1 + 1 = 2 Marks]

### Section C

**13 Generally it is observed that human males suffer from hemophilia more than human females, who rarely suffer from it. Explain giving reasons.**

Ans This is a sex linked / X chromosomes linked recessive disease, the heterozygous female / carrier for hemophilia may transmit the disease to sons (male progeny), The possibility of hemophilic female/daughter is rare because mother of such a female has to be at least carrier and the father should be hemophilic.

[3 Marks]

OR

**F<sub>1</sub> progeny of pea plant bearing violet flowers and snapdragon plant bearing red flowers were selfed to produce their respective F<sub>2</sub> progeny.**

**Compare the phenotypes, the genotypes and the pattern of inheritance of their respective F<sub>2</sub> progeny.**

Ans F<sub>1</sub> Violet flower of Pea

Ww Ww

Selfing

Case 1

	W	w
W	WW	Ww
w	Ww	ww

**Phenotypic ratio**

Violet : White

3 : 1

Genotypic Ratio

1 : 2 : 1

Pattern of inheritance

Pea plant

Snapdragon

/ WW WW

Selfing

Case 2

	W	W
W	WW	WW
W	WW	WW

100% WW /

all violet flowers

F<sub>1</sub> Red flower of snapdragon

RR RR

Selfing

	R	R
R	RR	RR
R	RR	RR

**Phenotypic ratio**

Red

100%

Genotypic Ratio

RR (100%)

Complete dominance

Incomplete dominance

$\frac{1}{2} \times 2$

$\frac{1}{2} \times 2$

$\frac{1}{2}$

$\frac{1}{2}$

[3 Marks]

**14. For a layman, both apple and banana are fruits. But a biology student categorises fruits as true fruits, false fruits and parthenocarpic fruits. Justify**

Ans True Fruits - Fruits that develop from mature ovary and are a result of fertilisation. = 1

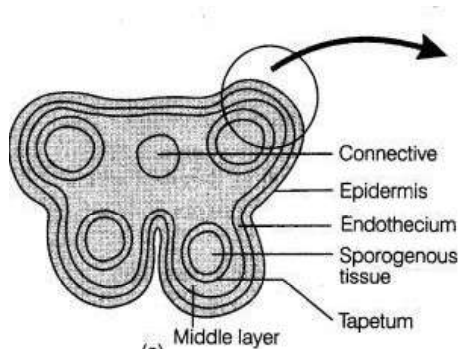
False Fruits - Fruits that develops from ovary along with some other floral parts / thalamus.=1

parthenocarpic fruits - Fruits that develop without fertilisation = 1

[ 3 Marks]

15. Draw a schematic transverse section of a mature anther of an angiosperm. Label its epidermis, middle layers, tapetum, endothecium, sporogenous tissue and the connective.

Ans



$$= \frac{1}{2} \times 6$$

[3 Marks]

16. Alien species invasion has been a threat to biodiversity. Justify with the help of a suitable example. List any other three causes responsible for such a loss.

Ans Example of Alien species invasion

Nile Perch , introduced into lake Victoria ( in East Africa) , led to extinction of Cichlid fish (more than 200 species) in the lake

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Introduction of African cat fish (*Clarias gariepinus*) , for aquaculture, posing threat to indigenous catfish

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Introduction of carrot grass (*Parthenium*) / *Lantana* / Water hyacinth (*Eicchornia*) ,which are invasive weed , that pose threat to native species

or any other appropriate example. =  $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Causes of biodiversity loss

- (i) Habitat loss and fragmentation
- (ii) Over exploitation
- (iii) Co-extinction

$$= \frac{1}{2} \times 3 = 1\frac{1}{2}$$

[3 Marks]

17. Explain the changes that milk undergoes when suitable starter/inoculum is added to it. How does the end product formed prove to be beneficial for human health ?

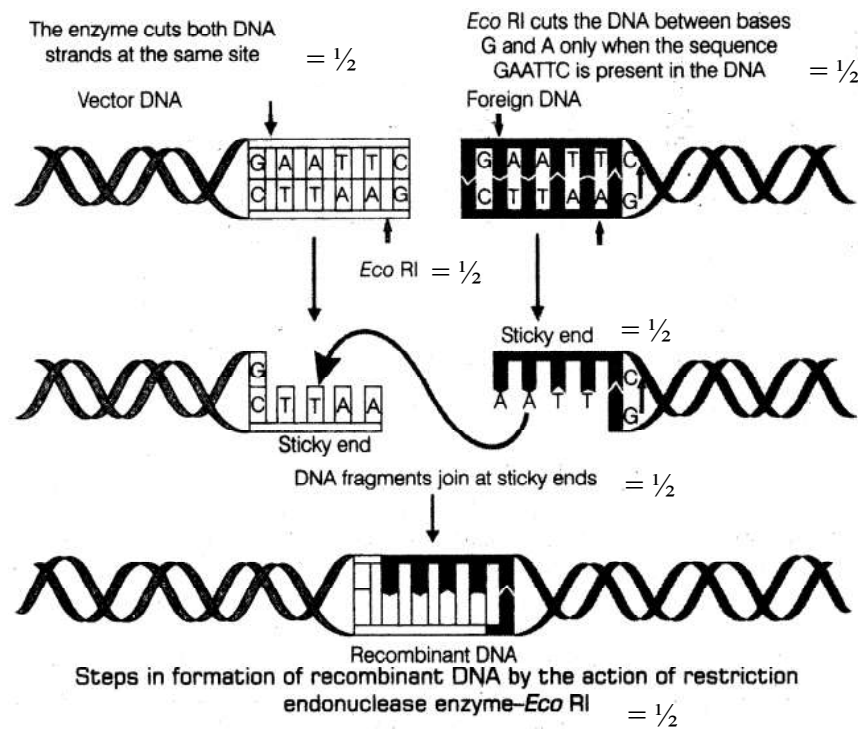
Ans. Lactobacillus / lactic acid bacteria (LAB) present in inoculum , grows in milk at a suitable / optimum temperature, multiplies converting milk to curd, produce acids that coagulate and partially digest the milk proteins. =  $\frac{1}{2} \times 4$

This improves its nutritional quality by increasing Vitamin B<sub>12</sub>, LAB check diseases causing microbes in our stomach =  $\frac{1}{2} \times 2$

[3 Marks]

18. Explain the three steps carried out in the formation of recombinant DNA using the enzyme EcoRI.

Ans



//

Eco RI cuts vector DNA , foreign DNA/ gene of interest , at pallindromic site /

5'GAATTC3'

3'CTTAAG5' (between bases G & A only), sticky end (over hanging stretch of bases) formed at each strand, Joining of sticky ends from DNA fragments by enzyme DNA Ligase,Recombinant DNA(rDNA) is formed =  $\frac{1}{2} \times 6$

[3 Marks]

19. In an E. coli cloning vector pBR 322, state the role of the following genes : 3

- (a) ori gene
- (b) Antibiotic resistance gene
- (c) rop gene

- Ans a) Ori-gene - The sequence from where replication start / any piece of DNA when linked to this sequence can be made to replicate within the host cell, this sequence control the copy number of linked DNA =  $\frac{1}{2} + \frac{1}{2}$
- b) Antibiotic resistance genes - Help in identifying and eliminating non transformant from transformant / acts as selectable marker /helps in ligation of alien DNA at recognition site ( present in one of the two antibiotic resistance gene) = 1
- c) rop- codes for proteins , involved in the replication of plasmids. =  $\frac{1}{2} + \frac{1}{2}$

[ 3 Marks]

20. Study the table given below and identify a, b, c, d, e and f :

Crops	Variety	Resistance to disease
a	Pusa sadabahar	b
c	d	White rust
e	Himgiri	f

- Ans
- |             |                           |                                    |
|-------------|---------------------------|------------------------------------|
| Crop        | Variety                   | Resistance to diseases.            |
| a. Chilli   | -                         | b. Mosaic Virus /Leaf Curl         |
| c. Brassica | d. Pusa Swarnim/karan Rai | -                                  |
| e. Wheat -  |                           | f. Leaf & stripe rust / hill bunt. |

=  $\frac{1}{2} \times 6$

[3 Marks]

OR

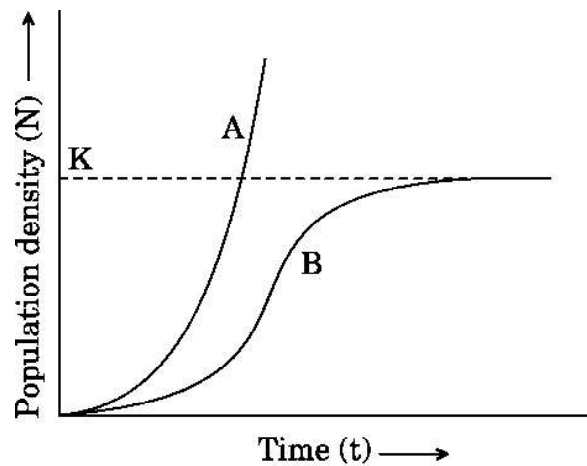
**What is plant breeding ? Explain the two steps involved in classical plant breeding.**

**Plant breeding** is the purposeful manipulation of plants species in order to create desired plant types, that are better suited for cultivation / better yield / disease resistant. =  $\frac{1}{2} \times 2$

**Classical Plant breeding** involves crossing or hybridisation of pure lines, followed by artificial selection to produce plants with desirable traits of higher yield / nutrition / resistance to diseases. = 1 + 1

[3 Marks]

21. Study the population growth curve given below and answer the questions that follow :



(a) Identify 'A' and 'B' shown in the graph.

(b) When and why do such curves occur in a population ?

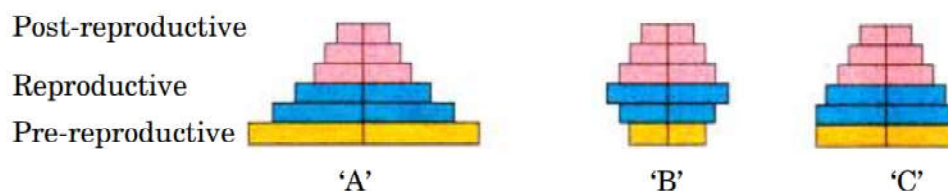
Ans a) 'A'- Exponential 'B' -Logistic  $=\frac{1}{2} + \frac{1}{2}$

b) 'A'- Exponential growth - when resources ( food and space) are not limiting / when resources in the habitat are unlimited , each species has the ability to realise its full potential to grow in number in absence of checks .  $=\frac{1}{2} + \frac{1}{2}$

'B' -Logistic growth - When resources become limiting / competition between individuals for limited resources occurs, the fittest individuals will survive and reproduce.  $=\frac{1}{2} + \frac{1}{2}$

[3 Marks]

22 Study the age pyramids 'A', 'B' and 'C' of the human population given below and answer the questions that follow :



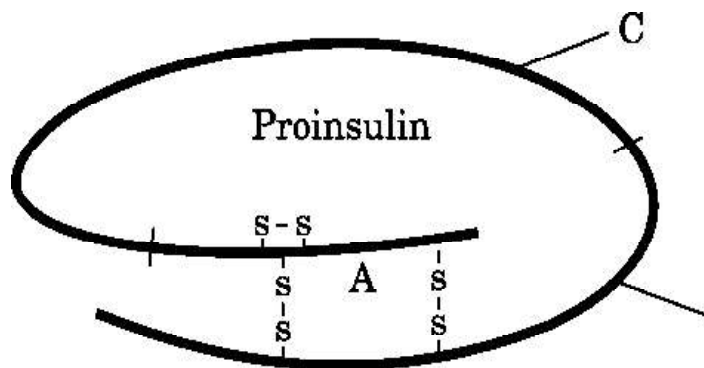
Ans (a) B- Stable population = 1  
C- Declining population = 1

(b) Age Distribution of male and female of human population = 1

[2 + 1 = 3 Marks]

23. Insulin in the human body is secreted by pancreas as prohormone/proinsulin. The schematic polypeptide structure of proinsulin is given below. This proinsulin needs to undergo processing before it becomes functional in the body. Answer the questions that follow



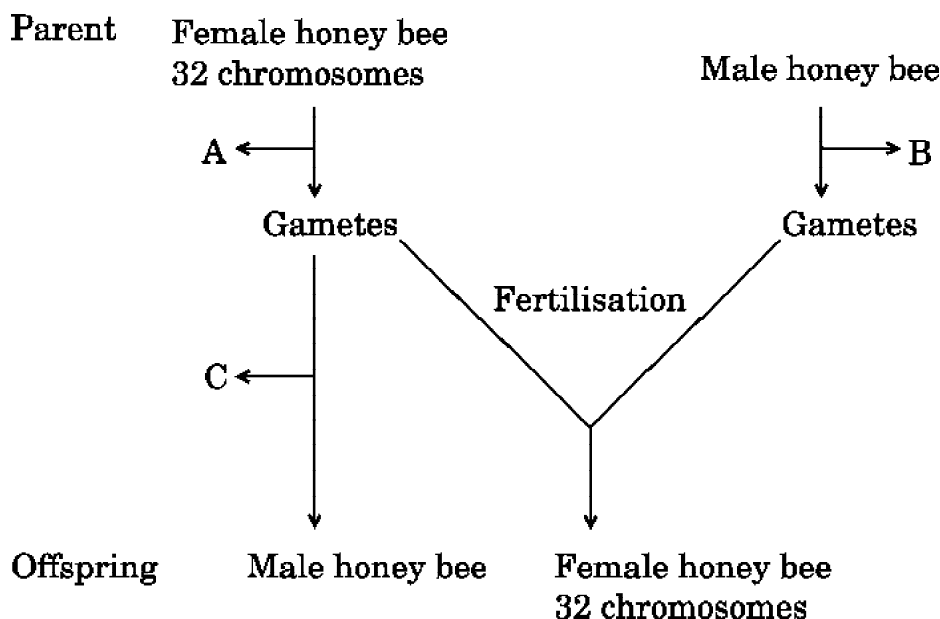


- State the change the proinsulin undergoes at the time of its processing to become functional.
- Name the technique the American company Eli Lilly used for the commercial production of human insulin.
- How are the two polypeptides of a functional insulin chemically held together ?

Ans a 'C' Peptide is removed = 1  
 b r-DNA technology / Recombinant DNA Technology = 1  
 c Disulphide bonds = 1

[1 + 1 + 1 = 3 Marks]

- The cytological observations made in a number of insects led to the development of the concept of genetic/chromosomal basis of sex-determination mechanism. Honey bee is an interesting example to study the mechanism of sex-determination. Study the schematic cross between the male and the female honey bees given below and answer the questions that follow :



(a) Identify the cell divisions 'A' and 'B' that lead to gamete formation in female and male honey bees respectively.

(b) Name the process 'C' that leads to the development of male honey bee (drone).

Ans (a) 'A' - meiosis = 1

'B'-Mitosis = 1

(b) 'C'-Parthenogenesis = 1

[2 + 1 = 3 Marks]

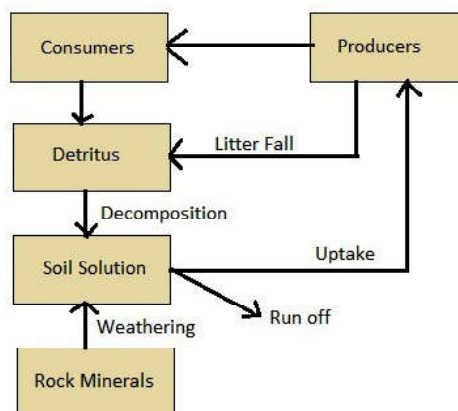
## SECTION – E

**25 Describe the model of phosphorus cycle in the terrestrial ecosystem.**

Ans Phosphorus a major constituent of biological membrane / nucleic acids / cellular energy transfer system , Many animals need it for making shells / bones and teeth , the natural reservoirs of phosphorous is rock , which contains phosphorous in the form of phosphate reserves , on weathering minute amount of phosphate dissolve in soil solution , and absorbed by roots , Herbivores , obtain these elements from plants waste products and dead organism , decomposed by phosphate-solubilising bacteria , releasing phosphorus =  $\frac{1}{2} \times 10$

//

Marks can also be awarded for the steps given in the proper sequence, with other details



=  $\frac{1}{2}$  marks for each given label

[5 Marks]

OR

**Describe the DDT biomagnification occurring in an aquatic food chain. State the negative effects the process has on the organisms at the last trophic level of the food chain.**

Ans Biomagnification refers to increase in concentration of the toxicant at successive trophic levels , Toxic substance accumulated by an organism cannot be metabolised or excreted and is passed on to the next higher trophic level =  $\frac{1}{2} \times 2$

### Biomagnification of DDT in an aquatic food chain

Water → Zooplankton → small fish → Large Fish → Fish eating bird. =  $\frac{1}{2} \times 5$   
0.003 ppb   0.04 ppm   0.5 ppm   2 ppm   25 ppm

High concentration of DDT disturb calcium metabolism in birds, causes thinning of eggshell, their premature breaking eventually causing decline in bird population =  $\frac{1}{2} \times 3$

[ 5 Marks]

26. (a) **Write the features that a biomolecule must fulfil to be able to act as a genetic material.**  
(b) **DNA and RNA are both genetic materials. Which one of the two is more stable and why ?**

Ans a) i. It should be able to replicate .  
ii. Should be structurally and chemically stable  
iii. Provide scope for slow change / mutations required for evolutions  
iv. should be able to express itself in the form of 'Mendelian characters'

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

b) DNA is more stable = 1

It is double stranded, lack OH<sup>-</sup> group on 2' carbon / chemically less reactive, presence of thymine confers stability. (Any two) =  $1 \times 2$

[2 + 3 = 5 Marks]

**OR**

- (a) **Explain Hardy-Weinberg Principle on the basis of the algebraic equation  $p^2 + 2pq + q^2 = 1$ .**  
(b) **How do gene migration and genetic drift affect this genetic equilibrium ?**

Ans (a) In a population of diploid organisms if frequency of allele A = p and frequency of allele a = q Expected genotype frequency under random mating are =  $\frac{1}{2}$

$$AA = p^2,$$

$$aa = q^2,$$

$$Aa = 2pq = \frac{1}{2} \times 3$$

The gene pool ( total genes and their alleles) in a population remains constant (genetic equilibrium). =  $\frac{1}{2}$

sum total of allelic frequencies is one =  $\frac{1}{2}$

- (b) When gene migration of a section of population to another place occurs, gene frequencies change in the original as well as in the new population and disturbs the equilibrium. =  $\frac{1}{2} + \frac{1}{2}$

Genetic drift - changes in gene frequency as in gene migration occurring by chance. = 1

[3 + 2 = 5 Marks]

27. a) IVF is a very popular method these days that is helping childless couples to bear a child. Describe the different steps that are carried out in this technique.
- (b) Would you consider Gamete Intrafallopian Transfer (GIFT) as an IVF ? Give a reason in support of your answer.

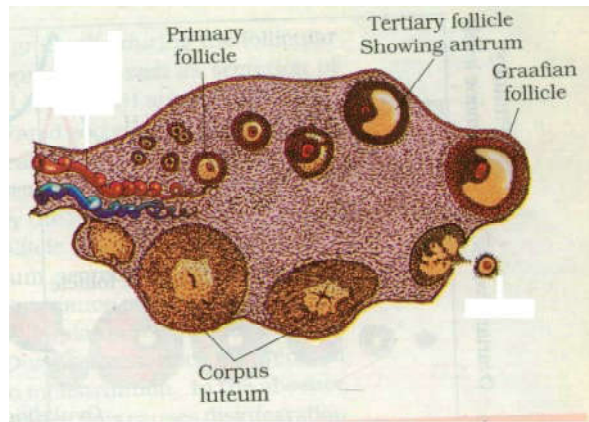
Ans a Ova from the wife /donor (female) and sperms from the husband / donor(male ), are collected and induced to form zygote , in simulated conditions in laboratory , the zygote / early embryos(upto 8 blastomeres) then transferred into the fallopian tube(ZIFT) , and embroyos with more than 8 blastomeres, into the uterus(IUT) to complete its further development. =  $\frac{1}{2} \times 6$

b No, GIFT cannot be considered as IVF technique because fertilisation takes place in the female body / in vivo. = 1 + 1

OR

- (a) Draw a sectional view of a human ovary and label primary follicle, tertiary follicle, Graafian follicle and corpus luteum in it.
- (b) Name the gonadotropins and explain their role in oogenesis and the release of ova.

Ans a.



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

b. LH , FSH =  $\frac{1}{2} + \frac{1}{2}$

Both LH & FSH increase during follicular phase and stimulate follicular development , secretion of estrogen by the growing follicles, LH surge ( rapid secretion of LH) during mid cycle / 14th day induces rupture of graffian follicle, and release of ova / secondary oocyte =  $\frac{1}{2} \times 4$

[5 Marks]