BIOTECHNOLOGY

ONE MARK QUESTIONS:

1. What are palindromic sequences ?
   Palindromic sequences are 'invert repeats' with bifold symmetry that have the same nucleotide sequences when read in 5' → 3' on both the strands.

2. Mention the role of cyanogen bromide in insulin synthesis by rDNA technology.
   Cyanogen bromide is used to separate proinsulin or A or B chain from β – galactosidase of the fusion protein.

3. What are DNA probes ?
   DNA probes are short fragments of ssDNA made up of a particular sequence of bases that are labelled with radioactive isotopes.

4. Why is germ line gene therapy advantageous over somatic gene therapy ?
   Germ line gene therapy is heritable whereas somatic gene therapy non-heritable.

5. Define emasculation.
   It is the removal of stamens from a bisexual flower which has been cross pollinated during hybridization so that self pollination is prevented.

6. What is hybridization ?
   It is the crossing of two varieties of a plant species or two plants belonging to different species or two plants belonging to different genera.

7. What is tissue culture ?
   It is the isolation or separation of cells or tissues or protoplasts from plants and growing them on a synthetic nutrient medium under aseptic conditions in the laboratory.

8. Name a chemical of plant origin which is used to induce polyploidy in plants ?
   Colchicine

9. What is explant ?
   It is any part of a plant that is inoculated (into the culture medium) during tissue culture.

10. What is callus ?
    It is an unorganized mass of undifferentiated cells produced by the explant in tissue culture.

11. What is hardening in tissue culture ?
    It is a procedure in which the plants obtained from tissue culture are acclimatized or made to adapt themselves to the natural environmental condition before they are transplanted.

12. What are transgenic animals ?
    These are genetically modified animals which contain one or more genes of a different organism in their genome.

13. What are 'stem cells' ?
    Stem cells are multipotent cells of animals which have the capacity to divide and specialize or differentiate into different tissues.

14. What is artificial insemination ?
    It is the technique of introducing (injecting) the semen of a desired bull into the uterus of a cow.

TWO MARKS QUESTIONS:

1. Mention four applications of biotechnology.
   - Bacteria and yeast are used in brewing industries for the manufacture of alcoholic drinks like beer, rum, whisky, etc.
   - Many microbes like bacteria are used in the manufacture of antibiotics, vaccines, vitamins, etc., in pharmaceutical industries.
   - Genetic engineering is used in obtaining genetically modified organisms that are high yielding or disease resistant or draught tolerant.
   - Gene therapy is used in treating debilitating genetic disorders.

2. Mention the tools used in gene cloning.
   Bioreactors, Host cell, Vector and Enzymes (RENs and DNA ligase)

3. Mention four applications of monoclonal antibodies.
   Applications:
   - ELISA technique to diagnose AIDS employs monoclonal antibodies
   - Monoclonal antibodies produced against T - lymphocytes can be used to prevent tissue rejection reactions in organ transplantations
   - Monoclonal antibodies are attached to cytotoxic drugs and are used to destroy cancer cells without harming the healthy cells
   - They are also employed in pregnancy tests

4. Mention four applications of gene therapy.
   - In the treatment of SCID
   - In the treatment of cystic fibrosis
   - In the treatment of Duchenne's muscular dystrophy
   - To dissolve clots in arteries by replacing gene for plasminogen activating factor

5. What are transgenic animals ? Mention two examples.
   These are genetically modified animals which contain one or more genes of a different organism in their genome.
   Ex: 'Tracy', a sheep whose milk has α, 1 – antitrypsin
   'Rosie', the cow whose milk has α lactalbumin

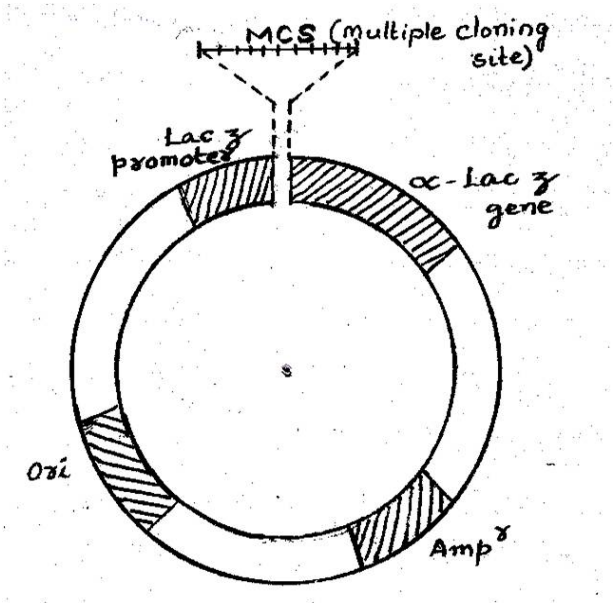
6. What are stem cells ? Mention two of their important characteristic features.
   Stem cells are multipotent cells of animals which have the capacity to divide and specialize or differentiate into different tissues.
   Features:
   - These are unspecialized or undifferentiated cells that can differentiate or specialize into any kind of tissue
   - These have a tremendous capacity of division or proliferation

7. Mention the role of prostaglandins and gonadotropins in MOET technique.
   Prostaglandins are injected to surrogate cows to bring them to the same estrous as that of the donor cow.
   Gonadotropins are injected into donor cow to induce the production of several ova simultaneously.

8. Mention two applications of stem cell culturing.
   - The technique can be used to produce heart muscles, insulin producing cells, etc., for transplantation surgeries.
   - Stem cells provide information about cell differentiation.

FIVE MARKS QUESTIONS:

1. Describe the structure of pUC 18 with a diagram.
   - It is a reconstructed plasmid of *Escherichia coli*.
   - It is a plasmid without the fertility factor (F^-).
   - It is made up of 2686 bp (2.686 kb).
   - It has `$Amp^r$' gene (for ampicillin resistance), `Ori' gene (for origin of replication) and `α - lac z' gene (for synthesis of β - galactosidase enzyme).
   - In the coding region of the α - lac z gene, a small segment of DNA with about 60 base pairs is inserted during the construction of the plasmid.
   - This region contains about 10 - 15 restriction endonuclease recognition sites. The foreign DNA or the gene to be cloned is inserted in this region to get recombinant DNA. This region acts as a multiple cloning site (MCS) as it has 10 -15 recognition sites or cleavage sites.



2. What are stem cells ? Mention two of their important characteristic features. Explain the types of stem cells based on their occurrence.

   Stem cells are multipotent cells of animals which have the capacity to divide and specialize or differentiate into different tissues.

   Characteristic features:
   - These are unspecialized or undifferentiated cells and can differentiate or specialize into many kinds of tissues
   - These have a tremendous capacity of division.

   Types of stem cells based on their occurrence:

   a. Embryonic stem cells:
      These are stem cells derived from embryos which are 4 - 5 days old developed out of *in vitro* fertilization.
   b. Adult stem cells:
      These are stem cells occurring among differentiated tissues or organs like bone marrow, peripheral blood vessels, skin, liver, brain of an individual.

3. Explain the technique of multiple ovulation and embryo transfer employed in cattle breeding.

   Superovulation (multiple ovulation):

   Donor cows are stimulated to produce a large number of ova (5 – 50) by injecting them with pituitary hormones (gonadotropins) like FSH and LH.

   Artificial insemination:

   Semen from a superior quality bull is collected, diluted and injected into the reproductive duct of the donor cows.

Embryo recovery:

Sperms fertilse the ova and the embryos that develop are flushed out on 6th or the 7th day. The embryos can be preserved by cryopreservation for future use.

Estrous synchronization:

The recipient cows or the surrogate cows are brought to the same estrous as that of the donor by injecting prostaglandins.

Embryo transfer:

The embryos flushed out from the donor cows are introduced into the uterine horns of the surrogate cows whose estrous have been synchronized.

GIVE SCIENTIFIC REASONS:

1. DNA ligase in rDNA technoogy is called 'molecular glue'. OR For the creation of rDNA, ligase enzyme is absolutely essential.

   DNA ligase joins the desired gene (passenger DNA) with the vector DNA (plasmid) to produce recombined DNA (rDNA) or hybrid DNA.

2. Humulin is better than insulin obtained from cow or pig in treating diabetics.

   Insulin from other sources may cause allergic reactions whereas humulin does not cause any allergy.

3. Without alkaline solution, DNA fingerprints cannot be obtained.

   ssDNA required for hybridization with DNA probe cannot be got from dsDNA fragments (restriction fragments).

4. Meristems used in tissue culture are considered to be totipotent.

   They have undifferentiated or embryonic cells which have the capacity to divide, differentiate and grow into whole plants.

5. Golden rice is rich in β carotene unlike any other variety of rice.

   It has three foreign gene, two from daffodil and one from Erwinia, which are involved in the synthesis of β carotene.

6. Golden rice is yellowish in colour.

   It contains a very large quantity of β - carotene.

7. Prostaglandin is injected into the recipient cows or surrogate cows during MOET procedure.

   It is to bring all the recipient cows are brought to estrous or reproductive stage simultaneously so that embryos could be transferred to them.
