SELECTION TEST FOR JRF EXAMINATION 2007
[TEST CODE: RAE]
[AGRICULTURAL AND ECOLOGICAL RESEARCH UNIT]
SYLLABUS

1. GENERAL KNOWLEDGE: General information on science, scientific and quantitative reasoning (10+2 level); elementary computer science in relation to plant and animal bioinformatics and biotechnology, Nobel prize winners in agriculture, medicine and basic biology (including famous Indian and scientists of Indian origin in the aforesaid areas); Preliminary genomics, proteomics, metabolomics and nanoscience (undergraduate level). [Mainly for multiple choice type questions]

2. Climate, soil and crops; water management; cropping patterns; Diseases of crops and insect pests of crops; Field crops; plantation crops; commercial crops; horticultural crops; Forage crops and grasses; Condiments and spices; Sericulture; basics of Animal Sciences and fishery sciences; Principles of plant breeding; Important conventional methods of breeding; self, cross pollinated and vegetatively propagated crops; Non-conventional methods; Polyploidy; Genetic variability; Plant diseases and defensive mechanisms; plant tissue culture and plant biotechnology.

3. Structure and function of cells and intracellular organelles; Mechanism of cell division; cell differentiation; Cell–cell interaction; Malignant growth; Immune response in relation biotechnology; Nucleic acid structure; genetic code; replication, transcription and translation; Enzymes and coenzyme; Respiration and photosynthesis. Reproduction and artificial control in plants, microbes and animals in relation to biotechnological applications; Principles of Mendelian inheritance, Linkage and genetic mapping; Mutation and Transposons in relation to plant and animal biotechnology; Economic importance of microbes, plants and animals.

4. Androgenesis and gynogenesis; Breeding system ; Pollination biology ; structural and functional aspects of pollen and pistil ; Male sterility ; Self- and inter-specific incompatibility ; Fertilization ; Embryo and seed development.

5. History of mammalian organ systems, nutrition, digestion and absorption; Circulation (open and closed circular, lymphatic systems, blood composition and function); Muscular contraction and electric organs; Excretion and osmoregulation; Nerve conduction and neurotransmitters; major sense organs and receptors; Homeostatic (neural and hormonal); Bioluminescence.

6. Important human and veterinary parasites; Life cycle and biology of Plasmodium; Molecular, cellular and physiological basis of host – parasite interactions.

7. Arthropods and vectors of human diseases (mosquitoes, lice, flies and ticks); Mode of transmission of pathogens by vectors; Chemical, biological and environmental control of anthropoid vectors; Biology and control of chief insect pests of agricultural importance; Plant host-insect interaction; insect pest management; useful insects.

8. History of molecular biology; nucleotide structures; bacterial restriction/modification system; DNA/RNA modification enzymes; DNA replication; plasmids; markers; Transcription and translation; Operon; DNA footprinting; General molecular biology and protein chemistry methodologies; PCR and phage display technology.

9. General plant and animal biotechnology: History and Basics, Terms associated with Biotechnology, laboratory methods, laboratory safety, Impact of plant and animal biotechnology on Agriculture and Horticulture; ethics in Biotechnology

10. Molecular Cloning: Plasmids and their usefulness in molecular cloning; Bacteriophage and bacteriophage based vectors; high capacity vectors; Gel electrophoresis of DNA and PFGE; Preparation and analysis of genomic DNA; Extraction, purification and analysis of mRNA from eukaryotic cells; Preparation of cDNA libraries and gene identification; DNA sequencing; Mutagenesis; Expression of cloned genes in *E. coli*; Protein interaction technologies; mammalian cell culture.

Suggested Reading materials:

1. Handbook of Agriculture, ICAR, New Delhi.
2. Standard text books of Botany, Zoology and Physiology (Masters level)
3. Kreuzer, Helen and Massey, Adrianne. “Recombinant DNA and Biotechnology: A Guide for Teachers.” American Society for Microbiology Press. 1325 Massachusetts Avenue, N.W. Washington D.C. 20005. Copyright 1996. ISBN: 1-55581-101-9
4. Micklos, David A. and Freyer, Greg, A., “DNA Science”: A First Course in Recombinant DNA Technology. Cold Spring Harbor Press and Carolina Biological Supply Company. 1990. ISBN 0-89278-4113
5. Modern Concepts of Biotechnology by H.D. Kumar, Vikas Publishing House Pvt. Ltd.
6. Elements of Biotechnology by P.K. Gupta, Rastogi Publications.

Sample questions for RAE I (FORENOON) 2007
Multiple choice answer type

[If all the choices given in a particular question are incorrect in your opinion, please feel free to suggest a new answer; but you must write not more than 3-4 sentences in separate sheet justifying your new answer. If your answer is found to be incorrect; you will score **-1** points (minus one)]

1. Which of the following is found in plant cells but not animal cells?
    A. Lignocelluose
    B. Lignicellulose
    C. Haemoglobin
    D. Haemocyanin
    E. None of the above
2. Buckyball means
    A. C60
    B. C200
    C. C80
    D. C120
3. Which pair of these restriction endonucleases is from *Bacillus sphaericus*?
    A. Bsp1286I and BspDI
    B. BsoFI and Bsp1286I
    C. BsoBI and BsmFI
    D. BsrI and BsrBI
    E. None of the above pairs
4. Jhum is-----
    A. A folk dance
    B. A tribe
    C. The name of the river valley
    D. A type of cultivation
    E. None of the above
5. Avian influenza (Bird Flu) is denoted by
    A. NH52
    B. NH51
    C. N1H5
    D. H5N1
    E. None of the above
6. If Phenotype is denoted as P, Genotypic contribution as G and Environmental contribution as E, then P is equal to
    A. G multiplied by E
    B. G + E
    C. G + (G multiplied by E)
    D. G + E + (G multiplied by E)
    E. None of the above

7. Which of the following metals is present in chlorophyll?
    A. Beryllium
    B. Magnesium
    C. Calcium
    D. Barium
    E. None of the above
8. MICR is an input device
    A. True
    B. False
    C. Not a logical statement
9. www.ncbl.nlm.nih.gov is website for National Center for Biotechnology Information
    A. True
    B. False
10. *Fugu sp*. (Puffer fish) has one of the most compact genomes in the animal world. This means
    A. Lower amount of non-coding DNA
    B. Higher amount of coding sequences
    C. All of the above
11. State yield index of a crop is
    A. Average yield of state / Average yield of country X 100
    B. Average yield of country / Average yield of state X 100
    C. Average yield of state / Average yield of state + Average yield of country x 100
    D. All of the above
12. If W is the dry weight of the crop, dw is the change in weight of a crop and dt refers to time intervals (t1 and t2) for the observations, then relative growth rate (RGR) is equal to
    A. 1/W X dw/dt
    B. W X dt/dw
    C. 1/2W X dw/dt
    D. 2W X dw/dt
    E. All of the above
13. If standard Human genomic DNA is cuț with *EcoRI* restriction endonuclease, then one *EcoRI* site is usually found after
    A. exactly 1024 base pairs
    B. approximately 2 million base pairs
    C. after 2048 base pairs
    D. approximately 5000 base pairs
    E. None of the above
14. DNA Drop dialysis is
    A. removing high molecular weight contaminants
    B. removing low molecular weight contaminants
    C. removing low and high molecular weight contaminants

D. removing >200 KD contaminants
E. None of the above

15. PHI-BLAST is
    A. position hit intron blast
    B. position specific blast
    C. position gapped hit blast
    D. position hit initiated blast
    E. All of the above
16. DNA PAM matrices
    A. uses Lodka model
    B. uses Markov model
    C. uses AI algorithm
    D. uses immuno-network algorithm
    E. None of the above
17. Ping and Ring is used for
    A. for sample spotting by a noncontact mechanism
    B. for solution mixing in faster kinetics
    C. solution preparation for fine chemicals
    D. for dissolving genomic DNA
    E. All of the above
18. Protein G was first isolated from-
    A. Streptococcal strains C and G
    B. Streptococcal strains A and B
    C. Streptococcal strain D
    D. Sreptococcal Strain E and F
    E. All of the above
19. G_{olf} was found to be involved in
    A. nasal epithelium
    B. nasal septal neurons
    C. vomeronasal neurons
    D. olfactory neurons
    E. All of the above
20. Goldman prize is for
    A. None of the choices below
    B. Environment
    C. Science
    D. Medicine
    E. Sports
21. ABDG, CDFI, EFHK, ?
    A. GHJM
    B. HILN
    C. HIMN
    D. HIKM
    E. None of the above.

Short Answer type model questions
[RAE II TEST (AFTERNOON) 2007]

[Please answer only with the salient points, preferably in bullet form]

1. Describe the process of `Viability Staining' of cultured cells?
2. Why Lithium Chloride is used for precipitating large RNA molecules?
3. Describe different methods of quantifying BAC DNA in solution?
4. Describe how Beer-Lambert law is utilized in absorption spectroscopy of nucleic acid?
5. What is HOECHAST33258 and Ethidium bromide? What is their principal use in cell biology?
6. Describe the method of precipitation of nucleic acid with Trichloroacetic acid?
7. What is DE-81 filters and what is their principal use in DNA studies?
8. Describe briefly a method of decontamination of ethidium bromide in your laboratory?
9. Describe pros and cons of four common hydrodynamic shearing methods used to fragment DNA?
10. What are the differences between Coomassie brilliant blue R250, Brilliant Blue G and brilliant R?
11. What are disadvantages of using the SYBR Green I and II?
12. Describe the mechanism of action of firefly luciferase enzyme?
13. Name five major insect pests and diseases of Rice.
14. Define crop-weed competition.
15. How herbicides are classified on the basis of the target plants?
16. Define weed. What are different types of weeds found in Agricultural land of Eastern India?
17. Write five common mechanical measures of erosion control in India.
18. What are the major types of soil and what are their names according to international soil taxonomy?
19. What are the major mites that affect coconut plants?
20. What is ER and mention three important functions of ER?
21. What is oxysomes and what are the dimensions of oxysomes?
22. What is the function of golgi in the life of a secretory protein?
23. What are the major functions of the Claude's particles?
24. Write the structure and function of the cardiac muscle?
25. What do you mean by Donnan membrane equilibrium? Discuss its major physiological properties.

26. Write the major features of BLAST? What are the statistical components in the BLAST?
27. What is RBD? What is ANOVA and when it is used in biological research?
28. Define prion and RNAi?
29. What is the size of RBC? How RBC is produced in the human body? How mRNAs in RBC degrades in mature human RBC?
30. Define leghaemoglobin and haemocyanin?
31. What is a genetically modified crop? Which agency in India acts as regulatory agency for GM crop? What is known as `iron fortified rice'? Name one such transgene, which has been used to make fortified rice?
32. What is colostrum? What is immature and mature milk?
33. Name two root promoting hormones which are frequently used in plant tissue culture.
34. What is the role of Trypsin-EDTA and Papain in animal cell cultures?
35. Name one gaseous plant hormone. Mention its function in Agro-business.
36. Define anal and integumental respiration in insects.

Sample Answer Sheets

a. Please use only HB pencils for filling the answer sheet.
b. Avoid erasing the filled circles and then refilling other choices. In case of ambiguous entries, 1 (one) mark will be deducted.
c. Please fill up the answer circle carefully. No marks will be given for half filled or partially filled circles.

Question No.	A	B	C	D	E
1.	○	○	○	○	○