Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Fourth Semester)

(NEP) EXAMINATION, 2025-26

ZOOLOGY

(Biotechnology) (Elective)

Paper Code							
B	0	5	1	0	0	5	T

Questions Booklet Series
D

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. Clinical applications of pluripotent stem cells include :
   (A) Tissue engineering, disease modeling, and regenerative medicine
   (B) RBC transport only
   (C) Platelet aggregation
   (D) Hormone secretion only

2. Pluripotent stem cells are capable of :
   (A) Differentiating into all cell types of the body except extra-embryonic tissues
   (B) Differentiating into only blood cells
   (C) Differentiating into only epithelial cells
   (D) Producing antibodies

3. Small molecules in reprogramming are used to :
   (A) Replace transcription factors or enhance efficiency
   (B) Induce cell death
   (C) Transport oxygen
   (D) Stimulate RBC formation

4. Advantages of cell reprogramming include :
   (A) Unlimited proliferation and patient-specific cell therapy
   (B) No need for transcription factors
   (C) Immediate tissue repair *in vivo*
   (D) Oxygen transport

5. The first step in wound healing is :
   (A) Fibroblast proliferation
   (B) Angiogenesis
   (C) Inflammation and clot formation
   (D) Collagen deposition

6. Permanent tissues include :
   (A) Liver
   (B) Bone marrow
   (C) Skin
   (D) Cardiac muscle and neurons

7. Which tissue has the highest regenerative capacity ?
   (A) Skeletal muscle
   (B) Liver
   (C) Cardiac muscle
   (D) Brain

8. Defective lymphangiogenesis can lead to :
   (A) Hypertension
   (B) Lymphedema
   (C) Diabetes
   (D) Hyperthyroidism

9. Lymphatic vessels are distinguished from blood vessels by :
   (A) Presence of valves and thin walls
   (B) Thick tunica media
   (C) Presence of RBCs
   (D) Endothelium made of squamous epithelium

10. Endothelial cells line :

(A) Only lymphatic vessels

(B) Blood vessels and lymphatic vessels

(C) Bone marrow only

(D) Nerve tissue

11. The first blood vessels in the embryo form in which structure ?

(A) Yolk sac

(B) Liver

(C) Heart

(D) Bone marrow

12. Angiogenesis refers to :

(A) Formation of vessels from angioblasts

(B) Formation of new blood vessels from pre-existing vessels

(C) Regression of vessels

(D) Formation of lymph vessels

13. Myoblasts in vitro can be used for :

(A) Muscle tissue engineering and therapy for muscular dystrophies

(B) RBC formation

(C) Hormone production

(D) Blood clotting

14. Age-related decline in skeletal muscle regeneration is mainly due to :

(A) Increased oxygen supply

(B) Reduced number and function of satellite cells

(C) Excessive fibroblast activity

(D) Increased myofiber fusion

15. The stem cells responsible for skeletal muscle regeneration are called :

(A) Hematopoietic stem cells.

(B) Satellite cells

(C) Fibroblasts

(D) Mesenchymal stem cells

16. Fibroblast proliferation during tissue repair is stimulated by :

(A) Platelet-derived growth factor (PDGF)

(B) Oxygen only

(C) Antibodies

(D) Neural impulses

17. During wound healing, fibroblasts :

(A) Differentiate into epithelial cells

(B) Migrate to wound site and synthesize collagen

(C) Produce antibodies

(D) Transport oxygen

18. A characteristic feature of epithelial stem cells is :

(A) Limited self-renewal

(B) Ability to differentiate into multiple epithelial cell types

(C) Unable to divide

(D) Only present during embryogenesis

19. Skin epidermal stem cells reside in :

(A) Dermis

(B) Basal layer of epidermis

(C) Stratum corneum

(D) Subcutaneous fat

20. The primary function of epithelial stem cells is to :

(A) Generate new epithelial cells to replace shed cells

(B) Produce antibodies

(C) Transport oxygen

(D) Stimulate nerve growth

21. Cancer stem cells (CSCs) are defined as cells that can :

(A) Only divide a few times

(B) Sustain tumor growth and initiate new tumors

(C) Die rapidly

(D) Produce only blood cells

22. Adult stem cell therapy is commonly used in :

(A) Cancer initiation

(B) Bone marrow transplantation

(C) Antibiotic therapy

(D) Vaccine production

23. One major advantage of adult stem cells over embryonic stem cells is :

(A) Unlimited differentiation

(B) Fewer ethical issues

(C) Higher tumor risk

(D) Totipotency

24. Pluripotent stem cells can differentiate into :

(A) Only blood cells

(B) All three germ layers (ectoderm, mesoderm, endoderm)

(C) Only nerve cells

(D) Only muscle cells

25. Embryonic stem cells are mainly used in :

(A) Gene editing only

(B) Tissue engineering and regenerative medicine

(C) Oxygen transport

(D) Vaccine production

26. The primary purpose of vaccination is to :

(A) Cure active infection

(B) Provide passive immunity

(C) Stimulate active immunity

(D) Destroy toxins directly

27. Germline gene therapy results in :

(A) No inheritance

(B) Temporary gene expression

(C) Inherited genetic changes

(D) Protein degradation

28. One major risk associated with viral gene therapy is :

(A) Increased oxygen transport

(B) Immediate immunity

(C) Insertional mutagenesis

(D) Vitamin deficiency

29. Which disease was one of the first successfully treated using gene therapy ?

(A) Diabetes mellitus

(B) Hypertension

(C) Severe Combined Immuno-deficiency (SCID)

(D) Tuberculosis

30. Monoclonal antibodies are highly specific because they :

(A) Bind multiple antigens

(B) Recognize a single epitope

(C) Are derived from many clones

(D) Contain different heavy chains

31. Monoclonal antibodies are widely used in :

(A) Oxygen transport

(B) Bone formation

(C) Blood grouping only

(D) Cancer immunotherapy

32. The technique commonly used for production of monoclonal antibodies is :

(A) PCR

(B) ELISA

(C) Hybridoma technology

(D) Chromatography

33. mRNA vaccines work by :

(A) Injecting weakened virus

(B) Delivering antigenic protein directly

(C) Stimulating antibody production through toxoid

(D) Delivering genetic code for antigen production

34. Which of the following is a viral vector vaccine ?

(A) Covishield

(B) Inactivated polio vaccine

(C) Tetanus toxoid

(D) Hepatitis B recombinant vaccine

35. One limitation of artificial blood products is :

(A) Unlimited oxygen capacity

(B) Long circulation time

(C) High risk of blood group mismatch

(D) Short intravascular half-life

36. One major advantage of artificial blood is :

(A) Requires blood grouping

(B) Short shelf life

(C) Risk of viral transmission

(D) Universal compatibility

37. Carbon nanotubes are mainly investigated for :

(A) Vaccine storage

(B) Drug and gene delivery

(C) Blood typing

(D) Dialysis

38. Liposomes are mainly used in nanomedicine for :

(A) Gene mutation

(B) Controlled drug delivery

(C) Radiation emission

(D) Blood filtration

39. Compared to ZFNs, TALENs are generally :

(A) Less specific

(B) Easier to design and more flexible

(C) Completely RNA-based

(D) Unable to edit animal genomes

40. TALEN stands for :

(A) Transcription Activator-Like Effector Nuclease

(B) Targeted Activator Linked Endonuclease

(C) Transgenic Animal Linked Editing Nuclease

(D) Terminal Activator Linear Endonuclease

41. CRISPR technology was originally discovered in :

(A) Plants

(B) Animals

(C) Viruses

(D) Bacteria

42. The guide RNA (gRNA) in CRISPR/Cas9 is responsible for :

(A) Cutting DNA

(B) Repairing DNA

(C) Recognizing and binding to target DNA sequence

(D) Synthesizing proteins

43. Knockout mice differ from transgenic nice because :

(A) Knockout mice have an inactivated gene

(B) Transgenic mice have no genetic changes

(C) Knockout mice are naturally occurring

(D) Both are identical

44. Which of the following is an application of knockout mice ?

(A) Vaccine production

(B) Drug toxicity testing

(C) Studying cancer development

(D) All of the above

45. The technique commonly used to create knockout mice involves :

(A) Selective breeding

(B) Homologous recombination

(C) Fermentation

(D) Artificial insemination

46. Transgenic animals help in the production of :

(A) Industrial enzymes

(B) Human therapeutic proteins

(C) Monoclonal antibodies

(D) All of the above

47. 'Pharming' in transgenic animals refers to :

(A) Fish breeding

(B) Production of vaccines in poultry

(C) Production of pharmaceutical proteins in animal milk

(D) Organic livestock farming

48. Ethical issues in animal biotechnology mainly concern :

(A) Climate change

(B) Animal welfare

(C) Soil fertility

(D) Water pollution

49. Transgenic animals are produced by :

(A) Selective breeding

(B) Artificial insemination

(C) Introduction of foreign genes

(D) Cross-breeding

50. Which of the following is a product of animal biotechnology ?

(A) Bt cotton

(B) Golden rice

(C) Recombinant insulin

(D) Biofertilizers

51. The Institutional Animal Ethics Committee (IAEC) is required under :

(A) Patent Act

(B) CPCSEA guidelines

(C) FDA regulations

(D) Environmental Protection Act

52. The main purpose of bioethics in biotechnology is to :

(A) Increase profit

(B) Ensure responsible and ethical use of biological knowledge and technology

(C) Promote patent filing

(D) Encourage unrestricted experimentation

53. The four basic principles of bioethics include :

(A) Autonomy, Beneficence, Non-maleficence, Justice

(B) Honesty, Secrecy, Profit, Compliance

(C) Freedom, Law, Technology, Growth

(D) Transparency, Regulation, Innovation, Safety

54. CPCSEA guidelines apply to :

(A) Plants only

(B) Laboratory animais used in research and education

(C) Fish in the wild

(D) Human clinical trials

55. CPCSEA was constituted under which Indian Act ?

(A) Indian Patents Act, 1970

(B) Prevention of Cruelty to Animals Act, 1960

(C) Wildlife Protection Act, 1972

(D) Environmental Protection Act, 1986

56. Patents are a form of :

(A) Copyright

(B) Intellectual property rights

(C) Trademark

(D) Trade secret

57. Which of the following is patentable ?

(A) Scientific principle

(B) Abstract idea

(C) Novel invention with industrial application

(D) Naturally occurring substance without modification

58. Post-approval monitoring under FDA guidelines is important to :

(A) Increase profit

(B) Ensure on going safety and compliance

(C) Improve taste

(D) Reduce feed cost

59. FDA risk assessment of transgenic animals includes evaluation of :

(A) Toxicity and allergenicity

(B) Color variation

(C) Market demand

(D) Fishing methods

60. Which US agency approved the first genetically engineered animal for human consumption ?

(A) USDA

(B) EPA

(C) FDA

(D) CDC

61. The main purpose of inserting reporter genes in fish embryos is to :

(A) increase fertility

(B) enhance taste

(C) track gene expression

(D) improve swimming speed

62. The antifreeze protein gene used in some transgenic fish is derived from :

(A) Tropical fish

(B) Ocean pout

(C) Catfish

(D) Tilapia

63. Transgenic technology in aquaculture mainly aims to :

(A) improve ship transport

(B) enhance fish growth and productivity

(C) increase salt content

(D) reduce market demand

64. The main advantage of GFP as a reporter molecule is that it :

(A) requires substrate addition

(B) is toxic to cells

(C) fluoresces without additional cofactors

(D) destroys host DNA

65. GFP stands for :

(A) Green Fluorescent Protein

(B) Genetic Functional Protein

(C) Growth Forming Protein

(D) Global Fluorescent Peptide

66. Transgenic zebrafish are important model organisms in :

(A) Forestry research

(B) Space biology only

(C) Developmental biology and toxicology

(D) Poultry science

67. Zebrafish are widely used in genetic engineering because they have :

(A) Long generation time

(B) Transparent embryos

(C) Large body size

(D) Low fecundity

68. Transgenic salmon technology is mainly applied in :

(A) Forestry

(B) Marine tourism

(C) Aquaculture

(D) Ornamental fisheries

69. AquAdvantage salmon is genetically modified from which base species ?

(A) Tilapia

(B) Atlantic salmon

(C) Rainbow trout

(D) Catfish

70. One major environmental concern regarding transgenic fish is :

(A) Reduced oxygen consumption

(B) Increased vitamin content

(C) Escape into wild populations

(D) Slower growth

71. The giant trout is an example of :

(A) Hybrid fish

(B) Cloned fish

(C) Transgenic fish

(D) Polyploid fish

72. The main original purpose of developing GloFish was to :

(A) Increase food production

(B) Detect water pollution

(C) Improve fish size

(D) Create aquarium pets

73. DNA fingerprinting is widely used in :

(A) Forensic identification, paternity testing, and genetic research

(B) RBC counting

(C) Oxygen transport

(D) Muscle repair

74. Which technique is commonly used to separate DNA fragments in DNA fingerprinting ?

(A) Gel electrophoresis

(B) PCR only

(C) RBC counting

(D) Southern blot only

75. Which of the following is a common method for nucleic acid labelling ?

(A) Radioactive labelling with ^{32}P

(B) Using DNA ligase

(C) Protein extraction

(D) RBC staining

76. Recombinant enzymes can be used in :

(A) Medicine, research, and industry

(B) Only digestion

(C) Only oxygen transport

(D) Only RBC production

77. DNA for fingerprinting can be obtained from :

(A) Muscle fibers only

(B) Only RBCs

(C) Blood, hair, saliva, or tissue samples

(D) Only skin cells

78. Recombinant antibodies are widely used for :

(A) Diagnosis of diseases (e.g., ELISA, immunoassays)

(B) Only digestion of food

(C) RBC formation

(D) Oxygen transport

79. Which host besides *E. coli* can be used for streptokinase production ?

(A) Yeast (*Saccharomyces cerevisiae*)

(B) RBCs

(C) Plant leaves only

(D) Muscle cells

80. Which vector is commonly used for streptokinase production in *E. coli* ?

(A) YAC

(B) Lambda phage

(C) pBR322 plasmid

(D) Ribosomal RNA

81. Recombinant insulin production is an example of :

(A) Gene therapy

(B) Therapeutic protein production using rDNA technology

(C) Vaccine production only

(D) Cloning humans

82. Human recombinant insulin is preferred over animal insulin because :

(A) It has identical sequence to human insulin and lower allergic reactions

(B) It is cheaper

(C) It is synthetic only

(D) Animal insulin is not effective

83. Which vector is commonly used for insulin production in bacteria ?

(A) pBR322

(B) Lambda phage

(C) YAC

(D) Ribosomal RNA

84. C-value is haploid or diploid ?

(A) Diploid

(B) Haploid

(C) Triploid

(D) Tetraploid

85. The C-value paradox refers to :

(A) No correlation between genome size and organismal complexity

(B) No DNA in prokaryotes

(C) Protein amount equals DNA amount

(D) RNA content determines complexity

86. Which library would you use to study promoter sequences of a gene ?

(A) cDNA library

(B) Genomic library

(C) mRNA library

(D) Ribosomal RNA library

87. cDNA libraries lack :

(A) Exons

(B) Introns and regulatory sequences

(C) Protein-coding sequences

(D) mRNA

88. Recombinant antibodies are sometimes called :

(A) Humanized or chimeric antibodies

(B) RBC proteins

(C) Digestive enzymes

(D) Muscle proteins

89. C-value includes :

(A) Only protein-coding DNA

(B) Only repetitive sequences

(C) Both coding and non-coding DNA

(D) Only mitochondrial DNA

90. Genomic library is tissue-specific ?

(A) Yes

(B) No, it represents the complete genome the organism

(C) Only in embryos

(D) Only in adults

91. cDNA library is made from :

(A) Genomic DNA

(B) mRNA

(C) Ribosomal DNA

(D) Mitochondrial DNA

92. BACs (Bacterial Artificial Chromosomes) are suitable for :

(A) Cloning very large DNA fragments (100-300 kB)

(B) Small DNA only

(C) RNA cloning

(D) Protein expression only

93. A key feature of cloning vectors is :

(A) Antibiotic resistance gene for selection

(B) Ribosomal RNA only

(C) Collagen production

(D) Oxygen transport

94. The main function of a cloning vector is to :

(A) Join DNA fragments

(B) Carry and replicate foreign DNA in a host organism

(C) Cut DNA at specific sites

(D) Transcribe RNA

95. Sticky ends generated by restriction enzymes :

(A) Have overhanging single-stranded DNA

(B) Have blunt ends

(C) Cannot be ligated

(D) Are RNA overhangs

96. Which type of restriction enzyme is most commonly used in molecular cloning ?

(A) Type I

(B) Type II

(C) Type III

(D) Type IV

97. Recognition sequences for most restriction enzymes are :

(A) Palindromic sequences

(B) Random sequences

(C) Only poly-A sequences

(D) Only RNA sequences

98. Which of the following is an application of rDNA technology in medicine ?

(A) Gene therapy

(B) Vaccine production

(C) Production of clotting factors

(D) All of the above

99. DNA ligase is used in rDNA technology to :

(A) Cut DNA

(B) Join DNA fragments

(C) Replicate DNA

(D) Transcribe RNA

100. Recombinant DNA technology involves :

(A) Cutting and joining DNA from different sources

(B) RNA transcription only

(C) Protein synthesis

(D) Cell division

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।