Mark Scored:

KATHMANDU UNIVERSITY
End `Semester Examination
August/September. 2017

AUG 2 7 2017

Level : B. Tech. | Course : BIOT 306
Year : III | Semester : II
Exam Roll No. : | Time: 30 min | F. M. : 20
Registration No.: | Date :

SECTION "A"
[20 Q × 0.75 = 15 marks]

Mark "X" in the most appropriate box.

1. Genetic engineering manipulates gene products at the level of.
[ ] DNA [ ] RNA [ ] Protein [ ] Amino acid

2. _____ are used to select gene of interest from genomic library.
[ ] Restriction enzymes [ ] DNA probes
[ ] Cloning vectors [ ] Gene targets

3. Formation of which type of bond is catalyzed by DNA ligase?
[ ] Glycosidic [ ] Hydrogen [ ] Phosphoester [ ] Ester

4. The first drug produced by recombinant DNA technology was used to treat
[ ] Haemophilia [ ] Dwarfism [ ] Heart attack [ ] Diabetes

5. What type of probe is used in Western blotting?
[ ] DNA. [ ] RNA. [ ] Protein [ ] Antibody

6. Which of the following would NOT be suitable as a selectable marker?
[ ] A gene encoding a protein that degrades the antibiotic ampicillin.
[ ] A gene encoding a protein that allows the cell to synthesize histidine.
[ ] A gene encoding a protein that is an essential structural component of a cell.
[ ] A gene encoding a protein that produces colicins.

7. The enzyme used in polymerase chain reaction is
[ ] DNA polymerase [ ] RNA polymerase
[ ] Reverse transcriptase [ ] Klenow fragment

8. A method used to distinguish DNA from one individual from another individual is
[ ] Polymerase chain reaction [ ] Restriction fragment length polymorphism
[ ] Chromosome walking [ ] Random amplified polymorphic DNA

9. Which of the following has been MOST successful for the introduction of DNA into human cells for the purpose of gene therapy?
[ ] Use of recombinant retroviruses as vector
[ ] Microinjection of DNA sequences
[ ] Use of yeast plasmids
[ ] Use of bacterial plasmids

10. Gel electrophoresis separates DNA fragments according to their
[ ] Base sequence [ ] Size [ ] Electrical charge [ ] Labeled nucleotides

11. The enzyme derived from calf thymus tissue
[ ] Exonuclease III [ ] Terminal deoxynucleotidyl transferase
[ ] Polynucleotide kinase [ ] Alkaline phosphatase

12. Which of the following restriction endonuclease is a blunt end cutter?
[ ] PvuI [ ] HinfI [ ] AluI [ ] SfiI

13. Which of the following restriction enzyme is NOT able to digest M13mp7 to excise part or all of the polylinker?
[ ] EcoRI [ ] BamHI [ ] PstI [ ] SalI

14. Phagemid pEMBL8 is a combination of
[ ] pBR322 and M13 [ ] pBR327 and M13 [ ] pUC8 and M13 [ ] pUC18 and M13

15. Which of the following is NOT a selectable marker of pYAC3?
[ ] TRP1 [ ] SUP4 [ ] CEN4 [ ] URA3

16. Vector used in gene cloning for production of recombinant pharmaceutical in insects.
[ ] Baculovirus [ ] Adenovirus [ ] SV 40 [ ] Retrovirus

17. The chemical used in strand separation in chemical degradation method.
[ ] PEG [ ] DMSO [ ] Urea [ ] Piperidine

18. The polygalacturonase activity starts after ___ weeks of flowering in normal tomato plant.
[ ] 4 [ ] 5 [ ] 6 [ ] 7

19. Which of the following is a component of Luria-Bertani (LB) medium?
[ ] $CaCl_2$ [ ] Glucose [ ] Tryptone [ ] $MgSO_4$

20. The RNA molecule that is mostly removed after phenol treatment is
[ ] tRNA [ ] snRNA [ ] rRNA [ ] mRNA

SECTION "B"

[10 Q. × 0.5 = 5 marks]

Fill in the blanks:

21. A term used to describe a situation when both alleles of heterozygous samples are detected _____.

22. For developing RFLP probe total DNA is first digested using _____ sensitive enzyme.

23. Gene transfer technique that involves the use of a fatty bubble to carry a gene into a somatic cell is _____.

24. Less than ____ ng of DNA cannot be visualized by EtBr staining.

25. Enzyme used for the synthesis of homopolymer tail is _____.

26. During insertional inactivation of the λ cI gene the recombinants produce _____ plaque.

27. Vectors that combine the features of P1 vector and BACs are called _____.

28. The secondary antibody in western blotting is generally conjugated with enzyme like _____.

29. In taqman probes the quencher (Q) generally _____ fluorescence of fluorescein(F).

30. The gene that codes for orotidine-5'-phosphate decarboxylase is _____.

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SECTION "C"

(Long answer questions)
[3 Q. × 7 = 21 marks]

Attempt *ANY THREE* questions:

1. What are the vector systems used for cloning genes in higher plants? Elaborate on binary vector strategy and cointegration strategy for inserting new DNA into the Ti plasmid. [2+5]

2. Elaborate on two methods used for sequencing of PCR products. What are the advantages of automated DNA sequencing? [5+2]

3. Describe the structure of insulin molecule. What strategies were adopted for its production in *E. coli* ? [2+5]

4. What is the importance of restriction endonucleases in gene cloning? A DNA when cut with restriction enzyme A creates fragment of size 12,900 bp. The same DNA when cleaved with enzyme B creates fragments of size 8,000 bp and 4,900 bp. Whereas restriction with enzyme C produces fragments of 8,900 bp and 4,000 bp. Restriction digestion with all the three enzymes creates fragments of 4,000 bp, 2,800 bp, 2,500 bp, 2,400 and 1200 bp. Construct a restriction map on the basis of the information provided. [2+5]

SECTION "D"

(Short answer questions)

5. Write short notes on (*ANY FOUR*): [4 Q. × 3.5 = 14]
   a. Selection of recombinants in pBR322.
   b. 2µm plasmid.
   c. Fluorescent probes used in real time PCR.
   d. Developing RFLP probes.
   e. Cloning strategy using pYAC3.

6. Write down **TWO** differences between (*ANY FOUR*): [4 Q. × 2 = 8]
   a. Genomic library and cDNA library.
   b. S1 nuclease analysis and Primer extension.
   c. Caulimovirus vector and Geminivirus vector.
   d. Bal31 and Exonuclease III.
   e. λgt10 and λZAPII.

7. Give reasons why/ how? (*ANY FOUR*): [4 Q. × 3 =12]
   a. In pUC8 vector identification of recombinants can be achieved in a single step.
   b. Natural selection can be used to isolate modified λ that lacks certain restriction sites.
   c. Correct concentrations of sodium and magnesium ions are crucial for restriction digestion.
   d. Sticky ends increase the efficiency of ligation.
   e. Transformed bacteria should not be placed onto selective medium immediately after heat shock treatment.

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SECTION "A"
[20 Q × 1 = 20 marks]

Choose and tick the most appropriate answer. The symbols, unless mentioned otherwise, have their usual meanings.

1. The relation between de-Broglie's phase velocity v_p and velocity of light c is
[a] $v_p > c$ [b] $v_p < c$ [c] $v_p = c$ [d] $v_p = c^2$

2. A free particle has
[a] definite energy but indefinite momentum [b]definite momentum but indefinite energy
[c] definite energy and definite momentum [d] indefinite energy and indefinite momentum

3. For a stationary state the probability density is
[a] function of time [b] independent of time
[c] independent of space coordinates [d] zero

4. For a particle trapped in a box of length L,the average value of momentum $< p >$ is
[a] $\frac{h}{l}$ [b] 1
[c] $\frac{h}{2l}$ [d] 0

5. The zero-point energy of a linear harmonic oscillator is
[a] $\frac{1}{2}\hbar\omega$ [b] $\frac{1}{4}\hbar\omega$
[c] $\frac{3}{2}\hbar\omega$ [d] 0

6. The commutation relation between Hamiltonian H and momentum p_x is
[a] $-i\hbar\frac{\partial V}{\partial x}$ [b] $i\hbar\frac{\partial V}{\partial x}$ [c] $-i\hbar\frac{\partial p}{\partial x}$ [d] 0

7. For harmonic oscillator the value of $< 4 | x^2 | 6 >$ is equal to
[a] $\frac{\hbar}{2m\omega}\sqrt{30}$ [b] $\frac{\hbar}{2m\omega}\sqrt{24}$ [c] $\frac{\hbar}{2m\omega}$ [d] 0

8. The value of $Y_1^0(\theta,\phi)$ is equal to
[a] $\frac{1}{4\pi}$ [b] $\frac{1}{\sqrt{4\pi}}$ [c] $\sqrt{\frac{3}{4\pi}}\cos\theta$ [d] $\sqrt{\frac{3}{4\pi}}\sin\theta$

9. Which of the following is not true about Pauli spin matrices?
[a] their square gives identity matrices [b] they commute with each other
[c] their trace is zero [d] their determinant is zero

10. The ground state energy of rigid rotator:
[a] is always zero
[b] has a fixed value equal to ½
[c] depends upon its mass
[d] has variable value which lies between 0 and 1

Fill in the following blanks with appropriate answer. The symbols, unless mentioned otherwise, have their usual meanings.

11. The inability to observe the wave and particle aspect of matter at the same time is called _____

12. The recursion formula for the harmonic oscillator wave function is _____

13. The value of Bohr magnetron is _____

14. The probability current density corresponding to the wave function $\varphi(x) = \frac{e^{ikx}}{x}$ is _____

15. The hyperfine splitting of hydrogen atom at ground state is approximately equal to _____

16. The expectation value of $\frac{1}{r^2}$ in the ground state hydrogen atom is _____

17. The y-component of angular momentum operator in spherical polar coordinates is _____

18. The commutation relation between S^2 and S_{2z} is _____

19. Particle of kinetic energy 9 eV is incident on a potential step of 5 eV. The reflection coefficient is _____

20. All the matrix element of vector operator $\vec{V}$ are proportional to those of $\vec{J}$. This statement is called _____