3 Hours **Total Marks: 100**

1. Attempt **all** questions.
2. **All questions** carry **equal** marks.
3. Draw **neat labelled diagrams** wherever necessary.
4. Use of **log tables** and **non-programmable calculators** is **allowed**.

Q.1 a. Select the correct alternative: (Any Six) **06**

1. IPN is one of the deadliest viral diseases in salmon. What does IPN stand for?
   a. Infectious Planar Necrosis b. Infectious Placental Necrosis
   c. Infectious Plant Necrosis d. Infectious Pancreatic Necrosis
2. Communities that occur in the open ocean beyond the edge of the continental shelf
   a. Pelagic b. Abyssopelagic c. Neritic d. Mesopelagic
3. Mangroves are salt-tolerant trees; they are also called
   a. Malophytes b. Salinityphiles
   c. Halophytes d. Tolerophytes
4. What is a coral reef?
   a. It is made up of stony corals that discharge limestone
   b. It is a foundation of stone with different varieties of marine life growing on it
   c. Composed of the skeletons of colonial marine invertebrates called coral.
   d. It is made up of soft corals that discharge calcium carbonate
5. The zone is characterized by a relative lack of life is
   a. Abyssopelagic b. Bathypelagic
   c. Mesopelagic d. Epipelagic
6. Brown Algae owe their color due to the presence of
   a. Fucoxanthin b. Chlorophyll a
   c. Phycobilin d. Chlorophyll c
7. Carrageenan can be used as
   a. Antibiotic b. Anti-inflammatory
   c. Anticoagulant d. Antioxidant
8. Which of the following is NOT a cytotoxic compound
   a. Eudistomins b. Dolastatins c. Triterpenes d. Ecteinascidins
9. One of the limitations encountered with the culturing of marine bacteria is the need to attach to a solid surface. What is the solution for this limitation?
   a. Chemical gradient systems b. Use of high-nutrient filtered seawater
   c. Dilution d. Short-term incubation

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Q.1 b. Answer the following questions: (Any Two) **14**

1. Define bioactive compounds and provide examples of two such compounds derived from marine bacteria and algae.
2. Write a detailed overview of deep-sea environments.
3. Explain the methods employed in microbial bioprospecting within marine environments.

Q.2 a. Select the correct alternative: (Any Six) **06**

1. Squalamine was found to inhibit _____ and stop tumor growth.
   a) Angiogenesis b) Immune system
   c) Lysosomal vacuolization d) Depolymerization of tubulin
2. Cellulases are not used in _____.
   a) Hydrolysis of lignocellulose b) Biofuel generation
   c) Tanning industry d) Textile industry
3. _____ drug is secreted by *Elysia rufescens*.
   a) Bryostatin 1 b) Halichondrin B
   c) Kahalalide F d) Squalamine
4. The mode of action of Aplidine is to _____.
   a) Interrupt cell cycle at G1 and G2/M phases as a way to induce p53 – independent apoptosis
   b) Bind covalently to DNA minor groove
   c) Block N-type voltage-gated calcium channels
   d) Bind to the vinca domain of tubulin and inhibits its polymerization
5. The marine enzyme _____ is used as a drug of choice for children with lymphoblastic leukaemia.
   a) Amylase b) Acid phosphatase
   c) L - asparaginase d) Vent polymerase
6. Eribulin mesylate is the commercial name for the active marine-derived drug _____.
   a) Halichondrin B b) Aplidine c) Cytarabine d) Bryostatin 1
7. After the controlled fermentation of the marine bacterium _____ which leads to ET-743 from cyanosafracin B.
   a) *Pseudomonas fluorescens* b) *Pseudomonas putida*
   c) *Pseudomonas aeruginosa* d) *Pseudomonas denitrificans*
8. The marine enzyme _____ is derived from *Methanococcus jannaschii.*
   a) Amylase b) Acid phosphatase
   c) Thermophilic protease d) Vent polymerase
9. The marine-derived drug used for the eye drop formulation is _____.
   a) Vidarabine b) Ecteinascidin
   c) Bryostatin 1 d) Squalamine

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Q.2 b. Give an account on the following questions: (Any Two) **14**

1. Discuss cytarabine to treat meningeal leukemia and vidarabine as an ophthalmic, non - corticosteroid antiviral.
2. Explain in detail - Marine natural products in advanced clinical trials.
3. Elaborate on the omega-conotoxin MVIIA - an analgesic for neuropathic pain.

Q.3 a. Select the correct alternative: (Any Six) **06**

1. The term nutraceutical was coined by _____.
   a. Stephen De Felice b. Hippocrates c. Aristotle d. El-Sohaimy
2. Laminarin exhibits _____activity.
   a. Antihypertensive b. Anti-inflammatory
   c. Antioxidant d. Antimicrobial
3. The pigment phycocyanin obtained from cyanobacteria is _____in colour.
   a. Green b. Blue c. Red d. Orange
4. _____is considered the highest astaxanthin-producing microalgae
   a. *Haematococcus pluvialis* b. *Dunaliella salina*
   c. *Spirulina* spp. d. *Spirogyra* spp.
5. Bioactive peptides usually contain _____ amino acid residues.
   a. 30 to 50 b. 3 to 20 c.100 to 200 d. 50 to 100
6. _____ are the rich sources of EPA and DHA.
   a. Diatoms b. Salmon fish c. Sponges d. Bombay duck
7. A live microorganism that is beneficial for gut microflora and restricting the growth of disease-causing bacteria is referred to as a _____.
   a. Prebiotic strain b. Probiotic strain
   c. Opportunistic pathogen d. Avirulent strain
8. _____ is the most common and representative marine sulphated polysaccharide.
   a. Histamine b. Heparin c. Fucoidan d. Pentosan
9. _____is a sulphated polysaccharide that has anti-cancer activity.
   a. Fucoidan b. Glucosamine c. Lycopene d. Gelatin

Q.3 b. Discuss the following: (Any Two) **14**

1. Biological role of proteins, peptides and amino acids derived from marine sources as functional food ingredients.
2. Nutraceutical potentials and applications of COS and COS derivatives.
3. Role of fish and crustaceans as a potential source of functional food ingredients.

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Q.4 a. Do as Directed: (Any Six) **06**

1. Give one example of a marine organism used as a source of anti-proliferative drugs.
2. Give one example of a marine organism used as a source of Gelatin.
3. Give the application of marine alga *Lithothamnium calcareum.*
4. Give any one advantage of marine proteins over conventional drugs
5. Name any one Colorant derived from marine resources.
6. Name any one Thickener obtained from marine resources.
7. Fill in the blank: _____ are inert substances or additives that are used in the cosmetic industries to serve various essential functions in the formulation of products.
8. State True or False: Jaspine B is able to kill melanoma cells.
9. Fill in the Blank: Carrageenan is obtained from _____.

Q.4 b. Give an account of the following questions: (Any Two) **14**

1. Major functions of marine components in cosmetics.
2. Secondary metabolites from marine organisms as a bioresource for the pharmaceutical industry.
3. Target organs for cosmetics derived from marine resources and add a note on the depigmenting activity of marine-derived cosmetics.

Q.5 Write Short notes on the following: (Any Four) **20**

a. Biotechnological potential of marine microbes.
b. Halotolerance and organic solvent stability.
c. Role of collagen and gelatine obtained from marine sources in nutraceuticals.
d. Functional foods incorporating marine-derived fish oils and fatty acids.
e. Anti-Pruritic activity of marine derived components for cosmetics
f. Cosmeceuticals.

_____

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3 Hours

Total Marks: 100

1. Attempt **all** questions.
2. **All questions** carry **equal** marks.
3. Draw **neat labelled diagrams** wherever necessary.
4. Use of **log tables** and **non-programmable calculators** is **allowed**.

Q.1 a. Select the correct alternative: (Any Six) **06**

1. Virion is defined as_____.
   a) Extracellular infectious virus particle
   b) Smallest virus
   c) A smallest particle similar to virus
   d) intracellular protein
2. Genetic material of the TMV virus is _____.
   a) d/s segmented DNA strand
   b) d/s unsegmented, positive RNA strand
   c) s/s unsegmented, positive RNA strand
   d) s/s segmented , positive RNA strand
3. Which of the following does the virus lack?
   a) Nucleic acid
   b) Ribosome
   c) Glycoprotein
   d) Phospholipid
4. Icosahedron symmetry of the capsid has _____.
   a) 20 sides and 12 corners
   b) 12 sides and 6 corners
   c) 8 sides and 4 corners
   d) 10 sides and 5 corners
5. Viruses lack metabolic machinery to synthesize
   a) Carbohydrate b) Alcohol c) Lipids d) Protein
6. In response to infection by herpes or measles virus results in formation of a multinucleated cell known as _____.
   a) Phagosome
   b) syncytium
   c) Negri bodies
   d) Inclusion bodies

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7. Which of the following is the first cell line derived from a human?
   a) HEK 293 b) HeLa c) Sf9 d) Chinese hamster ovary cells
8. Which of the following phases determines the specificity of the virus?
   a) Uncoating b) Release in c) Attachment d) Penetration
9. Which of the following RNA is present in most of the plant viruses?
   a) ssDNA b) ssRNA c) dsRNA d) dsDNA

Q.1 b. Answer the following questions: (Any Two) 14

1. How are viruses classified? Indicate the characteristics used in identifying and naming viruses.
2. Elaborate on primary and secondary cell culture for virus cultivation.
3. Give an illustrated account of the structure of viruses.

Q.2 a. Select the correct alternative: (Any Six) 06

1. Sulfonamides inhibits
   a) Dihydrofolate synthase
   b) Dihydropterine Pyrophosphokinase
   c) Dihydrofolate reductase
   d) Dihydropteroate synthase
2. Which of the following is a side effect of aminoglycosides?
   a) Ototoxicity
   b) Nephrotoxicity
   c) allergic reaction
   d) all of these
3. Beta-lactamase are responsible for
   a) Enzymatic inactivation of penicillin
   b) PBP modification
   c) Reduce permeability
   d) Increase efflux
4. Patients with cephalosporins allergies are frequently allergic to another class of antibiotics. Which one?
   a) Macrolides
   b) Penicillins
   c) Aminoglycosides
   d) Fluoroquinolones

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5. Which of the following inhibits protein synthesis by combining with the 30S subunit ribosome?
   a) nalidixic acid
   b) Chloramphenicol
   c) Streptomycin
   d) Penicillin
6. Name the agent which, on addition to a media, inhibits the growth of organisms and on removal the colony regrows.
   a) Bacteriostatic
   b) Bactericidal
   c) Antibiotic
   d) Antiseptic
7. The following drug is used in the treatment of fungal infections
   a) Gentamicin
   b) Quinone
   c) Flucytosine
   d) Metronidazole
8. Which of the following drugs inhibit herpes viruses?
   a) Amantadine
   b) Acyclovir
   c) Oseltamivir
   d) Azidothymidine
9. Which of these is an antiviral drug?
   a) Acetazolamide
   b) Rifampin
   c) Zidovudine
   d) Tetracycline

Q.2 b. Give an account on the following questions: (Any Two) 14

1. Explain the mode of action of Cell wall inhibitors giving suitable examples
2. Explain any two characteristics of a chemotherapeutic agent giving suitable example
3. What are anti metabolites? Explain their mode of action with one example

Q.3 a. Select the correct alternative: (Any Six) 06

1. The quantitative analysis of a non-luminescent compound is done by
   a) Fluorescent quenching
   b) Formation of fluorescent reactive product
   c) Fluorescence labelling
   d) All of the above

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2. In Atomic fluorescence spectrophotometry [AFS] the atoms are required to be vaporized by
    a) Flame
    b) Electric
    c) ICP
    d) All of these

3. In order to determine the molecular mass from light scattering, the parameters measured must be
    a) The intensity of scattered light at different angles
    b) The concentration of the macromolecule
    c) The specific refractive index increment of the solvent
    d) All of these

4. The commonly used enzyme in bioluminescence is
    a) Amylase
    b) Luciferase
    c) Protease
    d) Hexokinase

5. Spectrofluorimetry can be used for
    a) Enzyme assay
    b) Energy transfer studies
    c) Protein structure studies
    d) All of these

6. Inductively coupled plasma is used to
    a) to obtain gaseous form of sample
    b) to preserve the sample
    c) to duplicate the sample
    d) neither of these

7. Elastic light scattering is also known as
    a) Radiation
    b) Anti Stokes line
    c) Compton effect
    d) Rayleigh scattering

8. When the incident light beam hits a molecule in its ground state, there is a low probability that the molecule is excited and occupies the
    a) Next higher vibrational state
    b) Next lower vibrational state
    c) Heat energy
    d) Neither of these

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9. Due to rotation and translation, macromolecules move into and out of a very small region in the solution this is called
    a) Brownian motion
    b) Inertia
    c) Forward motion
    d) Backward motion

Q.3 b. Discuss the following: (Any Two) 14

1. What do you understand about elastic light scattering? Explain how molecular mass can be determined by multi-angle light scattering.
2. Discuss Atomic absorption spectroscopy.
3. What is luminometry? Explain the principle and applications of luminometry.

Q.4 a. Select the correct alternative: (Any Six) 06

1. Chromatography is generally used for the separation of mixtures based on the differences in their
    a) Shape
    b) Size
    c) Structure
    d) All of these
2. The number of protons present in the nucleus is
    a. Atomic structure
    b. Atomic mass number
    c. Atomic weight
    d. Atomic number
3. Unstable isotopes are called
    a. Radioisotopes
    b. Neutrons
    c. Electrons
    d. None of these
4. HPLC is an abbreviation for
    a. High Profit Liquid Chromatography
    b. High Pressure Liquid Chromatography
    c. Higher Performance Low Chromatography
    d. Higher Profit Low Chromatography
5. If an analyte is stable below its isoionic point, then we use
    a. Cationic exchanger
    b. Anionic exchanger
    c. Both (a) and (b)
    d. Neither

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6. The ability of a method to obtain test results that are directly proportional to the sample concentration over a given range is
   a. Selectivity
   b. Linearity
   c. Precision
   d. None of these
7. Detectors used in HPLC
   a. Variable wavelength detector
   b. Scanning wavelength detector
   c. Fluorescence detector
   d. All of these
8. The polymer often used for matrix materials in Affinity chromatography
   a. Agarose
   b. Cellulose
   c. Dextrose
   d. All of these
9. The molecules that will be eluted last in Gel Permeation Chromatography are
   a. Small molecules
   b. Intermediate molecules
   c. Larger molecules
   d. All of these

Q.4 b. Answer the following questions: (Any Two) **14**

1. Explain the principle, material and applications of Affinity chromatography.
2. What is scintillation? Explain types of scintillation counting.
3. What are radioisotopes? Explain types of radioactive decay.

Q.5 Write Short notes on the following: (Any Four) **20**

a. Dilution susceptibility test.

b. Cell membrane inhibitors.

c. Cytocidal infections and cell damage.

d. Applications of Raman spectroscopy.

e. Applications of tracer techniques in biology.

f. Geiger- Muller counter.

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3 Hours

Total Marks: 100

1. Attempt **all** questions.
2. **All questions** carry **equal** marks.
3. Draw **neat labelled diagrams** wherever necessary.
4. Use of **log tables** and **non-programmable calculators** is **allowed**.

Q.1 a. Select the correct alternative: (Any Six) **06**

1. Restriction check point is a 'master brake' as it is _____
   a. the point of commitment to the cell cycle
   b. the beginning of DNA replication
   c. the checkpoint which is reversible
   d. the beginning of Mitosis
2. When a human cell undergoing Mitosis is fused with a cell in G1 phase
   a. it causes condensation of all chromosomes
   b. it causes DNA replication
   c. it arrests the cell in interphase
   d. it does not affect the cell
3. If the Cell cycle time is shorter than the time required to double in size in yeast cells,
   a. cells will get smaller with each generation
   b. cells will get bigger with each generation
   c. cell size neither increases or decreases
   d. Cells lose their ability to reproduce
4. *Schizosaccharomyces pombe* is also called _____ yeast.
   a. Fusion b. fission c. budding d. mushroom
5. In budding yeast, the more stringent size check point is at _____.
   a. G1 b. G2 c. G0 d. spindle check point
6. The extracellular messenger TNF on triggering the extrinsic pathway binds to _____.
   a. TNFR1 b. EGF1 c. TNFR d. EGFR
7. The enzyme responsible for the "Eat Me" signal is _____.
   a. Caspase b. scramblase c. kinase d. Phosphatases
8. One major difference between yeast and Mammalian cell cycle is _____.
   a. There is no G0 phase in yeast
   b. No rigid rule coupling cell size and cell cycle
   c. Availability of growth factors and nutrients does not matter in yeast
   d. Mammalian cells do not require MPF for mitosis

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9. In multicellular organisms, growth factors play a crucial role in cell control and cell cycle. All of the following are broad specificity growth factors EXCEPT
   a. PDGF b. EGF c. FGF d. erythropoietin

Q.1 b. Answer the following questions: (Any Two) 14

1. Describe the intermediate phases of interphase. Add a note on M- phase of the cell cycle.
2. Explain the pathway of programmed cell death if the cell has internal stimuli such as irreparable genetically damaged and hypoxia.
3. Discuss the differences between the standard cell cycle and embryonic cell cycle and explain composition, activation and function of the cytoplasmic regulator MPF.

Q.2 a. Select the correct alternative: (Any Six) 06

1. G protein coupled receptors are examples of _____receptors.
   a. transmembrane b. nuclear
   c. cytoplasmic d. enzyme coupled
2. The enzyme responsible for formation of cAMP is _____
   a. adenylyl cyclase b. ATP synthase
   c. phosphodiesterase d. AMP kinase
3. The receptors for Ephrins are called _____ receptors.
   a. Eph b. Edu c. Epi d. Epu
4. RAS MAP kinase signalling relay is an example of activation of _____ receptors.
   a. enzyme coupled b. G protein coupled
   c. Ca^{+} gated ion d. Na^{+} gated ion
5. In _____ signalling, signalling molecules are released by a cell that only affect target cells at close proximity.
   a. autocrine b. paracrine c. endocrine d. neurotransmission.
6. Dimerization of the receptor polypeptide after ligand binding is one of the steps for activation of _____ receptors.
   a. Enzyme linked b. G protein coupled
   c. Ca+ gated ion d. Na+ gated ion
7. Receptor methylation in target adaptation is catalysed by _____
   a. methyl transferase b. methyl esterase
   c. methyl kinase d. methyl dehydrogenase

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8. Steroid hormone induced signalling is an example of _____ signalling.
   a. paracrine b. autocrine c. endocrine d. none of the above
9. Serine threonine receptors cause the activation of _____receptors.
   a. enzyme coupled b. G protein coupled
   c. Ca^{+} gated ion d. Na^{+} gated ion

Q.2 b. Give an account on the following questions: (Any Two) 14

1. How smell and vision signalling depend on activation of G protein coupled receptors?
2. JAK/STAT signalling pathway.
3. How do some developing cells respond to the morphogen gradient with the help of an example?

Q.3 a. Select the correct alternative: (Any Six) 06

1. The Fertilized egg cell is also called a
   a. Gamete b.Blastula c Morula d. Zygote
2. Morphogenic movement - ____ involves the local inward buckling of an epithelium.
   a. Epiboly b. invagination c. Involution d. delamination
3. Which one of the following is the source of embryonic stem cells?
   a. Heart b. Stomach c. Inner cell mass d. Gastrula
4. Mouse is a preferred model organism in developmental biology because:
   a. It is the closest mammalian model organism to humans.
   b. Option model organism should have huge adult size
   c. Model organisms should not be easily available.
   d. Model organisms should be expensive.
5. _____is NOT a derivative of the endoderm germ layer.
   a. Gut tube b. bone c. Thymus d. Lung
6. _____ are special molecules that play a very important role during oocyte maturation, in the female's ovary.
   a. Fate map b. ICM
   c. Cytoplasmic determinant d. Nuclear determinants

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7. Select Incorrect statement about model organisms
   a. should have a long life cycle b. should have a small adult size.
   c. should be easily available. d. should be inexpensive.

8. Which one of the following is an artificial marking technique used in the construction of a fate map?
   a. Ziel-Nielson carbolfuchsin staining b. Vital staining
   c. Gram's staining d. Capsule staining

9. _____ will form the placenta and extra-embryonic tissues embryo.
   a. Inner cell mass b. Trophoblast c. Gastrula d. Notochord

Q.3 b. Discuss the following: (Any Two) 14

1. With a suitable example give a brief account of the Importance of model organisms in developmental biology.
2. Fate map: Construction and uses.
3. Overview of developmental Biology and contribution of various disciplines in the emergence of developmental biology

Q.4 a. Select the correct alternative: (Any Six) 06

1. _____ are genes in which a gain of function mutation that drives a cell towards cancer.
   a. Pre-oncogenes b. Proto-oncogenes c. Viral genes d. Oncogenes
2. The accumulation of _____ protein is seen in cells where oncogenes such as Ras and Myc are unusually active.
   a. CA125 b. Rb c. p53 d. BCl2
3. _____are cancer arising from cells in the retina of the eye.
   a. Adenoma b. colour blindness c. Retinoblastomas d. Conjunctivitis
4. _____ genes are mutated in a wide range of human cancers and are one of the most important examples of cancer-critical genes.
   a. Ras b. Tas c. CA-125 d. Bcl-2
5. Penetration of cell into a blood vessel and the exit of the same elsewhere in the body to grow in a new site forming a small clump at first before metastasis is called _____.
   a. angiogenesis b. morphogenesis c. micro-metastasis d. metastasis
6. The virus associated with Burkitt's lymphoma is _____
   a. Papilloma virus b. Epstein-Barr virus
   c. Hepatitis B virus d. HIV virus

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7. _____ virus is associated with liver cancer or hepatocellular carcinoma.
   a. EBV virus b. Hepatitis B virus c. TMV virus d. HIV
8. _____ is an example of a drug that inhibits angiogenesis.
   a. Herceptin b. angiostatin c. heparin d. streptomycin
9. _____ is an assay used to detect potential mutagenicity and carcinogenicity of chemicals.
   a. Ashara test b. Ames test c. Replica plating d. CT Scan

Q.4 b. Attempt the following questions: (Any Two) **14**

1. What is a tumor? Give its types and elaborate on tumor progression with an example.
2. With reference to hallmarks for cancerous growth, discuss
   a. Replicative senescence.
   b. Altered growth with loss of contact inhibition and homeostasis.
3. Discuss lifestyles changes and chemotherapy for control of cancer.

Q.5 Write Short notes on the following: (Any Four) **20**

a. Prokaryotic cell cycle.

b. Programme cell death and its significance.

c. Bacterial chemotaxis.

d. Gastrulation.

e. Tumor suppressor genes- any one example.

f. Type of cancers based on tissues and cell types.

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