

SIKKIM UNIVERSITY

(A Central University established by an Act of Parliament of India, 2007)

6th Mile, Samdur, PO Tadong, Gangtok- 737102

Academic Session 2010-11

Entrance test (SET:A- MICROBIOLOGY)

M.Phil/PhD Integrated Programme

Time: Three hours

Maximum Marks: 75

Instructions for the candidates

1. Duration of the Entrance Test is three hours.
2. No candidate shall be allowed to enter the examination hall half an hour after the commencement of the examination.
3. Candidates can only be allowed to leave the examination hall one hour after the commencement of the examination.
4. No candidate shall be allowed to continue writing the examination after the final bell.
5. If any answer is to be crossed out, cancel it by drawing a line across it.
6. Please read the questions carefully before answering.
7. Each question shall carry 15 marks. Wherever required the marks distribution is indicated alongside the questions.
8. Candidates have to answer only 5 questions. One question from each section is compulsory.
9. Please (✓) mark the question you have attempted in the cover page of the answer booklet.
10. Candidates can choose any discipline/subject and can attempt any question subject to the condition mentioned at Sl. No. 8 above.
11. After finishing the work, handover the answer book only to the Invigilator.

One question from each section is compulsory

SECTION 1: GENERAL

1. What are the benefits of a scheme like NREGA for the Indian economy? How do you react to multiple criticisms of this scheme from different quarters?
2. Analyze the process and method of western domination upon third world countries with special references to IMF and GATT?
3. Discuss the various positions taken by major powers in the Copenhagen Summit on Climate Change in 2009.
4. Higher Education sector in India is all set for major reforms. Do you agree? Substantiate
5. Analyse the impacts of terrorist activities on the security of South Asian countries

SECTION 2: CORE-MICROBIOLOGY

6. What are the differences between primary lymphoid organ and secondary lymphoid organ? Describe the structure and function of lymphatic system and lymph node with appropriate diagrams?
7. After isolation and purification of protein what do you do to prove that your protein is pure? Describe peptide sequencing through Edman degradation?
8. Write three differences between Orthomyxoviruses and Para-myxoviruse? What is antigenic shift and antigenic drift in orthomyxovirus infection? Explain the structure and replication of Influenza virus?
9. What is primary cell culture, cell strains and cells line? Explain at least two biological assays and two physical assay used for quantitative assay for viruses.
10. Describe the Agrobacterium tumefaciens T-DNA transfer process with suitable diagrams. Describe the role of plant host selective toxins and non-host selective toxins produce by pathogens with examples.

SECTION 3: ELECTIVE

BOTANY

11. Give three each botanical names of endangered medicinal herbs, wild edible plants, ornamental plants, timber yielding plants and pathogenic fungi.
12. Mention characteristics features of family Fabaceae.
13. Mention characteristics features of family Orchidaceae. Name two species of Orchids.
14. Differentiate between the reproductive structures of Pinus and Gnetum.
15. What are fossils? Illustrate the dominant Jurassic flora.

CHEMISTRY

16. Explain the following:
 - (a) Benzyl carbocation is more stable than ethyl carbocation.
 - (b) In spite of the presence of keto-methyl group aceto acetic ester fails to respond to iodoform reaction
 - (c) Ethyl alcohol is more stable in water than in dimethyl ether.
 - (d) Both glucose and fructose respond to Fehling's reagent.
 - (e) Nitration of nitrobenzene requires drastic condition.
17.
 - (a) Draw the pictorial representation of the spectrum of a H-atom, clearly showing the different series of spectral lines.
 - (b) Give name and symbols of the four quantum numbers require to define the energy of electron in atoms. What do these quantum numbers relate to and what numerical values are possible for each ?
 - (c) Write the electronic configuration for the elements of atomic number 25 and 35. To which group in the periodic table does each element belong ? [6+8+6]
18. Explain the following:
 - (a) Specific conductance of a strong electrolyte decreases on dilution whereas equivalent conductance increases up to a limiting value.
 - (b) Lyophilic colloids are more stable than lyophobic colloids.
 - (c) CO_2 molecule has zero dipole moment whereas H_2O molecule has a fairly large dipole moment.

- (d) The behavior of real gases approaches ideal one at low pressure and high temperature.
 - (e) The rate of a chemical reaction increases with increase in temperature. [5 x 4]
19. (a) Show that hydrolysis of a salt of weak acid and weak base is independent of concentration.
- (b) How will you determine the molecular mass of a non-volatile substance by the study of relative lowering of vapour pressure of the solution?
- (c) A solution containing 5%(w/v) of a substance 'X' is isotonic with a solution containing 10 g of urea per liter. Calculate the molar mass of the substance 'X'.
- (d) What are concentration cells ? How are they classified. [6++5+5+4]
20. (a) What are the possible electronic transitions found in saturated ketones? Which of one of the transitions is the most affected by the polarity of the solvent used?
- (b) What is Walden Inversion ? Give an example.
- (c) write down the mechanism for the Hoffmann degradation of amide (Hoffmann rearrangement). Under what condition will the product be a nitrile ? [6+6+8]

ECONOMICS

- 21. Critically examine the pattern of development of India under British colonial rule
- 22. Explain the law of variable proportions and elaborate its different stages.
- 23. Critically examine Keynesian theory of the determination of rate of interest in a market economy.
- 24. Examine the view that globalisation is a serious threat to the survival of small scale sector in India.
- 25. What are the major changes in fiscal policy of India in recent times? Summarize the key arguments of W.A Lewis as regards the role of agriculture in economic development.

EDUCATION

- 26. Education is the practical aspect of philosophy and philosophy is the intellectual aspect of education. Discuss
- 27. What do you mean by "institutionalising education"? Elaborate

28. Discuss the concept and nature of intelligence. Explain with illustrated diagram Guilford's structure of Intellect
29. What would be the implication of 'Right to Education Act' 2009?
30. Write a note on the main characteristic features of either Aurobindo's ideas of education or Tagore's ideas of education.

ENGLISH

31. Write an essay on the mixture of Christian and Pagan elements in Anglo-Saxon poetry
32. Discuss the salient features of Shakespearean tragedy
33. Trace the origin and development of the novel in English literature
34. Write an essay on structuralism and post-structuralism and its impact on literary criticism
35. Trace the different stages in the growth of the early English drama through miracles and morality plays till the interludes

GEOGRAPHY

36. What is a Geographic Information System? Discuss the applications to which this tool lends itself.
37. Human beings have had serious effects on the hydrological cycle. Illustrate this statement citing examples from India and abroad.
38. Explain the distinction between the continental drift theory and the plate tectonics theory
39. What are the main features of the theory of demographic transition? Where do countries like India, France and Ethiopia stand in the context of this theory?
40. 'As technology has developed so has our impact on the environment'. Evaluate this statement and substantiate your answer with examples from South Asia and North America

HISTORY

41. Write a note on the emergence of Indian nationalism.
42. Discuss whether Akbar's religious policy primarily determined by political compulsion? How do you categorise Din-il-ahi?
43. State the position of women in the 19th century India and the factors responsible for the emancipation during this period?
44. Write a note on religion and society in Ancient India
45. Discuss the Land Revenue system of Akbar? How did it affect peasantry?

INTERNATIONAL RELATIONS

46. Write an essay on the Liberal Democratic transition in the contemporary world
47. Elucidate feminist contributions to the discipline of International Relations
48. Write an essay on the background and general principles of International law
49. Explain the major shifts in Indian Foreign Policy after the end of cold war
50. "21st century is Asian Century and India and China are becoming the key players in the 21st century international system/relations". Do you agree with this statement? Substantiate your arguments

MATHEMATICS

51. (a) Evaluate

$$\int \int_A xy dx dy$$

where A is the domain bounded by X -axis, ordinate $x = 2a$ and the curve $x^2 = 4ay$.

- (b) Change the order of integration in

$$\int_0^1 \int_{x^2}^{2-x} xy dx dy$$

and evaluate the same.

[10+10]

52. (a) Show that every maximal ideal in a commutative ring is a prime ideal. Is the converse true? Justify your answer.

- (b) If \mathcal{R} is a ring when all $a, b \in \mathcal{R}$ show that
- $a \cdot 0 = 0 \cdot a = 0$ where 0 is the additive identity in \mathcal{R} .
 - $(-1) \cdot a = -a$ where 1 is a unit element in \mathcal{R} . [10+10]
53. (a) The two regression equations of the variables x and y are $x = 19.13 - 0.87y$ and $y = 11.64 - 0.50x$
- Find mean of x 's
 - Find mean of y 's and the correlation coefficient between x and y .
- (b) An urn contains 5 red and 10 black balls. Eight of them are placed in another urn. What is the chance that the latter then contains 2 red and 6 black balls. [10+10]
54. (a) Obtain the reduction formula for
- $$\int \sec^n x dx$$
- (b) Evaluate
- $\int \frac{x^2}{x^4 + x^2 - 2} dx$
 - $\int_0^{\frac{\pi}{2}} \log(\tan x) dx$ [10+10]
55. (a) Define basis of a vector space V , giving example. Suppose $\beta = \{0, a_1, a_2, a_3\}$ is a set of vectors in V , can β form a basis for V ? Justify
- (b) Obtain an orthogonal basis of the subspace spanned by $\{\alpha_1, \alpha_2, \alpha_3\}$ in \mathbf{R}^3 where
- $$\alpha_1 = (3, 0, 4), \quad \alpha_2 = (-1, 0, 7), \quad \alpha_3 = (2, 9, 11)$$
- by using Gram-Schmidt orthogonalisation process. [10+10]

PEACE AND CONFLICT

56. Regional disparities have increased after the liberalisation of the Indian Economy. What are the social implications of this development?
57. Examine the strengths and weakness of the resurgence of the demand for separate states like Telangana and Gorkhaland.
58. The protracted conflict in Kashmir is the most serious issue facing democratic India. What in your opinion are the ways to resolve the conflict in Kashmir?
59. Man is by nature violent and aggressive. Discuss.
60. HIV/AIDS is an epidemic which poses danger to the nation. Discuss

PHYSICS

61. The Lagrangian for a particle with mass m and charge e moving in the general electrodynamic field $\{\mathbf{E}(\mathbf{r}, t), \mathbf{B}(\mathbf{r}, t)\}$ is given in Cartesian coordinates by

$$\mathbf{L}(\mathbf{r}, \dot{\mathbf{r}}, t) = \frac{1}{2}m\dot{\mathbf{r}} \cdot \dot{\mathbf{r}} - e\phi(\mathbf{r}, t) + e\dot{\mathbf{r}} \cdot \mathbf{A}(\mathbf{r}, t)$$

where $\mathbf{r} = (x, y, z)$ and (ϕ, \mathbf{A}) are the electrodynamic potentials of field $\{\mathbf{E}, \mathbf{B}\}$.

- (a) Show that the corresponding Hamiltonian is given by [10]

$$\mathbf{H}(\mathbf{r}, \mathbf{p}, t) = \frac{(\mathbf{p} - e\mathbf{A}) \cdot (\mathbf{p} - e\mathbf{A})}{2m} + e\phi$$

where $\mathbf{p} = (p_x, p_y, p_z)$ are the generalised momenta conjugate to the coordinates (x, y, z) .

- (b) State and prove the three Kepler's Laws. [5]

62. (a) Find the matrix elements of \hat{x} and \hat{p}_x for the linear harmonic oscillator using the raising operator $(\hat{a}_+)_{mn}$ and lowering operator $(\hat{a}_-)_{mn}$ [5+5]

- (b) Prove that [5]

$$\frac{d}{dt}\langle \hat{x}^2 \rangle = \frac{(\langle \hat{x}\hat{p}_x \rangle + \langle \hat{p}_x\hat{x} \rangle)}{m}$$

63. Determine whether the following statements are true or false. [5× 3 = 15]

- (a) Any subset of a vector space may not be a subspace.
 (b) Dimension of sum of two vector spaces is equal to sum of dimensions of them, i.e.

$$\dim(\mathbf{U} + \mathbf{V}) = \dim(\mathbf{U}) + \dim(\mathbf{V})$$

- (c) A basis of a vector space may be linearly dependent, but it has to span the vector space.
 (d) A one to one and onto mapping is always nonsingular.
 (e) An orthonormal basis a vector space on complex number, once transformed by a Unitary transformation matrix remains orthogonal but not orthonormal.
64. (a) Let \mathbf{W} be a subspace of \mathbf{R}^4 spanned by the above vectors u, v and w . Find a basis and dimension of vector space \mathbf{W} [10]
 (b) Let $F : \mathbf{R}^3 \rightarrow \mathbf{R}^3$ be a linear mapping given by

$$F(x, y, z) = (x + 2y - z, y + z, x + y - 2z).$$

Find a basis of $\text{Ker}(F)$. [5]

65. (a) Find the magnetic field of a very long solenoid, consisting of n closely wound turns per unit length on a cylinder of radius R and carrying a steady current I .
- (b) What is the meaning of continuity equation in electromagnetism? Derive it by considering the current flowing in a conductor of finite volume.
- (c) What is Gauss's theorem in a dielectric? Express it in integral and differential form. [5+5+5]

POLITICAL SCIENCE

66. Discuss the various theories of Civil Society.
67. Is state a necessary condition for the sustenance of good life? Substantiate your argument
68. Have regional disparities increased in India after the initiation of the structural adjustment programme in 1991? What are the economic and political implications of this development?
69. Discuss the salient features of liberalism. What changes did the advocates of egalitarianism and welfare introduce in the early liberal conception of state?
70. What is meant by Human Development? Is the development of human capacity a necessary and sufficient condition for ensuring justice and equity?

SOCIOLOGY

71. Discuss Talcott Parson's theory of functionalism
72. How do you differentiate between classical theories with modern social theory? Give your answer with suitable example.
73. Gender discrimination is recognised by many as the worst form of subordination which has resulted in the denial of necessities, opportunities and aspirations for women. Discuss
74. Critically examine Marx Weber's Theory of Social Action and its limitations.
75. What is the difference between caste and class? Describe the hierarchical system in rural India.

ZOOLOGY

76. Give an account of the morphology, ultra structure and chemistry of the chromosome. Distinguish between chromatid and chromosome.
77. Discuss Darwin's theory of "natural Selection" and "Origin of Species". What is the criticism against the theory of "Natural Selection"? Add a note on Neo-Darwinism.
78. (a) What is Ecological niche? Add a note on evolution of the concepts of ecological niche. Distinguish fundamental niche from realised niche.
(b) What are ecosystem energetics? With the help of a suitable model, describe energy flow in a typical ecosystem.
79. What do you understand by closed circulatory system? How does it differ from open circulatory system? With suitable diagrams, give a comparative account of heart in vertebrates.
80. Write short notes on any four of the following:
 - (a) Food chain
 - (b) Mimicry and its evolutionary significance
 - (c) Genetic engineering
 - (d) Global Warming
 - (e) Bilateral Symmetry
 - (f) Oogenesis
 - (g) Cancer