7136

Ph.D. ENTRANCE EXAMINATION, OCTOBER 2015

Section – B & C

Time : 140 Minutes Max. Marks : 160

Instructions :

(This is to test the candidate's ability of defining concepts through short answers.)

1) *Answer **any twelve** questions from Section **B** and **one** question from Section **C**.*
2) *In Section **B** **each** question carries **10** marks. Section **C** carries **40** marks.*
3) *In Section **B** an answer should not exceed **100** words. In Section **C** an answer should not exceed **500** words.*
4) *Candidates should **clearly** indicate the **Section**, **Question Number** and **Question Booklet code** in the answer paper.*
5) *The candidates are **permitted** to answer questions **only** from the subject that comes under the **faculty** in which he/she seeks registration as indicated in the **application** form.*

FACULTY OF APPLIED SCIENCE AND TECHNOLOGY

1. **Computer Science**
2. **Computational Biology and Bioinformatics**
3. **Future Studies**
4. **Environmental Sciences**
5. **Opto Electronics**

Name of Candidate	
Register Number	
Answer Booklet Code	
Signature of Candidate	
Signature of Invigilator	

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FACULTY OF APPLIED SCIENCE

1. Computer Science

Section – B **(12×10=120)**

1. Explain the working principle of any one error detecting and correcting binary code.
2. Explain how cluster computing aids in High performance computing.
3. Explain the 'preprocessor' concept and its application in C.
4. Define O, Ω and Θ in asymptotic analysis of algorithms. Comment on the significance of them in the design of algorithms.
5. What are the different approaches for the design of distributed DBMS ? List the major issues in the design of distributed DBMS.
6. Define Artificial Intelligence. Bring out the importance of search algorithms in AI.
7. Define window and viewport. Derive expression for window to viewport transformation.
8. Explain exception handling in Java.
9. Define deterministic Push Down Automata. Compare it with Deterministic Finite Automata.
10. Define Context Free Grammar. Give example. What is CFG's role in the design of compilers ?
11. List and briefly explain major activities in software project management.
12. Differentiate between clustering and classification. Explain the principle of any one clustering algorithm.
13. What are the benefits of inheritance in Object Oriented Programming ?
14. Give a scheme for digital signature using hash functions.
15. Explain any one spatial filter employed in Digital Image Processing.
16. Explain the term 'training' in the context of Artificial Neural Network.

Section – C (1×40=40)

1. a) You are asked to compare the performance of existing in-place sort algorithms. How will you accomplish the task ?
   b) Critically analyze the following statement :
   "As the main memory cost is reduced and systems with huge RAMs are available, sort algorithms (such as counting sort), which make use of an additional array of the same size as that of the array to be sorted, is feasible".
   c) Describe any one sort algorithm which makes use of an extra array for sorting. Compare its performance with any in-place sort algorithm. **(10+10+20)**

2. a) Frequent item set mining has become an integral part of many of the E-com sites. How will you assess the suitability of a frequent item set mining algorithm for such an application ?
   b) Big data Analytics is a contemporary topic of interest for industry as well as academic community. What are the most important enabling technologies for big data analytics ?
   c) Compare Relational, Object-relational and Object oriented DBMS. Evaluate the significance of the different normal forms from the point of view of distributed/parallel systems. **(10+10+20)**

3. a) Define virtualization in cloud computing. Give an overview of hardware virtualization. Critically analyze the following statement : "Virtualization is the most important enabling technology lead to the development of cloud computing".
   b) You are required to perform a detailed study on the attacks and other security risks associated with web sites. Discuss the important topics and parameters you have to explore. Also give an overview of the methodology you will adopt to give a comprehensive report on the problem. **(20+20)**

2. Computational Biology & Bioinformatics

Section – B

1. Explain the terms :
   a) Sequence Similarity and Sequence Identity
   b) E-value in BLAST

2. Align the following sequences using dynamic programming for Global alignment :
   ATTGC
   AGGC

3. Compare the following sequence alignment tools :
   a) PSI-BLAST
   b) FASTA

4. What is meant by Consensus sequences in Bioinformatics ? Compare Sequence logo and Consensus logo.
5. Explain the Multiple Sequence Alignment algorithm of ClustalW.
6. Describe how DNA sequence data might be used to reconstruct evolutionary (phylogenic)trees.
7. Use UPGMA method to derive the tree and branch lengths using the following distance matrix :

	A	B	C
B	0.40		
C	0.35	0.45	
D	0.60	0.70	0.55

8. Explain the maximum likelihood method of phylogeny construction with a suitable example.
9. What are Biological databases ? Explain its function and organization in detail.
10. Write notes on the following :
    a) Hidden Markov Model
    b) SVM (Support Vector Machine)
11. Explain the following :
    a) Folding Problem
    b) Motifs
12. Describe the Protein Structure Databases in detail.
13. Discuss the various algorithms for comparing Protein structures.
14. Write notes on :
    a) QSAR
    b) Docking
15. What is virtual screening in Drug discovery and design ? Explain the various techniques of virtual screening.
16. What do you understand by gene regulatory network ? Explain with a suitable example.

Section – C

1. Define the problem statement; explain the objectives and methodology to be adopted for Gene Prediction in Eukaryotic genomes using data mining method.
2. Prepare a synopsis for Computational Protein secondary structure prediction problem.
3. Prepare a detailed project proposal based on the application of a machine learning algorithm to any one problem in Bioinformatics of your choice.

3. Technology Management

Section – B

1. Distinguish between commonsense-knowledge and scientific knowledge. Give examples.
2. Explain the ways and means of knowledge production.
3. Discuss the distinctions between methodology, method and technique in research with examples.
4. Explain the different methods and models for demand forecasting.
5. Explain in detail about the interconnectedness between knowledge, science, technology and business.
6. Explain about the true interdisciplinary nature of Technology management.
7. What are various options for accomplishing technology transfer ? Explain about the different channels that allow the flow of technology.
8. Explain the role of research and development in technology management.
9. Explain the term reverse-engineering in technology management using examples.
10. Explain in detail the process of technology innovation and diffusion.
11. Explain the different methods for analyzing futuristic problems.
12. Distinguish between explorative forecasting and normative forecasting with suitable examples.
13. What is technology forecasting ? Explain the importance of technology forecasting in the management of technology.
14. Discuss the role of Intellectual Property Rights on Technology Management.
15. Explain the measures of central tendency in statistical analysis.
16. Write a short note on Knowledge Ethics.

Section – C

1. Explain the significance and importance of research and development in modern times. Briefly describe the different steps involved in a research process.
2. Consider a research problem of your choice and explain the steps that you will adopt in formulating the research problem and its approach by using a particular research methodology. Explain the rationale of the choice of the methodology.
3. Explain in detail the advantages and limitations of Technology Forecasting and Technology Assessment for Technology Management.

4. Environmental Sciences

Section – B

1. Explain the terms 1) Water Bloom and 2) Albedo.
2. Explain the methods and importance of conservation of biodiversity.
3. What is Eutrophication ? Discuss about its type and control methods.
4. What are the consequences of Ozone depletion ?
5. Discuss the different levels of environmental and conservation awareness.
6. Discuss the hazards associated with radioactive pollutants.
7. Explain the Indian strategies for water pollution control.
8. Give an account on the Indian air Quality standards.
9. Discuss in brief the basic components of the environment.
10. What is soil erosion ? Discuss its causes and consequences.
11. Discuss the role of society in conservation of natural resources.
12. Explain Acid Rain.
13. Explain Photochemical smog.
14. Explain the concept of energy flow in ecosystem.
15. Define Biome. Discuss Tundra Biome and Savanna Biome.
16. Write an essay on 'Hot spots of Biodiversity'.

Section – C

1. How does different types of pollution affect the biogeochemical cycles of the environment ?
2. Discuss in detail on the impacts of climate change on biodiversity
3. Write a detailed account on Indian legislative polices for the protection of environment.

5. Opto Electronics

Section – B

1. Distinguish between Q switching and mode locking.
2. Explain any two industrial applications of laser.
3. Explain the working principle of a semiconductor laser.
4. Explain the process of optical Parametric Amplification.
5. Write a note on the optical phase conjugation.
6. Explain any two important applications of holography.
7. Draw the attenuation curve and silica and explain the various loss mechanisms in an optical fiber.
8. Give notes on stimulated Raman effect.
9. Define numerical aperture of a fibre. Write down the expression for it.
10. Explain the acousto-Optic effect.
11. Distinguish between Fresnel and Fraunhofer diffraction.
12. Obtain the Jones matrix for a linear polariser at + 45°.
13. What are dispersion shifted and dispersion flattened fibers ?
14. Explain any two techniques for the synthesis of nanomaterials.
15. Give a note on the medical applications of nanostructured materials.
16. Explain any two techniques for the fabrication of thin films.

Section – C

1. a) What is the principle of Holography ? Explain its advantages.
   b) Explain the process of recording and reconstruction of holograms.
2. a) Explain the general characteristics of an EDFA.
   b) What is an Optical Time Domain Reflectometer (OTDR) ? Explain its application in an optical communication system.
3. a) What are the major techniques used for the characterisation of nanomaterials ?
   b) Discuss in detail the working principle of XRD and TEM.