Research Aptitude Syllabus for PHD Entrance Test RAC (Computer Science)

Research Aptitude (50%)

Linear Algebra:

Scalars, Vectors and Matrices, Vector space, Matrix operations, Rank of a matrix, Determinants and their properties

Calculus:

Limit, continuity, differentiation and integration.

Geometry:

System of circles, parabola, ellipse and hyperbola, classification and tracing of curves of second degree, sphere, cones, cylinders and their properties.

Discrete Structures:

Sets, functions, relations, counting; generating functions, recurrence relations and their solutions; algorithmic complexity, growth of functions and asymptotic notations.

Probability and Statistics:

Data Collection, Data Summarization: Frequency distribution tables, Data Visualization: Various data charts, Descriptive Statistics: Mean, Median, Mode, Standard Deviation, Mean Deviation, Quartile, Percentile, Deciles, Moments, Analytical Statistics: Regression, Correlation, Multiple Correlation, Analysis of Variance, Probability as a measure of uncertainty, probabilities for events, probability rules, conditional probability, Bayes' rule, random variables, probability distributions, discrete and continuous distributions: Binomial Distribution, Poison Distribution, Normal Distribution, Method of least squares

The literature review:

Writing a survey and identifying the problem. Planning and writing a research proposal: Research projects, Major funding agencies. Ethics and related issues in research: Concepts in ethics, Intellectual Property Rights,

Plagiarism, Fraud and misconduct in science, Information sources: Types of publications, Indexing and abstracting services, Online library, Search engines, Citation indexes, Citations analysis, Online searching methods, References: How to cite and list correctly, Common documentation styles, Citation of sources in the text

Application of ICT in research

Data processing utilities : Python, R, Spreadsheets

Computer Science

1. **Computer Organization and Fundamentals of Operating Systems**
2. Memory, Number System & Basic Computer Architecture
3. Operating System Concepts
4. Single User Operating System
5. Multiuser Operating System
6. Introduction to System S/W Components

2. Data Base Management System

1. Basic Concepts of Database Management System.
2. Structure of relational database model and integrity Constraints
3. Relational Commercial Language — SQL
4. Commercial RDBMS: Microsoft Access, DB2 & MySQL
5. Relational Database Design

3. Computer Programming and Programming Methodology

1. Algorithm & Flowcharting
2. Programming Languages & Structured Programming
3. User Defined Functions
4. Pointer's
5. Files and Pre-Processor

4. Enterprise Resource Planning

1. ERP Introduction
2. ERP Implementation Lifecycle
3. ERP Modules

5. Object Oriented Programming

1 Introduction to Object Oriented Paradigm
2. Object Modeling& Design
3. Procedure Oriented Programming Vs. Object Oriented Programming
4. Object Oriented Properties
S. Data Files and Exception Handling

6. Data Structures

1. Non-Primitive Data structures.
2. Analysis of Algorithms
3. Basic techniques & example algorithms
4. Searching and Sorting
5. Hashing

7.Relational Data Base Management Systems

- Storage and File Structure.
- Indexing and Hashing
- Database System Architectures and Crash Recovery
- Security and Integrity
- Query Processing and Concurrency Control

8.Optimization Techniques

1. Linear Programming
2. Special Cases of LPP
3. Job Sequencing
4. Inventory Problem5.
5. Network Analysis

9.Computer Network

1. Introduction to Data Communication
2. Data Link Layer
3. Upper Layers
4. The Presentation Layer
5. The Application Layer

10.Client Server Architecture

1. Database Computing Model
2. Overview of Oracle Database
3. Oracle tools and utilities
4. Database Administration

11.Operating System

1. Operating System Concepts
2. Process & Multi-processing
3. Process Coordination
4. Memory Management
5. File System
6. Device Management
7. Protection & Security
8. Introduction to Network and Distributed 0.S

12. Software Engineering

1. Introduction
2. Requirement Engineering and Requirement Analysis Model
3. Design Engineering
4. Software Testing
5. Software Project Management
6. Process and Project Metrics
7. Estimation
8. Project Scheduling
9. Risk Management
10. Quality Management

13. Programming in .NET

1. Overview of .NET framework
2. Visual basic .NET programming
3. Object Oriented Programming
4. Multithreading, File, and Streams
5. Database Access using ADO.NET
6. Introducing ASP.NET

14. Java Programming

1. Introduction of Java Language
2. Java Language Fundamentals
3. Object Oriented Programming
4. Exception Handling
5. Threads
6. Garbage Collection and Memory
7. The 1/0 Package
8. GUI Programming
9. Applets
10. Networking & Socket
11 Overview of Java Database Connectivity

15. Mobile Application Programming

1. An Introduction to Mobile Computing
2. Operating systems
3. Android Development Environment
4. Android Software Development Platform
5. Android Framework Overview
6. Views and Layouts
7. Buttons, Menus, and Dialogs
8. Graphics Resources in Android
9. Handling UI Events
10. Content Providers
11. Intents and Intent Filters
12. Advanced Android

13. New Features in Android 4.2
14. iOS Development Environment
15. Windows phone Environment

16.Information Systems

1. Information System in Enterprise
2. Management Information System
3. Information System, Organizations, Management and Strategy
4. Electronic Commerce and Electronic Business
5. Knowledge Based Systems
6. Decision Making
7. Control and Security of Information System

17.Data Communication and Network Protocols

1. Introduction
2. IP addressing and routing
3. IP protocol
4. ARP and RARP
5. ICMP
6. UDP
7. TCP
8. DNS
9. Introduction to protocols

18. Interactive Computer Graphics

1. Introduction to Computer Graphics
2. Display Devices
3. Basic Raster Graphics Algorithms
4. Polygons
5. Windowing and Clipping
6. Transformations
7. Viewing in 3D
8. Geometric Modeling
9. Introduction to Illumination and Shading
10. Image Manipulation and Storage
11. Animation
12. Introduction to OpenGL

19. Unix Internals & Shell Programming

1.Introduction
2. Overview
3. Shell Programming
4. Advanced Shell Programming
5. File System and Internal Representation
6. Process Management
7. Memory Management

8. The I/O subsystem

20. Cloud Computing

1. Introduction
2. Cloud Computing Architecture
3. Infrastructure as a Service (IaaS)
4. Platform as a Service (PaaS)
5. Software as a Service (SaaS)
6. Cloud Security
7. Cloud Databases (DbaaS)

21. Artificial Intelligence and Knowledge Based Systems

1. Introduction to Artificial Intelligence
2. Knowledge Overview
3. Representation and Search
4. Organization and Manipulation
5. Knowledge Acquisition
6. Expert System

22. Open Source Web Based Programming

1. Introduction to Web Based Programming
2. PHP functions
3. Object Oriented Features of PHP
4. MySQL Database Server
5. Ajax Basics
6. Templates : Smarty
7. MVC
8. Advance PHP programming

23. Advanced Database Administration

1. Oracle11g Instance creation and management
2. Oracle11g Database Architecture
3. Concurrency Management
4. Interfacing with Oracle
5. Oracle*Net
6. Tablespace Management Overview
7. UNDO Tablespace Management
8. Oracle Utilities
9. Oracle Performance Tuning
10. User Management
11. Oracle Security
12. Backup & Recovery

24. Advanced Java Programming

1. JDBC - Java Database Connectivity
2. Servlet
3. Javabeans& JSP
4. XML & Web Services
5. EJB - Enterprise Java Beans
6. Introduction to MVC

25. Advanced Web Technologies

1. Introduction to C# and .NET Framework
2. Web Form Fundamentals
3. Web Controls
4. Debugging, Tracing & Error Handling
5. Validation and Rich Controls
6. State Management
7. Customizing & Personalizing Web Apps
8. Website Navigation
9. ADO.NET Fundamentals
10. Databinding &Datacontrols
11. XML
12. LINQ
13. Caching and Asynchronous Pages
14. Profiles
15. Security Fundamentals
16. Web Services
17. ASP.NET AJAX
18. Creating Custom Control
19. Introduction to Sharepoint Portal
20. 3-Tier and MVC : Introduction

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1. Introduction to Web Based Programming
2. PHP functions
3. Object Oriented Features of PHP
4. MySQL Database Server
5. Ajax Basics 6.Templates : Smarty
7. MVC
8. Advance PHP programming

27. ERP using SAP

1. Introduction
2. Architecture of SAP Application Server
3. Data Dictionary & Data Structures in ABAP
4. Modularisaton Techniques
5. List Report, ALV Report
6. Module pool programming / Screen Programming

7. Selection-Screen programming
8. Smartform/Sapscript
9. BDC & LSMW
10. Enhancement(Exits & BADI)

28. Advanced Database Administration

1. Oracle11g Instance creation and management
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5. Oracle*Net
6. Tablespace Management Overview
7. UNDO Tablespace Management
8. Oracle Utilities
9. Oracle Performance Tuning
10. User Management
11. Oracle Security
12. Backup & Recovery
13. Introduction to Oracle 12c

29. Data ware Housing and Data mining .

1. Data warehouse: Introduction
2. Developing Data Warehouse
3. Data Pre-processing
4. Data Mining: Introduction
5. Mining Frequent Patterns, Associations, and Correlations
6. Classification & Prediction
7. Cluster Analysis
8. Application and Trends in Data Mining