

Indian Statistical Institute
Proposed Syllabus for Post Graduate Diploma in Computer Applications (PGDCA)
 (From Academic Year 2014-2015)

(I) Proposed Course Structure of Post Graduate Diploma in Computer Applications (PGDCA)

Subject Code	Subject Name	Mark	(No. classes of 90 mins each)
First Semester			
101	Introduction to Computer Architecture and Systems Software	100	36
102	Introduction to Programming	100	36
103	DBMS	100	36
104	Operating Systems	100	36
105	Discrete Mathematics and Statistics	100	36
Second Semester			
201	Object Oriented Programming	100	36
202	Web Technology	100	36
203	Software Engineering	100	36
204	Computer Network	100	36
205	Project	100	36

Detailed Syllabus

101: Introduction to Computer Architecture and Systems Software

Evolution of computing systems, Data and number representation, binary number system, BCD-ASCII, conversion of numbers form one system to the other, 2's complement representation, binary arithmetic;

Logic gates, basic logic operations, truth tables, Boolean expression, simplification, combination of circuits, adders, multiplexer, sequential circuits, flip-flops, registers, counters (asynchronous & synchronous);

Memory circuits, ROM, PROM, EPROM and dynamic RAM, digital components.

Microprocessors, bus structure, data representation, register transfer and micro-operations, central processing unit, pipeline and vector processing.

Computer arithmetic, input-output organisation, memory organisation, CPU architecture, instruction format, addressing mode, stacks, handling of interrupts.

Basic computer organization and design, programming the computer with assembly language (at very elementary level), micro-programmed control.

Books

1. Computer Organization, Hamacher, TMH
2. T. C. Bartee: Digital Computer Fundamentals, 6th ed., McGraw Hill, New York, 1985.
3. P. Pal Choudhury: Computer Organization and Design, Prentice Hall of India, New Delhi, 1994.
4. M. M. Mano: Computer System Architecture, 3rd ed., Prentice Hall of India, New Delhi, 1993.
5. W. Stallings: Computer Organization and Architecture: Principles of Structure and Function, 2nd ed., Macmillan, New York, 1990.
6. D. M. Dharmdhere: Introduction to Systems Software, Tata McGraw- Hill, New Delhi, 1986.
7. L. L. Beck: System Software: An Introduction to System Programming, Addison-Wesley, Mass., 1985.
8. Y. C. Liu and G. A. Gibson: Microcomputing Systems: The 8086/8088 Family Architecture, Programming and Design, 2nd ed., Prentice Hall of India, New Delhi, 1986.

102: Introduction to Programming

Problem analysis, need for programming languages, flow charts and decision tables, introduction to data structures and algorithms, structured programming and modular programming;

Overview of C Language: constants, variables, data types and size, variable declaration, operators and expressions, type conversion, conditional expression, special operators, precedence rules, decision making, looping and control structures, function, recursion, arrays, pointers, structures and unions;

Managing input/output operations, formatted I/O, standard library/user-defined functions, file management in C;

Handling of character strings, dynamic memory allocations, linked list, preprocessor;

Developing various C programs.

Elementary concepts of data structures, *viz.*, array, stack, queue, linked list, binary tree
Elementary concept of Algorithms - sorting and searching

Books

1. B. W. Kernighan and D. M. Ritchie: The 'C' Programming Language, Prentice Hall, Englewood Cliffs, NJ, 1980.
2. B. C. Gottfried: Programming in C, Schaum Outline Series, New Delhi, 1996.
3. T. A. Standish: Data Structure Techniques, Addison-Wesley, Reading, Mass., 1980.
4. E. Horowitz and S. Sahni: Fundamentals of Data Structures, CBS, New Delhi, 1977.
5. E. Horowitz and S. Sahni: Fundamentals of Algorithms, CBS, New Delhi, 1977.

103: Concepts of DBMS

Introduction to DBMS, architecture, administration roles, data dictionary;

Traditional models, three-level architecture, hierarchical model, network model and relational model, file organization, security;

Database design, conceptual, logical and physical models, ER diagram and model, functional dependency (Armstrong's axioms), normal forms (1NF, 2NF, 3NF, BCNF), indexing - primary, secondary, multilevel;

Relational model: definitions and properties, keys, integrity rules, relational algebra, joins, set operations,

tuple relational calculus;

SQL constructs, embedded SQL, Query & Query optimization techniques;

Database tuning

MySQL: MySQL SERVER, working with databases and tables, value types, SQL language : insert, select, alter, delete, table creation and deletion, table drop, database change

Books

1. H. F. Korth and A. Silberschatz: Database System Concepts, McGraw Hill, New Delhi, 1997.
2. R. A. Elmasri and S. B. Navathe: Fundamentals of Database Systems, 3rd ed., Addison-Wesley, 1998.
3. R. Ramakrishnan: Database Management Systems, 2nd ed., McGraw Hill, New York, 1999.

104: Operating Systems

Introduction: Basic architectural concepts, interrupt handling, concepts of batch-processing, multiprogramming, time-sharing, real-time operations; resource manager view, process view and hierarchical view of an OS;

Memory management: partitioning, paging, concepts of virtual memory, demand-paging – page replacement algorithms, working set theory, load control, segmentation, segmentation and demand- paging, cache memory management;

Processor management: CPU scheduling algorithms, performance evaluation, inter-process communication and synchronization, mutual exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problem of concurrent programming, deadlocks;

Security and protection, authentication, protection and access control, formal models of protection, worms and viruses;

Multiprocessor system, classification and types, OS functions and requirements, Introduction to parallel computing, multiprocessor interconnection synchronization;

UNIX operating system, file system, general-purpose utilities;

Programming with the Shell.

Books

1. Operating Systems, Galvin, John Wiley
2. Modern Operating System, Tannenbaum, PHI
3. Understanding UNIX, Srirangan, PHI
4. P. Pal Choudhury, Principles and design of Operating Systems, PHI, 2009.

105: Computer Networks

Introduction to computer network: topology; base-band & broad-band topology; guided & unguided media; overview of data & signal bits, baud & bit rate. modulation (AM, PM, FM);

Multiplexing (TDM, FDM, STDM);

Digital To analog – ASK, PSK, FSK, QPSK;

Transmission methods–synchronous & asynchronous, flow control, error control & detection methods;

Goals of layered protocols - introduction to OSI, TCP/IP;

HDLC- frame format, station, states, configuration, access control;

LAN Topology – ethernet (IEEE 802.3), token bus (IEEE 802.4), token ring (IEEE 802.5);
switching technologies – circuit, message, and packet;

X.25, X.21, RS-232 C – frame format, channel, packet frames, facilities (in brief only);

ISDN- D channel, B-Channel, international standards, NT1, NT2, TA, TE devices;

Bridging & Routing – Static;

Congestion control – leaky bucket & token bucket algorithms;

Introduction to data security (private key, public key);

TCP/IP, addressing in Internet – IP and domains, Servers, type of Connectivity;

Email services and protocols (X400, SMTP, UUCD, PPP, POP), FTP;

Web publishing - HTTP, browsers (naming), introduction to HTML, Java script, use of Java applets within HTML files, ASP (cookies and database connectivity only);

Internet security, Introduction to e-commerce, electronic payment standards and methods.

Books

1. Computer Networks, Tannenbaum, PHI
2. V. P. Ahuja: Design and Analysis of Computer Communication Networks, McGraw Hill, New York, 1987.
3. L. Gracial and I. Widjaja: Communication Networks, Tata-McGraw Hill, New Delhi, 2000.

201: Object Oriented Programming

Objectives: To understand the use of object oriented features along with their applications;

Fundamentals: Introduction of OOPs concepts, data types, variable, arrays, expressions, operators, and control structures;

Objects and Classes: Fundamentals, methods, access specifiers, constructors, abstract classes, static classes, inner classes, packages, wrapper classes, interfaces;

Inheritance: Super class, sub class, this and super operator;

Polymorphism: Method overloading, constructor overloading, use of final;

Library: String handling, string buffer class;

Exception handling: Exception as objects, exception hierarchy, built in checked and unchecked exceptions, user defined exceptions;

IO package: Elementary concepts of input/output, input streams and output streams, reading/writing a file. sample programs on IO files, filter and pipe streams;

Multi-threading: Overview, comparison with multiprocessing, thread class and runnable interface, multi-threading advantages and issues, thread life cycle, simple thread program, thread priorities, thread synchronization;

Networking Basics: Socket (datagram and TCP/IP based client and server socket), creating and executing SQL statements, working with result set programming in VISUAL BASIC and JAVA as case studies.

Books

1. Programming with Java, A Primer : E. Balaguruswamy Tata McGraw Hill Companies
2. Java Programming Language : Ken Arnold Pearson 3rd Ed.
3. The complete reference JAVA2 : Herbert schildt. TMH
4. Big Java : Cay Horstmann, Wiley India
5. Java server programming : Ivan Bayross SPD
6. Introduction to Java Programming, Comprehensive Version, 7/e : Y. Daniel Liang, Pearson.

202: Web Technology

This course focuses on the phenomenon known as the World Wide Web (WWW or Web). Its focus is to present many of the core technologies that the Web is based upon. These core technologies include:

Static Web Pages: Web pages - types and issues, tiers; comparisons of Microsoft and java technologies, WWW basic concepts, web client and web server, http protocol (frame format), universal resource locator (url), HTML- different tags, sections, image & pictures, listings, tables, frame, frameset, form.

Java Script: Data types, variables, operators, conditional statements, array object, date object, string object, dynamic positioning and front end validation, event handling

Dynamic Web Pages: The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation.

J2SE 1.4: Concepts and prerequisites: data types, arrays, type casting, classes and objects, inheritance, interfaces, exception handling, multi-threading

J2EE Architecture: J2EE as a framework, client server traditional model, comparison amongst 2-tier, 3-tier and N-tier architectures, thin and thick clients

Java Servlet: Brief origin and advantages over CGI, J2EE Servlet 2.x specification, writing small Servlet programs, deployment descriptor, inter Servlet collaboration,

Session: Definition, state on web, different ways to track sessions,

JSP: Concept of MVC architecture and the role of JSP, JSP life cycle,

Syntax: declarations, scriptlets, expression language, declaration, directives, action tags

PHP: Dynamic web page programing, difference between PHP and HTML, installation & PHP basics,

PHP configuration : PHP.ini, PHP programing principle, PHP variables,

Using PHP with MySQL: Database connection and disconnection, Error_reporting(), arrays and custom

functions, creating basic programs with PHP, editing records and performing queries

Books

1. Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Professional Java Server Programming --- Allamaraju et al WROX
3. Java Server Programming Black Book
4. J2EE Guide---- Hunt, Loftus SPD
5. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers.
6. Steven Suehring & Janet Valade, PHP, MySQL, JavaScript & HTML5 all in 1 for Dummies (web Technology, HTML & CSS, JavaScript, PHP, MySQL, Web application & PHP & Templates)
7. Tricia Ballard & William Ballard, Securing PHP Web Application.

203: Software Engineering

Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline.

Software Project Management: Basic concepts of life cycle models – different models and milestones; software project planning – identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

Object Oriented Analysis, Design and Construction: Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object oriented construction principles; object oriented metrics.

Software testing: Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency efficiency; concepts of inspection.

Project and assignments

Book

1. Software Engineering –Ian Sommerville
2. Fundamentals of Software Engineering –Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino
3. An Integrated Approach to Software Engineering –P Jalote
4. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices –Michael Jackson
5. The Unified Development Process –Ivar Jacobson, Grady Booch, James Rumbaugh
6. Design Patterns: Elements of Object-Oriented Reusable Software –Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides
7. Software Metrics: A Rigorous and Practical Approach –Norman E Fenton, Shari Lawrence Pfleeger

8. Software Engineering: Theory and Practice --Shari Lawrence Pfleeger and Joanne M. Atlee
9. Object-Oriented Software Construction --Bertrand Meyer
10. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson
11. Touch of Class: Learning to Program Well with Objects and Contracts --Bertrand Meyer

12. UML Distilled: A Brief Guide to the Standard Object Modelling Language --Martin Fowler

204: Discrete Mathematics and Statistics

Discrete Mathematics: Propositional logic, Logical equivalence, Permutation and combinations, Generating functions, Recurrence relations, Elementary Graph Theory, Trees, spanning trees, binary trees, Algorithms- MST, shortest path, connected components, etc.

Statistics: Definition, types of variables, organising data, descriptive measures for central tendency, dispersion, basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform, and Normal distributions, Correlation and regression.

Books

1. C. L. Liu: Elements of Discrete Mathematics, 2nd ed., McGraw Hill, New Delhi, 1985.
2. N. Deo: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall, Englewood Cliffs, 1974.
3. A. M. Goon, M. K. Gupta and B. Dasgupta, Fundamentals of Statistics, Volume 1.
4. N. G. Das, Statistical Methods (Volume I & II), Tata McGraw Hill, 2012.
- 5.

205: Project