Syllabus for M.Sc. (Computer Science)
in affiliated colleges to University of Pune

(To be implemented from Academic year 2014-2015)

Credit Based System

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-III	Core	CS-301	Software Metrics & Project Management	4	5	50	50	100
	Core	CS-302	Mobile Computing	4	5	50	50	100
	Core	CS-303	Soft Computing	4	5	50	50	100
	Elective	CS-304	Project	4	5	50	50	100
	Elective	CS-305	Web Services	4	5	50	50	100
	Elective	CS-306	Database and System Administration	4	5	50	50	100
	Elective	CS-307	Functional Programming	4	5	50	50	100
	Elective	CS-308	Business Intelligence	4	5	50	50	100

Minimum Credit : 25,   Maximum Credit : 35 Core Subject is compulsory, From elective courses student can select two course for minimum credit and four for maximum credit. IA :- Internal Assessment, UE :- University Examination

Year/ Semester	Subject	Paper	Title of Paper	Hours/ Week	Credit	% of Assessment		
						IA	UE	Total
II Year Sem-IV	Core	CS-401	Industrial Training /Institutional project	-	15	50	50	100
	Elective	CS-402	Parallel Computing	4	5	50	50	100
	Elective	CS-403	Embedded System	4	5	50	50	100
	Elective	CS-404	Software Quality Assurance	4	5	50	50	100
	Elective	CS-405	Modeling and Simulation	4	5	50	50	100

Core Subject is compulsory. If student had completed 85 credit within three semesters then no need to select any elective course otherwise student should select appropriate number of elective courses to minimum complete 100 credits.

IA :- Internal Assessment, UE :- University Examination

M.Sc (Computer Science)

Part - II / Semester 3

(CORE) CS 301: Software Metrics & Project Management

No of lectures: 48

Pre-requisites

- Software Engineering
- Basic testing concepts

Objectives

- Software Metrics and Project Management covers skills that are required to ensure successful medium and large scale software projects.
- It examines Requirements Elicitation, Project Management, Verification and Validation and Management of Large Software Engineering Projects.
- Student learn to select and apply project management techniques for process modeling, planning, estimation, process metrics and risk management; perform software verification and validation using inspections, design and execution of system test cases.

Chapter 1 : Introduction to Project Management [4]

- What is a Project?
- What is Project management?
- Project phases and project life cycle
- Organizational structure
- Qualities of Project Manager

Chapter 2 : Project Management Components [6]

- Project Integration Management-Project plan development and execution
- Change controls
- Configuration management

Chapter 3 : Scope Management [4]

- Strategic planning
- Scope planning, definition
- Verification and control

Chapter 4 : Time management [2]

- Activity planning
- Schedule development and control

Chapter 5 : Cost Management   **[2]**

- Cost estimation and Control

Chapter 6 : Quality Management   **[2]**

- Quality planning and assurance

Chapter 7 : Human Resource Management   **[2]**

- Organizational planning
- Staff acquisition

Chapter 8 : Communication Management   **[2]**

- Information distribution
- Reporting

Chapter 9 : Risk Management   **[2]**

- Risk identification
- Quantification and control

Chapter 10 : Procurement Management   **[2]**

- Solicitation
- Contract administration

Chapter 11 : Software Metrics   **[6]**

- The scope of software metrics
- Software metrics data collection
- Analyzing software data
- Measuring size, structure, external attributes

Chapter 12 : Software Reliability   **[6]**

- Measurement and prediction
- Resource measurement
- Productivity, teams and tools

Chapter 13 : Planning a measurement program   **[4]**

- What is metrics plan?
- Developing goals, questions and metrics

- Where and When: Mapping measures to activities
- How: Measurement tools
- Who: Measurers , analyst, tools revision plans

Chapter 14 : Quality Standards [4]

- CMM
- PSP/TSP

Reference Books
1. Information Technology Project Management, 6th Edition Kathy Schwalbe ISBN-13 :9781111221751 , Cenage Learning
2. Software Metrics: A rigorous and Practical Approach by Norman E. Fenton and Shari Lawrence Pfleeger, International Thomson Computer Press
3. Software Engineering: A Practioner's Approach by Roger S. Pressman ISBN: 9780071267823
4. Practical Software Metrics for Project Management and Process Improvement Robert B. Grady, Prentice hall, ISBN : 9780137203840

Note: -
- Numerical should be covered on Cost Management (COCOMO), Time Management.
- For Internal Evaluation group-wise case study is compulsory.

(CORE) CS 302: Mobile Computing

No of Lectures: 48

Prerequisites

- Concepts of multiplexing and modulation
- Concepts of Networking
- Conversant with OS internals
- Familiar with event handling
- Web browsers
- Create and Compile Java Programs
- Brief History of wireless communication

Objectives

- To familiarize the students with the buzz words and technology of mobile communication
- Understand the GSM architecture
- Understand the issues relating to Wireless applications

Chapter 1 : Introduction to Mobile Computing [2]

- Introduction and need for Mobile computing
- Mobility and portability
- Mobile and Wireless devices
- Applications
- Brief History of wireless communication

Chapter 2 : Wireless Transmission [3]

- General Concepts of multiplexing and modulation
- Spread Spectrum
- Cellular Systems

Chapter 3 : Medium Access Control Layer [4]

- Why specialized MAC?
    - a. hidden and exposed terminals
    - b. near and far terminals
- ii. General Concepts and comparison of SDMA, FDMA, TDMA , CDMA

Chapter 4 : Mobile IP [8]

- Goals, assumptions and requirements
- Entities and terminologies
- Agent Discovery
- Registration

- Tunneling and encapsulation

- Optimization
- Reverse Tunneling
- IPv6
- IP micro-mobility support – Cellular IP, Hawaii, Hierarchical, mobile IPv6
- Mobile Routing :
  - Destination sequence distance Vector, Dynamic Source Routing,
  - Alternative Metrics, Adhoc Routing Protocols -Flat, Hierarchical,
  - Geographic-position-assisted

Chapter 5 : Mobile TCP   [5]

- Traditional TCP
  - o Congestion Control, Slow start, Fast retransmit / Fast recovery
  - o Implications on mobility
- Classical TCP improvements
       Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit / Fast recovery, Transmission / Timeout freezing, Selective Retransmission, Transaction oriented TCP
- TCP over 2.5/3G wireless networks

Chapter 6 : GSM   [8]

- Mobile Services (Bearer, Tele-and-supplementary services)
- System Architecture
  - o Radio subsystem
  - o Network and switching subsystem
  - o Operation subsystem
- Protocols
- Localization and calling
- Handover
- Value Added Services
  - o SMS: Architecture, Mobile Originated and Mobile Terminated procedures
  - o Cell Broadcast Service: Architecture, Message Transfer Procedure
  - o MMS: Architecture, Protocol framework, Message Transfer Procedure
  - o Location Services: Logical Reference Model, Control Procedures, Network
  - o Architecture, determination of Location Information, Location based services
- GPRS

Chapter 7 : 3G mobile networks   [8]

- UMTS
       System architecture, radio interface
- UTRAN
       Architecture, Functions of RNC, Core network
- Handover
       Hard and soft handover

Chapter 8 : Wireless Application Protocol **[4]**

- Architecture
- Wireless datagram protocol
- Wireless transport layer security
- Wireless transaction protocol
- Wireless session protocol
- Wireless application environment
- WAP Push Architecture, protocols

Chapter 9 : Introduction to Android Operating System& Programming **[10]**

- Overview and evolution of Android
- Features of Android
- Android architecture
- Components of an Android Application, Manifest file
- Android Activity and Service Lifecycle
- UI Designing (layout desiginig)
- All components (e.g Button , Slider, Image view, Toast)
- Event Handling

Reference Books

1. Mobile Communications Jochen Schiller, Pearson Education, 2nd Edition, ISBN : 9780321123817
2. Beginning Android Application Development by Wei-Meng Lee Wiley India ISBN:9788126531066
3. Mobile Networks GSM and HSCSD- Nishit Narang, Sumit Kasera, TataMcGrawHill
4. Mobile Computing: Technology, Applications, and Service Creation by Asoke K. Talukder,
5. Beginning Android 3 by Mark Murphy APress , ISBN 9788132203568
6. The Android Developers Guide [http://developer.android.com/guide/index.html]

Note: -
> **For internal evaluation Android Application Development / Assignments are compulsory for 20 marks.**

(CORE) CS 303: Soft Computing

No of Lectures: 48

Objective
- To understand the concepts of how an intelligent system work and its brief development process.

Prerequisites
- Probability
- First Order Predicate Logic
- Classical Logic
- Calculus

Description

Intelligent systems can function as intelligent assistants, augmenting or supplementing human expertise while increasing productivity. This course exposes learners to Neural Network, Fuzzy Logic and Genetic Algorithms, which are the major building blocks of Intelligent Systems.

Chapter 1 : Introduction to Fuzzy Logic [16 to 20]

The Illusion : Ignoring Uncertainty and accuracy, Uncertainty and information, Fuzzy set and membership, Chance versus Fuzziness. Classical Sets, Fuzzy Sets, Cartesian Product, Crisp Relations, Fuzzy relations, Tolerance and equivalence Relations, Fuzzy Tolerance and equivalence Relations, Value assignments, Other Forms of the Composition Operations, Features of the membership Function, various forms, Fuzzification, Defuzzification to Crisp set, λ-Cuts for fuzzy Relations, Defuzzification to Scalars, Fuzzy Logic, Approximate Reasoning, Others forms of implication operations, Natural Language, Linguistic Hedges, Fuzzy (Ruled-Based) system, Graphical technique of inference, Membership value assignment-Intuition, Inference.

From Book 1 Chapters 1,2,3,4,5,6

Chapter 2 : Fuzzy System and Classification [10 to 12]

Fuzzy System Simulation- Fuzzy Relation, Equations, Nonlinear Simulation Using Fuzzy Systems, Fuzzy Associative Memories.
Fuzzy Classification- Classification by Equivalence Relations, Cluster Analysis, Cluster Validity, c-Means Clustering, Hard c-Means, Fuzzy c-Means, Classification Metric, Hardening the Fuzzy c-Partition, Similarity Relations from Clustering.
Fuzzy Arithmetic and Extension Principle-Extension Principle, Fuzzy Arithmetic, Interval Analysis in Arithmetic, Approximate Methods of Extension.

From Book 1 Chapters 8, 10, 12

Chapter 3 : Neural Network [20 to 22]

Neural networks: Artificial Neural Network: Definition, Advantages of Neural Networks
Application Scope of Neural Networks

Fundamental Concept: Artificial Neural Network, Biological Neural Network, Brain vs. Computer-Comparison Between Biological Neuron and Artificial Neuron (Brain vs. Computer) Book3.

Artificial Neurons, Neural Networks and Architectures: Neuron Abstraction, Neuron Single Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feedforward and Feedback, Salient Properties of Neural Networks

Geometry of Binary Threshold Neurons and Their Networks: Pattern Recognition and Data Classification, Convex Sets, Convex Hulls and Linear Separability, Space of Boolean Functions, Binary Neurons are Pattern Dichotomizers, Non-linearly Separable Problems, Capacity of a Simple Threshold Logic Neuron, Revisiting the XOR Problem, Multilayer Networks, How Many Hidden Nodes are Enough?

Learning and Memory: An Anecodatal Introduction, Long Term Memory, The Behavioral Approach to Learning, The Molecular Problem of Memory, Learning Algorithms, Error Correction and Gradient Descent Rules, Learning Objective for TLNs, Pattern Space and Weight Space. From Book 2

Linear Seperabilty, Hebb Network , Perceptron Network. From Book3
α- Least Mean Square Learning, MSE Error Surface and Its Geometry, Steepest Descent Search with Exact Gradient Information, μ-LMS: Approximate Gradient Descent, Application of LMS TO Noise Cancelation.

From Book 2

Chapter 4 :Genetic Algorithms: [2 to 4]

A Gentle Introduction to Genetic Algorithms: What are Genetic Algorithm? , Robustance of Traditional Optimization and Search Methods, The Goals of Optimization, How are Genetic Algorithms Different from Traditional Methods?, A simple Genetic Algorithm, Genetic Algorithms at Work—a Simulation by hand, Grist for the Search Mill—Important Similarities, Similarity Templates (Schemata), Learning the Lingo.

From Book 4

Reference Books

1. Fuzzy Logic With Engineering Applications, 3rd Edition By Timothy Ross , Wiley Publication
2. Neural Networks By Satish Kumar, Tata McGraw Hill
3. Introduction to Soft Computing by Deepa &Shivanandan, Wiley Publication
4. Genetic Algorithms in Search, Optimization and Machine Learning By David E. Goldberg, Pearson Education

(ELECTIVE) CS 304: Project

- ➢ The Project can be platform, Language and technology independent.
- ➢ Project will be evaluated by project guide.
- ➢ Assessment will be done weekly in the respective batch.
- ➢ Evaluation will be on the basis of weekly progress of project work, progress report, oral, results and documentation and demonstration.
- ➢ You should fill your status of the project work on the progress report and get the Signature of project guide regularly. Progress report should sharply focus how much time you have spent on specific task. (The format of progress report is given as follow.)
- ➢ You should keep all signed progress report.
- ➢ Project will not be accepted if progress report is not submitted and all responsibility remains with student.
- ➢ Students should prepare design document using SE/UML techniques depends on your project.

About project Report: -
- ➢ The report should be typed on A4 size, executive bond paper for the final submission. The report should be in the good quality Rexene bound. We suggest, using one-and-half spaced printing, Times New Roman 12 font sizes for the normal text, 14-16 font sizes for headings & page titles.
- ➢ Number of copies:
  For one project you should prepare 2 copies of the project report. One for yourself, one for college (**College copy can be in CD**).

Evaluation for internal 50 Marks

Description	Marks
UML Diagrams	10 M
Technology And Design Based First Demo	15 M
Project Technology Based 2 assignments	10 M
Second Demo	15M

Evaluation for external 50 Marks

Description	Marks
Demo	15 M
Report	15 M
Presentation	15 M
Viva	05M

(ELECTIVE) CS 305: Web Services

No of lectures: 48

Pre-requisites

- Strong knowledge about Java programming.
- Good Understanding of Object Oriented Programming concepts.
- Must be familiar with XML.

Objectives

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- Understanding cloud computing as a web service
- Discuss the concept of virtualization and data in cloud.

Chapter 1 : Web Service and SOA fundamentals   **[8]**

Introduction, Concept of Software as a Service(SaaS), Web services versus Web based applications, Characteristics of Web services, Service interface and implementation, The Service Oriented Architecture(SOA), Quality of service (QoS), Web service interoperability, Web services versus components, RESTful services , Impact and shortcomings of Web services.

Chapter 2 : Web Services Architecture.   **[8]**

Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, basic steps of implementing web services, developing web services enabled applications.

Chapter 3 : SOAP: Simple Object Access Protocol   **[10]**

Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP communication model, Building SOAP Web Services, developing SOAP Web Services using Java, Error handling in SOAP, Advantages and disadvantages of SOAP.

Chapter 4 : Describing and Discovering Web Services [12]

WSDL in the world of Web Services, Web Services life cycle, anatomy of WSDL definition document, WSDL bindings, WSDL Tools, limitations of WSDL, Service discovery, role of service discovery in a SOA, service discovery mechanisms, UDDI – UDDI Registries, uses of UDDI Registry, Programming with UDDI, UDDI data structures, support for categorization in UDDI Registries, Publishing API, Publishing information to a UDDI Registry, searching information in a UDDI Registry, deleting information in a UDDI Registry, limitations of UDDI.

Chapter 5 : Emerging trends: Cloud Computing [10]

What is Cloud Computing?, SOA meets the Cloud, Cloud Service Models, SaaS-Salesforce.com, PaaS-Google App Engine, IaaS-Amazon EC2, Cloud Deployment Models – Public, Community, Private, Hybrid. Virtualization , Virtual Machine(VM) Technology, Virtual Machine Monitor or Hypervisor - KVM, Xen, VMware hypervisors and their features, Multi-tenancy, Architecture model for Cloud Computing .

Case Study: Use Cloud Services – Amazon EC2, Google App Engine, Salesforce.com

Text books:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.
4. Gautam Shroff, "Enterprise Cloud Computing" ,Cambridge.

Reference Books:

1. Building Web Services with Java, 2nd Edition, S. Graham and others, Pearson Edn., 2008.
2. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly,SPD.
3. J2EE Web Services, Richard Monson-Haefel, Pearson Education.
4. Java Web Services Programming,R.Mogha,V.V.Preetham,Wiley India Pvt.Ltd.
5. 5.Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India
6. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
7. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication
8. Borko Furht, "Handbook of Cloud Computing", Springer

(ELECTIVE) CS 306: Database and System Administrator

No of lectures: 48

Pre-requisites

- Concepts of Databases
- Basic knowledge of any operating system and programming language.

Objectives

- This curriculum offers you the opportunity to acquire a combination of both Operating Systems & Database Administration skills.
- SDBA program gives you ideal opportunity to practice what you have learned through real life case studies.

DBMS Administration

Chapter 1 : Client/Server Concepts   [1]

- Client server Architecture
- Invoking Client Programs

Chapter 2 : MySQL Client Program   [4]

- Using MySQL interactively
- Statement Terminators
- Using Script Files with MySQL
- MySQL Output Formats
- Client Commands and SQL Statements
- Using Server-Side Help
- Using the – safeupdates Option

Chapter 3 : MySQL Architecture   [3]

- Client/Server Overview
- Communication Protocols
- The SQL Parser and Storage Engine
- Tiers
- How MySQL Uses Disk Space
- How MySQL Uses Memory

Chapter 4 : Starting, Stopping, and Configuring MySQL   [3]

- Types of MySQL Distributions
- Starting and Stopping MySQL Server on Windows
- Starting and Stopping MySQL Server on Unix
- Runtime MySQL Configuration
- Log and Status Files

- Loading Time Zone Tables
- Security-Related Configuration
- Setting the Default SQL mode
- Upgrading MySQL

Chapter 5 : Locking [2]

- Locking Concepts
- Explicit Table Locking
- Advisory Locking

Chapter 6 : Storage Engines [5]

- MySQL Storage Engines
- The MyISAM Engine
- The MERGE Engine
- The InnoDB Engine
- The MEMORY Engine
- The FEDERATED Engine
- The Cluster Storage Engine
- Other Storage engines

Chapter 7 : Data (Table) Maintenance [3]

- Types of Table Maintenance Operations
- SQL Statements for Table Maintenance
- Client and Utility Programs for Table Maintenance
- Repairing InnoDB Tables
- Enabling MyISAM Auto-Repair

Chapter 8 : Data Backup and Recovery Methods [3]

- Introduction
- Binary Versus Textual Backups
- Making Binary Backups
- Making Text Backups
- Backing Up Log and Status Files
- Replication as an Aid to Backup
- MySQL Cluster as Disaster Prevention
- Data Recovery

System Administration

Chapter 9 : Introduction [1]

- Know Your PC
- Different Linux Distribution

- Daily tasks of system Administrator
- Responsibilities of System Administrator

Chapter 10 : Linux Installation   **[2]**

- Text VS Graphics
- Partitioning & Disk management
- GUI Configuration

Chapter 11 : File manipulations Under Linux   **[4]**

- Copy rename, delete & move
- File & directory listing
- File handling & I/O redirection
- File systems and their types
- Names & contents of important Unix/Linux file directories
- Compatibility of file Systems
- fsck & Disk check Commands, Log files

Chapter 12 : Command Line Interface   **[3]**

- Text Manipulation Commands e.g. cut, grep, egrep, split, paste
- Vi editor
- su, ps, find, make, df/du
- Introduction to Regular expression
- awk, sed, passwd, wc, Antivirs, utilities, tar, gzip/gunzip, accessing pen drive, CD

Chapter 13 : Users and Groups   **[2]**

- Concept of users & groups
- Owner creator
- Primary and Secondary group
- Types of file and directory permission

Chapter 14 : Startup/shut down   **[2]**

- Booting
- Run Levels
- /etc/init tab
- shut down
- handling crashes

Chapter 15 : Basic system Administration   **[6]**

- Managing Users and groups (from console & GUI modes) Using command like adduser, userdel, groupadd, groupdel etc.
- Basic Network Setup Setting hostname, IP address of the machine. Setting a dialup connection.

- Installing and removing packages. Using the RPM, source package installation, URPMI.
- Managing Partitions
- Boot loader management Understanding the lilo and grub boot loader and its configuration files.
- Configuring services, chkconfig, ntsys, start, Resart & stop Service

Chapter 16 : Networking [2]

- Internetworking with windows (samba)
- Ping Telnet, ftp program
- NIS, NFS, Tomcat web server

Chapter 17 : Print Services [2]

- Printers Installation
- Print command

Reference Books

1. Linux System Administrator's guide by Lars Wirzenius, Joanna Oja, Stephen Stafford, Alex Weeks
2. Linux Administration Made Easy by Steve Frampton
3. MySQL 5 for Professionals By Ivan Bayross, Sharanam Shah [SPD Publications]
4. High Performance MySQL By Jeremy D. Zawodny, Derek J. Balling [O'Reilly Media Publications]
5. MySQL in a Nutshell By Russell Dyer [O'Reilly Media Publications]

Important Links

1. http://www.thegeekstuff.com/2008/11/overview-of-mysql-information_schema-database-with-practical-examples/
2. http://www.learn-mysql-tutorial.com/Identifiers.cfm

Note: -

- ➢ **Some chapters are practical oriented so faculty should teach those chapter with demonstration.**
- ➢ **And, those chapters are kept for internal evaluation.**
- ➢ **Hence, hands on must be taken for these chapters.**

(ELECTIVE) CS 307: Functional Programming

No of Lectures: 48

Prerequisites

Anyone who has a mature understanding of programming in an imperative language (e.g., Java, C/C++, or Pascal), of basic algorithms and data structures (e.g., sorting, searching, lists, stacks, and trees), and of basic discrete mathematics (e.g., sets, relations, functions, induction, and simple algebraic concepts)

Objectives

- Understand what functional programming is, what different variants are there and have some grasp of their history;
- Explain the semantics of different functional languages using precise formal specifications;
- Know how to implement functional languages and what optimizations are important;
- Be able to state and critique what it means for an implementation of a functional programming language to be correct;
- Be able to (in principle) formally prove correctness of their implementations, including their compilers and garbage collectors

Chapter 1 : Introduction to FP & Mathematical Functions   [6]

Principles of FP, History, Varieties of FP languages, Declarative style of programming, Declarative style of programming, Why functional programming Mathematical functions : definition, lambda expression, Functional Forms or a higher-order function :- Function Composition, Construction, Apply-to-all, Disadvantages of FP

Chapter 2 : Introduction to Lambda calculus   [12]

Introduction, The benefits of lambda notation, Lambda calculus as a formal system - Lambda terms (Variables, Constants, Combinations, Abstractions), Free and bound variables, Substitution, Conversions (Alpha conversion, Beta conversion, Eta conversion), Lambda equality, Lambda reduction, Reduction strategies, Combinators

Chapter 3 : Reduction strategies and lazy evaluation   [8]

Reduction, Evaluation in a strongly typed language, What is reduction?, 2 types of reduction rules, Reduction rules, Alternate reductions, Reduction strategies - Eager evaluation and Lazy Evaluation, Advantages and disadvantages of reduction strategies, Graph Reduction, Reduction of higher order functions and currying

Chapter 4 : Introduction to Python
          Scripting versus Traditional Programming   **[2]**

Why Scripting is Useful in Computational Science, Classification of Programming Languages, Productive Pairs of Programming Languages, Gluing Existing Applications, Scripting Yields Shorter Code, Efficiency, Type-Specification (Declaration) of Variables, Flexible Function Interfaces, Interactive Computing, Creating Code at Run Time, Nested Heterogeneous Data Structures, GUI Programming, Mixed Language Programming, When to Choose a Dynamically Typed Language, Why Python?, Script or Program?

Chapter 5 : Basic Python   **[2]**
Python identifiers and reserved words, Lines and indentation, multi-line statements, comments, print and raw_input()/input, command line arguments and processing command line arguments, standard data types - basic, none, boolean (true & False), numbers, Python strings, data type conversion, Python basic operators (Arithmetic, comparision, assignment, bitwise logical), Python membership operators (in & not in), Python identity operators (is & is not), Operator precedence, Control Statements, Python loops, Iterating by subsequence index, loop control statements (break, continue, pass) , Mathematical functions and constants (import math), Random number functions

Chapter 6 : Python strings   **[4]**
Concept, Slicing, escape characters, String special operations, String formatting operator, Triple quotes, Raw String, Unicode strings, Built-in String methods.

Python Lists - concept, creating and accessing elements, updating & deleting lists, basic list operations, reverse, Indexing, slicing and Matrices, built-in List functions, Functional programming tools - filter(), map(), and reduce(), Using Lists as stacks and Queues, List comprehensions

Chapter 7 : Python tuples and sets   **[1]**

Concept (immutable), creating & deleting tuples, accessing values in a tuple, updating tuples, delete tuple elements, basic tuple operations, Indexing, slicing and Matrices, built-in tuple functions. Sets - Concept, operations.

Chapter 8 : Python Dictionary   **[1]**

Concept (mutable), creating and accessing values in a dictionary , updating dictionary, delete dictionary elements, properties of dictionary keys, built-in dictionary functions and methods.

Chapter 9 : Functions   **[3]**

Defining a function (def), calling a function, Function arguments - Pass by value, Keyword Arguments, default arguments, Scope of var - basic rules and , Documentation Strings, Variable Number of Arguments, Call by Reference, Order of arguments (positional, extra & keyword), Anonymous functions, Recursion, Treatment of Input and Output Arguments, Unpacking argument lists, Lambda forms, Function Objects, function ducktyping & polymorphism, generators (functions and expressions) and iterators, list comprehensions

Chapter 10 : Working with Files and Directories   [3]

Creating files, Operations on files (open, close, read, write), file object attributes, file positions, Listing Files in a Directory, Testing File Types, Removing Files and Directories, Copying and Renaming Files , Splitting Pathnames, Creating and Moving to Directories, Traversing Directory Trees

Chapter 11 : Python Classes / Objects   [3]

Object oriented programming and classes in Python - creating classes, instance objects, accessing members, data hiding (the double underscore prefix), built-in class attributes, garbage collection, the constructor, overloading methods and operators, inheritance - implementing a subclass, overriding methods, Recursive calls to methods, Class variables, class methods, and static methods

Chapter 12 : Python regular expressions   [1]

Matching Vs searching, match & search functions, search & replace, option flags, RE patterns, non-greedy repetitions, grouping, back references, alternatives, anchors.

Chapter 13 : Python Exceptions   [1]

Exception handling, assert statement, except clause - with no exceptions and multiple exceptions, try - finally, raising exceptions, user-defined exceptions

Reference Books

1. Functional Programming: Practice and Theory by Bruce J. Maclennan
   - ISBN-10: 0201137445
   - ISBN-13: 978-0201137446
2. An Introduction to Functional Programming Through Lambda Calculus (Dover Books on Mathematics) Paperback by Greg Michaelson
   - ISBN-10: 0486478831
   - ISBN-13: 978-0486478838
3. Computational Semantics with Functional Programming by Jan van Eijck (Author), Christina Unger (Author)
   - ISBN-10: 0521757606
   - ISBN-13: 978-0521757607
4. Programming Languages: Principles and Practice By Kenneth C. Louden
   - ISBN-10: 1575864967
   - ISBN-13: 978-1575864969
5. E-Books : python_tutorial. pdf, python_book_01.pdf

Note: -

➢ **For Internal Evaluation ,**
   20M Theory + 30M Programming

(ELECTIVE) CS 308: Business Intelligence

No of lectures: 48

Pre-requisites

- Relational database concepts, database design and entity-relationship (E-R) modeling, data normalization, and Structured Query Language (SQL).

- Data Mining techniques

Objectives

- Understand the role of BI in enterprise performance management and decision support.

- Understand the applications of data mining and intelligent systems in managerial work.

- Understand data warehousing and online analytical processing (OLAP) concepts, including dimensional modeling, star and snowflake schemas, attribute hierarchies, metrics, and cubes.

- Learn data analysis and reporting using an available BI software.

Chapter 1 : Introduction to Business intelligence   **[6]**

Definition and History of BI, Transaction processing versus analytical processing, BI implementation , Major tools and techniques of BI

Chapter 2 : Data warehousing   **[10]**

Definition and concepts, , Data warehouse architecture, ETL process, data warehouse development, Top down vs. Bottom up, Data Mart vs. EDW, Implementation issues, Real-time data warehousing

Chapter 3 : Business performance management   **[14]**

Key performance indicators and operational metrics, Balanced scorecard , Six Sigma , Dashboards and scorecards

Chapter 4 : Data Mining for Business Intelligence   **[10]**

Data mining process, Data mining methods, ANN for Data Mining

Chapter 5 - Text, and Web mining for Business intelligence   [08]

Text mining Applications, Process and Tools, Web content, structure and usage mining

Chapter 6 : BI implementation , Integration and emerging trends   [10]

Implementing BI, BI Application Life Cycle , Connecting BI to Enterprise systems, On-demand BI, Issues of legality, privacy and Ethics, Emerging topics in BI, Social Networking and BI, RFID and BI

Reference Books

1. Business Intelligence: A Managerial Approach, 2nd Edition, PEARSON 2012
   Authors: EfraimTurban, Ramesh Sharda, Dursun Delen, and David King
   ISBN-10: 0-13-610066-X
   ISBN-13: 978-0-13-610066-9

2. Oracle Business Intelligence Applications, McGraw Hill Education 2013

   Authors : Simon Miller, William Hutchinson ISBN-10: 93-5134-153-4
   ISBN-13: 978-93-5134-153-6

Note : -

➢ **Group wise Case studies can be given for Internal Evaluation.**

M.Sc (Computer Science)

Part - II / Semester 4

(CORE) CS 401: Full Time Industrial Training/ Industrial Project

Period – Minimum 4 months

1. There will be a teacher coordinator for a group of students. A teacher coordinator will take care of joining letters from students along with other necessary submission listed below.

2. A student will have to submit 2 reports during the period of ITP to the Department of the college.

3. After the completion of the ITP, a student will have to submit a synopsis along with the project completion certificate from the respective industry/research institute /educational institute.

4. A student will submit one hard copy (Student Copy) and a soft copy's (preferably 2 CDs) of the work carried out towards ITP.

5. The project will be graded by the experts (One internal examiner, one external examiner(academic expert) and one industrial expert) as follows:

O – 75 and above	**C**– 50 and above	**F**- A student will have to carry out project once again for a complete semester
A – 65 and above	**D**– 45 and above	
B – 55 and above	**E**– 40 and above	

Important Note: A student can complete ITP with a research project of a teacher / an expert funded by the University of Pune/ a funding agency.

Evaluation for internal 50 Marks will be done according to Progress Report written by Teacher Coordinator

Evaluation for external 50 Marks will be done by Industrial Expert, Academic Expert and One Internal Examiner.

(ELECTIVE) CS 402: Parallel Computing

No. of lectures: 48

Pre-requisites

- Ability to program well in C, C++ or Fortran.
- Willingness to rethink how problems should be solved.
- Algorithm & Data Structures
- Basics of Computer Architecture

Objectives

- Learning basic models of parallel machines and tools
- How to parallelize programs and how to use basic tools like MPI and POSIX threads.

Chapter 1 : Introduction to Parallel Computing   **[6]**

Why Parallel Computing & Scope of Parallel Computing, Sieve of Eratosthenes, Control and Data Approach, PRAM model of parallel computation, Design paradigms of Parallel Computing, examples, Bulk Synchronous Parallel (BSP) model.

Chapter 2 :   Classification   **[12]**

Flynn's Taxonomy, MPP, SMP, CC-NUMA, Clustering of Computers, Beowulf Cluster, Use of MPI in Cluster Computing. Debugging, Evaluating and tuning of Cluster Programs, Partitioning and Divide and Conquer Strategies. Cluster: dedicated high performance (HP), high availability (HA), CoPs, PoPs, CoWs; distributed, on-demand, high-throughput, collaborative, data-intensive computing, Interconnection networks.

Chapter 3 : An overview of Parallel Programming Paradigms   **[10]**

Foster's design paradigm for Multi computing programming, Programmability Issues, Programming Models: Message passing, Message passing standards: PVM (Parallel Virtual Machine), MPI (Message Passing Interface) and its routines, Advanced Features of MPI

Chapter 4 : Overview of Programming with Shared Memory   **[12]**

Overview of Programming with Shared Memory: OpenMP (History, Overview, Programming Model, OpenMP Constructs, Performance Issues and examples, Explicit Parallelism: Advanced Features of OpenMP)

Chapter 5 : Multi-Core programming [8]

Multi-Core programming: Introduction to Multi cores Programming Software Multi-threading using Tread Building Blocks (TBB) and Cilk++ programming, GPGPU programming with CUDA

Reference Books

1. Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.).

2. Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.

3. R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.

4. William Gropp, Rusty Lusk, Tuning MPI Applications for Peak Performance, Pittsburgh (1996).

5. W. Gropp, E. Lusk, N. Doss, A. Skjellum, A high performance portable implementation of the message passing Interface (MPI) standard, Parallel Computing 22 (6), Sep 1996.

6. Gibbons, A., W. Rytter, Efficient Parallel Algorithms (Cambridge Uni. Press).

7. Shameem A and Jason, Multicore Programming, Intel Press, 2006.

8. CUDA Programming A Developer's Guide to Parallel Computing with GPUs Shane Cook, Morgan Kaufmann

(ELECTIVE) CS 403: Embedded System

No of Lectures: 48

Pre-requisites

- Knowledge of microprocessor architecture and assembly language, microprocessor peripherals, digital design, and the C programming language is a prerequisite for this course.
- An understanding of compilers, assemblers, linkers, operating systems, analog design, diodes, transistors, and electromagnetic fields and waves will be useful

Objectives

- Understand and design embedded systems and real-time systems
- For real-time systems:
    - Identify the unique characteristics of real-time systems
    - Explain the general structure of a real-time system
    - Define the unique design problems and challenges of real-time systems
- Apply real-time systems design techniques to various software programs.
- For embedded systems, it will enable you to :
    - Understand the basics of an embedded system
    - Program an embedded system
    - Design, implement and test an embedded system.

Chapter 1 : Introduction to ES   [2]
- What is ES
- Examples of ES
- Inside ES : processor, memory, peripherals, software

Chapter 2 : Embedded Processors , Memories & Peripherals   [6]

- Microcontrollers 8051
- Discrete processors : 8-bit architecture, 16/32 bit CISC, RISC, DSP
- Integrated processors : ARM RISC
- Choosing a processor
- Memory systems : types (SRAM, DRAM, FLASH), organization, access time, validating the contents of memory
- Basic peripherals : parallel ports, timers, clocks

Chapter 3 : Real time system concepts   [12]
- Foreground/ background systems
- Critical section of code
- Resourse, shared resourse
- Multitasking, task, task switch

• Kernel, scheduler, non-preemptive kernel, preemptive kernel

• Reentrancy, round-robin scheduling

• Task priority, static priority, dynamic priority, priority inversions, assigning task priorities

• Mutual exclusion, deadlock, synchronization, event flags, intertask communication

• Interrupts : latency, response, recovery, ISR processing time, NMI

 (For 'C' implementation of above concepts, please refer to chapters 4,5,6,7 of the book "An Embedded Software Primer" by David E. Simon published by Pearson Educations)

Chapter 4 : Writing software for embedded systems   [8]

• The compilation process : compile, link, load
• Cross compilers
• Run-time-libraries : processor dependent, I/O dependent, system calls,exit routines
• Writing a library, using alternative libraries
• Porting Kernels
• C extensions for embedded systems
• Buffering and other data structures
        Linear buffers, Directional buffers, Double buffering, Buffer exchange, Linked lists, FIFO, Circular buffers, Buffer underrun and overrun, Allocating buffer memory, Buffer leakage
• Downloading

Chapter 5 : Emulation and Debugging techniques   [6]

- Debugging techniques :
    - HLL simulation, low level simulation, on-board debugger, task level debugging, symbolic debug
- Emulation
- Optimization problems

Chapter 6 : Basic design using RTOS   [6]
 • Overview
• Principles
• Example
• Encapsulating semaphores and queues
• Hard real time scheduling considerations
• Saving memory space
• Saving power

Chapter 7 : Real time without RTOS   [8]

• Choosing the SW environment
• Deriving real time performance from non-real time system
• Scheduling and data sampling
• Controlling from an external switch
• Problems

Reference Books

1. Embedded Systems Design – Steve Heath
2. Programming Embedded Systems – Michael Barr
3. Embedded Systems Building Blocks _ Jean J. Labrosse
4. An Embedded Software Primer _ David E. Simon published by Pearson Educations

(ELECTIVE) CS 404: Software Quality Assurance

No of lectures: 48

Pre-requisites

- Basic concepts of software testing

Objectives

- To enable student to learn Software Quality Assurance good practices with the help of various techniques, Strategies and tools

Chapter 1 : Software quality   [4]

- Definition
- Software errors, software faults and software failures
- Software quality assurance – definition and objectives
- Software quality assurance vs. software quality control
- The objectives of SQA activities

Chapter 2 : Pre-project SQA Components   [4]

- Contract Review
- Development and Quality Plan

Chapter 3 : SQA components in Project life cycle activities assessment   [10]

- Verification and Validation
- Various types of Reviews
- Inspections
- Walkthrough
- Software testing
- Impact of CASE Tools

Chapter 4 : SQA Infrastructure Components   [8]

- Procedures and procedure manuals
- Templates and Checklists
- Staff training
- Corrective and preventive actions
- Documentation control

Chapter 5 : Software Quality Factors   [5]

- Mccall's Quality Model
- Product, Process quality metrics

Chapter 6 : Standardization [4]
- ISO 9001 and ISO 9000-3
- SEI-CMM,
- IEEE 1012 standard
- ISO/IEC 12207 standard

Chapter 7 : Configuration Management [4]
- Change control
- Release and version control
- Software configuration management audit

Chapter 8 : Quality Improvement Technique [4]
- Pareto Diagrams
- Cause-Effect Diagrams
- Scatter Diagrams
- Run Charts

Chapter 9 : Quality Costs [5]
- Quality Cost Measurement
- Utilizing Quality Costs for Decision-Making

Reference books

1. Software Quality Assurance from theory to implementation – Danial Galin
2. Software Project management - Edwin Bennatan
3. Software Engineering Roger S. Pressman,TMH,7Th Ed.
4. Software Quality Assurance : Principles and Practices Nina Godbole,
5. Project Management Body of Knowledge – PMI
6. www.softwarecertifications.org
7. Quality, 5th ed., Prentice-Hall, 2010.   Donna C. S. Summers
8. Total Quality Management, Prentice Hall, 2003.   Dale H. Besterfield
9. Software engineering: An Engineering approach, John Wiley.   J.F.Peters, W.Pedrycz

Note: -

➢ **Group wise case studies are expected as a part of Internal Evaluation.**

(ELECTIVE) CS 405: Modeling and Simulation

No of lectures: 48

Pre-requisites

- The course assumes a previous knowledge of probability and statistics.
- Basic concepts of network topologies.

Objectives

- The purpose of this course is to provide students with an opportunity to develop skills in modeling and simulating a variety of problems.
- After learning thesimulation techniques, the students are expected to be able to solve real world problemswhich cannot be solved strictly by mathematical approaches.

Chapter 1 : Systems modeling [2]

Concepts of continuous and discrete formalisms. Stepped and Event-based Time in Simulations, Sources and Propagation of Error

Chapter 2 : Types of Simulations [4]

Graph or Network Transitions Based Simulations, Actor Based Simulations, Mesh Based Simulations, Hybrid Simulations, Framework for Simulation and Modeling,

Chapter 3 : Modeling and simulators [20]

Modeling formalisms and their simulators, discrete time, continuous time, discrete event, process based simulators. Hybrid systems and their simulators

Chapter 4 : Probability [8]

Basic probability, probability distributions, estimation, testing of hypotheses

Chapter 5 : Probability in modeling [8]

Selecting input probability distributions, models of arrival processes, Queues and Random Noise, Random number generators, their evaluation, generating random variates from various distributions

Chapter 6 : Analyzing models [6]

Output analysis, transient behavior, steady state behavior of stochastic systems, computing alternative systems, variance reduction techniques. Sensitivity Analysis, Verification and Validation

Text books

1. Discrete-Event System Simulation, Fourth Edition, Banks, by J., et.el. (2005), Publisher Pearson, ISBN-13: 9780131293427
2. Simulation Modeling and Analysis, Third Edition, by Law, A.M. and W.D. Kelton (2000), Publisher McGraw-Hill, ISBN-13: 978-0071165372

Reference Books

1. Continuous System Simulation, by Kofman and Cellier, Publisher Springer, ISBN-13: 9780387261027
2. Theory of modeling and Simulation, 2nd ed., B. Zeigler, H. Praehofer, T. Kim, Publisher Academic Press, 2000, ISBN-13: 978-0127784557
3. Modeling with Data: Tools and Techniques for Scientific Computing, by Ben Klemens, Publisher: Princeton University Press 2008, ISBN-13: 9780691133140

Note: -

➢ **Hands on can be taken with any simulating software.**

M.Sc. (Computer Science) End Semester Examination Paper Layout for Semester 3 and Semester 4

CS-301: Software Metrics and Project Management

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows:

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Project Management	6
2	Project Management Components	10
3	Scope Management	6
4	Time Management	4 (Numerical)
5	Cost Management	4 (Numerical)
6	Quality Management	4
7	Human Resource Management	4
8	Communication Management	4
9	Risk Management	4
10	Procurement Management	4
11	Software Metrics	10
12	Software Reliability	10
13	Planning a measurement Program	6
14	Quality Standards	4

Numerical weightage : 15M

Different Types of Numerical on topics Cost Management (COCOMO), Time Management.

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
   - There should not be more than one sub questions on the same unit
   - There should not be more than one question containing sub questions
     on the same pair of units.

CS-302: Mobile Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Mobile Computing	04
2	Wireless Transmission	06
3	Medium Access Control Layer	08
4	Mobile IP	14
5	Mobile TCP	10
6	GSM	14
7	3G mobile networks	12
8	Wireless Application Protocol	08
9	Introduction to Android Operating System & Programming	04

Examiner should note that, there should not be any programming question for chapter 9. (Only theory must be asked.)

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
    - There should not be more than one sub questions on the same unit
    - There should not be more than one question containing sub questions
       on the same pair of units

CS-303: Soft Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Fuzzy Logic	22
2	Fuzzy System and Classification	18
3	Neural Network	30
4	Genetic Algorithms	10

Fuzzy Logic: 40

Neural Networks: 30

Genetic Algorithms: 10

Every question from Q.1 to Q.8 must contain at least 1 numerical.

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions
    on the same pair of units

CS-305: Web Services

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Web Service and SOA fundamentals	08
2	Web Services Architecture	10
3	SOAP: Simple Object Access Protocol	20
4	Describing and Discovering Web Services	22
5	Emerging trends: Cloud Computing	20

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

CS-306: Database and System Administrator

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Client/Server Concepts	4
2	MySQL Client Program	12
3	MySQL Architecture	12
4	Starting, Stopping, and Configuring MySQL	NIL
5	Locking	4
6	Storage Engines	16
7	Data (Table) Maintenance	NIL
8	Data Backup and Recovery Methods	4
9	Introduction	4
10	Linux Installation	NIL
11	File manipulations Under Linux	16
12	Command Line Interface	NIL
13	Users and Groups	4
14	Startup/shut down	NIL
15	Basic system Administration	NIL
16	Networking	4
17	Print Services	NIL

Chapters for which weightage written as "NIL", are kept for Internal Evaluation. And, End Semester exam will have questions only from remaining chapters.

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
    - There should not be more than one sub questions on the same unit
    - There should not be more than one question containing sub questions on the same pair of units

CS-307: Functional Programming

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to FP & Mathematical Functions	10
2	Introduction to Lambda calculus	20
3	Reduction strategies and lazy evaluation	12
4	Introduction to Python	04
5	Basic Python	04
6	Python strings	04
7	Python tuples and sets	02
8	Python Dictionary	04
9	Functions	06
10	Working with Files and Directories	06
11	Python Classes / Objects	04
12	Python regular expressions	02
13	Python Exceptions	02

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions
    on the same pair of units

CS-308: Business Intelligence

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Business intelligence	08
2	Data warehousing	14
3	Business performance management	20
4	Data Mining for Business Intelligence	14
5	Text, and Web mining for Business intelligence	12
6	BI implementation , Integration and emerging trends	12

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
    - There should not be more than one sub questions on the same unit
    - There should not be more than one question containing sub questions on the same pair of units

(Elective) CS 402: Parallel Computing

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to Parallel Computing	10
2	Classification	20
3	An overview of Parallel Programming Paradigms	16
4	Overview of Programming with Shared Memory	18
5	Multi-Core programming	16

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
   - There should not be more than one sub questions on the same unit
   - There should not be more than one question containing sub questions
     on the same pair of units

CS-403 Embedded System

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Introduction to ES	04
2	Embedded Processors , Memories & Peripherals	10
3	Real time system concepts	20
4	Writing software for embedded systems	12
5	Emulation and Debugging techniques	12
6	Basic design using RTOS	10
7	Real time without RTOS	12

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
  - There should not be more than one sub questions on the same unit
  - There should not be more than one question containing sub questions on the same pair of units

CS-404 Software Quality Assurance

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Software quality	6
2	Pre-project SQA Components	6
3	SQA components in Project life cycle activities assessment	18
4	SQA Infrastructure Components	14
5	Software Quality Factors	8
6	Standardization	6
7	Configuration Management	6
8	Quality Improvement Technique	6
9	Quality Costs	10

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
    - There should not be more than one sub questions on the same unit
    - There should not be more than one question containing sub questions
      on the same pair of units

CS 405 : Modelling and Simulation

According to the guidelines provided in the Handbook published by University of Pune, the duration of the ESE paper is 3 Hours and the paper pattern is 5 out of 8 questions where each question is of 10 marks. Thus the final paper is of 80 Marks. The division of 80 marks chapter wise is as follows

Chapter No	Name of the Chapter	Weightage in terms of marks
1	Systems modeling	04
2	Types of Simulations	08
3	Modeling and simulators	30
4	Probability	14
5	Probability in modeling	14
6	Analyzing models	10

- 6 Questions are supposed to be of the format 4 + 4 + 2 (4 +3 +3 or 5 +3 +2)
- 2 Questions are supposed to be of the format 5 +5
- The layout should be such that
    - There should not be more than one sub questions on the same unit
    - There should not be more than one question containing sub questions
      on the same pair of units