B.L.D.E.A's

Vachana Pitamaha Dr. P.G. Halakatti College of Engineering & Technology, Vijayapur – 586 103

COURSE FILE

2017-18

Semester – VI

Department of Information Science & Engineering

Name :

USN :

Roll No. :

Dear student,

Wish you happy academic year 2017-18.

You can go through this course file which gives overview of each course you are going to study and its relevance to your program. You will find each course interesting / understandable if you have complete knowledge of prerequisites. Learning objectives are defined for each unit followed by lesson plan.

Assignment questions are given at the end of each unit which will help you to prepare well during I.A. Tests and VTU Exams. Portion for I.A. Tests is known to you in advance to plan your studies. VTU question papers are put at the end.

This course file will help you and your teacher in delivering curriculum systematically. Kindly note following to achieve academic excellence.

1) Ask for return of your assignments submitted for checking from teacher's atleast three days prior to commencement of I.A. Tests. This will help you in your preparation.
2) Ensure that each teacher solves VTU question papers in the class room / Tutorial class.
3) For subject difficulties, each teacher will be announcing contact hours in the class and display the same outside his cubicle. Utilize these contact hours to improve your performance.
4) Each teacher will display I.A. Marks within 3 days after completion of last subject Test.
5) To be eligible to appear for I.A. Tests, cumulative 85% attendance in theory classes is mandatory.
6) If you abstain from theory classes after II I.A. Test because of scoring well in I & II I.A. Tests, you will not be allowed to appear for laboratory internals.
7) Attend meetings with counselors whenever arranged. Speak freely to counselors about your academic difficulties.
8) Kindly request your parents to attend parents meet whenever your dept. organizes the same.

If Sl.No. 1 to 4 are not fulfilled contact concerned HOD or Academic Coordinator immediately for necessary action. If you have any suggestions for further improvement of course file kindly contact Academic Coordinator.

Prof. R.G.Talasadar
Coordinator (Academic)

Dr. V.P. Huggi
Principal

B.L.D.E. Associations
V.P. Dr. P.G. Halakatti College of Engineering & Technology, Vijayapur.

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

VISION

To become a Centre of Excellence in Information Technology Education and Research that is adaptable to the ever-changing needs of the mankind.

MISSION

1. To provide quality technical education coupled with innovative research to boost the career of students in IT industry, entrepreneurship, higher education and research.
2. To instill moral values, professional ethics and leadership qualities in students to achieve professional success.

Program Educational Objectives (PEOs)

1. A graduate will be a successful IT professional, with ability to provide solutions to real-world problems.
2. A graduate will understand the need for and engage in life-long learning and research to contribute in IT domain.
3. A graduate develops project management techniques by the virtue of leadership qualities and team work capabilities.
4. A graduate inculcates moral values, understands professional, social and environmental responsibilities.

Program Outcomes (POs):

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engg. specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
10. Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one’s own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes:

The Graduates demonstrates the ability to

1. Apply the knowledge of basic science, mathematics and Information Technology to facilitate automation of various scientific applications.
2. Analyze, design, simulate and implement solutions to multi-disciplinary real-world problems using relevant hardware and software tools.
3. Develop the IT related product, with the understanding of business aspects and economic impacts, showcasing the leadership qualities required for IT project management, and exhibiting ethical, social and environmental responsibilities.

INDEX

1. CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW

Semester: VI **Year: 2017-18**

Subject Title: Cryptography, Network Security and Cyber Law	**Subject Code: 15CS61**
Total Contact Hours: 50	Duration of Exam : 03
Total Exam Marks: 80	Total IA Marks : 20
Staff : Prof. Sahebgouda R Patil	

MODULE - 1 **10 Hours**

Introduction - Cyber Attacks, Defense Strategies and Techniques, Guiding Principles, Mathematical Background for Cryptography - Modulo Arithmetic's, The Greatest Comma Divisor, Useful Algebraic Structures, Chinese Remainder Theorem, Basics of Cryptography - Preliminaries, Elementary Substitution Ciphers, Elementary Transport Ciphers, Other Cipher Properties, Secret Key Cryptography – Product Ciphers, DES Construction, Modes of Operation, MAC and Other Applications, Attacks, Linear Cryptanalysis.

MODULE - 2 **10 Hours**

Public Key Cryptography and RSA – RSA Operations, Why Does RSA Work?, Performance, Applications, Practical Issues, Public Key Cryptography Standard (PKCS), Cryptographic Hash - Introduction, Properties, Construction, Applications and Performance, The Birthday Attack, Discrete Logarithm and its Applications - Introduction, Diffie-Hellman Key Exchange, Other Applications, Elliptic Curve Cryptography and Advanced Encryption Standard - Elliptic Curve
Cryptography, Applications, Practical Considerations, Advanced Encryption Standard (AES).

MODULE - 3 **10 Hours**

Key Management - Introduction, Digital Certificates, Public Key Infrastructure, Identity–based Encryption, Authentication–I - One way Authentication, Mutual Authentication, Dictionary Attacks, Authentication – II – Centralized Authentication, The Needham-Schroeder Protocol, Kerberos, Biometrics, IPSec- Security at the Network Layer – Security at Different layers: Pros and Cons, IPSec in Action, Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, Virtual Private Networks, Security at the Transport Layer - Introduction, SSL Handshake Protocol, SSL Record Layer Protocol, Open SSL.

MODULE - 4 **10 Hours**

IEEE 802.11 Wireless LAN Security - Background, Authentication, Confidentiality and Integrity, Viruses, Worms, and Other Malware - Preliminaries Viruses, Worm Features, Internet Scanning Worms, Topological Worms, Web Worms and Case Study, Firewalls – Basics, Practical Issues, Intrusion Prevention and Detection - Introduction, Prevention Versus Detection, Types of Instruction Detection Systems, DDoS Attacks Prevention/Detection, Web Service Security – Motivation, Technologies for Web Services, WSSecurity, SAML, Other Standards.

MODULE - 5 **10 Hours**

IT act aim and objectives, Scope of the act, Major Concepts, Important provisions, Attribution, acknowledgement, and dispatch of electronic records, Secure electronic records and secure digital signatures, Regulation of certifying authorities: Appointment of Controller and Other officers, Digital Signature certificates, Duties of Subscribers, Penalties and adjudication, The cyber regulations appellate tribunal, Offences, Network service providers not to be liable in certain cases, Miscellaneous Provisions.

TEXT BOOKS:

1. Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition (Chapters-1,3,4,5,6,7,8,9,10,11,12,13,14,15,19(19.1-19.5),21(21.1-21.2),22(22.1-22.4),25

REFERENCE BOOKS:

1. Cryptography and Network Security- Behrouz A Forouzan, Debdeep Mukhopadhyay, Mc-GrawHill, 3rd Edition, 2015
2. Cryptography and Network Security- William Stallings, Pearson Education, 7th Edition
3. Cyber Law simplified- Vivek Sood, Mc-GrawHill, 11th reprint , 2013
4. Cyber security and Cyber Laws, Alfred Basta, Nadine Basta, Mary brown, ravindra kumar, Cengage learning.

CRYPTOGRAPHY, NETWORK SECURITY AND CYBER LAW COURSE PLAN

1. Prerequisites:

To help the students design and develop secure solution to provide confidentiality and integrity, user authentication, secure network and transport layer communication, secure wireless communication, defeat vulnerabilities, cyber laws and electronic payment.

2. Course objectives:

This course will enable students to

- Explain the concepts of Cyber security
- Illustrates the key management issues and solutions.
- Familiarize with Cryptography and very essential algorithms
- Introduce cyber Laws and ethics to be followed.

Course outcomes

The students should be able to:

- Discuss cryptography and its need to various applications
- Design and develop simple cryptography algorithms
- Understand cyber security and need cyber Law

3. Application:

Many feature combine to throw network security to the top issues in the organization and face IS professional daily. Nowadays business operation decentralization and correspondence growth of computer network is the number one driver of concern about the network security. As far as security concern, many organization networks are accidently waiting to occur, such accident will occur is impossible to predict but security breaches will occur.

Module Wise Plan:
MODULE - 1

Module Number/ Module Title : 01	Planned Hours: **10**

Learning Objectives: At the end of this Module student will be able to:

01	Understand Cyber Attacks and Guiding Principles
02	Defense Strategies and Techniques
03	Perform Mathematical Background for Cryptography-GCD and Chinese Remainder Theorem
04	Basics of Cryptography – Preliminaries and Elementary Substitution Ciphers
05	Elementary Transport Ciphers, Secret Key Cryptography
06	Perform DES Construction
07	Understand Modes of Operation
08	MAC, Attacks, Linear Cryptanalysis.

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L1	Introduction to Cyber Attacks	Chalk and Board	2,3,5	1,2	1	T1/1,R1,R2
L2	Defense Strategies and Techniques	Chalk and Board, ppt		1,2	1	T1/1, R1,R2
L3	Guiding Principles	Chalk and Board		1,2	1	T1/1, R1,R2
L4	Mathematical Background for Cryptography - Modulo Arithmetic's	Chalk and Board, ppt		1,2	1	T1/3, R1,R2
L5	The Greatest Comma Divisor	Chalk and Board, ppt		1,2	1	T1/3, R1,R2
L6	Useful Algebraic Structures and Chinese Remainder Theorem	Chalk and Board ,ppt		1,2	1	T1/3, R1,R2
L7	Basics of Cryptography – Preliminaries and Elementary Substitution Ciphers	Chalk and Board ,ppt		1,2	1	T1/4, R1,R2
L8	Elementary Transport Ciphers	Chalk and Board ,ppt		1,2	1	T1/4, R1,R2
L9	Secret Key Cryptography – Product Ciphers, DES Construction	Chalk and Board ,ppt		1,2	1	T1/5, R1,R2
L10	Modes of Operation and MAC, Attacks, Linear Cryptanalysis.	Chalk and Board ,ppt		1,2	1	T1/5, R1,R2

T1/1:Text book number 1 in VTU syllabus and chapter number 1 in that text book.

T1/3: Text book number 1 in VTU syllabus and chapter number 3 in that text book.
T1/4: Text book number 1 in VTU syllabus and chapter number 4 in that text book.
T1/5: Text book number 1 in VTU syllabus and chapter number 5 in that text book.
R1:Reference book number 1.
R2:Reference book number 2.

Assignment Questions:

Assignment Questions	COs attained
1. Define attack ? Explain common cyber attacks	1
2. Write short note on Defense Strategies and Techniques	1
3. List and explain guiding principles	1
4. Explain Euclid's algorithm with an example	1
5. Write Extended Euclidean algorithm	1
6. Explain Chinese Remainder Theorem with an example	1
7. Define cipher and explain Elementary Substitution Ciphers	1
8. With neat diagram explain Three-round SPN network	1
9. With neat diagram explain DES operations	1
10. Write short note on MAC and ATTACKS	1

MODULE – 2

Module Number/ Module Title : 02	Planned Hours: **10**

Learning objectives: At the end of this module student will be able to**:**

01	Understand working of RSA, PKCS and Diffie-Hellman Key Exchange
02	Know Performance, Applications, Practical Issues
03	Encryption technique
04	Discrete Logarithm and its Applications
05	Cryptography and Practical Considerations

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L11	Public Key Cryptography and RSA – RSA Operations	Chalk and Board	1,3,5,	1,2	2	T1/6,R1,R2
L12	Performance, Applications	Chalk and Board		1,2	2	T1/6, R1,R2
L13	Practical Issues, Public Key Cryptography Standard (PKCS)	Chalk and Board		1,2	2	T1/6, R1,R2
L14	Cryptographic Hash - Introduction	Chalk and Board		1,2	2	T1/7, R1,R2
L15	Properties, Construction	Chalk and Board		1,2	2	T1/7, R1,R2
L16	Applications and Performance and The	Chalk and Board		1,2	2	T1/7, R1,R2

	Birthday Attack					
L17	Discrete Logarithm and its Applications	Chalk and Board		1,2	2	T1/8, R1,R2
L18	Diffie-Hellman Key Exchange, Other Applications	Chalk and Board		1,2	2	T1/8, R1,R2
L19	Elliptic Curve Cryptography, Applications	Chalk and Board		1,2	2	T1/9, R1,R2
L20	Practical Considerations, (AES).	Chalk and Board		1,2	2	T1/9, R1,R2

T1/6:Text book number 1 in VTU syllabus and chapter number 6 in that text book.
T1/7: Text book number 1 in VTU syllabus and chapter number 7 in that text book.
T1/8: Text book number 1 in VTU syllabus and chapter number 8 in that text book.
T1/9: Text book number 1 in VTU syllabus and chapter number 9 in that text book.
R1:Reference book number 1.
R2:Reference book number 2.

Assignment Questions:

Assignment Questions	COs attained
1. Write RSA algorithm and Explain RSA operation with example	2
2. Expain Public Key Cryptography Standard (PKCS)	2
3. Explain properties of cryptographic hash	2
4. With neat diagram explain computation of SHA-1	2
5. Explain digital signature and birthday attack	2
6. Explain Diffie-Hellman Key Exchange algorithm	2
7. Explain elliptic curve operations	2
8. With neat diagram explain AES operation	2

MODULE - 3

Module Number/ Module Title : 03	**Planned Hours: 10**

Learning Objectives: At the end of this module student will be able to:

01	Key Management
02	Public Key Infrastructure, Identity–based Encryption
03	Authentication
04	The Needham-Schroeder Protocol
05	Biometrics and IPSec- Security at the Network Layer
06	Internet Key Exchange (IKE) Protocol
07	Security Policy and IPSEC
08	Virtual Private Networks
09	Security at the Transport Layer
10	SSL Handshake Protocol, SSL Record Layer Protocol

Lesson plan:

Lecture	Topics Covered	Teaching	POs	PSOs	COs	Reference

No.		Method	attained	attained	attained	Book/ Chapter No.
L21	Key Management - Introduction	Chalk and Board	2,3,5	1,2	3	T1/10,R1,R2
L22	Digital Certificates, Public Key Infrastructure	Chalk and Board		1,2	3	T1/10,R1,R2
L23	Identity–based Encryption	Chalk and Board		1,2	3	T1/10,R1,R2
L24	Authentication–I - One way Authentication	Chalk and Board		1,2	3	T1/11,R1,R2
L25	Mutual Authentication, Dictionary Attacks	Chalk and Board		1,2	3	T1/11,R1,R2
L26	Authentication – II – Centralized Authentication	Chalk and Board		1,2	3	T1/12,R1,R2
L27	The Needham-Schroeder Protocol, Kerberos, Biometrics	Chalk and Board		1,2	3	T1/12,R1,R2
L28	IPSec- Security at the Network Layer, IPSec in Action	Chalk and Board		1,2	3	T1/13,R1,R2
L29	Internet Key Exchange (IKE) Protocol, Security Policy and IPSEC, VPN	Chalk and Board		1,2	3	T1/13,R1,R2
L30	Security at the Transport Layer	Chalk and Board		1,2	3	T1/14,R1,R2
L31	SSL Handshake Protocol, SSL Record Layer Protocol, Open SSL	Chalk and Board		1,2	3	T1/14,R1,R2

T1/10:Text book number 1 in VTU syllabus and chapter number 10 in that text book.
T1/11: Text book number 1 in VTU syllabus and chapter number 11 in that text book.
T1/12: Text book number 1 in VTU syllabus and chapter number 12 in that text book.
T1/13: Text book number 1 in VTU syllabus and chapter number 13 in that text book.
T1/14: Text book number 1 in VTU syllabus and chapter number 14 in that text book.

R1:Reference book number 1.
R2:Reference book number 2.

Assignment Questions:

Assignment Questions	COs attained
1. With neat diagram explain PKI architecture	3
2. Explain identity based encryption	3
3. Explain password-based one- way authentication	3
4. With neat diagram explain mutual authentication using shared secret	3

5. Explain The Needham-Schroeder Protocol	3
6. Write short note on KERBEROS and BIOMETRIC	3
7. Explain AH and ESP in transport mode	3
8. Explain IKE phase-1 with neat diagram	3
9. Explain SSL handshake with neat diagram	3

MODULE – 4

Module Number/ Module Title : 04	**Planned Hours: 10**

Learning Objectives: At the end of this module student will be able to:

01	IEEE 802.11 Wireless LAN Security
02	Confidentiality and Integrity
03	Preliminaries Viruses and Worm Features
04	Web Worms and Firewalls
05	Intrusion Prevention and Detection
06	DDoS Attacks Prevention/Detection
07	Web Service Security
08	Technologies for Web Services, SAML

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L32	IEEE 802.11 Wireless LAN Security - Background	Chalk and Board	2,3,5,9	1,2,3	3	T1/15,R1,R2
L33	Authentication, Confidentiality and Integrity	Chalk and Board		1,2,3	3	T1/15,R1,R2
L34	Viruses, Worms, and Other Malware - Preliminaries Viruses	Chalk and Board		1,2,3	3	T1/19,R1,R2
L35	Worm Features, Internet Scanning Worms	Chalk and Board		1,2,3	3	T1/19,R1,R2
L36	Topological Worms, Web Worms and Case Study	Chalk and Board		1,2,3	3	T1/19,R1,R2
L37	Firewalls – Basics, Practical Issues	Chalk and Board		1,2,3	3	T1/21,R1,R2
L38	Intrusion Prevention and Detection - Introduction	Chalk and Board		1,2,3	3	T1/22,R1,R2
L39	Prevention Versus Detection, Types of Instruction Detection Systems, DDoS	Chalk and Board		1,2,3	3	T1/22,R1,R2

L40	Web Service Security – Motivation, Technologies for Web Services	Chalk and Board		1,2,3	3	T1/25,R1,R2
L41	WSSecurity, SAML, Other Standards	Chalk and Board		1,2,3	3	T1/25,R1,R2

T1/15:Text book number 1 in VTU syllabus and chapter number 15 in that text book.
T1/19: Text book number 1 in VTU syllabus and chapter number 19 in that text book.
T1/21: Text book number 1 in VTU syllabus and chapter number 21 in that text book.
T1/22: Text book number 1 in VTU syllabus and chapter number 22 in that text book.
T1/25: Text book number 1 in VTU syllabus and chapter number 25 in that text book.
R1:Reference book number 1.
R2:Reference book number 2.

Assignment Questions:

Assignment Questions	COs attained
1. Explain authentication and master session key exchange in 802.11i	3
2. Explain MAC generation and encryption in CCMP	3
3. Define worm and explain topological worm	3
4. Discuss prevention and detection and explain IDS	3
5. Explain types of intrusion detection system	3
6. Explain purchase order in XML	3
7. Explain web security	3
8. Write short note on SAML	3

MODULE - 5

Module Number/ Module Title : 05	Planned Hours: 10

Learning Objectives: At the end of this module student will be able to:

01	IT act aim and objectives
02	Important provisions, Attribution and acknowledgement
03	Secure electronic records
04	secure digital signatures
05	Appointment of Controller and Other officers
06	Digital Signature certificates
07	Duties of Subscribers
08	Penalties and adjudication
09	The cyber regulations appellate tribunal
10	Classes and types
11	Network service providers
12	Miscellaneous Provisions

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L42	IT act aim and	Chalk and		1,2,3	3	R3,R4

	objectives, Scope of the act	Board	2,3,5,9			
L43	Major Concepts, Important provisions	Chalk and Board		1,2,3	3	R3,R4
L44	Attribution, acknowledgement, and dispatch of electronic records	Chalk and Board		1,2,3	3	R3,R4
L45	Secure electronic records and secure digital signatures	Chalk and Board		1,2,3	3	R3,R4
L46	Regulation of certifying authorities: Appointment of Controller and Other officers	Chalk and Board		1,2,3	3	R3,R4
L47	Digital Signature certificates, Duties of Subscribers	Chalk and Board		1,2,3	3	R3,R4
L48	Penalties and adjudication	Chalk and Board		1,2,3	3	R3,R4
L49	The cyber regulations appellate tribunal, Offences	Chalk and Board		1,2,3	3	R3,R4
L50	Network service providers not to be liable in certain cases	Chalk and Board		1,2,3	3	R3,R4
L51	Miscellaneous Provisions	Chalk and Board		1,2,3	3	R3,R4

R3: Reference book number 3.
R4: Reference book number 4.

Assignment Questions:

Assignment Questions	COs attained
1. Explain IT act aim and objectives	3
2. Explain Secure electronic records and secure digital signatures	3
3. Explain Appointment of Controller	3
4. Write a note on Digital Signature certificates	3
5. Explain Network service providers	3
6. Discuss Miscellaneous Provisions	3

ASSIGNMENT-I

Assignment Questions	COs attained
1. Define attack ? Explain common cyber attacks	1
2. Write short note on Defense Strategies and Techniques	1
3. List and explain guiding principles	1
4. Write RSA algorithm and Explain RSA operation with	2

example	
5. Expain Public Key Cryptography Standard (PKCS)	2
6. Explain properties of cryptographic hash	2

ASSIGNMENT-II

Assignment Questions	COs attained
1. With neat diagram explain mutual authentication using shared secret	3
2. Explain The Needham-Schroeder Protocol	3
3. Write short note on KERBEROS and BIOMETRIC	3
4. Define worm and explain topological worm	3
5. Discuss prevention and detection and explain IDS	3
6. Explain types of intrusion detection system	3

ASSIGNMENT-III

Assignment Questions	COs attained
1. Explain IT act aim and objectives	3
2. Explain Secure electronic records and secure digital signatures	3
3. Explain Appointment of Controller	3
4. Explain purchase order in XML	3
5. Explain web security	3
6. Write short note on SAML	3

PORTION FOR I. A. TEST:

Test	Module	COs attained
I I.A. Test	I, II	1,2
II I.A. Test	III,IV	3
III I.A. Test	V	4

COURSE COORDINATOR **MODULE COORDINATOR**

2. FILE STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)

Semester: VI **Year: 2017-18**

Subject Title: FILE STRUCTURES	**Subject Code: 10IS62**
Total Contact Hours: 50	Duration of Exam : 03
Total Exam Marks: 80	Total IA Marks : 20
Staff : Prof.S. K. Honawad	**CREDITS – 04**

Course objectives: This course will enable students to

- Explain the fundamentals of file structures and their management.
- Measure the performance of different file structures
- Organize different file structures in the memory.
- Demonstrate hashing and indexing techniques.

Module – 1 **10 Hours**

Introduction:

File Structures: The Heart of the file structure Design, A Short History of File Structure Design, A Conceptual Toolkit; Fundamental File Operations: Physical Files and Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking, Special Characters, The Unix Directory Structure, Physical devices and Logical Files, File-related Header Files, UNIX file System Commands; Secondary Storage and System Software: Disks, Magnetic Tape, Disk versus Tape; CD-ROM: Introduction, Physical Organization, Strengths and Weaknesses; Storage as Hierarchy, A journey of a Byte, Buffer Management, Input /Output in UNIX.

Fundamental File Structure Concepts, Managing Files of Records:

Field and Record Organization, Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes, Managing Fixed Length, Fixed Field Buffers, An Object-Oriented Class for Record Files, Record Access, More about Record Structures, Encapsulating Record Operations in a Single Class, File Access and File Organization.

Module – 2 **10 Hours**

Organization of Files for Performance, Indexing:

Data Compression, Reclaiming Space in files, Internal Sorting and Binary Searching, Key sorting; What is an Index? A Simple Index for Entry-Sequenced File, Using Template Classes in C++ for Object I/O, Object-Oriented support for Indexed, Entry- Sequenced Files of DatObjects, Indexes that are too large to hold in Memory, Indexing to provide access by Multiple keys, Retrieval Using Combinations of Secondary Keys, Improving the Secondary Index structure: Inverted Lists, Selective indexes, Binding.

Module – 3 **10 Hours**

Consequential Processing and the Sorting of Large Files:

A Model for Implementing Consequential Processes, Application of the Model to a General Ledger Program, Extension of the Model to include Multiway Merging, A Second Look at Sorting in Memory, Merging as a Way of Sorting Large Files on Disk.

Multi-Level Indexing and B-Trees:

The invention of B-Tree, Statement of the problem, Indexing with Binary Search Trees; Multi-Level Indexing, B-Trees, Example of Creating a B-Tree, An Object-Oriented Representation of B-Trees ,B-Tree Methods; Nomenclature, Formal Definition of B-Tree

Properties, Worst case Search Depth, Deletion, Merging and Redistribution, Redistribution during insertion; B* Trees, Buffering of pages; Virtual B-Trees; Variable-length Records and keys.

Module – 4 **10 Hours**

Indexed Sequential File Access and Prefix B + Trees:

Indexed Sequential Access, Maintaining a Sequence Set, Adding a Simple Index to the Sequence Set, The Content of the Index: Separators Instead of Keys, The Simple Prefix B+ Tree and its maintenance, Index Set Block Size, Internal Structure of Index Set Blocks: A Variable-order B- Tree, Loading a Simple Prefix B+ Trees, B-Trees, B+ Trees and Simple Prefix B+ Trees in Perspective.

Module – 5 **10 Hours**

Hashing:

Introduction, A Simple Hashing Algorithm, Hashing Functions and Record Distribution, How much Extra Memory should be used?, Collision resolution by progressive overflow, Buckets, Making deletions, Other collision resolution techniques, Patterns of record access.

Extendible Hashing:

How Extendible Hashing Works, Implementation, Deletion, Extendible Hashing Performance, Alternative Approaches.

Question paper pattern:

The question paper will have TEN questions.
There will be TWO questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Michael J. Folk, Bill Zoellick, Greg Riccardi: File Structures-An Object Oriented Approach with C++, 3rd Edition, Pearson Education, 1998. (Chapters 1 to 12 excluding 1.4, 1.5, 5.5, 5.6, 8.6, 8.7, 8.8)

Reference Books:

1. K.R. Venugopal, K.G. Srinivas, P.M. Krishnaraj: File Structures Using C++, Tata McGraw-Hill, 2008.
2. Scot Robert Ladd: C++ Components and Algorithms, BPB Publications, 1993.
3. Raghu Ramakrishan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw Hill, 2003.

FILE STRUCTURES COURSE PLAN

Course Prerequisites:

1. The students should have idea of data files and its need.
2. Also, the students must have the basic knowledge of any object oriented programming language like C++..

Course Overview and its relevance to program:

Storage capacity and accessing speed is the tradeoff between disks and memory. File structure deals with the organization of data in the disks to improve the performance in terms of its accessing speed. This course is intended to study the object oriented approach for file structure design in a progressive manner.

The course starts with the introduction and need for file structures. Then the fundamental concepts of file structures are discussed. It helps us to understand how the data in the file is

organized and managed. The course includes the discussion about the progress of research in the field of file structure design with the objective that minimizes the time taken to retrieve the required data stored in the disk i.e., getting the data with single access. Binary search is the first developed approach. Then the high level file structure tools, including indexing, tree structures: AVL tree, B-tree, B^+ tree and finally the concept of hashing and extendible hashing are introduced and are discussed in detail.
The course includes the extensive discussion of the object-oriented approach to represent information and algorithms.

Course Outcomes

1. Basics of file structure design
2. Data accessing from files
3. Select suitable indexing and hashing techniques for better performance to a given Problem
4. Merging of files
5. Construction of trees to make faster access of data from file
6. Choose appropriate file structure for storage representation.
7. Identify a suitable sorting technique to arrange the data.

Applications:

With the advancement of computers in every field, the need for storing large amount of data and fast retrieval of stored data is also increasing. This course helps to develop new file structure tools that best satisfies the present needs.

MODULE WISE PLAN
MODULE-I

Chapter Number: 1,2,3,4,5	**No. of Hours: 10**
Unit Title: Introduction Fundamentals File Structure Concepts, Managing Files Of Records	

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter no.
L1	File Structures: The Heart of the file structure Design, A Short History of File Structure Design, A Conceptual Toolkit; Fundamental File Operations: Physical Files and Logical Files	Chalk & Board,PPT		1,2	1	T1/1,2,3
L2	Fundamental File Operations: Physical Files and	Chalk & Board,PPT			1	T1/1,2,3

	Logical Files, Opening Files, Closing Files, Reading and Writing, Seeking, Special Characters, The Unix Directory Structure		1,2,3,4,5,7	1,2		
L3	Unix Directory Structure, Physical devices and Logical File	Chalk & Board,PPT		1,2	1	T1/1,2,3
L4	File-related Header Files, UNIX file System Commands; Secondary Storage and System Software	Chalk & Board,PPT		1,2	1	T1/1,2,3
L5	File-related Header Files, UNIX file System Commands; Secondary Storage and System Software: Disks, Magnetic Tape	Chalk & Board,PPT		1,2	1	T1/1,2,3
L6	Disk versus Tape; CD-ROM: Introduction, Physical Organization, Strengths and Weaknesses;	Chalk & Board,PPT		1,2	1	T1/1,2,3
L7	Storage as Hierarchy, A journey of a Byte, Buffer Management, Input /Output in UNIX	Chalk & Board,PPT		1,2	1	T1/1,2,3
L8	Field and Record Organization Using Classes to Manipulate Buffers, Using Inheritance for Record Buffer Classes	Chalk & Board,PPT		1,2	2	T1/4,5
L9	Managing Fixed Length, Fixed Field Buffers, An Object-	Chalk & Board,PPT		1,2	2	T1/4,5

	Oriented Class for Record Files Record Access, More about Record Structures					
L10	Encapsulating Record Operations in a Single Class File Access and File Organization	Chalk & Board,PPT			2	T1/4,5

Assignment Questions:

Assignment Questions	Cos Attained
1) What is File Structure?	1
2) Explain the conceptual tool kit for the file structure?	1
3) Explain the OO Tool kit for the file structure?	1
4) Give the brief history of File Structure?	
5) Give the syntax for Reading & Writing of information to the file.	1
6) Give the list of C & C++ stream classes.	
7) How to seek the information in the file.	1
8) Explain the UNIX directory system of the FS.	1
9) Why are there inter block gap on linear tapes. Why do we not just jam all records in to one block.	1
10) Use the internet to determine the characteristics of the second generation of DVD.	1
11) Define the Fields & Records.	2
12) Explain the field structure.	2
13) Explain the record structure.	2
14) Explain the buffer class for delimited text fields.	2
15) Explain the buffer class for length based & fixed length fields.	2
16) Explain the inheritance in the C++ stream classes for record buffer class.	2
17) Explain the UNIX tools for sequential processing.	2
18) Explain the file access & file organization in FS.	2
19) Define the metadata	2

MODULE-II

Chapter Number: 6,7	**No. of Hours: 10**
Unit Title: Organization Of Files For Performance, Indexing	

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.

L11	Data Compression, Reclaiming Space in files,	Chalk & Board,PPT	1,2,3,4,5	1,2	3	T1/6,7
L12	Internal Sorting and Binary Searching	Chalk & Board,PPT		1,2	3,7	T1/6,7
L13	Keysorting; What is an Index? A Simple Index for Entry-Sequenced File	Chalk & Board,PPT		1,2	3,7	T1/6,7
L14	Using Template Classes in C++ for Object I/O	Chalk & Board,PPT		1,2	3	T1/6,7
L15	Object- Oriented support for Indexed	Chalk & Board,PPT		1,2	3	T1/6,7
L16	Entry-Sequenced Files of Data Objects	Chalk & Board,PPT		1,2	3,6	T1/6,7
L17	Indexes that are too large to hold in Memory	Chalk & Board,PPT		1,2	3,6	T1/6,7
L18	Indexing to provide access by Multiple keys	Chalk & Board,PPT		1,2	3,6	T1/6,7
L19	Retrieval Using Combinations of Secondary Keys	Chalk & Board,PPT		1,2	3,6	T1/6,7
L20	Improving the Secondary Index structure: Inverted Lists, Selective indexes, Binding	Chalk & Board,PPT		1,2	3,6	T1/6,7

Assignment Questions:

Assignment Questions	Cos Attained
1) Define the data compression.	3
2) Give the compression routines in UNIX.	3
3) How to reclaim space in files.	3
4) Explain deleting fixed length records for reclaiming space dynamically.	3,6
5) Explain the deleting variable length records.	3
6) Define the indexing.	3
7) Give the OO method of entry sequenced files of data objects.	3
8) Give the different operations required to maintain an indexed file.	3
9) Explain the indexing to provide access by multiple keys.	3,6

10) How to retrieve the information using the combination of secondary keys.	3,7

UNIT-IV

Chapter Number: 8,9	**No. of Hours: 10**
Unit Title: Consequential Processing And The Sorting Of Large Files Multi-Level Indexing And B-Trees	

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L21	A Model for Implementing Cosequential Processes	Chalk & Board,PPT	1,2,3,4,5,7	1,2	4	T1/8
L22	Application of the Model to a General Ledger Program	Chalk & Board,PPT		1,2	4	T1/8
L23	Extension of the Model to include Mutiway Merging	Chalk & Board,PPT		1,2	4	T1/8
L24	A Second Look at Sorting in Memory Merging as a Way of Sorting Large Files on Disk	Chalk & Board,PPT		1,2	4	T1/8
L25	The invention of B-Tree, Statement of the problem	Chalk & Board,PPT		1,2	5	T1/9
L26	Indexing with Binary Search Trees; Multi-Level Indexing	Chalk & Board,PPT		1,2	5	T1/9
L27	B-Trees, Example of Creating a B-Tree	Chalk & Board,PPT		1,2	5	T1/9
L28	Example of Creating a B-Tree, An Object-Oriented	Chalk & Board,PPT		1,2	5	T1/9

	Representation of B-Trees, B-Tree Methods					
L29	Nomenclature, Formal Definition of B-Tree Properties, Worst-case Search Depth, Deletion, Merging and Redistribution	Chalk & Board,PPT		1,2	5	T1/9
L30	B* Trees, Buffering of pages; Virtual B-Trees Variable-length Records and keys	Chalk & Board,PPT		1,2	5	T1/9

Assignment Questions:

Assignment Questions	Cos Attained
1) Define co-sequential processing.	4
2) Provide a general OO model for implementing all variety of co-sequential processing.	4
3) Explain the merging of two lists.	4
4) Give the applications of the co-sequential processes to ledger program.	4
5) Explain the K-Way merge algorithm.	4
6) How much time does a merge sort take in co-sequential processing.	4
7) How to decrease the number of seeks in co-sequential processing.	4
8) Explain the co-sequential process for to disc drives with replacement selection.	4
9) Explain the sorting files on tape.	4
10) Explain the merging of two lists.	4
11) Explain the multi level indexing.	5
12) What is B-Tree.	5
13) Explain the implementation of the fundamental operation of the B-Trees.	5
14) Explain the OO design of the B-Trees.	5
15) Give the notion of page buffering & virtual B-Trees	5
16) Show the B-Trees of order 4 that result from loading following sets of keys in order a) C G J X b) C G J X N S U O A E B H I	5

MODULE-IV

Chapter Number: 10	**No. of Hours:10**
Unit Title: Indexed Sequential File Access And Prefix B + Trees	

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L31	Indexed Sequential Access	Chalk & Board, PPT	1,2,3,4,5,7	1,2	5	T1/10
L32	Maintaining a Sequence Set	Chalk & Board, PPT		1,2	5	T1/10
L33	Adding a Simple Index to the Sequence Set	Chalk & Board, PPT		1,2	5	T1/10
L34	The Content of the Index: Separators Instead of Keys	Chalk & Board		1,2	5	T1/10
L35	The Simple Prefix B+ Tree and its maintenance	Chalk & Board, PPT		1,2	5	T1/10
L36	Index Set Block Size	Chalk & Board,PPT		1,2	5	T1/10
L37	Internal Structure of Index Set Blocks	Chalk & Board, PPT		1,2	5	T1/10
L38	A Variable-order B-Tree	Chalk & Board		1,2	5	T1/10
L39	Loading a Simple Prefix B+ Trees, B-Trees	Chalk & Board, PPT		1,2	5	T1/10
L40	B+ Trees and Simple Prefix B+ Trees in Perspective.	Chalk & Board,PPT		1,2	5	T1/10

Assignment Questions:

Assignment Questions	**Cos Attained**
1) Explain the B+ Tree.	5
2) Describe operations on sequence set of block that maintains records in order by key.	5

3) Describe the structure that permit the each of the following type of access. a) Sequential access only. b) Direct access only.	5
4) The Index set of a B+ Tree is just a B Tree but unlike the B Trees the separation do not have to be keys. Why the difference.	5
5) How does block splitting in the sequence set of a simple prefix B+ tree differ from block splitting in index set.	5
6) If the key BOLEN in the simple prefix B+ Tree in fig. 10.7 (Page No – 460) is deleted from the sequence set node, how is the separator BO in the parent node affected.	5
7) Show a conceptual view of an index set block.	5
8) If the initial set record is sorted by key, the process of loading a B+ tree can be handled by using a single pass sequential process instead of randomly inserting new records in to the trees. What are the advantages of this approach.	5

Module-V

Chapter Number: 11,12	**No. of Hours: 10**
Unit Title: Hashing, Extendible Hashing	

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L41	Introduction	Chalk & Board, PPT	1,2,3,4,56,7,8	1,2	6	T1/11
L42	A Simple Hashing Algorithm	Chalk & Board, PPT		1,2	6	T1/11
L43	Hashing Functions and Record Distribution	Chalk & Board, PPT		1,2	6	T1/11
L44	How much Extra Memory should be used?	Chalk & Board, PPT		1,2	6	T1/11
L45	Collision resolution by progressive overflow.	Chalk & Board, PPT		1,2	6	T1/11
L46	Buckets, Making deletions, Other collision resolution techniques	Chalk & Board, PPT		1,2	6	T1/11
L47	Patterns of record access.	Chalk & Board, PPT		1,2	6	T1/11

L48	How Extendible Hashing Works	Chalk & Board, PPT		1,2	6	T1/12
L49	Implementation, Deletion ,Extendible Hashing Performance	Chalk & Board, PPT		1,2	6	T1/12
L50	Alternative Approaches	Chalk & Board, PPT		1,2	6	T1/12

Assignment Questions:

Assignment Questions	Cos Attained
1) What is hashing.	6
2) Explain the collisions in Hashing.	6
3) Explain the simple hashing algorithm.	6
4) Explain hashing function and record distributions.	6
5) Explain the Poisson distribution.	6
6) Make a table showing Poisson function values for r/N = 0.1, 0.5, 0.8, 1, 2, 5 & 11. examine the table and discuss any features and patterns that provide useful information about hashing	6
7) Define extendable hashing.	6
8) Briefly describe the differences between extendable hashing, dynamic hashing, and linear hashing.	6
9) What are the strengths & weakness dynamic hashing, and linear hashing.	6
10) If buckets are large, a bucket contain only a few records is not much less wasteful than an empty bucket. How could we minimize empty buckets.	6

Assignment-I

1) Explain the UNIX tools for sequential processing.
2) Explain the field structure.
3) Explain the record structure.
4) Give the different operations required to maintain an indexed file.
5) How to reclaim space in files.

Assignment-II

1) Explain the K-Way merge algorithm.
2) Explain the merging of two lists.
3) Explain the implementation of the fundamental operation of the B-Trees.
4) Describe operations on sequence set of block that maintains records in order by key.
5) How does block splitting in the sequence set of a simple prefix B+ tree differ from block splitting in index set.

Assignment-III

1) Explain the collisions in Hashing.
2) Explain the simple hashing algorithm.
3) Explain hashing function and record distributions.
4) Briefly describe the differences between extendable hashing, dynamic hashing, and linear hashing.
5) What are the strengths & weakness dynamic hashing, and linear hashing.

PORTION FOR THE I.A. TEST

Test	Units/Modules	Cos Attained
IA Test –I	Module-I,II	1,2,3,6,7
IA Test –II	Module-III,IV	4,5
IA Test –III	Module-V	6

Course coordinator Module coordinator

3. SOFTWARE TESTING

Semester: V **Year: 2017-18**

Subject Title: Software Testing	**Subject Code: 15IS63**
Total Contact Hours: 50	Duration of Exam : 03
Total Exam Marks: 80	Total IA Marks : 20
Staff : Prof. A. A. Javaji	CREDITS – 04

CREDITS – 04

Course objectives: This course will enable students to

- Differentiate the various testing techniques
- Analyze the problem and derive suitable test cases.
- Apply suitable technique for designing of flow graph
- Explain the need for planning and monitoring a process

Module – 1	**Teaching Hours**
Basics of Software Testing: Basic definitions, Software Quality , Requirements, Behaviour and Correctness, Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram, Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies , Levels of testing, Testing and Verification, Static Testing. **Problem Statements:** Generalized pseudocode, the triangle problem, the NextDate function, the commission problem, the SATM (Simple Automatic Teller Machine) problem, the currency converter, Saturn windshield wiper **T1:Chapter1, T3:Chapter1, T1:Chapter2.**	10 Hours
Module – 2	
Functional Testing: Boundary value analysis, Robustness testing, Worst-case testing, Robust Worst testing for triangle problem, Nextdate problem and commission problem, Equivalence classes, Equivalence test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations, Decision tables, Test cases for the triangle problem, NextDate function, and the commission problem, Guidelines and observations. **Fault Based Testing:** Overview, Assumptions in fault based testing, Mutation analysis, Fault-based adequacy criteria, Variations on mutation analysis. **T1: Chapter 5, 6 & 7, T2: Chapter 16**	10 Hours
Module-3	
Structural Testing: Overview, Statement testing, Branch testing, Condition testing , Path testing: DD paths, Test coverage metrics, Basis path testing, guidelines and observations, Data –Flow testing: Definition-Use testing, Slicebased testing, Guidelines and observations**. Test Execution:** Overview of test execution, from test case specification to test cases, Scaffolding, Generic versus specific scaffolding, Test oracles, Self-checks as oracles, Capture and replay **T3:Section 6.2.1, T3:Section 6.2.4, T1:Chapter 9 & 10, T2:Chapter 17**	10 Marks
Module – 4	

Process Framework : Basic principles: Sensitivity, redundancy, restriction, partition, visibility, Feedback, the quality process, Planning and monitoring, Quality goals, Dependability properties ,Analysis Testing, Improving the process, Organizational factors. **Planning and Monitoring the Process:** Quality and process, Test and analysis strategies and plans, Risk planning, monitoring the process, Improving the process, the quality team **Documenting Analysis and Test:** Organizing documents, Test strategy document, Analysis and test plan, Test design specifications documents, Test and analysis reports. **T2: Chapter 3 & 4, T2: Chapter 20, T2: Chapter 24.**	**10 Hours**
Module – 5	
Integration and Component-Based Software Testing: Overview, Integration testing strategies, Testing components and assemblies. System, Acceptance and Regression Testing: Overview, System testing, Acceptance testing, Usability, Regression testing, Regression test selection techniques, Test case prioritization and selective execution. **Levels of Testing, Integration Testing:** Traditional view of testing levels, Alternative life-cycle models, The SATM system, Separating integration and system testing, A closer look at the SATM system, Decomposition-based, call graph-based, Path-based integrations**.** **T2: Chapter 21 & 22, T1 : Chapter 12 & 13**	**10 Hours**
Course outcomes: The students should be able to: • Derive test cases for any given problem • Compare the different testing techniques • Classify the problem into suitable testing model • Apply the appropriate technique for the design of flow graph. • Create appropriate document for the software artefact. **Question paper pattern:** The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module. **Text Books:** 1. Paul C. Jorgensen: Software Testing, A Craftsman's Approach, 3rd Edition, Auerbach Publications, 2008. (Listed topics only from Chapters 1, 2, 5, 6, 7, 9, 10, 12, 13) 2. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009. (Listed topics only from Chapters 3, 4, 16, 17, 20,21, 22,24) 3. Aditya P Mathur: Foundations of Software Testing, Pearson Education, 2008.(Listed topics only from Section 1.2 , 1.3, 1.4 ,1.5, 1.8,1.12,6. 2.1,6. 2.4) **Reference Books:** 1. Software testing Principles and Practices – Gopalaswamy Ramesh, Srinivasan Desikan, 2nd Edition, Pearson, 2007. 2. Software Testing – Ron Patton, 2nd edition, Pearson Education, 2004.	

3. The Craft of Software Testing – Brian Marrick, Pearson Education, 1995. 4. Anirban Basu, Software Quality Assurance, Testing and Metrics, PHI, 2015. 5. Naresh Chauhan, Software Testing, Oxford University press	

SOFTWARE TESTING COURSE PLAN

Prerequisites:

1. Fundamentals of Software Engineering
2. Fundamentals of Testing types
3. Fundamentals of OOMD (Object Oriented Modelling and Design)

Course Overview and its relevance to program:

The software testing course describes the concept and technologies used in software testing along with implementations using programming languages and packages. It provides the basic information regarding how to develop a software product with minimum errors. The significant features of this course are efficiency of software testing and getting to know how to apply for different types of modeling designed. It helps to build the real time applications, and it is the basic requirement when a person stepped into any software company as a software engineer. The course provides how human error prone nature affects our software development and why testing is a necessary and an important field. It also provides vital definitions of important software qualities and terms like correctness and reliability and affect of testing on these, describes a simple overview of testing and debugging process.

Course Outcome:

CO365. 1. Apply modern software testing processes in relation to software development and project management
CO365. 2. Create test strategies and plans, design test cases, prioritize and execute them.
CO365. 3. Manage incidents and risks within a project.
CO365. 4. Contribute to efficient delivery of software solutions and implement improvements in the software development processes.
CO366. 5Application of software testing techniques in commercial environments.

Applications:

1. The ultimate aim of software testing is to develop error free software product.
2. Software Testing helps any software /system products those are getting into market.

Module I
MODULE WISE PLAN

Module: 01	**No. of Hours: 10**
Module Title: Basics of Software Testing	

Learning Objectives: At the end of this Module students will be able to:

1.	Defines to what is software testing and need of testing and its significance.
2.	Indentify test cases using Venn Diagram
3.	Differentiate between the error and fault
4.	Explain the levels of the testing
5.	Write test case for given problem E.g. Triangle Problem, Next Date Function, Commission problem, SATM System

Lesson Plan:

Lecture	Topics Covered	Teaching	PO's	PSOs	CO's	Text/

No.		Method	attained	attained	attained	Reference Books
L1.	Basic definitions, Software Quality , Requirements, Behaviour and Correctness	Chalk and Board	2,3,4,5,6	1,2	1,2	T1/1, R1/1
L2.	Correctness versus Reliability, Testing and Debugging, Test cases, Insights from a Venn diagram,	Chalk and Board		1,2	1,2	T1/1,R1/1
L3.	Identifying test cases, Test-generation Strategies, Test Metrics, Error and fault taxonomies	Chalk and Board		1,2	1,2	T1/1, R1/1
L4.	Levels of testing, Testing and Verification, Static Testing.	PPT		1,2	1,2	T1/1, R1/1
L5.	**Problem Statements:** Generalized pseudocode,	PPT		1,2	1,2	T1/2, R1/1
L6	the triangle problem, the NextDate function,	PPT		1,2	1,2	T1/2, R1/1
L7	The commission problem	Chalk and Board		1,2	1,2	T1/2, R1/1
L8	the SATM (Simple Automatic Teller Machine) problem	Chalk and Board		1,2	1,2	T1/2, R1/1
L9	the currency converter	Chalk and Board		1,2	1,2	T1/2, R1/1
L10	Saturn windshield wiper	Chalk and Board		1,2	1,2	T1/2, R1/1

Assignment Questions:

Assignment Questions	CO's Attainted
1. Define error, fault, failure and Test Case.	1
2. Differentiate between Correctness versus Reliability, Testing and debugging	1
2. Explain the levels of testing.	1
3. Explain Insights from a Venn diagram,	1
4. Explain error and fault taxonomies.	1

5. Explain Testing and Verification.	1
6. Write a Generalized pseudocode, the triangle problem, the NextDate function.	1
7. Explain the SATM (Simple Automatic Teller Machine) problem.	1
8. Explain currency converter, Saturn windshield wiper controller.	1

MODULE II

Module: 02	**No. of Hours:** 07
Module: Functional Testing	

Learning Objectives: At the end of this Module students will be able to:

1.	Explain and generate test cases using Boundary value analysis and Robustness testing methods
2.	Explain Equivalence Classes and Equivalence class testing
3.	Explain Fault Based Testing
4.	Explain Variations on Mutation Analysis

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	PO's attained	PSOs attained	CO's attained	Text/ Reference Books
L11.	Boundary value analysis, Robustness testing,	Chalk and Board	2,3,4,5,6	1,2	1,2	T1/1, R1/1
L12.	Worst-case testing, Robust Worst testing for triangle problem,	Chalk and Board		1,2	1,2	T1/1,R1/1
L13.	Nextdate problem and commission problem, Equivalence classes	Chalk and Board		1,2	1,2	T1/1, R1/1
L14.	Equivalence test cases for the triangle problem, NextDate function, and the commission problem,	PPT		1,2	1,2	T1/1, R1/1
L15.	Guidelines and observations, Decision tables, Test cases for the triangle problem,	PPT		1,2	1,2	T1/2, R1/1
L16	NextDate function, and the commission problem, Guidelines	PPT		1,2	1,2	T1/2, R1/1

	and observations.					
L17	**Fault Based Testing:** Overview	Chalk and Board		1,2	1,2	T1/2, R1/1
L18	Assumptions in fault based testing,	Chalk and Board		1,2	1,2	T1/2, R1/1
L19	Mutation analysis, Fault-based adequacy criteria,	Chalk and Board		1,2	1,2	T1/2, R1/1
L20	Variations on mutation analysis.	Chalk and Board		1,2	1,2	T1/2, R1/1

Assignment Questions:

Assignment Questions	**CO's Attainted**
1. Explain Boundary value Analysis.	2
2. Explain Robustness testing, Worst-case testing, Robust Worst testing for triangle problem	2
3. What is Equivalence classes. explainEquivalence test cases for the triangle problem	2
4. what are decision Tables? Write a Decision Tables for Test cases for the triangle problem, NextDate function, and the commission problem	2
5. what is fault based testing and fault based adequacy criteria.	2
6. Explain Variations on mutation analysis.	2

MODULE III

Module: 03	**No. of Hours:** 10
Module Title: STRUCTURAL TESTING	

Learning Objectives: At the end of this Module students will be able to:

1.	Explain the DD path and its importance
2.	Express the Test coverage metrics and it use
3.	Define the Basis path testing and Slice-based testing
4.	Explain the Test Execution

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	PO's attained	PSOs attained	CO's attained	Text/ Reference Books
L21.	Overview, Statement testing, Branch testing,	Chalk and Board		1,2	2,3	T1/9 R1/3
L22.	Condition testing , Path testing:	Chalk and Board		1,2	2,3	T1/9 R1/3
L23.	DD paths, Test coverage metrics	Chalk and Board	2,5,6,7,8	1,2	2,3	T1/9 R1/3

L24.	Basis path testing	Chalk and Board		1,2	2,3	T1/9 R1/3
L25.	guidelines and observations, Data – Flow testing:	Chalk and Board		1,2	2,3	T1/10 R1/3
L26.	Definition-Use testing, Slicebased testing, Guidelines and observations.	Chalk and Board		1,2	2,3	T1/10 R1/3
L27.	**Test Execution:** Overview of test execution, from test case specification to test cases, Scaffolding	Chalk and Board		1,2	2,3	T1/10 R1/3
L28.	Generic versus specific scaffolding,	Chalk and Board		1,2	2,3	
L29	Test oracles, Self-checks as oracles,	Chalk and Board		1,2	2,3	
L30.	Capture and replay	Chalk and Board		1,2	2,3	

Assignment Questions:

Assignment Questions	CO's Attainted
1. Write a structured triangle program draw the program graph and find the DD paths, DD path graph for the triangle problem.	3
2. Explain test coverage metrics and basis path testing with example.	3
3. Explain in detail, path based , cell graph based and path based interpretation, with an example.	3
4. Define predicate node, du-paths and dc-paths.	3
5. Give du-paths for stocks, locks, total locks, sales and commission for commission sale problem.	3
6. Define Statement testing, Branch testing, Condition testing.	2
7. Differentiate between Scaffolding, Generic versus specific scaffolding.	2
8. Explain Slice based testing.	2

MODULE IV

Module: 04	**No. of Hours: 10**
Module Title: Process Framework	

Learning Objectives: At the end of this Module students will be able to:

1.	Explain the Sensitivity principal, redundancy, restriction.
2.	Explain Quality goals, Dependability properties.
3.	Explain Planning and Monitoring the Process.

4.	Explain Risk planning, monitoring the process.
5.	Explain Organizing documents.

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	PO's attained	PSOs attained	CO's attained	Text/ Reference Books
L31.	Basic principles: Sensitivity, redundancy,	Chalk and Board	2,3,4,5,6	1,2	2,3,4	T1/12,R1/4
L32.	restriction, partition,	Chalk and Board		1,2	2,3,4	T1/12,R1/4
L33.	visibility, Feedback, the quality process,	Chalk and Board		1,2	2,3,4	T1/12,R1/4
L34.	Planning and monitoring,	Chalk and Board		1,2	2,3,4	T1/13,R1/4
L35.	Quality goals, Dependability properties	Chalk and Board		1,2	2,3,4	T1/13,R1/4
L36.	Analysis Testing, Improving the process, Organizational factors.	Chalk and Board		1,2	2,3,4	T1/13,R1/4
L37.	Quality and process, Test and analysis strategies and plans,	Chalk and Board		1,2	2,3,4	T1/12,R1/4
L38.	Risk planning, monitoring the process,	Chalk and Board		1,2	2,3,4	T1/13,R1/4
L39.	Improving the process, the quality team, Organizing documents, Test strategy document, Analysis and test plan,	Chalk and Board		1,2	2,3,4	T1/13,R1/4
L40.	Test design specifications documents, Test and analysis reports	Chalk and Board		1,2	2,3,4	T1/13,R1/4

Assignment Questions:

Assignment Questions	CO's Attainted
1. Explain the following terms Sensitivity, redundancy, restriction, partition,	1,2,3
2. Explain visibility and Feedback.	1,2,3

3. Explain quality process with diagram.	1,2,3
4. What are dependability properties? Explain.	1,2,3
5. explain organizational factors influencing software testing.	1,2,3
6. what is risk? Explain risk planning.	1,2,3
7. write a short note on a. Organizing documents b. Test and analysis reports.	1,2,3
8. write a short note on a. The quality team b. Improving the process	1,2,3

MODULE V

Module: 05	**No. of Hours: 10**
Module Title: Integration and Component-Based Software Testing	

Learning Objectives: At the end of this Module students will be able to:

1.	Define Integration testing strategies, Testing components
2.	Explain the requirements of System testing, Acceptance testing
3.	Define the Levels of Testing, Integration Testing
4.	Explain the concept of SATM system
5.	Understand call graph-based

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	PO's attained	PSOs attained	CO's Attained	Text/ Reference Books
L41.	Overview, Integration testing strategies, Testing components and assemblies	Chalk and Board	1,2,3,4,5	1,2	3,4	T1/14, R2/1
L42.	System, Acceptance and Regression Testing: Overview, System testing	Chalk and Board		1,2	3,4	T1/14,R2/1
L43.	Acceptance testing, Usability, Regression testing	Chalk and Board		1,2	3,4	T1/14, R2/1
L44.	Regression test selection techniques	Chalk and Board		1,2	3,4	T1/14, R2/1
L45.	Test case prioritization and selective execution.	Chalk and Board		1,2	3,4	T1/15,R2/1
L46.	Levels of Testing, Integration Testing: Traditional view of testing levels,	Chalk and Board		1,2	3,4	T1/15, R2/1
L47.	Alternative life-cycle models, The SATM	Chalk and		1,2	3,4	T1/15, R2/1

	system, Separating integration and system testing,	Board				
L48.	A closer look at the SATM system, Decomposition-based			1,2		
L49.	call graph-based			1,2		
L50.	Path-based integrations			1,2		

Assignment Questions:

Assignment Questions	CO's Attainted
1. Explain Integration testing strategies.	3
2. Explain Acceptance and Regression Testing:	3
3. Explain Regression test selection techniques	3
4. Explain Test case prioritization and selective execution.	3
5. Explain The SATM system.	3
6. Explain Decomposition-based testing, call graph-based testing.	3

ASSIGNMENT QUESTIONS

ASSIGNMENT – I	COs attained
1. Define error, fault, failure and Test Case.	1
2. Differentiate between Correctness versus Reliability, Testing and debugging	1
3. Explain error and fault taxonomies.	1
4. Explain Testing and Verification.	1
5. Write a Generalized pseudocode, the triangle problem, the NextDate function.	1

ASSIGNMENT – II	COs attained
1. Explain Robustness testing, Worst-case testing, Robust Worst testing for triangle problem	2
2. what are decision Tables? Write a Decision Tables for Test cases for the triangle problem, NextDate function, and the commission problem	2
3. Explain Boundary value Analysis.	2
4. Explain test coverage metrics and basis path testing with example.	3
5. Define predicate node, du-paths and dc-paths.	3
6. Define Statement testing, Branch testing, Condition testing.	2

ASSIGNMENT – III	COs attained
1. Explain visibility and Feedback.	1,2,3
2. Explain quality process with diagram.	1,2,3
3. What are dependability properties? Explain.	1,2,3
4. Explain Acceptance and Regression Testing:	3
5. Explain Regression test selection techniques	3

6. Explain Test case prioritization and selective execution.	2

SOFTWARE TESTING IA PORTION

Test	Units	Co's
Internal Assessment I	Module 1 and Module 2	1,2,3
Internal Assessment II	Module 3 and Module 4	2,3,4
Internal Assessment III	Module 5	1,2,3,4

Course Coordinator **Module Coordinator**

4.Operating System

Semester: VI **Year: 2017-2018**

Subject Title:	OPERATING SYSTEMS	Subject Code:	15CS64
Number of Lecture Hours/Week	04	IA Marks	20
Total Number of Lecture Hours	50	Exam Marks	80
Credits	04	Exam Hours	03

MODULE – 1 **10 Hours**

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication.

MODULE - 2 **10 Hours**

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

MODULE - 3 **10 Hours**

Deadlocks : Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

MODULE - 4 **10 Hours**

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. File System, Implementation of File System: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

MODULE – 5 **10 Hours**

Secondary Storage Structures, Protection: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability- Based systems. Case Study: The Linux Operating System: Linux history; Design principles; Kernel modules; Process management; Scheduling; Memory Management; File systems, Input and output; Inter-process communication.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006.

Reference Books:

1. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGrawHill, 2013.
3. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014. 4. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson

Operating System COURSE PLAN

1) Prerequisites:

1. Familiarity with any one operating system (OS) like UNIX, Windows-XP
2. Data structures, computer organization, High level language like C.

2) Course overview and its relevance to this programme:

An operating system acts as an intermediary between the user of a computer and the computer hardware. Operating systems are an essential part of any computer system. Similarly, a course on operating systems is an essential part of any computer-science education. This field is undergoing rapid change, as computers are now prevalent in virtually every application, from games for children through the most sophisticated planning tools for governments and multinational firms. The fundamental concepts and algorithms used in this course are based on existing commercial operating systems. The examples are taken from most popular and the most innovative operating systems, including Sun Microsystems' Solaris; Linux, Mach, Microsoft MS-DOS, Windows NT, Widows 2000, Windows XP; DEC VMS and TOPS-20; IBM OS/2 and Apple Mac OS X.

This course contains the operating systems fundamentals, operating System structure, process and memory management. It deals with managing process synchronization and deadlocks. Process concept and concurrency are the heart of modern operating systems. Process scheduling and inter process communication are discussed in this course. Concurrent access to shared data may result in data inconsistency. Process synchronization and deadlock handling are mechanisms to ensure the orderly execution of processes that share a logical address space, so that data consistency is maintained.

Various methods for implementing file system and managing secondary storage structures are introduced in this course. To improve both the utilization of the CPU and the speed of its response to its users, the computer must keep several processes in memory. There are many different memory-management schemes, reflecting various approaches to memory management. Storage management deals with file system, mass storage and I/O handling. For the purposes of protection and security, mechanisms are used that ensure that only processes that have gained proper authorization from OS can operate on files, memory, CPU, and other resources. Linux OS is explained as a case study to understand various concepts of OS.

Applications:

1. For applying various OS.
2. For developing the custom OS and building tools.
3. It helps for developing algorithms for various OS functions

Course Outcomes:
After studying this course, students will be able to

CO1: Demonstrate need for OS and different types of OS .
CO2: Apply suitable techniques for management of different resources.
CO3: Use processor, memory, storage and file system commands.
CO4: Realize the different concepts of OS in platform of usage through case studies.

MODULE WISE PLAN

Module Number:1	**No. of Hours: 10**

Learning Objectives: The main objectives of this module are to

1.	Define functions and services of OS
2.	Write computer system organization and architecture
3.	Demonstrate different OS structures
4.	Evaluate OS protection and security
5.	Compile system calls and Virtual machines

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	Cos attained	Text or Reference Book/Chapter No.
L1.	What operating systems do?	PPT Chalk and Board	1,2,3,4,5	1,2	1	T1/1
L2.	Computer System organization; Computer System architecture;	PPT, Chalk and Board			1	T1/1
L3.	Operating System structure Operating System operations;	PPT, Chalk and Board			1	T1/1
L4.	Process management; Memory management; Storage management;	PPT, Chalk and Board			1	T1/1
L5.	Protection and security;	PPT, Chalk			1	T1/1

	Distributed system; Special purpose systems.	and Board				
L6.	Computing environments.Operating System Services; User - Operating System interface	PPT, Chalk and Board			1	T1/1,2
L7.	System calls; Types of system calls; System programs;	PPT, Chalk and Board			1	T1/2
L8.	System design and implementation	PPT, Chalk and Board			1	T1/2
L9.	Process concept; Process scheduling	PPT, Chalk and Board			1	T1/3
L10.	Operations on processes; Inter process communication.	PPT, Chalk and Board			1	T1/3

Assignment Questions:

Questions	COs Attained
1. What is an OS? List out the different services that an OS provides. Explain.	1
2. Explain the layered approach to structuring of an OS along with a relevant diagram	1
3. What are the major activities of an OS with regard to (i) Process management (ii) Memory management.	1
4. Explain the fundamental difference between(i) N/W OS and Distributed OS (ii) Web-Based Computing and Embedded Computing.	1
5. What is a process? Draw and explain the process state diagram.	1

MODULE-2

Module Number: 2	**No. of Hours: 10**

Learning Objectives: The main objectives of this module are to

1.	Develop multithreading
2.	Construct scheduling algorithms
3.	Implement thread scheduling
4.	Analyze multiple-processor scheduling.
5.	Apply synchronization, Develop practical knowledge of process Synchronization
6.	Demonstrate Monitors.
7.	Implement semaphores

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L11.	Multi-Threaded Programming: Overview; Multithreading models	PPT, Chalk and Board	1,2,3,4,5	1,2	1,2	T1/4
L12.	Thread Libraries; Threading issues.	PPT, Chalk and Board			1,2	T1/4
L13.	Process Scheduling: Basic concepts; Scheduling criteria Scheduling algorithms	PPT, Chalk and Board			1,2	T1/5
L14.	Multiple-Processor scheduling; Thread scheduling	PPT, Chalk and Board			1,2	T1/5
L15.	Synchronization, The Critical section problem	PPT, Chalk and Board			1,2	T1/3
L16.	The Critical section problem, Peterson's solution	PPT, Chalk and Board			1,2	T1/3
L17.	Synchronization hardware;	PPT, Chalk and Board			1,2	T1/3

L18.	Semaphores	PPT, Chalk and Board			1,2	T1/3
L19.	Classical problems of synchronization	PPT, Chalk and Board			1,2	T1/3
L20.	Monitors.	PPT, Chalk and Board			1,2	T1/3

Assignment Questions:

Questions	COs Attained
1. Explain the differences between single-threaded and multithreaded processes using neat diagram. What are the benefits of multithreading? Explain the multithreading models	1,2
2. List and explain the different scheduling criteria. Explain priority scheduling with an example.	1,2
3. Problem based on Scheduling	1,2
4. Explain critical-section problem and solution to it..	1,2
5. Explain Synchronization Hardware in detail.	1,2

MODULE-3

Module Number: 3	**No. of Hours: 10**

Learning Objectives: The main objectives of this MODULE are to

1.	Develop a description of deadlocks.
2.	Incorporate methods to allow sets of concurrent processes from completing their tasks
3.	Implement deadlock prevention and avoidance
4.	Apply Banker's Algorithm
5.	Demonstrate deadlock handling in modern OS such as UNIX, Win-XP etc
6.	Define memory Management Strategies such as swapping, paging ,segmentation
7.	Implement contiguous memory allocation

Lesson Plan:

Lecture	Topics Covered	Teaching	POs	PSOs	Cos	Text or

No.		Method	Attained	Attained	Attained	Reference Book/Chapter No.
L21.	Deadlocks: System model;	PPT, Chalk and Board	1,2,3,4,5	1,2	2,3	T1/4
L22.	Deadlock characterization;	PPT, Chalk and Board			2,3	T1/4
L23.	Methods for handling deadlocks				2,3	T1/4
L24.	Deadlock prevention	PPT, Chalk and Board			2,3	T1/4
L25.	Deadlock avoidance	PPT, Chalk and Board			2,3	T1/4
L26.	Deadlock detection and recovery from deadlock	PPT, Chalk and Board			2,3	T1/4
L27.	Memory Management Strategies: Background.	PPT, Chalk and Board			2,3	T1/8
L28.	Swapping; Contiguous memory allocation	PPT, Chalk and Board			2,3	T1/8
L29.	Paging	PPT, Chalk and Board			2,3	T1/8
L30.	Structure of page table; Segmentation	PPT, Chalk and Board			2,3	T1/8

Assignment Questions:

Questions	COs Attained
1. Explain necessary conditions for deadlock to occur	2,3
2. Explain resource-allocation graph algorithm with an example	2,3

3. Explain deadlock detection algorithms	2,3
4. What do you mean by fragmentation? Explain difference between internal and external fragmentation with neat diagrams	2,3
5. Explain basic method and hardware required for segmentation.	2,3

MODULE-4

Module Number: 4	**No. of Hours: 10**

Learning Objectives: The main objectives of this Module are to

1.	Analyze demand paging
2.	Implement algorithms like FIFO, LRU etc.
3.	Analyze reasons for thrashing and methods to prevent it.
4.	Express function of file systems.
5.	Define interfaces to file systems
6.	Incorporate file-system design tradeoffs, including access methods, file sharing
7.	Develop locking and directory structures.
8.	Explore file-system protection

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference Book/Chapter No.
L31.	Demand paging,	PPT, Chalk and Board	1,2,3,4,5	1,2	2,3	T1/9
L32.	Copy-on write; Page replacement.	PPT, Chalk and Board			2,3	T1/9
L33.	Allocation of frames; Thrashing	PPT, Chalk and Board			2,3	T1/9
L34.	File System: File concept	PPT, Chalk and Board			2,3	T1/10
L35.	Access methods; Directory structure	PPT, Chalk and Board			2,3	T1/10
L36.	File system mounting; File sharing	PPT, Chalk and Board			2,3	T1/10

L37.	Protection. Implementing File System: File system structure	PPT, Chalk and Board			2,3	T1/10,11
L38.	File system implementation	PPT, Chalk and Board			2,3	T1/11
L39.	Directory implementation.	PPT, Chalk and Board			2,3	T1/11
L40.	Allocation methods; Free space management	PPT, Chalk and Board			2,3	T1/11

Assignment Questions:

Questions	COs Attained
1. Consider the following page reference stream 7,0,1,2,0,3,0,4,2,3,0. Calculate the number of page faults when number of frames is equal to 3, using FIFO, LRU and Optimal page replacement algorithms..	2,3
2. Explain the different LRU-approximation page replacement algorithms.	2,3
3. What are different types of file sharing? Explain.	2,3
4. Explain different Directory Structure in brief.	2,3
5. Explain different free space management	2,3

MODULE-5

Module Number:5	No. of Hours: 10

Learning Objectives: The main objectives of this Module are to

1	Evaluate mass storage structures like disk and tape
2	Implement disk scheduling algorithms and disk management.
3	Demonstrate protection and access matrix.
4	Write history of the UNIX operating system from which Linux is derived.
5	Evaluate Linux process model
6	Implement Linux Operating System operations
7	Write Linux Operating System structure
8	Explore how Linux implements file systems and manages I/O devices

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs Attained	PSOs Attained	Cos Attained	Text or Reference

						Book/Chapter No.
L41.	Mass storage structures; Disk structure	PPT, Chalk and Board	1,2,3,4,5	1,2	3,4	T1/12
L42.	Disk attachment; Disk scheduling Disk management; Swap space management	PPT, Chalk and Board			3,4	T1/12
L43.	Disk management; Swap space management Protection: Goals of protection, Principles of protection	PPT, Chalk and Board			3,4	T1/12 T1/14
L44.	Principles of protection Domain of protection, Access matrix	PPT, Chalk and Board			3,4	T1/14
L45.	Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems	PPT, Chalk and Board			3,4	T1/14
L46.	Linux history; Design principles ,Kernel modules	PPT, Chalk and Board			3,4	T1/12
L47.	Process management; Scheduling	PPT, Chalk and Board			3,4	T1/12

L48.	Memory management	PPT, Chalk and Board			3,4	T1/14
L49.	File systems, Input and output	PPT, Chalk and Board			3,4	T1/14
L50.	Inter process communication.	PPT, Chalk and Board			3,4	T1/14

Assignment Questions:

Questions	COs Attained
1. Explain the different steps involved in disk formatting	3,4
2. Suppose that a disk has 50 cylinders named 0 to 49. The read/write head is currently serving at cylinder 15. The queue of pending requests are in order: 4, 40,11, 35, 7,14.For each of the scheduling algorithms: SCAN, C-LOOK and C-SCAN. i) Show the graphical representation for above scheduling algorithms.(ii) Find the average head movement for above scheduling algorithms	3,4
3. Explain the different methods for implementation of access matrix.	3,4
4. Explain Linux kernel modules in detail.	3,4
5. Explain File Systems in Linux.	3,4

Operating System
IA PORTION

I. A. Test No.	Modules
I	1,2
II	3
III	4,5

5.OPERATIONS RESEARCH

Semester: VI **Year: 2017-18**

Subject Title: OPERATIONS RESEARCH	**Subject Code:** 15CS653
Total Contact Hours: 40	Duration of Exam : 03
Total Exam Marks: 80	Total IA Marks : 25
Staff : Prof. K. B. Pawar	

PART - A

MODULE – 1 **8 Hours**

INTRODUCTION, LINEAR PROGRAMMING – 1 : Linear Programming: Introduction: The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation . Introduction to Linear Programming Problem (LPP): Prototype example, Assumptions of LPP, Formulation of LPP and Graphical method various examples.

MODULE – 2 **8 Hours**

SIMPLEX METHOD – 1: The essence of the simplex method; Setting up the simplex method; Types of variables, Algebra of the simplex method; the simplex method in tabular form; Tie breaking in the simplex method, Big M method, Two phase method.

MODULE – 3 **8 Hours**

SIMPLEX METHOD – 2: Duality Theory - The essence of duality theory, Primal dual relationship, conversion of primal to dual problem and vice versa. The dual simplex method

MODULE – 4 **8 Hours**

Transportation and Assignment Problems: The transportation problem, Initial Basic Feasible Solution (IBFS) by North West Corner Rule method, Matrix Minima Method, Vogel's Approximation Method. Optimal solution by Modified Distribution Method (MODI). The Assignment problem; A Hungarian algorithm for the assignment problem. Minimization and Maximization varieties in transportation and assignment problems.

MODULE – 5 **8 Hours**

Game Theory: Game Theory: The formulation of two persons, zero sum games; saddle point, maximin and minimax principle, Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure. Metaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.

TEXT BOOK:

T1. Introduction to Operations Research - Frederick S. Hillier and Gerald J. Lieberman, 8th Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

R1. Operations Research Applications and Algorithms - Wayne L. Winston, 4th Edition, Thomson Course Technology, 2003.

R2. Operations Research: An Introduction - Hamdy A Taha, 8th Edition, Prentice Hall India, 2007.

OPERATIONS RESEARCE COURSE PLAN

1. Prerequisites:

The use of mathematics to describe and analyze large-scale decision problems. Fundamentals of algebra. Graphs of linear equations, first-degree equations and inequalities, and systems of equations. Matrix notations and probability theory, etc.

2. Overview of the course and its relevance to this programme:

Operations research(OR), also known as **operational research**, is an interdisciplinary arithmetical science that focuses on the effective use of technology by organizations. Operations research arrives at optimal or near-optimal solutions to complex decision-making problems. Because of its emphasis on human-technology interaction and of its focus on practical applications, operations research has overlap with other disciplines, notably industrial engineering and management science, and draws on psychology and organization science. Operations Research is often concerned with determining the maximum(of profit, performance, or yield) or minimum (of loss, risk, or cost) of some real-world objective. Originating in military efforts before World War II, its techniques have grown to concern problems in a variety of industries, in various fields.

Course objectives: This course will enable students to

- Formulate optimization problem as a linear programming problem.
- Solve optimization problems using simplex method.
- Formulate and solve transportation and assignment problems.
- Apply game theory for decision making problems.

Course Outcomes (COs): After completing this course, students will be able to:

- Select and apply optimization techniques for various problems.
- Model the given problem as transportation and assignment problem and solve.
- Apply game theory for decision support system

Applications:

- Successful operations research(OR) applications can be found in a broad array of industries dealing with challenges such as planning, routing, scheduling, forecasting, process analysis and decision analysis.
- OR is also contributing greatly to health care services such as surgical and bed scheduling, emergency transport, accident trend analysis and treatment optimization.
- In the service sector, OR techniques have been found especially helpful when dealing with variability in service delivery such as call centers, queues for services and medical wait times.
- OR is also applied in various other fields such as agriculture, finance etc.

Module Wise Plan:

Module 1- INTRODUCTION, LINEAR PROGRAMMING – 1	**Planned Hours: 08**

Learning Objectives: The main objectives of this unit are to

1. The origin of OR
2. The major phases of OR study
3. Linear Programming, the most important technique used in the field of OR

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L1	Introduction: The origin, nature and impact of OR	Chalk and Board	1,2,3,5	a	1	T1/1, R1
L2	Defining the problem & gathering data	Chalk and Board			1	T1/1, R1
L3	Formulating a mathematical model, Deriving solutions from the model	Chalk and Board			1	T1/2, R1
L4	Testing the model, preparing to apply the model, implementation	Chalk and Board			1	T1/2,R1
L5	Introduction to Linear programming: prototype example	Chalk and Board			1	T1/3,R1
L6	The linear programming model	Chalk and Board			1	T1/3,R1
L7	Prototype example, Assumptions of LPP	Chalk and Board			1	T1/1, R1
L8	Formulation of LPP and Graphical method various examples	Chalk and Board			1	T1/1, R1

T1/1/2/3 : Text book number 1 in VTU syllabus and chapter number 1/2/3 in that text book.
R1 : Reference book number 1.

Assignment Questions:

Q.1.Briefly discuss the origin, nature and impact of Operations Research(OR).
Q.2.What is OR ?
Q.3.Explain briefly the applications of OR.
Q.4.Explain how to define the problem and gather data.
Q.5.Explain the formulation of a mathematical model.
Q.6.Explain how to derive solutions from the model.
Q.7.Discuss testing of the model.
Q.8.Explain the implementation of model.
Q.9.What are various phases of OR problems? Explain them briefly.
Q.10.What is meant by linear programming(LP) problem? Explain with an example.
Q.11.Solve problems on LP.
Q.12Explain briefly the graphical method of solving linear programming problems.
Q.13.Solve LP problems using graphical method.
Q.14.Define the following terms:
a)A feasible solution b)An infeasible solution b)The feasible region c)An optimal solution d)A corner point feasible(CPF) solution.

MODULE 2- SIMPLEX METHOD – 1	**Planned Hours: 08**

Learning Objectives: The main objectives of this unit are to

1. Assumptions of LP in the model formulation Explain assembly language in brief.
2. The simplex method for solving LP problems
3. Algebraic form and tabular form of the simplex method

Lesson Plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L9	Assumptions of LP	Chalk and Board	1,2,3,5	a	1,2	T1/4, R2
L10	Additional examples	Chalk and Board			1,2	T1/4, R2
L11	The essence of the simplex method	Chalk and Board			2	T1/4, R2
L12	Setting up the simplex method	Chalk and Board			2	T1/4, R2
L13	Algebra of the simplex method	Chalk and Board			2	T1/4, R2
L14	The simplex method in tabular form	Chalk and Board			2	T1/4, R2
L15	Tie breaking in the simplex method	Chalk and Board			2	T1/4, R2
L16	Big M method, Two phase method.	Chalk and Board			2	T1/4, R2

T1/4 : Text book number 1 in VTU syllabus and chapter number 4 in that text book.
R2 : Reference book number 2.

Assignment Questions:

Q.1.Explain the following terms w.r.t.linear programming
a)proportionality b)additively c)divisibility d)certainty e)perspective:
Q.2.Define the following terms:
a)slack variables b)an augmented solution c)a basic solution d)a basic feasible(BF) solution e) artificial variables f)surplus variables
Q.3.Solve problems to find basic solutions for a system of equations identifying in each case the basic and non basic variables.
Q.4.Explain the steps involved in simplex method.
Q.5.Solve Problems using simplex method.
Q.6.Solve problems using simplex method in tabular form.

Simplex Method – 2: Duality Theory	**Planned Hours: 08**

Learning Objectives: The main objectives of this unit are to

1. Other forms of LP model.
2. Typical steps in post optimality analysis.
3. Implementation of the simplex method.

4.Foundation of the simplex method.
5.The matrix of form of the simplex method.
6.The origin of dual problem.The relationships between the dual problem and the original problem(primal)

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L17	The essence of duality theory	Chalk and Board	1,2,3,5	a	2	T1/4, R2
L18	Primal dual relationship	Chalk and Board			2	T1/4, R2
L19	conversion of primal to dual problem	Chalk and Board			2	T1/4, R2
L20	conversion of dual to primal problem	Chalk and Board			2	T1/4, R2
L21	The dual simplex method	Chalk and Board			2	T1/4, R2
L22	Problems	Chalk and Board			2	T1/4, R2
L23	Problems	Chalk and Board			2	T1/4, R2
L24	Problems	Chalk and Board			2	T1/4, R2

Assignment Questions:

Q.1.Discuss artificial variable technique to convert other forms of LP model into standard form.
Q.2.Solve the radiation therapy problem using Big M method..
Q.3.Solve the radiation therapy problem using Two-Phase method..
Q.4.Solve problems using Big M method.
Q.5.Solve problems using Two-Phase method.
Q.6.Explain the concept of duality.
Q.7. Conversion from Primal to dual
Q.8. Conversion from dual to primal

Module 4 -Transportation and Assignment Problems:	**Planned Hours: 08**

Learning Objectives: The main objectives of this unit are to

1. Two important types of LP problems-transportation and assignment problems.
2. Transportation simplex method.
3. Hungarian method for assignment problems

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Book/ Chapter No.
L25	The transportation problem	Chalk and Board	1,2,3	a	3	T1/8 , R1, R2
L26	Initial Basic Feasible Solution (IBFS) by North West Corner Rule method	Chalk and Board			3	T1/8 , R1, R2
L27	Matrix Minima Method	Chalk and Board			3	T1/8 , R1, R2
L28	Vogel's Approximation Method	Chalk and Board			3	T1/8 , R1, R2
L29	Optimal solution by Modified Distribution Method (MODI)	Chalk and Board			3	T1/8 , R1, R2
L30	The Assignment problem; A Hungarian algorithm for the assignment problem	Chalk and Board			3	T1/8 , R1, R2
L31	Minimization and Maximization varieties in transportation and assignment problems	Chalk and Board			3	T1/8 , R1, R2
L32	problems	Chalk and Board			3	T1/8 , R1, R2

T1/8 : Text book number 1 in VTU syllabus and chapter number 8 in that text book.
R2 : Reference book number 2.

Assignment Questions:
Q.1.What are transportation problems?
Q.2.Briefly explain the steps used in transportation simplex method.
Q.3,Explain Northwest corner rule with an example.
Q.4.Explain Vogel's approximation method with an example.
Q.5.Explain Russell's approximation method with an example.
Q.6.Solve problems using transportation simplex method.
Q.7.What are assignment problems ?
Q.8.State the steps involved in Hungarian algorithm.
Q.9.Solve assignment problems.

Module – 5 Game Theory:	**Planned Hours: 07**

Learning Objectives: The main objectives of this unit are to

1. Game theory that deals with the general features of competitive situations.
2. Graphical solution for games with mixed strategies.
3. Decision making with experimentation and without experimentation.
4. Met heuristic ,a general solution method for developing a heuristic method.
5. Tabu search and simulated annealing, the widely used metaheuristics.
6. Genetic algorithms, the third type of metaheuristics.

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Book/ Chapter No.
L33	Game Theory: The formulation of two persons, zero sum games	Chalk and Board	1,2,3,5,6	a,c	3	T1/14, R1
L34	Solving simple games-a prototype example, games with mixed strategies	Chalk and Board			3	T1/14, R1
L35	Graphical solution procedure, solving by linear programming, extensions	Chalk and Board			3	T1/14, R1
L36	Decision analysis: a prototype example	Chalk and Board			3	T1/14, R1
L37	Decision making without experimentation	Chalk and Board			3	T1/14, R1
L38	Decision making with experimentation, decision trees	Chalk and Board			3	T1/14, R1
L39	Game Theory: The formulation of two persons, zero sum games	Chalk and Board			3	T1/14, R1
L40	PMetaheuristics: The nature of Metaheuristics, Tabu Search, Simulated Annealing, Genetic Algorithms.	Chalk and Board			3	T1/14, R1

T1/14 : Text book number 2 in VTU syllabus and chapter number 14 in that text book.
R1 : Reference book number 1.
R2 : Reference book number 2.

Assignment Questions:
Q.1.What are two-person, zero-sum games ?
Q.2.Explain the formulation of two-person, zero-sum games.
Q.3.Explain the 3 different methods for solving two-person, zero-um games.
Q.4.Solve problems on games.
Q.5.Explain decision making without experimentation.
Q.6.Explain decision making with experimentation.
Q.7.How to construct decision trees ?

Q.8.How to perform analysis on the constructed decision trees ?
Q.9.Explain the concept of Tabu Search.
Q.10.Explain the steps involved in Basic Tabu Search algorithm.
Q.11.Solve problems using Tabu Search algorithm

Tests	Portion
I. A -I	M 1,2
I.A-II	M 3,4
I.A -III	M 4,5

Course Coordinator **Module Coordinator**

6. PYTHON APPLICATION PROGRAMMING

Semester: VI **Year: 2017-18**

Subject Title: Python Application Programming	**Subject Code: 15CS664**
Total Contact Hours: 40	Duration of Exam : 03
Total Exam Marks: 80	Total IA Marks : 20
Staff : Prof. Santosh Chinchali	

MODULE - 1 **8 Hours**

Why should you learn to write programs, Variables, expressions and statements, Conditional execution, Functions

MODULE - 2 **8 Hours**

Iteration, Strings, Files

MODULE - 3 **8 Hours**

Lists, Dictionaries, Tuples, Regular Expressions

MODULE - 4 **8 Hours**

Classes and objects, Classes and functions, Classes and methods.

MODULE - 5 **8 Hours**

Networked programs, Using Web Services, Using databases and SQL

TEXT BOOKS:

1.Charles R. Severance, "Python for Everybody: Explor ing Data Using Python 3", 1 st Edition, CreateSpace Independent Publishing Platform, 2016.

2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press,2015

REFERENCE BOOKS:

1.Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014

2.Mark Lutz, "Programming Python", 4 th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873

3.Wesley J Chun, "Core Python Applications Programmin g", 3 rd Edition,Pearson Education India, 2015. ISBN-13: 978-9332555365

4.Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python",1 stEdition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176

5.Reema Thareja, "Python Programming using problem so lving approach", Oxford university press, 2017

PYTHON APPLICATION PROGRAMMING COURSE PLAN

1. Prerequisites:

This subject requires the student to have basic programming techniques and knowledge regarding current issues.

2. Overview of the course & its relevance to this program:

This course will enable students to

- Learn Syntax and Semantics and create Functions in Python.

- Handle Strings and Files in Python.
- Understand Lists, Dictionaries and Regular expressions in Python.
- Implement Object Oriented Programming concepts in Python
- Build Web Services and introduction to Network and Database Programmingin Python.

Course outcomes

The students should be able to:

- Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
- Demonstrate proficiency in handling Strings and File Systems.
- Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

3. Application:

More Efficient and easily understanding platform will enable the programmer to develop complex project in short duration.

Unit Wise Plan:
UNIT-1

Module Number/ Module Title : 01	Planned Hours: **08**

Learning Objectives: At the end of this Module student will be able to:

01	Creativity and motivation
02	Computer hardware architecture
03	Understanding programming
04	Words and sentences
05	Converting with python
06	Terminology: Interpreter and compiler
07	Values and types
08	Operators and keywords
09	expression
10	String operation
11	Conditional execution
12	Function call and type conversion
13	Writing a program and debugging

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L1	Computer hardware architechture	Chalk and Board		1,2	1	T1/1,R1
L2	Understanding program	Chalk and Board, ppt		1,2	1	T1/1, R1

L3	Words and sentences	Chalk and Board	2,3,5	1,2	1	T1/1, R1
L4	Conversion with python	Chalk and Board, ppt		1,2	1	T1/1, R1
L5	Interpreter and compiler	Chalk and Board, ppt		1,2	1	T1/1, R1
L6	Operators and keywords	Chalk and Board ,ppt		1,2	1	T1/2, R1
L7	Expression and string operation	Chalk and Board ,ppt		1,2	1	T1/2, R1
L8	Debugging	Chalk and Board ,ppt		1,2	1	T1/3, R1
L9	Conditional execution and alternative execution	Chalk and Board ,ppt		1,2	1	T1/3, R1
L10	Function call and type conversion	Chalk and Board ,ppt		1,2	1	T1/4, R1
L11	Parameters and arguments	Chalk and Board ,ppt		1,2	1	T1/4, R1

T1/1:Text book number 1 in VTU syllabus and chapter number 1 in that text book.
T1/2: Text book number 1 in VTU syllabus and chapter number 2 in that text book.
T1/3: Text book number 1 in VTU syllabus and chapter number 3 in that text book.
T1/4: Text book number 1 in VTU syllabus and chapter number 4 in that text book.
R1:Reference book number 1.

Assignment Questions:

Assignment Questions	COs attained
11. Explain creativity and motivation of learning python	1
12. Briefly explain computer hardware architechture	1
13. Explain conversing with python	1
14. Explain operators and keywords	1
15. Explain String operation with example	1
16. Explain Condition execution and alternative execution	1
17. Define function call and parameter passing techniques	1
18. Explain program writing and debugging	1

UNIT- II

Module Number/ Module Title : 02	Planned Hours: **08**

Learning objectives: At the end of this Module student will be able to**:**

01	Updating Variables
02	Looping statements
03	Debugging
04	String properties
05	String methods and parsing of strings
06	File operation like read, write, open
07	Try and catch

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L12	Variable updation and looping statements	Chalk and Board	1,3,5,	1,2	2	T1/5,R1
L13	Program writing debugging	Chalk and Board		1,2	2	T1/5,R1
L14	String properties	Chalk and Board		1,2	2	T1/6,R1
L15	String methods and parsing strings	Chalk and Board		1,2	2	T1/6,R1
L16	File operation	Chalk and Board		1,2	2	T1/7,R1
L17	Try and catch	Chalk and Board		1,2	2	T1/7,R1
L18	Searching through file	Chalk and Board		1,2	2	T1/7,R1

T1/5: Text book number 1 in VTU syllabus and chapter number 5 in that text book.
T1/6: Text book number 1 in VTU syllabus and chapter number 6 in that text book.
T1/7: Text book number 1 in VTU syllabus and chapter number 7 in that text book.
R1:Reference book number 1.

Assignment Questions:

Assignment Questions	COs attained
9. Explain how to update variable.with proper example	2
10. Expain Looping Statements with syntax of each	2
11. Explain Debugging function	2
12. Find length of strings	2
13. Explain parsing of string	2
14. Explain Searching of a file with an example	2
15. Explain different file operation	2
16. Discuss try and catch.	2

UNIT - III

Module Number/ Module Title : 03	**Planned Hours: 08**

Learning Objectives: At the end of this Module student will be able to:

01	A list of sequence
02	List of operation
03	Deleting elements
04	Objects and values
05	Dictionaries as a set of counters
06	Adavanced text parsings
07	Tuples and immutable

08	Comparing tuples
09	Using tuple as a keys in dictionaries
10	Regular expression
11	Characters in regular expression
12	Combining searching and extraction

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L19	Introduction a list of sequences	Chalk and Board	2,3,5	1,2	3	T1/8,R1
L20	List operation, deleting elements	Chalk and Board		1,2	3	T1/8,R1
L21	Dictionaries as asset of counters,looping and dictionaries	Chalk and Board		1,2	3	T1/9,R1
L22	Advanced text parsing	Chalk and Board		1,2	3	T1/9,R1
L23	Tuple ,dictionaries and tuple	Chalk and Board		1,2	3	T1/10,R1
L24	Regular expression ,charcters in RE	Chalk and Board		1,2	3	T1/11,R1
L25	Escape charactes in RE	Chalk and Board		1,2	3	T1/11,R1

T1/8: Text book number 1 in VTU syllabus and chapter number 8 in that text book.
T1/9: Text book number 1 in VTU syllabus and chapter number 9 in that text book.
T1/10: Text book number 1 in VTU syllabus and chapter number 10 in that text book.
T1/11: Text book number 1in VTU syllabus and chapter number 11 in that text book.
R1:Reference book number 1.

Assignment Questions:

Assignment Questions	COs attained
1. Explain list of sequences with syntax.	3
2. Write a program to delete element from list	3
3. Explain objects and values.	3
4. Explain looping and dictionaries.	3
5. Explain how to use tuple as keys in dictionaries	3
6. Explain regular expression with charter matching.	3
7. Discuss combing ,searching in regular expression	3
8. Write a program to match character in regular exprssion	3

UNIT -IV

Module Number/ Module Title : 04	Planned Hours: 08

Learning Objectives: At the end of this Module student will be able to:

01	Programmer defined types

02	Attributes,rectangles
03	Copying and debugging
04	Time and pure functions
05	Prototype and versus planning
06	Object orientation features
07	Printing objects and init method
08	Operator overloading
09	Polymorphism
10	Interface and implementation

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L25	Programmer defined types	Chalk and Board	2,3,5,9	1,2,3	4	T2/15,R1
L26	Attributes and rectangles	Chalk and Board		1,2,3	4	T2/15,R1
L27	Copying and debugging	Chalk and Board		1,2,3	4	T2/16,R1
L28	Time and pure functions	Chalk and Board		1,2,3	4	T2/16,R1
L29	Object orientation features ,printing objects	Chalk and Board		1,2,3	4	T2/17,R1
L30	Init method,operator overloading	Chalk and Board		1,2,3	4	T2/17,R1
L31	Polymorphism	Chalk and Board		1,2,3	4	T2/17,R1
L32	Interface and implementation	Chalk and Board		1,2,3	4	T2/17,R1

T2/15: Text book number 2 in VTU syllabus and chapter number 15 in that text book.
T2/16: Text book number 2 in VTU syllabus and chapter number 16 in that text book.
T2/17: Text book number 2 in VTU syllabus and chapter number 17 in that text book.

R1: Reference book number 1.

Assignment Questions:

Assignment Questions	COs attained
1. Explain attributes,rectangles in brief	4
2. Explain copying and debugging	4
3. Discuss object mutable	4
4. Write a program on time and pure functions	4
5. Explain prototype and versus planning	4
6. Discuss object orientation features	4
7. Explain operator overloading with syntax	4
8. Explain polymorphism with syntax	4
9. Explain interface and implementation	4

UNIT –V

Module Number/ Module Title : 05	Planned Hours: 08

Learning Objectives: At the end of this Module student will be able to:

01	Introduction to HTTP
02	Retrieve image over HTTP
03	Parsing RE
04	Xtensible markup language-XML
05	Parsing of XML
06	Explaination of javascript object notation
07	Application programming interface
08	Managing larger program
09	Encapsulation
10	Classes and types
11	Objet life cycle and inheritance
12	Database ,creating db
13	Basic data modeling,programming with multiple tables

Lesson plan:

Lecture No.	Topics Covered	Teaching Method	POs attained	PSOs attained	COs attained	Reference Book/ Chapter No.
L33	Introduction to hyper text markup language-HTTP	Chalk and Board	2,3,5,9	1,2,3	5	T1/12,R1
L34	Retrieve image over HTTP	Chalk and Board		1,2,3	5	T1/12,R1
L35	Parsing beautiful Soup	Chalk and Board		1,2,3	5	T1/12,R1
L36	Introduction to XML	Chalk and Board		1,2,3	5	T1/13,R1
L37	Javascript object notation and parsing of it	Chalk and Board		1,2,3	5	T1/13,R1
L38	Crating API's	Chalk and Board		1,2,3	5	T1/13,R1
L39	Managing large programs	Chalk and Board		1,2,3	5	T1/14,R1
L40	Encapsulation	Chalk and Board		1,2,3	5	T1/14,R1
L41	Classes and types	Chalk and Board		1,2,3	5	T1/14,R1
L42	Inheritance,database	Chalk and Board		1,2,3	5	T1/15,R1
L43	Creating database and basic data modeling	Chalk and Board		1,2,3	5	T1/15,R1

T1/12: Text book number 1 in VTU syllabus and chapter number 12 in that text book.
T1/13: Text book number 1 in VTU syllabus and chapter number 13 in that text book.
T1/14: Text book number 1 in VTU syllabus and chapter number 14 in that text book.
T1/15: Text book number 1 in VTU syllabus and chapter number 15 in that text book.
R1: Reference book number 1.

Assignment Questions:

Assignment Questions	COs attained
1. Write a program to retrieve image over HTTP	5
2. Explain parsing if regular expression	5
3. Explain parsing of XML	5
4. Write a note on javascript object notation	5
5. Explain how to manage large programs	5
6. Discuss classes and types	5
7. Explain inheritance	5
8. Design database browser for SQLITE	4

Assignment -1

Assignment Questions	COs attained
1.Computer hardware architecture	1
2.Terminology: Interpreter and compiler	1
3.Function call and type conversion	1
4.Writing a program and debugging	1
5.Explain Searching of a file with an example	2
6.Explain different file operation	2
7.Explain Debugging function	2

Assignment -2

Assignment Questions	COs attained
1. Explain list of sequences with syntax.	3
2. Explain looping and dictionaries.	3
3. Explain regular expression with charter matching.	3
4. Explain attributes,rectangles in brief	4
5. Explain copying and debugging	4
6. Explain operator overloading with syntax	4

Assignment -3

Assignment Questions	COs attained
1. Write a program to retrieve image over HTTP	5
2. Explain parsing of XML	5
3. Write a note on javascript object notation	5
4. Explain how to manage large programs	5
5. Explain inheritance	5

I.A. TEST PORTION:

Test	Module	COs attained
I I.A. Test	I, II	1,2
II I.A. Test	III,IV	3,4
III I.A. Test	V	5

COURSE COORDINATOR **MODULE COORDINATOR**

SOFTWARE TESTING LABORATORY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15ISL67	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Analyze the requirements for the given problem statement
- Design and implement various solutions for the given problem
- Employ various design strategies for problem solving.
- Construct control flow graphs for the solution that is implemented
- Create appropriate document for the software artifact

Description (If any):

Design, develop, and implement the specified algorithms for the following problems using any language of your choice under LINUX /Windows environment.

Lab Experiments:

1. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results.

2. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

3. Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.

4. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.

5. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.

6. Design, develop, code and run the program in any suitable language to implement the NextDate function. Analyze it from the perspective of equivalence class value testing, derive different test cases, execute these test cases and discuss the test results.

7. Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.
8. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.
9. Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.
10. Design, develop, code and run the program in any suitable language to implement the binary search algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
11. Design, develop, code and run the program in any suitable language to implement the quicksort algorithm. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results.
12. Design, develop, code and run the program in any suitable language to implement an absolute letter grading procedure, making suitable assumptions. Determine the basis paths and using them derive different test cases, execute these test cases and discuss the test results

Study Experiment / Project:

1. Design, develop, code and run the program in any suitable language to solve the triangle problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.

2. Design, develop, code and run the program in any suitable language to solve the Nextdate problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.

Course outcomes: The students should be able to:

- List out the requirements for the given problem
- Design and implement the solution for given problem in any programming language(C,C++,JAVA)
- Derive test cases for any given problem
- Apply the appropriate technique for the design of flow graph.
- Create appropriate document for the software artifact.

FILE STRUCTURES LABORATORY WITH MINI PROJECT
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2016 -2017)
SEMESTER – VI

Subject Code	15ISL68	IA Marks	20
Number of Lecture Hours/Week	01I + 02P	Exam Marks	80
Total Number of Lecture Hours	40	Exam Hours	03

CREDITS – 02

Course objectives: This course will enable students to

- Apply the concepts of Unix IPC to implement a given function.
- Measure the performance of different file structures
- Write a program to manage operations on given file system.
- Demonstrate hashing and indexing techniques

Description (If any):

Design, develop, and implement the following programs

Lab Experiments:

PART A

1. Write a program to read series of names, one per line, from standard input and write these names spelled in reverse order to the standard output using I/O redirection and pipes. Repeat the exercise using an input file specified by the user instead of the standard input and using an output file specified by the user instead of the standard output.
2. Write a program to read and write student objects with fixed-length records and the fields delimited by "|". Implement pack ( ), unpack ( ), modify ( ) and search ( ) methods.
3. Write a program to read and write student objects with Variable - Length records using any suitable record structure. Implement pack ( ), unpack ( ), modify ( ) and search ( ) methods.
4. Write a program to write student objects with Variable - Length records using any suitable record structure and to read from this file a student record using RRN.
5. Write a program to implement simple index on primary key for a file of student objects. Implement add ( ), search ( ), delete ( ) using the index.
6. Write a program to implement index on secondary key, the name, for a file of student objects. Implement add ( ), search ( ), delete ( ) using the secondary index.
7. Write a program to read two lists of names and then match the names in the two lists using Consequential Match based on a single loop. Output the names common to both the lists.
8. Write a program to read k Lists of names and merge them using k-way merge algorithm with k = 8.

Part B --- Mini project:

Student should develop mini project on the topics mentioned below or similar applications

Document processing, transaction management, indexing and hashing, buffer management, configuration management. Not limited to these. Course outcomes: The

students should be able to:

- Implement operations related to files
- Apply the concepts of file system to produce the given application.
- Evaluate performance of various file systems on given parameters.

Conduction of Practical Examination:

1. All laboratory experiments from part A are to be included for practical examination.
2. Mini project has to be evaluated for 30 Marks as per 6(b).
3. Report should be prepared in a standard format prescribed for project work.
4. Students are allowed to pick one experiment from the lot.
5. Strictly follow the instructions as printed on the cover page of answer script.
6. Marks distribution:
    a) Part A: Procedure + Conduction + Viva:10 + 35 +5 =50 Marks
    b) Part B: Demonstration + Report + Viva voce = 15+10+05 = 30 Marks
7. Change of experiment is allowed only once and marks allotted to the procedure part to be made zero.

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10IS63

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
File Structures

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. What are the three distinct operations that contribute to the total cost of access on disk? **(04 Marks)**

b. Implement UNIX command grep. Display output of your program on standard output. **(06 Marks)**

c. Explain the following functions:
i) Open a file
ii) Close a file. **(10 Marks)**

2 a. What is a record? Explain different methods for organizing records of a file with example. **(11 Marks)**

b. Explain the concept of Inheritance using the I/O buffer class hierarchy. **(06 Marks)**

c. Explain the tools available in UNIX for sequential processing of file. **(03 Marks)**

3 a. Briefly explain with example how spaces can be reclaimed dynamically in fixed length records. **(08 Marks)**

b. Explain the different operations required to maintain indexed file. **(12 Marks)**

4 a. Explain how co-sequential is implemented in a general ledger program. **(10 Marks)**

b. Explain with an example, the K-way merge algorithm. **(10 Marks)**

PART – B

5 a. In detail, discuss paged binary tree. What are its advantages and disadvantages? **(10 Marks)**

b. What is B-tree? Explain deletion, merging and redistribution of elements on B-tree. **(10 Marks)**

6 a. What is indexed sequential access? Explain the block splitting and merging due to insertion and deletion in sequence set with example. **(10 Marks)**

b. With a diagram, explain simple prefix B^+ trees and its maintenance. **(10 Marks)**

7 a. What is hashing? Explain the simple hashing algorithm with example. **(10 Marks)**

b. What is collision? Explain the process of collision resolution by progressive over flow technique. **(10 Marks)**

8 a. Explain the working of extendible hashing in detail. **(10 Marks)**

b. Write short notes on:
i) Pinned records
ii) Dynamic hashing. **(10 Marks)**

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10IS63

Sixth Semester B.E. Degree Examination, June/July 2016
File Structures

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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PART – A

1 a. Explain briefly the evolution of file structures design. **(05 Marks)**

b. Suppose it is needed to store a backup of a large mailing list with one million records of 1 hundred bytes record on a 2400 foot reels of 6250 bpi –tape with an internal block gap of 0.3 inch and tape speed is 200 inches per second.
i) What would be the minimum blocking factor required to fit the file on to the tape?
ii) If a blocking factor of 50 is used how long would it take to read one block including the gap?
iii) How long it would take to read to entire file? **(08 Marks)**

c. Explain the functions of READ, WRITE and SEEK with parameters. **(07 Marks)**

2 a. What are the different ways of adding structures to a file to maintain the identity of fields ? **(10 Marks)**

b. Explain the concept of inheritance using I/O buffer class hierarchy. **(06 Marks)**

c. Define the following terms:
i) File access method ii) Meta-data iii) RRN iv) Template class. **(04 Marks)**

3 a. How spaces can be reclaimed from deletion of records from fixed length record file and variable length record file? **(10 Marks)**

b. What is data compression? Explain different techniques available for data compression. **(10 Marks)**

4 a. Explain the object-oriented model for implementing co-sequential process. **(08 Marks)**

b. With example, explain K-Way merge and selection tree for merging large number of lists. **(06 Marks)**

c. Write a algorithm for heap sorting method for insertion. Show the construction of heap tree for following sequence FDCGHIBEA **(06 Marks)**

PART – B

5 a. Define a B-tree. Explain the creation of a B-tree, with examples. **(10 Marks)**

b. What are the properties of B-tree? Explain worst case search. **(06 Marks)**

c. List the four properties of B* trees. **(04 Marks)**

6 a. With an example, explain adding a simple index to the sequence set. **(10 Marks)**

b. Explain how to load a simple prefix B+ tree. **(10 Marks)**

7 a. Suppose that 1000 locations are allocated to hold 700 records in randomly hashed file and that each address can hold 4 records (bucket size = 4). Compute the following values:
   i) The packing density.
   ii) The expected number of addresses with no records assigned to them by hash function.
   iii) The expected number of addresses with exactly one record assigned.
   iv) The expected number of addresses with one record plus one or more synonyms.
   v) The expected number of overflow records assuming that only 4 records can be assigned to each home address. **(10 Marks)**

   b. Explain the different collision resolution techniques. **(10 Marks)**

8 a. Explain how extendible hashing works. **(10 Marks)**

   b. Write short notes on:
   i) Dynamic hashing.
   ii) Storage fragmentation. **(10 Marks)**

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10IS63

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016

File Structures

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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PART – A

1 a. What do you mean by file structure? Explain in brief a short history of file structure design. **(04 Marks)**

b. Bring out the differences between physical files and logical files. **(05 Marks)**

c. Define the following terms :
i) Seek time ii) Rotational Delay iii) Transfer time **(06 Marks)**

d. With neat sketch, explain UNIX directory structure. **(05 Marks)**

2 a. What do you mean by a record? Explain different methods for organizing records of a file with an example. **(10 Marks)**

b. Explain the tools available in UNIX for sequential processing of a file. **(04 Marks)**

c. Write a Pack( ) and unpack ( ) methods in C++ for employee id, employee name, employee designation, employee contact number fields for variable length records. **(06 Marks)**

3 a. Explain the different limitations of binary searching and internal sorting. **(06 Marks)**

b. Explain the algorithm for keysort. **(06 Marks)**

c. Explain the different operations required to maintain an indexed file. **(08 Marks)**

4 a. Explain how co – sequential processing is implemented in a general ledger program. **(10 Marks)**

b. Explain how much time merge sort takes to sort a given file. **(10 Marks)**

PART – B

5 a. What do you mean by B – tree? Explain deletion, merging and redistribution of elements on B – tree. **(10 Marks)**

b. What are paged binary trees? Explain the problems associated with paged binary trees. **(06 Marks)**

c. Mention the four properties of B* trees. **(04 Marks)**

6 a. Define indexed sequential access. Explain the block splitting and merging due to insertion and deletion in a sequence set with example. **(10 Marks)**

b. Explain simple prefix B^1 trees and its maintenance. **(10 Marks)**

7 a. What do you mean by hashing? Explain the simple hashing algorithm with example. **(10 Marks)**

b. What is collision? Explain the process of collision resolution by progressive overflow. **(10 Marks)**

8 Write a short note on :
i) Linear Hashing ii) AVL trees
iii) Strengths and weakness of CD Rom iv) Pinned Records. **(20 Marks)**

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10IS65

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Software Testing

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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PART – A

1 a. What are Test cases? Explain approaches used to identify test cases. **(06 Marks)**

b. Explain:
   i) Currency converter
   ii) Saturn wind shield wiper controller. **(08 Marks)**

c. Briefly explain testing using Venn Diagram. **(06 Marks)**

2 a. Explain Decision table testing and generate test cases for triangle problem using decision table. **(08 Marks)**

b. Develops test cases for commission problem using Boundary value testing. **(06 Marks)**

c. Give the Guidelines and observations for equivalence class testing. **(06 Marks)**

3 a. Explain in detail Basis path testing with respect to triangle problem. **(10 Marks)**

b. Define def/use pair and identify def/use paths for commission problem. **(10 Marks)**

4 a. Explain why it is essential to separate integration and system testing. **(08 Marks)**

b. Define MM path graph. Draw MM paths in SATM system. **(12 Marks)**

PART – B

5 a. Briefly explain process of generating system level SATM test Threads. **(10 Marks)**

b. Explain four basic types of interactions. **(10 Marks)**

6 a. Explain validation and verification. **(06 Marks)**

b. Explain : i) Visibility ii) Feedback iii) Dependability
   iv) MTBF v) Availability. **(10 Marks)**

c. Write a short note on Software quality goals. **(04 Marks)**

7 a. What is fault based testing? What are assumptions in fault base testing? **(06 Marks)**

b. Explain : i) scaffolding ii) Test oracles
   iii) Capture and Replay iv) Test case specification. **(10 Marks)**

c. Write a note on mock. **(04 Marks)**

8 a. Briefly explain test and Analysis strategies. **(10 Marks)**

b. Explain root cause analysis technique for improving the process. **(10 Marks)**

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10IS65

Sixth Semester B.E. Degree Examination, June/July 2016
Software Testing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. What is software testing? Why it is so important in software development life cycle? **(06 Marks)**

b. Define the following : i) Error ii) fault iii) failure iv) incident v) test vi) test case. **(06 Marks)**

c. Explain with a neat diagram the currency converter and Saturn wind shield wiper controller. **(08 Marks)**

2 a. Justify the usage of boundary value analysis with function of two variables and highlight the limitations of BVA. **(08 Marks)**

b. Briefly explain weak normal and strong robust equivalence class testing with an example. **(08 Marks)**

c. Write a short note on random testing. **(04 Marks)**

3 a. What is cyclomatic complexity? Explain how to calculate cyclomatic complexity of a given program by considering the biggest of three number logic. **(08 Marks)**

b. Explain slice –based testing guidelines and observations in detail. **(08 Marks)**

c. Write a short note on define/use testing. **(04 Marks)**

4 a. With a neat diagram explain the waterfall life cycle and clearly show partial functional decomposition of the ATM system. **(08 Marks)**

b. List and explain pros and cons of the water fall model. **(04 Marks)**

c. With supporting diagrams and examples explain top-down and bottom-up integration. **(08 Marks)**

PART – B

5 a. Explain the basis concept for requirements specification. **(12 Marks)**

b. Explain with supporting diagram the client server testing. **(08 Marks)**

6 a. Define validation. With a neat sketch explain the relation of verification and validation activities with respect to artifacts produced in a software development project. **(10 Marks)**

b. Explain sensitivity and redundancy. **(06 Marks)**

c. Define the terms reliability and availability. **(04 Marks)**

7 a. Distinguish between :

i) Competent programmer hypothesis and coupling effect hypothesis

ii) Distinguished mutant and equivalent mutant. **(04 Marks)**

b. Explain the fault–based adequacy criteria. **(08 Marks)**

c. What is scaffolding? Explain briefly generic versus specific scaffolding. **(08 Marks)**

8 Write short notes on :

a. Clean room process. **(06 Marks)**

b. Different types of risks specific to the quality process. **(06 Marks)**

c. A standard organization of an analysis and test plan. **(08 Marks)**

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Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Software Testing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Why do we test software? Discuss what a typical test case information should include. **(07 Marks)**

b. Differentiate between black box testing and white box testing. **(05 Marks)**

c. Explain the levels of abstraction and testing in the waterfall model. **(08 Marks)**

2 a. What is boundary value analysis? Write the test cases using boundary value analysis testing for triangle problem. **(07 Marks)**

b. Define equivalence class testing. Write weak robust equivalence class testing for commission problem. **(06 Marks)**

c. Write the decision table for triangle problem and discuss how well decision table testing deals with multiple fault assumption. **(07 Marks)**

3 a. Explain metric based testing. **(08 Marks)**

b. Using Mc-Cabe's strongly connected graph, write the path/edge traversal. **(09 Marks)**

c. Draw the lattice on sales and communication. (Hint slices on sales and commission). **(03 Marks)**

4 a. Define regression and progression testing. **(04 Marks)**

b. Draw the context diagram of the SATM system and explain the same. **(08 Marks)**

c. Draw the PIN entry finite machine, explain with corresponding screens. **(08 Marks)**

PART – B

5 a. What is decomposition–based integration? Explain any one of them with an example. **(07 Marks)**

b. Define thread. How do we test them? **(05 Marks)**

c. Explain atomic system function testing by taking an example of next date. **(06 Marks)**

d What is interaction testing? **(02 Marks)**

6 a. Validation activities check work product against actual user requirement while verification activities check consistency of work product – justify your answer with suitable diagram and explanation. **(07 Marks)**

b. Write six principles which constitute the core of software testing. **(06 Marks)**

c. List the goals of quality process. **(04 Marks)**

d. Can a system be correct and yet unsafe? **(03 Marks)**

7 a. Write the fault based testing terminology and assumptions. **(06 Marks)**

b. What is scaffolding? What purposes it serves, explain with an example. **(06 Marks)**

c. What are test oracles? Explain comparison based oracle. **(05 Marks)**

d. Write about a paragraph on any one :
i) Self-checks on oracles ii) Capture and replay. **(03 Marks)**

8 a. Based on test and analysis strategies explain any one :
i) Clean room
ii) Software reliability engineered testing
iii) Extreme programming. **(07 Marks)**

b. Explain risk management in the quality plan. **(10 Marks)**

c. What is test and analysis report. **(03 Marks)**

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10CS53

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Operating Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Differentiate between multiprogramming and multiprocessing. **(05 Marks)**

b. Explain the various functions of operating system with respect to process and memory management. **(05 Marks)**

c. What are the different ways in which the Pthread terminates? **(05 Marks)**

d. Explain any two facilities provided for implementing interacting process in programming language and operating system. **(05 Marks)**

2 a. Differentiate between :

i) User level and kernel level threads

ii) Process and thread. **(06 Marks)**

b. Following is the snapshot of a cpu

Process	CPU Burst	Arrival time
P_1	10	0
P_2	29	1
P_3	03	2
P_4	07	3

Draw Gantt charts and calculate the waiting and turnaround time using FCFS, SJF and RR with time quantum 10 scheduling algorithms. **(09 Marks)**

c. Explain different scheduling criteria that must be kept in mind while choosing different scheduling algorithms. **(05 Marks)**

3 a. Explain critical section problem. What are the requirements that critical section problem must satisfy? **(05 Marks)**

b. Explain Reader's – writers problem and provide a semaphore solution using semaphore's for reader's priority problem. **(10 Marks)**

c. What are monitors? Compare with semaphores with their relative advantages and disadvantages. **(05 Marks)**

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4 a. Consider a system containing m resources of the same type being shared by n processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock free if the following two conditions hold :
i) The maximum need of each process is between 1 and m resources
ii) The sum of all maximum needs is less than m + n. **(10 Marks)**

b. For the given snapshot :

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_1	0	0	1	2	0	0	1	2	1	5	2	0
P_2	1	0	0	0	1	7	5	0				
P_3	1	3	5	4	2	3	5	6				
P_4	0	6	3	2	0	6	5	2				
P_5	0	0	1	4	0	6	5	6				

Using Banker's algorithm :
i) What is the need matrix content?
ii) Is the system in safe state?
iii) If a request from process P2(0, 4, 2, 0) arrives, can it be granted? **(10 Marks)**

PART – B

5 a. What is locality of reference? Differentiate between paging and segmentation. **(05 Marks)**
b. Explain the differences between :
i) Logical and physical address space
ii) Internal and external fragmentation. **(05 Marks)**
c. For the following page reference calculate the page faults that occur using FIFO and LRU for 3 and 4 page frames respectively : 5, 4, 3, 2, 1, 4, 3, 5, 4, 3, 2, 1, 5. **(10 Marks)**

6 a. What are the different techniques with which a file can be shared among users? **(06 Marks)**
b. Given memory partitions of 100 k, 500 k, 200 k, 600 k (in order), which algorithm from best fit, worst fit and first fit places processes with requirements 212 k, 417 k, 112 k and 426 k in an efficient manner? **(06 Marks)**
c. Explain the various storage mechanisms available to store files, with near diagram. **(08 Marks)**

7 a. Given the following queue 95, 180, 34, 119, 11, 123, 62, 64 with head initially at track 50 and ending at track 199 calculate the number of moves using FCFS, SSTF, Elevator and C look algorithm. **(12 Marks)**
b. What are access matrices? Explain its implementation. **(04 Marks)**
c. Differentiate between protection and security. **(04 Marks)**

8 a. Explain the different IPC mechanism available in Linux. **(08 Marks)**
b. Explain how process is managed on Linux platform. **(08 Marks)**
c. Write a brief note on the design principles of Linux. **(04 Marks)**

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10CS53

Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Operating Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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PART – A

1 a. Distinguish between the following pairs of terms :
   i) Symmetric and asymmetric multiprocessor systems
   ii) Cpu burst and I/O burst jobs
   iii) User's view and systems view of OS
   iv) Batch systems and time sharing systems
   v) User mode and kernel mode operations. **(10 Marks)**

   b. List the three main advantages of multiprocessor systems. Also bring out the difference between graceful degradation and fault tolerance in this context. **(05 Marks)**

   c. What are virtual machines? How are they implemented? **(05 Marks)**

2 a. What is a process? What are the states a process can be in? Give the process state diagram clearly indicating the conditions for a process to shift from one state to another. **(08 Marks)**

   b. What are the merits of inter process communication? Name the two major models of inter process communication. **(06 Marks)**

   c. What is a thread? What is need for multithreaded processes? Indicate the four major categories of benefits derived from multi threaded programming. **(06 Marks)**

3 a. What is a critical section problem? What requirements should a solution to critical section problem satisfy? State Peterson's solution and indicate how it satisfies the above requirements. **(10 Marks)**

   b. Explain the operation of semaphores. Bring out how their operation may lead to priority inversion. **(10 Marks)**

4 a. Define deadlock. What are the necessary conditions for deadlock to occur? Indicate how many of these should occur for dead lock to happen? **(10 Marks)**

   b. State and explain banker's algorithm for deadlock avoidance. **(10 Marks)**

PART – B

5 a. What is the principle behind paging? Explain its operation, clearly indicating how the logical addresses are converted to physical addresses. **(10 Marks)**

   b. A hypothetical main memory can store only 3 frames simultaneously. The sequence in which the pages will be required is given below:
   7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1 (Twenty operations).
   Indicate the sequence in which the three frames will be filled in i) FIFO ii) Optimal Page Replacement and iii) Least Recently used methods of page replacement. Indicate number of page faults in each case. **(10 Marks)**

6 a. List any five typical file attributes and any five file operations indicating their purpose in one line each. **(10 Marks)**

   b. Briefly explain the methods of keeping track of free space on disks. **(10 Marks)**

7 a. What is disk scheduling? Discuss different disk scheduling techniques. **(12 Marks)**

   b. Explain the capability lists methods of implementing access matrix. **(08 Marks)**

8 a. How does Linux achieve interprocess communication? **(10 Marks)**

   b. How does Linux manage authentication and access control mechanisms **(10 Marks)**

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10CS53

Fifth Semester B.E. Degree Examination, June/July 2017
Operating Systems

Time: 3 hrs. Max. Marks: 100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. What is operating system? Explain multiprogramming and time sharing systems. **(06 Marks)**

b. Explain dual mode operation in OS with a neat block diagram. **(04 Marks)**

c. What are system calls? Briefly point out its types. **(04 Marks)**

d. What are virtual machines? Explain with block diagram. Point out its benefits. **(06 Marks)**

2 a. Why is it important for the scheduler to distinguish I/O bound programs from CPU bound programs? **(02 Marks)**

b. What is interprocess communication? Explain its types. **(06 Marks)**

c. Consider the following set of processes, with the length of the CPU burst given in milliseconds.

Process	Burst time	Priority
P_1	10	3
P_2	1	1
P_3	2	3
P_4	1	4
P_5	5	2

The processes are assumed to have arrived in the order P_1, P_2, P_3, P_4, P_5 all at time 0.

(i) Draw the Gantt charts for the following scheduling algorithms, FCFS, SJF and RR (quantum = 1)

(ii) Find out turn around time and waiting time of each process for each of these scheduling algorithm and also find out average turn around time and average waiting time. **(12 Marks)**

3 a. Define Semaphores. Explain its usage and implementation. **(06 Marks)**

b. What are monitors? Explain its usage and implementation. **(08 Marks)**

c. Explain Dining philosophers solution using monitors. **(06 Marks)**

4 a. What are deadlocks? What are its characteristics? **(05 Marks)**

b. Consider the following snapshot of a system:

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

(i) Find out need matrix. **(02 Marks)**

(ii) If a request from process P_1 arrived for (0, 4, 2, 0) can the request be granted immediately? **(02 Marks)**

(iii) Is the system in a safe state? **(06 Marks)**

c. Explain the process of recovery from deadlock. **(05 Marks)**

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PART – B

5 a. Explain the multistep processing of a user program with a neat block diagram. **(05 Marks)**

b. Distinguish between internal and external fragmentation. **(02 Marks)**

c. Explain segmentation with an example. **(06 Marks)**

d. Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2		
90	100	
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

(i) 0, 430 (ii) 1, 10 (iii) 2, 500 (iv) 3, 400 (v) 4, 112 **(07 Marks)**

6 a. Explain briefly the various operations performed on files. **(06 Marks)**

b. Explain the various access method of files. **(06 Marks)**

c. Explain various allocation methods in implementing file systems. **(08 Marks)**

7 a. Explain the various Disk Scheduling algorithms with example. **(10 Marks)**

b. Point out and explain briefly the problems with RAID. **(05 Marks)**

c. Explain Access Matrix method of system protection. **(05 Marks)**

8 a. Explain the various components of a Linux system. **(06 Marks)**

b. Explain process scheduling in a linux system. **(06 Marks)**

c. Explain file systems implementation in linux. **(08 Marks)**

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10CS/IS661

Sixth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART - A

1 a. Define Operation Research. List and briefly explain the phases of Operations Research. **(08 Marks)**

b. Solve the following LPP by graphical method.

Min $Z = 20x_1 + 10x_2$

Constraints $x_1 + 2x_2 \leq 40$

$3x_1 + x_2 \geq 30$

$4x_1 + 3x_2 \geq 60$

$x_1, x_2 \geq 0$ **(06 Marks)**

c. A farmer has 100 acres of form. He can sell all tomatoes, lettuce or radishes and can raise the price to obtain Re 1.00 per kg for tomatoes, Rs 0.75 ahead for lettuce and Rs 2.00 per kg for radishes. The average yield per acre is 2000kg of tomatoes, 3000 heads of lettuce, and 1000 kgs of radishes. Fertilizers are available at Rs 0.50 per kg and the amount required per acre is 100 kgs each for tomatoes and lettuce and 50 kgs for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man – days for tomatoes and radishes and 6 man – days for lettuce. A total of 400 man – days of labour are available at Rs 20.00 per man – day. Formulate this problem as a linear programming model to maximize the farmer's total profit. **(06 Marks)**

2 a. Explain 6 basic assumptions of Simplex method. **(06 Marks)**

b. Solve the following LPP using Simplex method. **(10 Marks)**

Max $Z = 3x_1 + 2x_2 + 5x_3$

Constraints $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0.$

c. Write a brief note on 'Unbounded solution' and 'Infeasible solution' of Simplex method. **(04 Marks)**

3 a. Solve using 'Big – M' method.

Min $Z = 12x_1 + 20x_2$

Constraints $6x_1 + 8x_2 + \geq 100$

$7x_1 + 12x_2 \geq 120$

$x_1, x_2 \geq 0.$ **(10 Marks)**

b. Solve using '2 – Phase' method.

Max $Z = 5x_1 - 4x_2 + 3x_3$

Constraints $2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$

$x_1, x_2, x_3 \geq 0.$ **(10 Marks)**

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4 a. List any 5 differences between Simplex (Primal) and Dual Simplex method. **(05 Marks)**

b. Give the dual of the following problem

Max $Z = x + 2y$

Constraints $2x + 3y \geq 4$

$3x + 4y = 5$; $x \geq 0$, y is unrestricted. **(05 Marks)**

c. Use 'Revised Simplex method' to solve the following LPP.

Max $Z = x_1 + 2x_2$

Constraints $x_1 + x_2 \leq 3$

$x_1 + 2x_2 \leq 5$

$3x_1 + x_2 \leq 6$; $x_1, x_2 \geq 0$. **(10 Marks)**

PART - B

5 a. Use 'Dual Simplex method' to solve the following LPP

Min $Z = 5x_1 + 6x_2$

Constraints $x_1 + x_2 \geq 2$

$4x_1 + x_2 \geq 4$

$x_1, x_2 \geq 0$. **(10 Marks)**

b. Solve the following LPP using 'Branch and Bound' technique

Max $Z = 7x_1 + 9x_2$

Constraints $-x_1 + 3x_2 \leq 6$

$7x_1 + x_2 \leq 35$

$x_2 \leq 7$

$x_1, x_2 \geq 0$. **(10 Marks)**

6 a. Find an optimal solution after obtaining the IBFS using 'Vogels Approximation method'. **(10 Marks)**

	W_1	W_2	W_3	W_4	Capacity
F_1	19	30	50	10	07
F_2	70	30	40	60	09
F_3	40	08	70	20	18
Demand	05	08	07	14	34

b. Solve the given Assignment problem, so that the total cost is minimized. **(10 Marks)**

	M_1	M_2	M_3	M_4
J_1	05	07	11	06
J_2	08	05	09	06
J_3	04	07	10	07
J_4	10	04	08	03

7 a. Use graphical method to solve the following game **(10 Marks)**

$$\begin{array}{c} \\ A \end{array} \begin{array}{c} B \\ \begin{bmatrix} 1 & 3 & 11 \\ 8 & 5 & 2 \end{bmatrix} \end{array}$$

b. A firm owner is seriously considering of drilling a farm well in the past, only 70% of wells drilled were successful at 200 Feet of depth. Moreover on finding no water at 200 Ft., some persons drilled it further upto 250 Ft but only 20% struck water at 250 Ft. The prevailing cost of drilling is Rs 50/Foot. The farm owner estimated that in case he does not get his own wells he will have to pay Rs 15,000 over the next 10 years in PV term, to buy water from the neighbor. The following decisions can be optimal : i) Do not drill any well ii) Drill upto 200 Ft and iii) If no water is found at 200 Ft, drill further upto 250 Ft.

Draw an appropriate decision tree and determine the farm owner's strategy under Expected Monetary Value (EMV) approach. **(10 Marks)**

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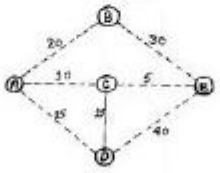
8 a. Use Tabu search algorithm to find an optimal solution of the following illustration.
Constraint 1 : Link AD can be included only if link DE also included.
Constraint 2 : At most one of the three links AD, CD and AB can be included. Charge a penalty of Rs 100 if Constraint 1 is violated. Charge a penalty of Rs 100 if two of the three links specified in constraints 2 are included. Increase this penalty to Rs 200 if all the three of links are included. **(10 Marks)**



b. Write a brief note on :
i) Simuted Annealing ii) Genetic Algorithm. **(10 Marks)**

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10CS/IS661

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. What are different phases of operation research? Briefly explain phases of operations research study. **(08 Marks)**

b. Old hens can be brought at ₹50/each but young ones cost ₹100/- each. The old hens lay 3 eggs/week and young ones lay 5 eggs/week. Each egg sold at ₹2/-. A hen costs ₹5/week to feed. If a person has only ₹3000/- to spend for hens. Formulate the problem to decide how many of each kind of hen should he buy? Assume that he cannot house more than 50 hens. **(06 Marks)**

c. Define the following with respect to a LPP. Give example for each :
(i) Feasible solution
(ii) Feasible region
(iii) Infeasible solution **(06 Marks)**

2 a. Solve the following LPP by using graphical method:
Maximize $Z = 5x_1 + 4x_2$
Subject to $6x_1 + 4x_2 \le 24$
$x_1 + 2x_2 \le 6$
$-x_1 + x_2 \le 1$
$x_2 \le 2$
where $x_1, x_2 \ge 0$ **(08 Marks)**

b. What are methods of post optimality analysis of LPP? **(02 Marks)**

c. Solve the following LPP by using Simplex method.
Maximize $Z = 5x_1 + 3x_2$
Subject to $x_1 + x_2 \le 2$
$5x_1 + 2x_2 \le 10$
$3x_1 + 8x_2 \le 12$
where $x_1, x_2 \ge 0$ **(10 Marks)**

3 a. Solve the following by using Big-M method.
Maximize $Z = 6x_1 + 4x_2$
Subject to $2x_1 + 3x_2 \le 30$
$3x_1 + 2x_2 \le 24$
$x_1 + x_2 \ge 3$
where $x_1, x_2 \ge 0$ **(10 Marks)**

b. Solve the following LPP by using Two-phase Simplex method.
Maximize $Z = 5x_1 + 3x_2$
Subject to $2x_1 + x_2 \le 1$
$x_1 + 4x_2 \ge 6$
where $x_1, x_2 \ge 0$ **(08 Marks)**

c. Mention software packages used to solve LPP. **(02 Marks)**

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4 a. Solve the following LPP by using revised Simplex method.

Maximize $Z = 2x_1 + x_2$

Subject to $3x_1 + 4x_2 \le 6$

$6x_1 + x_2 \le 3$

where $x_1, x_2 \ge 0$ **(10 Marks)**

b. Explain the following terms :

(i) Weak duality property (ii) Strong duality property (iii) Complimentary solution property. **(06 Marks)**

c. Write the dual of the following :

(i) Maximize $Z = 4x_1 + 10x_2 + 25x_3$

Subject to $2x_1 + 4x_2 + 8x_3 \le 25$

$4x_1 + 9x_2 + 8x_3 \le 30$

$6x_1 + 2x_3 \le 40$

where $x_1, x_2, x_3 \ge 0$

(ii) Minimize $Z = 20x_1 + 40x_2$

Subject to $2x_1 - 20x_2 \ge 40$

$20x_1 + 3x_2 \ge 20$

$4x_1 + 20x_2 \ge 30$

where $x_1, x_2 \ge 0$

(04 Marks)

PART – B

5 a. Briefly explain about sensitivity analysis. **(05 Marks)**

b. Explain primal-dual relationship with an example. **(05 Marks)**

c. Solve the following by using dual simplex method.

Minimize $Z = 2x_1 + 2x_2 + 4x_3$

Subject to $2x_1 + 3x_2 + 5x_3 \ge 2$

$3x_1 + x_2 + 7x_3 \le 3$

$x_1 + 4x_2 + 6x_3 \le 5$

where $x_1, x_2, x_3 \ge 0$ **(10 Marks)**

6 a. Solve the following transportation problem by using (i) North-West corner method (ii) Vogel's approximation method.

		Destination 1	2	3	4	Supply
Source	1	3	1	7	4	300
	2	2	6	5	9	400
	3	8	3	3	2	500
Demand		250	350	400	200	

(10 Marks)

b. Solve the following assignment problem.

		Subject S_1	S_2	S_3	S_4
Professor	P_1	2	10	9	7
	P_2	15	4	14	8
	P_3	13	14	16	11
	P_4	3	15	13	8

Find the schedule so as to minimize the total subject preparation time for all subjects. **(10 Marks)**

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7 a. Explain following terms with example :
(i) Saddle point (ii) Value of the game (iii) Payoff matrix **(06 Marks)**

b. Solve the following game by dominance principle :

		Player B				
		1	2	3	4	5
Player A	1	2	5	**10**	7	2
	2	3	3	6	6	4
	3	4	4	8	12	1

(07 Marks)

c. Solve optimally using graphical method by considering the payoff matrix of player A as shown below:

		Player B				
		1	2	3	4	5
Player A	1	3	6	8	4	4
	2	-7	4	2	10	2

(07 Marks)

8 Explain the following terms:
a. Metaheuristics, advantages and disadvantages
b. Tabu search algorithm
c. Genetic algorithm
d. Simulated annealing **(20 Marks)**

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Sixth Semester B.E. Degree Examination, June/July 2017
Operations Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Define operations research. Explain the phases of operations research. **(08 Marks)**

b. A firm can be produced 3 types of body sweaters say A, B and C. Three kinds of wool are required for it, say red wool, green wool and blue wool. One unit of type A sweater needs 2 yards of red wool and 3 yards of blue wool, one unit of type B sweater needs 3 yards red wool 2 yards of green wool and 2 yards of blue wool. One unit of type C sweater needs 5 yards of green wool and 4 yards of blue wool. The firm has only a stock of 80 yards of red wool, 100 yards of green wool and 150 yards of blue wool. It is assumed that the income obtained from each unit of type A sweater is Rs. 30, type B sweater is Rs. 50 and type C sweater is Rs. 40. Formulate this problem as LPP. **(05 Marks)**

c. Using graphical method solve the following :

Maximize $Z = 3000x_1 + 2000x_2$

Subject to $x_1 + 2x_2 \le 6$

$2x_1 + x_2 \le 8$

$x_2 \le 2$

$-x_1 + x_2 \le 1$

and $x_1, x_2 \ge 0$. **(07 Marks)**

2 a. Explain the setting up of simplex method. **(04 Marks)**

b. Using Simplex method, solve the following LPP taking

$x_1 = y_1 + 10$, $x_2 = y_2 + 20$ and $x_3 = y_3 + 30$, the LPP becomes.

Maximize $Z = 10y_1 + 15y_2 + 8y_3 + 640$

Subject to $y_1 + 2y_2 + 2y_3 \le 90$

$2y_1 + y_2 + y_3 \le 150$

$3y_1 + y_2 + 2y_3 \le 70$

and $y_1, y_2, y_3 \ge 0$. **(13 Marks)**

c. Why Simplex method is better than graphical method? **(03 Marks)**

3 a. Using Big-M method solve the following LPP :

Maximize $Z = 2x_1 + x_2$

Subject to $3x_1 + x_2 = 3$

$4x_1 + 3x_2 \ge 6$

$x_1 + 2x_2 \le 4$

$x_1, x_2 \ge 0$. **(08 Marks)**

b. Using Two-phase method solve the LPP :

Maximize $Z = -4x_1 - 3x_2 - 9x_3$

Subject to $2x_1 + 4x_2 + 6x_3 \ge 15$

$6x_1 + x_2 + 6x_3 \ge 12$

and $x_1, x_2, x_3 \ge 0$. **(12 Marks)**

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4 a. Explain the computational procedure of revised Simplex method in standard form. **(08 Marks)**

b. Using revised Simplex method solve the following LPP :

Minimize $Z = x_1 + x_2$

Subject to $x_1 + 2x_2 \geq 7$

$4x_1 + x_2 \geq 6$

and $x_1, x_2 \geq 0$. **(12 Marks)**

PART – B

5 a. Explain the role of duality theory in sensitivity analysis. **(05 Marks)**

b. Explain the procedure of dual Simplex method. **(05 Marks)**

c. Use dual Simplex method and solve the following LPP and also find the solution to the primal.

Minimize $Z = 2x_1 + 9x_2 + x_3$

Subject to $x_1 + 4x_2 + 2x_3 \geq 5$

$3x_1 + x_2 + 2x_3 \geq 4$

and $x_1, x_2, x_3 \geq 0$. **(10 Marks)**

6 a. Find the initial basic feasible solution using North West corner rule and Vogel's approximation method for the following transportation problem : **(10 Marks)**

19	30	50	10	7
70	30	40	60	9
40	8	70	20	18
5	8	7	14	

b. Write the procedure of Hungarian method. **(05 Marks)**

c. Find the optimal solution to the following assignment problem showing the costs (Rs) for assigning workers to jobs. **(05 Marks)**

		Job		
	W_1	18	17	16
Workers	W_2	15	13	14
	W_3	19	20	21

7 a. Using the dominance concept, obtain the optimal strategies for both the players and determine the value of game. The pay off matrix for player A is given. **(10 Marks)**

		B				
		I	II	III	IV	V
A	I	2	4	3	8	4
	II	5	6	3	7	8
	III	6	7	9	8	7
	IV	4	2	8	4	3

b. Using Graphical method solve the following : **(10 Marks)**

		B		
		I	II	III
A	I	1	3	11
	II	8	5	2

8 Explain briefly :

a. Meta heuristics

b. Decision trees

c. Simulated annealing

d Genetic algorithm. **(20 Marks)**

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