MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

Department Of Computer Science and Engineering

STUDENT HAND BOOK
FOR
IV B.Tech I Sem

INSTITUTION VISION AND MISSION

Vision:

To be as an ideal academic institution by graduating talented engineers to be ethically strong, competent with quality research and technologies.

Mission:

- Utilize rigorous educational experiences to produce talented engineers
- Create an atmosphere that facilitates the success of students
- Programs that integrate global awareness, communication skills and Leadership qualities
- Education and Research partnership with institutions and industries to prepare the students for interdisciplinary research

DEPARTMENT VISION AND MISSION

Vision:

To empower the students to be technologically adept, innovative, self-motivated and responsible global citizen possessing human values and contribute significantly towards high quality technical education with ever changing world.

Mission:

- To offer high-quality education in the computing fields by providing an environment where the knowledge is gained and applied to participate in research, for both students and faculty.
- To develop the problem-solving skills in the students to be ready to deal with cutting edge technologies of the industry.
- To make the students and faculty excel in their professional fields by inculcating the communication skills, leadership skills, team building skills with the organization of various co-curricular and extra-curricular programmes.
- To provide the students with theoretical and applied knowledge, and adopt an education approach that promotes lifelong learning and ethical growth.

PROGRAM OUTCOMES

PO Name	Graduate Attributes	PO Statements
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO 2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design/ development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO 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.
PO 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.
PO 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.
PO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES

Sl. No.	PEOs Name	Program Education Objective Statements
1	PEO - 1	To induce strong foundation in mathematical and core concepts, which enable them to participate in research, in the field of computer science.
2	PEO – 2	To be able to become the part of application development and problem solving by learning the computer programming methods, of the industry and related domains.
3	PEO – 3	To gain the multidisciplinary knowledge by understanding the scope of association of computer science engineering discipline with other engineering disciplines
4	PEO – 4	To improve the communication skills, soft skills, organizing skills which build the professional qualities, there by understanding the social responsibilities and ethical attitude.

PROGRAM SPECIFIC OUTCOMES

Program Specific Outcomes	
PSO1	Applications of Computing: Ability to use knowledge in various domains to provide solution to new ideas and innovations.
PSO2	Programming Skills: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.
PSO3	Make use of computational and experimental tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.

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COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	CRYPTOGRAPHY AND NETWORK SECURITY			
Course Code	CS701PC			
Regulation	R18-JNTUH			
Course Structure	Lectures	Tutorials	Practical	Credits
	4	-	-	3
Course Coordinator	**T. Srinivas Assoc.Prof**			

I. COURSE OVERVIEW:

To assess the security needs of an organization effectively, the manager responsible for security needs some systematic way of defining the requirements for security and characterization of approaches to satisfy those requirements. One approach is to consider three aspects of information security: Security attack – Any action that compromises the security of information owned by an organization. Security mechanism – A mechanism that is designed to detect, prevent or recover from a security attack. Security service – A service that enhances the security of the data processing systems and the information transfers of an organization. The services are intended to counter security attacks and they make use of one or more security mechanisms to provide the service.

II. PREREQUISITES:

Level	Credits	Periods / Week	Prerequisites
UG	3	4	Computer Networks

III. COURSE ASSESSMENT METHODS:

Session Marks	University End Exam Marks	Total Marks
Mid Semester Test There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 10 marks of 60 minutes duration. Subjective test of shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks of 20 minutes duration. It consists of 10 Multiple choice and 10 objective type questions; the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first four units of syllabus and second midterm examination shall be conducted for the remaining portion. **Assignment** Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.	70	100

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1	I Mid Examination	90 minutes	25
2	I Assignment	-	5
3	II Mid Examination	90 minutes	25
4	II Assignment	-	5
5	External Examination	3 hours	70

V. COURSE OBJECTIVES:

I. To impart fundamental concepts in the area of cloud computing
II. To impart knowledge in applications of cloud computing
III. To introduce the broad perceptive of cloud architecture and model.
IV. To understand the concept of virtualization and design of cloud services.
V. To be familiar with the lead players in a cloud.
VI. To understand the features of Cloud Simulator.
VII. To apply different cloud programming model as per need.
VIII. To learn to design the trusted cloud computing system.

VI. COURSE OUTCOMES:

CO	Course outcome	Blooms taxonomy level
C411.1	Understand basic cryptographic algorithms, message and web authentication and security issues	Understand
C411.2	Identify information system requirements for both of them such as client and server.	Create
C411.3	Understand the current legal issues towards information security and can explain the importance and application of each of confidentiality, integrity, authentication and availability	Analyse
C411.4	Generate and distribute a PGP key pair and use the PGP package to send an encrypted email message	Analyse
C411.5	Discuss Web security and Firewalls	Create

VII HOW PROGRAM OUTCOMES ARE ASSESSED

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	S	Assignment, Exercises
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	S	Exercises
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Exercises
PO4	**Conduct investigations of complex problems**: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	N	----------
PO5	**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.	N	----------
PO6	**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.	N	----------
PO7	**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.	N	----------
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Seminars, Discussions
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	N	----------
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	----------
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	H	Exercises, Discussions
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	N	----------

N - None **S - Supportive** **H - Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	Applications of Computing: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	1	Lectures, Assignments
PSO2	Programming Skills: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	2	
PSO3	Make use of computational and experimental tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	

IX. SYLLABUS:

UNIT I

Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security
Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.
Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, El Gamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, El Gamal Digital Signature Scheme.
Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

UNIT IV

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer
Security, HTTPS, Secure Shell (SSH)
Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN,
IEEE 802.11i Wireless LAN Security

UNIT V

E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload, Combining security associations,
Internet Key Exchange
Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single
sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability..

TEXT BOOKS: 1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition 2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

REFERENCE BOOKS: 1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition. 2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition 3. Information Security, Principles, and Practice: Mark Stamp, Wiley India. 4. Principles of Computer Security: WM. Arthur Conklin,

Greg White, TMH 5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE LearningReese ,O reilly,SPD,rp2011
Cloud security and privacy: An Enterprise perspective on Risks and compliance,im Mather,Subra Kumaraswamy,Shahed Latif,O reilly,SPD,rp2011

X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

L. No	Name of the Topic	Plan Date	Actual Date
1	**UNIT – 1** Introduction		
2	The Need for Security		
3	Security Approaches, Principles Of Security		
4	Types Of Security Attacks		
5	Security Services ,Security Mechanisms		
6	A Model for Network Security.		
7	Introduction, Plain text and Cipher Text, Substitution Techniques,		
8	Transposition Techniques		
10	Encryption & Decryption		
11	Symmetric and Assymetric Cryptography		
13	Steganography, Key range and Key Size		
14	Possible Types Of Attacks.		
15	Review		
15	**UNIT – 2** Block Cipher Principles		

16	DES,AES			
17	Blowfish ,RC5			
18	IDEA			
19	Block Cipher Operation			
20	Stream Ciphers,RC4			
21	Principles of Public Key Crypto Systems			
22	RSA Algorithm, Elgamal Cryptography			
23	Diffie Hellman Key Exchnage, Knapsack Algorithm			
	Review			
24	**UNIT – 3** Message Authentication , Secure Hash Algorithm (SHA -512)			
25	Authentication Requirements, HMAC			
26	CMAC			
27	Digital Signatures			
28	Elgamal Digital Signature Scheme.			
29	Symmetric Key Distribution Using Symmetric and Asymmetric Encryption			
30	Symmetric Key Distribution Using Symmetric and Asymmetric Encryption			
31	Distribution of Public Key			
32	Kerberos			

33	X.509 Authentication Service			
34	Public Key Infrastructure			
35	Review			
36	**UNIT – 4** Web Security Considerations			
37	Secure Socket Layer and Transport Layer Security			
38	HTTPS , Secure Shell (SSH).			
39	Wireless Security , Mobile Device Security			
40	IEEE 802.11 Wireless LAN			
41	IEEE 802.11i Wireless LAN Security			
	Review			
	UNIT – 5			
42	Pretty Good Privacy			
43	S/MIME			
44	IP Security Overview			
45	IP Security Architecture			
46	Authentication Header			
47	Encapsulating Security Payload			
48	Combining Security Associations			

49	Internet Key Exchange			
50	Secure Multi Party Calculation			
51	Virtual Elections			
52	Single Sign on			
53	Secure Inter Branch Payment Transactions			
54	Secure Inter Branch Payment Transactions			
55	Cross site Scripting Vulnerability			
56	Review			

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
C411.1	3	3	3	3	3	1	0	0	0	0	0	1	3	3	3
C411.2	3	3	3	3	3	1	0	0	0	0	0	1	3	3	3
C411.3	3	3	3	3	3	1	0	0	0	0	0	1	3	3	3
C411.4	3	3	3	3	3	1	0	0	0	0	0	1	3	3	3
C411.5	3	3	3	3	3	1	0	0	0	0	0	1	3	3	3
Total	15	15	15	15	15	5						5	15	15	15
Average	**3**	**3**	**3**	**3**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**3**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	:	CRYPTOGRAPHY AND NETWORK SECURITY
Course Code	:	CS701PC
Class	:	IV B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2021-2022
Course Faculty	:	**T.Srinivas Assoc.Prof**

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	Explain model for Internetwork Security.	Knowledge	2
2	Discuss about the types of Security attacks in network security	Create	1
3	Differentiate symmetric and asymmetric key cryptography?.	Create	1
4	Use RSA algorithm, Perform encryption and decryption with p=3,q=11,e=7 and N=5	Knowledge	2
5	Explain briefly about DES algorithm	Create	2
6	Explain the Cipher block modes of operation	Understand	1
7	Draw a neat sketch to explain the concept of Secured Hash Algorithm (SHA)	Create	1
8	Explain about the process of Diffie Hellman Key Exchange Algorithm	Understand	2
9	Explain about Design Principles of Computer Clusters	Understand	2
10	List out the design principles of computer clustures	Understand	1
	UNIT – II		
1	Describe HMAC Algorithm.	Understand	1
2	Describe Signing and Verification in Digital Signature Algorithm	Understand	2
3	Describe Signing and Verification in Digital Signature Algorithm	Understand	2
4	Explain architectural design of compute and storage clouds?	Understand	2
5	Discuss IEEE 802.11i Wireless LAN Security	Understand	2
6	Explain any six benefits of Software as Service in Cloud computing?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – III		
1	**Explain** in detail about RVWS design?	Understand	1
2	**What** is ANEKA cloud platform?	Understand	2
3	**Explain** the technologies for data security in cloud computing?	Understand	1
4	**Implement** in detail about hybrid cloud?	Knowledge	2
5	**Explain** the importance of quality and security in clouds?	Knowledge	1
6	**Explain** in detail about hybrid cloud implementation	Understand	2
7	**Draw** a neat sketch for architectural overview	Application	1
8	**Explain** about ANEKA resource provisioning service?	Understand	2
	UNIT - IV		
1	**Write** about SAP systems in detail	Understand	2
2	**List** out the business benefits of cloud computing	Knowledge	2
3	**List** out the business benefits of cloud computing	Knowledge	2
4	**Explain** about SLA management in cloud	Understand	1
5	**Explain** about SLA management in cloud	Understand	2
6	**Draw** a neat sketch for automated policy based management with brief explanation	Application	1
7	**Write** about HPC systems and HPC on clouds	Understand	2
8	**List** out the technical benefits of cloud computing	Knowledge	2
9	**Explain** in detail about decouple your components	Understand	2
	UNIT - V		
1	**Explain** about a framework to comprehend the competitive environment	Understand	1
2	**Explain** about digital identity and data security	Understand	2
3	**Write** about quality of service and value composition	Understand	2
4	**Explain** about common change management models(CMMM)	Understand	2
5	**List** out the cloud contracting models	Knowledge	1
6	**List** out the data privacy and security issues	Knowledge	1
7	**Explain** about management maturity model	Understand	2

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	CRYPTOGRAPHY AND NETWORK SECURITY
Course Code	:	CS701PC
Class	:	IV B. Tech I Semester
Branch	:	CSE
Year	:	2021 – 2022
Course Faculty	:	**T.Srinivas Assoc.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

S No	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT - I **System Modeling, Clustering And Virtualization**		
	Part - A (Short Answer Questions)		
1	**Define** distributed systems	Remember	1
2	**Write** about parallel computing	Understand	1
3	**Write** about virtual machines	Understand	1
4	**Define** single system image	Understand	2
5	**Write** about resources sharing in clusters	Understand	2
6	**Explain** briefly about HTC	Remember	1
7	**Write** about middleware support for virtualization	Remember	2
8	**Explain** briefly about HPC	Remember	2
9	**Write** about virtual support at os level	Remember	2
10	**List** the disadvantages of extending os level	Remember	2
11	**What** are the basic characteristics of cloud computing?	Understand	2
12	**How** does cloud computing provides on- demand functionality?	Remember	2
13	**Define** multi core CPU?	Remember	1
14	Define GPU?	Remember	2
15	Define anything-as-a-service?	Understand	1

16	Define private cloud, public cloud & hybrid cloud?	Understand	2
17	Difference between distributed and parallel computing?	Understand	2
18	Define cloud provider and cloud broker?	Understand	2
19	List the design objectives of cloud computing?	Remember	2
20	Why should one prefer public cloud over private cloud?	Remember	2
Part - B (Long Answer Questions)			
1	Write about distributed system models and enabling technologies	Remember	1
2	Explain in detail about system models and distributed cloud computing	Analyze	1
3	Explain about Design Principles of Computer Clusters	Evaluate	2
4	List out the design principles of computer clustures	Remember	2
5	Explain about Computer Clusters and MPP Architectures	Understand	2
6	Write about technologies for network based system with suitable diagrams	Remember	2
7	Write about Virtual Clusters and Resource Management	Understand	2
8	Explain the virtualisation structure/Tools and mechanisms	Understand	1
9	Explain the Cluster Architecture in detail?	Understand	1
10	What is cloud computing? Enlist and Explain three service models, and four deployment models of cloud computing	Remember	1
11	Explain the cloud eco system?	Understand	1
12	Explain the NIST cloud computing reference architecture?	Analyze	2
13	Explain the infrastructure of Grid computing in detail?	Analyze	2
14	Explain multithreading model in detail?	Understand	2
15	Explain the architecture of P2P system?	Remember	2
16	Explain the infrastructure of Grid computing in detail?	Remember	1
17	Explain the system models for distributed and cloud computing?	Understand	2
18	Explain architectural design of compute and storage clouds?	Understand	1
19	What is mean by Virtualization Middleware	Understand	1
20	List the design issues in clusters?	Remember	2
Part - C (Problem Solving and Critical Thinking Questions)			
1	What are the three computing paradigms for cloud computing	Analyze	2
2	Draw a neat graph for hype cycle for emerging technologies	Evaluate	2
3	Sketch a three cloud service models in a cloud landscape of major providers	Evaluate	2
4	Explain in detail about evaluation of SOA	Evaluate	2
5	Explain in detail about evaluation of SOA	Remember	2
6	Explain about parallel and distributed programming models	Evaluate	2
7	Discuss GPU clusters for massive parallelism	Remember	2
8	How does cloud architecture overcome the difficulties faced by traditional architecture? What are the three differences that separate out cloud architecture from the tradition one?	Evaluate	2
9	Explain the virtualization for data center automation?	Evaluate	2
10	Explain the concept dynamic deployment of virtual clusters?	Evaluate	2

UNIT - II			
Part – A (Short Answer Questions)			
1	Define cloud?	Remember	1
2	How does cloud computing provides on demand functionality?	Remember	2
3	Define cloud computing?	Understand	2
4	List out characteristics of cloud computing?	Remember	1
5	Define utility computing?	Remember	2
6	List out the features of cloud computing?	Remember	1
7	Define grid computing?	Apply	1
8	What is autonomic computing?	Analyze	1
9	List out the challenges in cloud	Remember	1
10	What is boomi software?	Remember	2
11	List the design goals for generic cloud?	Remember	2
12	List the cloud enabling technologies?	Create	2
13	Explain the QoS factors in cloud?	Evaluate	1
14	Define hardware virtualization?	Remember	2
15	Explain the storage virtualization?	Remember	2
16	Define VM cloning?	Create	1
17	Explain runtime support service?	Evaluate	2
18	Define software stack?	Remember	2
19	List out different layers which define cloud architecture?	Remember	1
20	What is the use of “EUCALYPTUS” in cloud computing?	Evaluate	2
Part - B (Long Answer Questions)			
1	What is cloud computing? Enlist and Explain three service models, and four deployment models of cloud computing.	Understand	2
2	Explain the system models for distributed and cloud computing?	Analyze	2
3	Explain the architecture of P2P system?	Analyze	2
4	Explain architectural design of compute and storage clouds?	Understand	1
5	Explain the infrastructure of Grid computing in detail?	Understand	1
6	Explain any six benefits of Software as Service in Cloud computing?	Understand	2
7	Why is cloud called as eco system? justify	Analyze	2
8	Difference between process virtual machines, host VMMs, native VMMs.	Analyze	1
9	Explain the importance of virtualization	Remember	1
10	“SOA as step forward cloud computing”, Explain?	Understand	2
11	Discuss inter-cloud resource management.	Analyze	2
12	Discuss in detail about global exchange of cloud resources.	Understand	2
13	Mention the name of some large cloud providers and databases?	Understand	2
14	As a infrastructure as a service what are the resources that are provided by it?	Understand	1
15	Explain the different levels of virtualization implementation?	Understand	2

16	Explain the OS level virtualization? List the pros and cons of OS level virtualization?	Understand	2
17	Explain in details the tools and mechanisms for virtualization?	Remember	2
18	Explain the different types of virtualization in detail?	Understand	2
19	Explain the virtualization of CPU, Memory and I/O devices?	Understand	2
20	Explain the virtualization of multi core processor?	Remember	1
Part – C (Problem Solving and Critical Thinking)			
1	Explain cloud computing architecture and cloud components?	Evaluate	2
2	Explain the NIST reference architecture of cloud computing in detail?	Evaluate	2
3	Explain risk from multi tenancy environment. How IDS can be used in environment?	Evaluate	2
4	Discuss SAAS, PAAS, IAAS and compare them?	Evaluate	2
5	Explain Information and Data Model for Virtual machine.	Evaluate	2
6	How does cloud architecture overcome the difficulties faced by traditional architecture? What are the three differences that separate out cloud architecture from the tradition one?	Evaluate	2
7	Explain the infrastructure of Grid computing in detail?	Remember	2
8	Explain multithreading model in detail?	Evaluate	2
9	Mention some open source cloud computing platform databases?	Evaluate	1
10	Explain the difference between cloud and traditional datacenters?	Evaluate	1
UNIT-III Infra Structure As Service (IAAS)& Platform And Software Service			
Part - A (Short Answer Questions)			
1	Define fault tolerance?	Remember	2
2	What is load balancing?	Understand	2
3	Explain in brief about public cloud and infrastructure services	Understand	2
4	Write about Google app engine	Understand	2
5	Sketch the Aneka architecture	Understand	2
6	Draw a neat diagram for Open Nebula high level architecture	Understand	2
7	Write about VM life cycle	Remember	2
8	Explain in brief about private cloud and infrastructure services	Remember	2
9	Write about Microsoft windows azure	Understand	1
10	Define on demand service	Remember	1
11	List the design goals for generic cloud?	Understand	2
12	List the cloud enabling technologies?	Understand	2
13	Explain the QoS factors in cloud?	Remember	2
14	Define hardware virtualization?	Understand	2
15	Explain the storage virtualization?	Remember	2
16	Define VM cloning?	Remember	2
17	Explain runtime support service?	Remember	2
18	Define software stack?	Remember	1
19	Define dynamic resource deployment?	Remember	2
20	Define the provisioning of compute resources?	Remember	2

Part – B (Long Answer Questions)			
1	Explain in detail about RVWS design?	Understand	2
2	What is ANEKA cloud platform?	Remember	2
3	Explain the technologies for data security in cloud computing?	Remember	2
4	Implement in detail about hybrid cloud?	Understand	1
5	Explain the importance of quality and security in clouds?	Evaluate	1
6	Explain in detail about hybrid cloud implementation	Understand	2
7	Draw a neat sketch for architectural overview	Understand	2
8	Explain about ANEKA resource provisioning service?	Evaluate	2
9	Draw a neat a of autonomic cloud bridging	Remember	2
10	List out the importance of quality and security in cloud	Evaluate	2
11	Explain the cloud architecture with suitable block diagram?	Understand	2
12	Explain the layered cloud architecture development?	Understand	2
13	Explain the various design challenges for effective cloud computing environment?	Understand	2
14	Explain the cloud service tasks and trends? Explain the different methods of resource provisioning and platform deployment in detail with a neat diagram?	Understand	2
15	Explain the provisioning of storage resources in detail?	Understand	1
16	What is quality of service (QoS) monitoring in a cloud computing? Enlist and Explain different issues in inter-cloud environments.	Understand	2
17	What is the use of “EUCALYPTUS” in cloud computing?	Understand	1
18	Mention some open source cloud computing platform databases?	Understand	1
19	Mention the name of some large cloud providers and databases?	Understand	2
20	As a infrastructure as a service what are the resources that are provided by it?	Understand	2
UNIT-IV **Monitoring, Management And Applications**			
Part – A (Short Answer Questions)			
1	Write about federation	Remember	1
2	Define isolation	Remember	1
3	Explain in brief about the virtual execution environment manager	Remember	1

4	Sketch a neat diagram for hosting of applications on servers	Remember	2
5	Define federation scenarios	Evaluate	2
6	Draw a flow chart of the SLA management in cloud	Remember	2
7	Write about elasticity	Apply	2
8	Write about grid and cloud	Remember	2
9	Explain in brief about the virtual execution environment host	Evaluate	2
10	List out the technical benefits of cloud computing	Understand	1
11	Define BigTable?	Remember	1
12	What is mean by NOSQL?	Apply	1
13	Explain the Google"s distributed lock service?	Apply	1
14	Explain the Google"s distributed lock service?	Remember	2
15	Define SQLAzure?	Remember	2
16	Define GFS?	Remember	2
17	Define block replication	Remember	2
18	List the characteristics of HDFS?	Analyze	2
19	Define block replication?	Apply	2
20	Define heart beat in Hadoop?	Analyze	2
Part – B (Long Answer Questions)			
1	Write about SAP systems in detail	Remember	2
2	List out the business benefits of cloud computing	Understand	2
3	List out the business benefits of cloud computing	Remember	2
4	Explain about SLA management in cloud	Understand	2
5	Explain about SLA management in cloud	Remember	2
6	Draw a neat sketch for automated policy based management with brief explanation	Apply	2
7	Write about HPC systems and HPC on clouds	Apply	2
8	List out the technical benefits of cloud computing	Remember	2
9	Explain in detail about decouple your components	Remember	2
10	List out the technical benefits of cloud computing	Evaluate	2
11	Explain in detail about decouple your components	Evaluate	2
12	Explain the dataflow and control flow of MapReduce?	Remember	2
13	Explain the architecture of MapReduce in Hadoop?	Remember	2
14	Explain a user view of Google App Engine with suitable block schematic	Remember	1
15	Explain the structure of BigTable data model?	Remember	1
16	Explain the programming structure ofAmazon EC2?	Remember	1
17	Explain the architecture of Amazon EC2 ?	Remember	2
18	Explain the Microsoft Azure programming support?	Remember	2
19	Discuss the architecture and components of OpenNebula?	Remember	1
20	Explain the architecture of OpenStack system?		
UNIT-V Governance and case studies			
Part - A (Short Answer Questions)			
1	List out the strengths of information cards	Evaluate	1
2	Draw a neat sketch of perception of quality	Remember	1
3	Distinguish direct versus indirect distribution	Remember	1
4	Write about cloud service life cycle	Remember	2

5	List out the weakness of information cards	Remember	2
6	Define service strategy	Understand	2
7	Write about acceptance testing	Remember	2
8	What is digital entity	Remember	2
9	Write about service design	Understand	2
10	What is data security	Remember	2
11	What are the security challenges in cloud computing?	Remember	1
12	Define security governance?	Understand	1
13	Explain the security awareness in cloud?	Remember	2
14	Define third party risk management?	Understand	2
15	What are the layers in security architecture design?	Remember	2
16	Define VM security?	Understand	1
17	Explain change management?	Understand	2
18	Define security images?	Understand	2
19	What is mean by vulnerability assessment?	Remember	2
20	Define data shredding technique.	Remember	2
21	What is mean by password assurance testing?	Remember	2
Part - B (Long Answer Questions)			
1	Explain about a framework to comprehend the competitive environment	Understand	1
2	Explain about digital identity and data security	Understand	2
3	Write about quality of service and value composition	Apply	2
4	Explain about common change management models(CMMM)	Remember	1
5	List out the cloud contracting models	Remember	1
6	List out the data privacy and security issues	Create	1
7	Explain about management maturity model	Remember	1

8	Write about acceptance testing	Understand	1
9	Explain the Security challenges in cloud computing in detail?	Understand	1
10	Explain the security architecture in detail?	Understand	1
11	Explain the following a. Security governance b. Security monitoring	Remember	2
12	Explain the Secure Software Development Life Cycle?	Remember	2
13	Explain in detail about Software-as-a-Service security?	Remember	2
14	Explain the application security in detail?	Analyze	1
15	Explain the data security and virtual machine security in detail?	Analyze	1
16	Explain the identity management and access control in detail?	Analyze	1
17	Explain the two fundamental functions, identity management and access control, which are required for secure cloud computing.	Remember	1
18	Explain the following a. Autonomic Security b. Risk management	Analyze	2
19	What are the measures included in GuestOS hardening technique ?	Understand	1
20	How is intrusion detection implemented under SAAS model?	Understand	1

Prepared By: **HOD, CSE**

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**DATA MINING**			
Course Code	**CS702PC**			
Regulation	**R18 - JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	3	-	-	2
Course Faculty	**Y APPARAO Assoc.Prof**			

I. COURSE OVERVIEW:

The course addresses the concepts, skills, methodologies, and models of data warehousing. The proper techniques for designing data warehouses for various business domains, and covers concepts for potential uses of the data warehouse and other data repositories in mining opportunities are addressed. Data mining, the extraction of hidden predictive information from large databases, is a powerful new technology with great potential to help companies focus on the most important information in their data warehouses. Data mining tools predict future trends and behaviors, allowing businesses to make proactive, knowledge- driven decisions.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	2	3	Database Management Systems, Probability & Statistics

III. COURSE ASSESSMENT METHODS:

Session Marks	University End Exam Marks	Total Marks
Mid Semester Test There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 10 marks of 60 minutes duration. Subjective test of shall contain 4 questions; the student has to answer 2 questions, each carrying 5 marks. The objective type test is for 10 marks of 20 minutes duration. It consists of 10 Multiple choice and 10 objective type questions; the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first four units of syllabus and second midterm examination shall be conducted for the remaining portion. **Assignment** Five marks are earmarked for assignments. There shall be two assignments in every theory course. Marks shall be awarded considering the average of two assignments in each course.	70	100

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	90 minutes	25
2.	I Assignment	-	5
3.	II Mid Examination	90 minutes	25
4.	II Assignment	-	5
5.	External Examination	3 hours	70

V. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

I. Be familiar with mathematical foundations of data mining tools.

II. Understand and implement classical models and algorithms in data warehouses and data mining.

III. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

IV. Master data mining techniques in various applications like social, scientific and environmental context.

V. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

VI. Be familiar with the process of data analysis, identifying the problems, and choosing the relevant models and algorithms to apply.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

CO	Course outcome	Blooms taxonomy level
C412.1	Understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system	Understand
C412.2	Apply preprocessing methods for any given raw data.	Create
C412.3	Extract interesting patterns from large amounts of data and can discover the role played by data mining in various fields	Analyse
C412.4	Choose and employ suitable data mining algorithms to build analytical applications	Analyse
C412.5	Evaluate the accuracy of supervised and unsupervised models and algorithms.	Create

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Tutorials
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Lectures, Assignments, Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Mini Projects
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Projects
PO5	**Modern tool usage**: Create, select, and apply appropriate technique s, resources and modern engineering and IT tools		

	including prediction and modeling to complex engineering activities with an understanding of the limitations.	S	Projects

PO6	**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.	N	--
PO7	**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.	N	--
PO8	**Ethics**: Apply Principle and commit ethical to professional ethics and responsibilities and norms of the engineering practice.	S	Discussions
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	N	--
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	N	--
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Projects

N - None **S - Supportive** **H - Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	Applications of Computing: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	1	Lectures, Assignments
PSO2	Programming Skills: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	2	Projects
PSO3	Make use of computational and experimental tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	

IX. SYLLABUS:

UNIT - I
Data Mining: Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining–Data Preprocessing.

UNIT - II
Association Rule Mining: Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM.

UNIT - III
Classification: Classification and Prediction – Basic concepts–Decision tree induction–Bayesian classification, Rule–based classification, Lazy learner.

UNIT - IV
Clustering and Applications: Cluster analysis–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods– Density–Based Methods, Grid–Based Methods, Outlier Analysis.

UNIT - V
Advanced Concepts: Basic concepts in Mining data streams–Mining Time–series data—Mining sequence patterns in Transactional databases– Mining Object– Spatial– Multimedia–Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

TEXT BOOKS:
1. Data Mining – Concepts and Techniques – Jiawei Han & Micheline Kamber, 3rd Edition Elsevier.
2. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

REFERENCE BOOK:
1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.

IX. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	References
1-3	Introduction to Data warehouse, Difference between operational database systems and data warehouses, Data warehouse characteristics	**Distinguish** data warehouse from other databases.	T1: 3.1
4-6	Data warehouse Architecture and its components, Extraction-Transformation-Loading, Logical (Multi-Dimensional),	**Prepare Data warehouse** architecture.	T1: 3.3
7-10	Modeling, Schema Design, Star and show-Flake Schema, Fact Consultation, Fact Table, Fully Addictive, Semi-Addictive, Non Addictive Measures; Fact-Less Facts, Dimension Table Characteristics	**Design** Multidimensional Data Model.	T1: 3.2
11-14	OLAP Cube, OLAP Operations, OLAP Server Architecture-ROLAP, MOLAP and HOLAP.	**Implementation** of Data Warehouse.	T1: 3.4-3.5
15-18	Introduction, Fundamentals of Data Mining, Definition, KDD, Challenges, Data Mining Tasks	**Outline** the importance of data mining in big data technology.	T1: 1.1-1.7
19-23	Data Processing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selections, Data Transformation	**List** the data Preprocessing techniques.	T1: 2.1-2.5
24-26	Discretization and Binaryzation,	**Define** data Discretization.	T1: 2.6

	Measures of Similarity and Dissimilarity-Basics.		
27-28	Association Rules: Problem Definition, Frequent item set generation, The APRIORI Principle	**Illustrate** the process of association rule mining	T1: 5.3
29-30	Support and confidence measures, association rule generation; APRIORI algorithm.	**Define** basic concepts of Apriori Algorithm.	T1: 5.2
31-33	The Partition Algorithms, FP-Growth Algorithms,	**Define** basic concepts of frequent pattern mining.	T1: 5.2
34-37	Compact Representation of Frequent item Set-Maximal Frequent item set, closed frequent item set.	**Illustrate** frequent item set.	T1: 5.1
38-41	Classification Problem Definition, General Approaches to solving classification problem, Evaluation of Classifiers, Classification techniques.	**Describe** Classification.	T1: 6.1-6.2
42-45	Decision Trees-Decision trees construction, Methods, for expressing attribute test conditions, Measures for selecting the best split, Algorithm for Decision tree induction.	**Construct** an optimal decision tree for a given dataset.	T1: 6.3
46-48	Naive-Bayes Classifier, Bayesian Belief Network	**Classify** Bayesian methods.	T1: 6.4
49-50	K-Nearest neighbor classification-Algorithm and characteristics.	**Generalize** the learning from your neighbors.	T1: 6.9
51-52	Clustering Problem Definition, Clustering Overview, Evaluation of Clustering algorithms	**Differentiate** classification and clustering.	T1: 7.1-7.3
53-55	partitioning clustering-K-Means Algorithm, K-Means Additional issues, PAM Algorithm	**Understand** partitioning methods used for clustering.	T1: 7.4
56-58	Hierarchical Clustering-Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering Algorithms Specific techniques	**Identify** various types of Hierarchical clustering techniques	T1: 7.5
59-60	Key issues in Hierarchical Clustering, Strengths and weakness; outlier detection.	**Analyze** outlier detection methods.	T1: 7.11

X. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
C412.1	3	3	2	2	3	1	0	0	0	0	0	1	3	3	2
C412.2	3	3	2	2	3	1	0	0	0	0	0	1	3	3	2
C412.3	3	3	2	2	3	1	0	0	0	0	0	1	3	3	2
C412.4	3	3	2	2	3	1	0	0	0	0	0	1	3	3	2
C412.5	3	3	2	2	3	1	0	0	0	0	0	1	3	3	2
Total	15	15	10	10	15	6	0	0	0	0	0	6	15	15	10
Average	**3**	**3**	**2**	**2**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**2**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

		DATA MINING
Course Code	:	
Class	:	IV B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2021 - 22
Course Faculty	:	**Y APPARAO Assoc.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.
In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner"s learning process.

ASSIGNMENT – I

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - 1		
1	**Explain** with an example the different schemas for multidimensional databases?	Understand	1
2	**Explain** about the concept description? And what are the differences between concept description in large databases and OLAP?	Understand	3
3	**Differentiate** operational database systems and data warehousing?	Understand	2
4	**Describe** the three-tier data warehousing architecture?	Knowledge	1
5	**Describe** the complex aggregation at multiple granularity?	Knowledge	2
6	**Discuss** briefly about the data warehouse architecture?	Understand	2
7	**Demonstrate** the efficient processing of OLAP queries?	Understand	3
8	**Compare** the schemas for the multidimensional data models?	Analyze	2
9	**Explain** the Data warehouse applications?	Understand	2
10	**Discuss** briefly about the multidimensional data models?	Understand	3

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT-II		
1	**Distinguish** between the data warehouse and databases? How they are similar?	Understand	2
2	**Describe** three challenges to data mining regarding data mining methodology and user interaction issues?	Knowledge	3
3	**Discuss** briefly about the data smoothing techniques?	Understand	2
4	**Explain** Data Integration and Transformation?	Understand	1
5	**Describe** the various data reduction techniques?	Understand	3
6	**Define** data cleaning? **Express** the different techniques for handling missing values?	Knowledge	2
7	**Explain** data mining as a step in the process of knowledge discovery?	Understand	2
8	**List** and describe the five primitives for specifying a data mining task?	Understand	2
9	**Explain** the difference between discrimination and classification? Between characterization and clustering? Between classification and prediction? For each of these pairs of tasks, how are they similar?	Understand	2
10	**Distinguish** between the data warehouses and data mining?	Understand	3
	UNIT-III		
1	**Define** the terms frequent item sets, closed item sets and association rules?	Knowledge	3
2	**Discuss** which algorithm is an influential algorithm for mining frequent item sets for boolean association rules? Explain with an example?	Understand	2
3	**Describe** the different techniques to improve the efficiency of Apriori? Explain?	Knowledge	2
4	**Discuss** the FP-growth algorithm? Explain with an example?	Understand	2
	ASSIGNMENT – II		
5	**Discuss** about mining multilevel association rules from transaction databases in detail?	Understand	3
6	**Discuss** about constraint-based association mining?	Understand	2
7	**Discuss** about mining multilevel association rules from transaction databases in detail?	Understand	3
8	**Describe** about the correlation analysis using Chi-square?	Knowledge	2
9	**Explain** what are additional rule constraints to guide mining?	Understand	2
10	**Illustrate** about the correlation analysis using All-certainty Measure?	Apply	2

UNIT - IV			
1	**Explain** about the classification and prediction? Example with an example?	Understand	3
2	**Discuss** about basic decision tree induction algorithm?	Understand	2
3	**Summarize** how does tree pruning work? What are some enhancements to basic decision tree induction?	Understand	2
4	**Explain** how scalable is decision tree induction? Explain?	Understand	3
5	**Describe** the working procedures of simple Bayesian classifier?	Knowledge	2
6	**Discuss** the back propagation algorithm and Explain?	Understand	3
7	**Explain** about classifier accuracy? Explain the process of measuring the accuracy of a classifier?	Understand	2
8	**Explain** training of Bayesian belief networks?	Understand	2
9	**Explain** briefly about the Navie Bayesian Classification?	Understand	3
10	**Differentiate** classification and prediction methods?	Understand	2
UNIT - V			
1	**Discuss** the various types of data in cluster analysis?	Understand	2
2	**Explain** the categories of major clustering methods?	Understand	2
3	**Write** algorithms for k-means and k-medoids? Explain?	Understand	2
4	**Describe** the different types of hierarchical methods?	Understand	2
5	**Discuss** about the DBSCAN density-based methods?	Understand	2
6	**Demonstrate** about the following hierarchical methods a)BIRCH b)Chamelon	Understand	3
7	**Explain** the working of CLIQUE algorithm	Understand	3
8	**Define** the distance-based outlier? Illustrate the efficient algorithms for mining distance-based algorithm?	Knowledge	2
9	**Explain** about the Statistical-based outlier detection?	Understand	2
10	**Explain** about the agglomerative and divisive hierarchical methods?	Understand	2

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Name	**DATA MINING**
Course Code	**CS702PC**
Class	IV B. Tech I Semester
Branch	Computer Science and Engineering
Year	2021 – 2022
Course Faculty	**Y APPARAO Assoc.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner"s learning process.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
	PART – A (Short Answer Questions)		
1	**Define** online analytical processing?	Knowledge	3
2	**List** the key features of data warehouse?	Understand	3
3	**Define** data mart?	Knowledge	3
4	**Define** enterprise warehouse?	Knowledge	3
5	**Define** virtual warehouse?	Knowledge	2
6	**List** the metadata repository?	Understand	2
7	**List** the various multidimensional models?	Understand	2
8	**Explain** about the star schema?	Understand	2
9	**Explain** the snowflake schema?	Understand	1
10	**Define** about the fact constellation model?	Knowledge	1
11	**Name** the OLAP operations?	Understand	1
12	**Express** what is slice and dice operation?	Understand	1
13	**Define** Pivot operation?	Knowledge	1
14	**Distinguish** between the OLAP Systems and Statistical databases?	Understand	1
15	**State** the various views of data warehouse design?	Understand	1
16	**Define** Relational OLAP(ROLAP) server?	Knowledge	2
17	**Explain** Multidimensional OLAP(MOLAP) server?	Understand	2
18	**State** what is Hybrid OLAP(HOLAP) server?	Understand	3
19	**Define** Data warehouse?	Knowledge	3

20	**Define** the use of concept hierarchy?	Knowledge	1
	Part - B (Long Answer Questions)		
1	**Differentiate** operational database systems and data warehousing?	Understand	2
2	**Discuss** briefly about the multidimensional data models?	Understand	1
3	**Explain** with an example the different schemas for multidimensional databases?	Understand	1
4	**Describe** the three-tier data warehousing architecture?	Knowledge	1
5	**Discuss** the efficient processing of OLAP queries?	Understand	2
6	**Explain** the data warehouse applications?	Understand	3
7	**Explain** the architecture for on-line analytical mining?	Understand	3
8	**Describe** the common techniques are used in ROLAP and MOLAP?	Knowledge	1
9	**Describe** the complex aggregation at multiple granularity?	Knowledge	2
10	**Explain** about the concept description? And what are the differences between concept description in large databases and OLAP?	Understand	3
11	**Discuss** about Metadata Repository?	Understand	2
12	**Compare** the schemas for the multidimensional data models?	Analyze	2
13	**Explain** about the data warehouse implementation with an example?	Understand	2
14	**Discuss** about types of OLAP Servers?	Understand	2
15	Explain OLAP operations in the Multidimensional Data Model?	Understand	3
16	**Compare** Enterprise warehouse, data mart, virtual warehouse?	Analyze	2
17	**Compare** Data cleaning, data transformation?	Analyze	2
18	**Explain** what are the differences between the three main types of data warehouse usage: information processing, analytical processing and data mining? Discuss the motivation behind OLAP mining(OLAM)?	Understand	2
19	**Explain** a data warehouse can be modeled by either a star schema or a snowflake schema. Briefly describe the similarities and the differences of the two models, and then analyze their advantages and disadvantages with regard to one another?	Understand	3
20	**Explain** Indexing OLAP Data?	Understand	3
	Part - C (Problem Solving and Critical Thinking Questions)		
1	**Analyze** that a data warehouse consists of the three dimensions time, doctor and patient, and the two measures count and charge, where charge is the fee that a doctor charges a patient for a visit. (a) Enumerate three classes of schemas classes of schemas that are popularly used for modeling data warehouses. (b) Draw a schema diagram for the above data warehouse using one of the schema classes listed in (a). (c) Starting with the base cuboid [day, doctor, patient], what specific OLAP operations should be performed in order to list the total fee collected by each doctor in 2004? (d) To obtain the same list, write an SQL query assuming the data is stored in a relational database with the schema fee (day, month, year, doctor, hospital,patient, count, charge).	Understand	3
2	**State** why, for the integration of multiple heterogeneous information sources, many companies in industry prefer the update-driven approach (which constructs and uses data warehouses), rather than the query-driven approach (which applies wrappers and integrators). Describe situations where the query-driven approach is preferable over the update-	Knowledge	3

	driven approach.		
3	Suppose that a data warehouse for Big University consists of the following four dimensions: student, course, semester, and instructor, and two measures count and avg grade. When at the lowest conceptual level (e.g., for a given student, course, semester, and instructor combination), the avg grade measure stores the actual course grade of the student. At higher combination. **Compute** the number of cuboids(a) Draw a snowflake schema diagram for the data warehouse. (b) Starting with the base cuboid [student, course, semester, instructor], what specific OLAP operations (e.g., roll-up from semester to year) Should one perform inorder to list the average grade of CS courses for each Big University student. (c) If each dimension has five levels (including all), such as "student < major < status < university < all", how many cuboids will this cube contain(including the base and apex cuboids)?	Apply	3
4	Suppose that a data warehouse consists of the four dimensions, date, spectator location, and game, and the two measures, count and charge, where charge is the fare that a spectator pays when watching a game on a given date. Spectators may be students, adults, or seniors, with each category having it"s own charge rate. **Write** the following (a) Draw a star schema diagram for the data warehouse. (b) Starting with the base cuboid [date,spectator,location,game], what specific OLAP operations should one perform in order to list the total charge paid by student spectators at GM_Place in 2004? (c) Bitmap indexing is useful in data warehousing. Taking this cube as an example,briefly discuss advantages and problems of using a bitmap index structure.	Apply	3
5	**Design** a data warehouse for a regional weather bureau. The weather bureau has about 1,000 probes, which are scattered throughout various land and ocean locations in the region to collect basic weather data, including air pressure, temperature, and precipitation at each hour. All data are sent to the central station, which has collected such data for over 10 years. Your design should facilitate efficient querying and on-line analytical processing, and derive general weather patterns in multidimensional space.	Create	2
6	**Explain** the computation of measures in a data cube: (a) Enumerate three categories of measures, based on the kind of aggregate functions used in computing a data cube. (b) For a data cube with the three dimensions time, location, and item, which category does the function variance belong to? Describe how to compute it if the cube is partitioned into many chunks. Hint: The formula for computing variance is $\frac{1}{N}\sum_{i=1}^{N}(x_i - \bar{x}_i)^2$ where xi is the average of N xis.	Understand	3

	(c) Suppose the function is "top 10 sales". Discuss how to efficiently compute this measure in a data cube		
7	Suppose that we need to record three measures in a data cube: min, average, and median. **Design** an efficient computation and storage method for each measure given that the cube allows data to be deleted incrementally (i.e., in small portions at a time) from the cube.	Understand	3
8	**Observe** that a data warehouse contains 20 dimensions, each with about five levels of granularity. (a) Users are mainly interested in four particular dimensions, each having three frequently accessed levels for rolling up and drilling down. How would you design a data cube structure to efficiently support this preference? (b) At times, a user may want to drill through the cube, down to the raw data for one or two particular dimensions. How would you support this feature?	Knowledge	3
9	**Observe** A data cube, C, has n dimensions, and each dimension has exactly p distinct values in the base cuboid. Assume that there are no concept hierarchies associated with the dimensions. (a) What is the maximum number of cells possible in the base cuboid? (b) What is the minimum number of cells possible in the base cuboid? (c) What is the maximum number of cells possible (including both base cells and aggregate cells) in the data cube, C? (d) What is the minimum number of cells possible in the data cube, C?	Knowledge	3
10	**Observe** A popular data warehouse implementation is to construct a multidimensional database, known as a data cube. Unfortunately, this may often generate a huge, yet very sparse multidimensional matrix. Present an example illustrating such a huge and sparse data cube.	Knowledge	3
	UNIT - II		
	Part – A (Short Answer Questions)		
1	**Define** data mining?	Knowledge	1
2	**Explain** the definition of data warehouse?	Understand	1
3	**Distinguish** between data mining and data warehouse?	Understand	2
4	**Identify** any three functionality of data mining?	Knowledge	3
5	**Interpret** major issues in data mining?	Understand	1
6	**Name** the steps in the process of knowledge discovery?	Knowledge	1
7	**Discuss** relational databases?	Understand	1
8	**State** object –oriented Databases?	Understand	1
9	**Explain** the spatial databases?	Understand	2
10	**Contrast** heterogeneous databases and legacy databases?	Understand	2
11	**Differentiate** classification and Prediction?	Understand	2
12	**Describe** transactional data bases?	Knowledge	2
13	**List** the types of data that can be mined?	Knowledge	3
14	**Define** data cube?	Knowledge	3
15	**Define** multidimensional data mining?	Knowledge	3
16	**Define** data characterization?	Knowledge	3
17	**Express** what is a decision tree?	Understand	3
18	**Explain** the outlier analysis?	Understand	3
19	**Name** the steps involved in data preprocessing?	Understand	3
20	**Interpret** the dimensionality reduction?	Understand	3
	Part - B (Long Answer Questions)		

1	**Describe** data mining? In your answer, address the following: a)Is it another hype? b) Is it a simple transformation of Technology developed from databases, statistics, and machine learning? c) Explain how the evolutions of database technology lead to data mining? d) Describe the steps involved in datamining when viewed as a process of knowledge discovery.	Understand	2
2	**Distinguish** between the data warehouse and databases? How they are similar?	Knowledge	2
3	**Explain** the difference between discrimination and classification? Between characterization and clustering? Between classification and prediction? For each of these pairs of tasks, how are they similar?	Understand	2
4	**Describe** three challenges to data mining regarding data mining methodology and user interaction issues?	Knowledge	2
5	**Distinguish** between the data warehouses and data mining?	Knowledge	2
6	**Discuss** briefly about the data smoothing techniques?	Understand	2
7	**Explain** Data Integration and Transformation?	Understand	3
8	**Describe** the various data reduction techniques?	Understand	3
9	**Define** data cleaning? **Express** the different techniques for handling missing values?	Knowledge	2
10	**Differentiate** between descriptive and predictive data mining?	Understand	2
11	**Explain** data mining as a step in the process of knowledge discovery?	Understand	3
12	**Describe** briefly Discretization and concept hierarchy generation for numerical data?	Knowledge	3
13	**Discuss** about the concept hierarchy generation for categorical data?	Understand	3
14	**List** and describe the five primitives for specifying a data mining task?	Understand	3
15	**Discuss** issues to consider during data integration?	Understand	1
16	**Describe** the following advanced database systems and applications: object- relational databases, spatial databases, text databases, multimedia databases, stream data, the World Wide Web.	Knowledge	2
17	**Describe** why concept hierarchies are useful in data mining.	Knowledge	2
18	**Describe** the differences between the following approaches for the integration of a data mining system with a database or data warehouse system: no coupling, loose coupling, semitight coupling, and tight coupling. State which approach you think is the most popular, and why	Knowledge	1
19	**Explain** Data quality can be assessed in terms of accuracy, completeness, and consistency. Propose two other dimensions of data quality.	Understand	1
20	**Apply** the two methods below to normalize the following group of data: 200, 300, 400, 600, 1000 (a) min-max normalization by setting min = 0 and max = 1 (b) z-score normalization	Apply	2
	Part – C (Problem Solving and Critical Thinking)		
1	Suppose that the data for analysis includes the attribute age. The age values for the data tuples are (in increasing order) 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25,25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52,70. **Compute** the following: (a) Mean of the data? Median? (b) mode of the data? Comment on the data‟s modality(i.e.,bimodal,trimodal,etc.). (c) midrange of the data?	Apply	1

2	Suppose that the data for analysis includes the attribute age. The age values for the data tuples are (in increasing order) 13, 15, 16, 16, 19,20,20,21,22,22,25,2525, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52,70. **Compute** the following: (a) Can you find (roughly) the first quartile (Q1) and the third quartile (Q3) of the data? (b) Give the five-number summary of the data. (c) Show a boxplot of the data. (d) How is a quantile-quantile plot different from a quantile plot?	Apply	1
3	**Use** the data for age given above answer the following. (a) Use smoothing by bin means to smooth the above data, using a bin depth of 3. Illustrate your steps. Comment on the effect of this technique for the given data (b) How might you determine outliers in the data? (c) What other methods are there for data smoothing?	Apply	1
4	Suppose a hospital tested the age and body fat data for 18 randomly selected adults with the following result age 23 23 27 27 39 41 47 49 50 %fat 9.5 26.5 7.8 17.8 31.4 25.9 27.4 27.2 31.2 age 52 54 54 56 57 58 58 60 61 %fat 34.6 42.5 28.833.4 30.2 34.1 32.9 41.2 35.7 **Examine** the following (a) the mean, median and standard deviation of age and %fat. (b) Draw the box plots for age and %fat. (c) Draw a scatter plot and a q-q plot based on these two variables.	Knowledge	2
5	**Write** an example where data mining is crucial to the success of a business. What data mining functions does this business need? Can they be performed alternatively by data query processing or simple statistical analysis?	Apply	2
6	Suppose your task as a software engineer at Big University is to design a data mining system to examine the university course database, which contains the following infor- mation: the name, address, and status (e.g., undergraduate or graduate) of each student, the courses taken, and the cumulative grade point average (GPA). **Describe** the architecture you would choose. What is the purpose of each component of this architecture?	Understand	2
7	Outliers are often discarded as noise. However, one person‟s garbage could be another‟s treasure. For example, exceptions in credit card transactions can help us detect the fraudulent use of credit cards. Taking fraudulence detection as an example, **Write** two methods that can be used to detect outliers and discuss which one is more reliable.	Apply	3
9	**Examine** the following consider the following data for analysis includes the attribute age. The age values for the data tuples are (in increasing order) 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70. (a) Usemin-maxnormalizationtotransformthevalue 35 for age on to the range [0.0, 1.0]. (b) Use z-score normalization to transform the value 35 for age, where the standard deviation of age is 12.94 years. (c) Use normalization by decimal scaling to transform the value 35 for age. (d) Comment on which method you would prefer to use for the given data, giving reasons as to why.	Knowledge	3
10	Suppose a group of 12 sales price records has been sorted as follows	Knowledge	2

	follows: 5, 10, 11, 13, 15, 35, 50, 55, 72, 92, 204, 215 **Examine** the following methods by partition them into three bins (a) equal-frequency (equidepth) partitioning (b) equal-width partitioning (c) clustering		
	UNIT-III		
	Part - A (Short Answer Questions)		
1	**Define** frequent patterns?	Knowledge	3
2	**Define** closed itemset?	Knowledge	3
3	**State** maximal frequent itemset?	Understand	3
4	**List** the techniques of efficiency of Apriori algorithm?	Understand	3
5	**Explain** ECLAT algorithms usage?	Understand	1
6	**Name** the pruning strategies in mining closed frequent itemsets?	Understand	2
7	**Define** substructure of a structural pattern?	Knowledge	2
8	**Interpret** the rule of support for itemsets A and B?	Understand	2
9	**Classify** the confidence rule for itemsets A and B?	Understand	1
10	**Define** itemset?	Knowledge	2
11	**Name** the steps in association rule mining?	Understand	3
12	**Explain** the join step?	Understand	1
13	**Describe** the prune step?	Knowledge	1
14	**State** how can we mine closed frequent itemsets?	Understand	2
15	**Name** the pruning strategies of closed frequent itemsets?	Understand	3
16	**Explain** the two kinds of closure checking?	Understand	3
17	**Summarize** the constraint-based mining?	Understand	2
18	**Describe** the five categories of pattern mining constraints?	Knowledge	1
19	**List** the applications of pattern mining?	Understand	2
20	**Define** Support and Confidence?	Knowledge	2
	Part – B (Long Answer Questions)		
1	**Define** the terms frequent itemsets, closed itemsets and association rules?	Knowledge	2
2	**Discuss** which algorithm is an influential algorithm for mining frequent itemsets for boolean association rules? Explain with an example?	Understand	2
3	**Describe** the different techniques to improve the efficiency of Apriori? Explain?	Knowledge	2
4	**Discuss** the FP-growth algorithm? Explain with an example?	Understand	3
5	**Explain** how to mine the frequent itemsets using vertical data format?	Understand	1
6	**Discuss** about mining multilevel association rules from transaction databases in detail?	Understand	3
7	**Explain** how to mine the multidimensional association rules from relational databases and data warehouses?		
8	**Describe** briefly about the different correlation measures in association analysis?		
9	**Discuss** about constraint-based association mining?	Understand	2
10	**Explain** the Apriori algorithm with example?	Understand	3
11	**Discuss** the generating association rules from frequent itemsets.	Understand	3
	Discuss about mining multilevel association rules from transaction databases in detail?		
13	**Describe** multidimensional association rules using static	Knowledge	3

<table>
<tr><td></td><td>Discretization?</td><td></td><td></td></tr>
<tr><td>14</td><td>Explain what are additional rule constraints to guide mining?</td><td>Understand</td><td>3</td></tr>
<tr><td></td><td>Explain, how can we tell which strong association rules are really
interesting? Explain with an example?</td><td></td><td></td></tr>
<tr><td>16</td><td>Describe about the correlation analysis using Chi-square?</td><td>Knowledge</td><td>3</td></tr>
<tr><td>17</td><td>Apply the following rules on a database has five transactions. Let min sup = 60% and min con f = 80%.
<table><tr><td>TID</td><td>items bought</td></tr><tr><td>T100</td><td>{M, O, N, K, E, Y}</td></tr><tr><td>T200</td><td>{D, O, N, K, E, Y }</td></tr><tr><td>T300</td><td>{M, A, K, E}</td></tr><tr><td>T400</td><td>{M, U, C, K, Y}</td></tr><tr><td>T500</td><td>{C, O, O, K, I ,E}</td></tr></table>(a) Find all frequent itemsets using Apriori .
(b) List all of the strong association rules (with support s and confidence
(c) matching the following metarule, where X is a variable representing customers, and itemi denotes variables representing items (e.g., “A”, “B”, etc.):
∀x ∈ transaction, buys(X , item1) ∧ buys(X , item2) ⇒ buys(X , item3) [s, c]</td><td>Apply</td><td>2</td></tr>
<tr><td>18</td><td>Describe about the Mining closed Frequent Itemset</td><td>Knowledge</td><td>2</td></tr>
<tr><td>19</td><td>Write a short example to show that items in a strong association rule may actually be negatively correlated.</td><td>Apply</td><td>3</td></tr>
<tr><td>20</td><td>Explain Association rule mining often generates a large number of rules. Discuss effective methods that can be used to reduce the number of rules generated while still preserving most of the interesting rules.</td><td>Understand</td><td>3</td></tr>
<tr><td colspan="4">Part – C (Problem Solving and Critical Thinking Questions)</td></tr>
<tr><td>1</td><td>The Apriori algorithm uses prior knowledge of subset support properties.
Analyze
(a) That all nonempty subsets of a frequent itemset must also be frequent.
(b) The support of any nonempty subset s 0 of itemset s must be at least as great as the support of s.
(c) Given frequent itemset l and subset s of l, prove that the confidence of the rule “s 0 ⇒ (l − s 0)” cannot be more than the confidence of “s ⇒ (l –s)”, where s 0 is a subset of s.
(d) A partitioning variation of Apriori subdivides the transactions of a database D into n nonoverlapping partitions. Prove that any itemset that is frequent in D must be frequent in at least one partition of D.</td><td>Analyze</td><td>3</td></tr>
<tr><td>2</td><td>Implement three frequent itemset mining algorithms introduced in this chapter :
(1) Apriori [AS94], (2) FP-growth [HPY00], and (3) ECLAT [Zak00] (mining using vertical data format), using a programming language that you are familiar with, such as C++ or Java.</td><td>Understand</td><td>2</td></tr>
</table>

<table>
<tr><td></td><td>Compare the performance of each algorithm with various kinds of large data set.
Write a report to analyze the situations (such as data size, data distribution, minimal support threshold setting, and pattern density) where one algorithm may perform better than the others, and state why.</td><td></td><td></td></tr>
<tr><td>3</td><td>Suppose that a large store has a transaction database that is distributed among four
locations. Transactions in each component database have the same format , namely Tj : {i1, . . . , im}, where Tj is a transaction identifier, and ik ($1 \leq k \leq m$) is the identifier of an item purchased in the transaction.
Construct an efficient algorithm to mine global association rules (without
considering multilevel associations). You may present your algorithm in the form of an outline. Your algorithm should not require shipping all of the data to one site and should not cause excessive network communication overhead.</td><td>Apply</td><td>3</td></tr>
<tr><td>4</td><td>Suppose that frequent itemsets are saved for a large transaction database, DB.
Illustrate how to efficiently mine the (global) association rules under the same
minimum support threshold if a set of new transactions, denoted as ΔDB, is
(incrementally) added in?</td><td>Apply</td><td>3</td></tr>
<tr><td>5</td><td>Most frequent pattern mining algorithms consider only distinct items in a transaction However, multiple occurrences of an item in the same shopping basket, such as four cakes and three jugs of milk, can be important in transaction data analysis.
Analyze how can one mine frequent itemsets efficiently considering multiple occurrences of items? Propose modifications to the well-known algorithms, such as Apriori and FP-growth, to adapt to such a situation.</td><td>Analyze</td><td>1</td></tr>
<tr><td>6</td><td>A database has five transactions. Let min sup = 60% and min con f = 80%.
<table><tr><td>TID</td><td>items bought</td></tr><tr><td>T100</td><td>{M, O, N, K, E, Y}</td></tr><tr><td>T200</td><td>{D, O, N, K, E, Y }</td></tr><tr><td>T300</td><td>{M, A, K, E}</td></tr><tr><td>T400</td><td>{M, U, C, K, Y}</td></tr><tr><td>T500</td><td>{C, O, O, K, I ,E}</td></tr></table>Examine the following
(d) Find all frequent itemsets using FP-growth.
(e) List all of the strong association rules (with support s and confidence c) matching the following metarule, where X is a variable representing customers, and itemi denotes variables representing items (e.g., “A”, “B”, etc.):
∀x ∈ transaction, buys(X , item1) A buys(X , item2) ⇒ buys(X , item3)
[s, c]</td><td>Knowledge</td><td>3</td></tr>
<tr><td>7</td><td>The following contingency table summarizes supermarket transaction data,</td><td>Knowledge</td><td>2</td></tr>
</table>

	where hot dogs refers to the transactions containing hot dogs, hot dogs refers to the transactions that do not contain hot dogs, hamburgers refers to the transactions containing hamburg- ers, and hamburgers refers to the transactions that do not contain hamburgers. **Observe** that the association rule "hot dogs ⇒ hamburgers" is mined. Given a minimum support threshold of 25% and a minimum confidence threshold of 50%, is this association rule strong? Based on the given data, is the purchase of hot dogs independent of the purchase of hamburgers? If not, what kind of correlation relationship exists between the two?		
8	Sequential patterns can be mined in methods similar to the mining of association rules. **Design** an efficient algorithm to mine multilevel sequential patterns from a transaction database. An example of such a pattern is the following: "A customer who buys a PC will buy Microsoft software within three months," on which one may drill down to find a more refined version of the pattern, such as "A customer who buys a Pentium PC will buy Microsoft Office within three months."	Create	2
9	The price of each item in a store is nonnegative. The store manager is only interested in rules of the form: "one free item may trigger $200 total purchases in the same transaction." **Describe** how to mine such rules efficiently.	Knowledge	2
10	The price of each item in a store is nonnegative. For each of the following cases, identify the kinds of constraint they represent and briefly **discuss** how to mine such association rules efficiently. (a) Containing at least one Nintendo game (b) Containing items the sum of whose prices is less than $150 (c) Containing one free item and other items the sum of whose prices is at least $200 (d) Where the average price of all the items is between $100 and $500	Understand	2

	UNIT-IV		
	Part – A (Short Answer Questions)		
1	**State** classification?	Understand	2
2	**Define** regression analysis?	Knowledge	2
3	**Name** the steps in data classification?	Understand	2
4	**Define** training tuple?	Knowledge	2
6	**Describe** accuracy of a classifier?	Knowledge	2
7	**Differentiate** supervised learning and unsupervised learning?	Understand	3
8	**Define** the decision tree?	Understand	2
9	**Define** information gain?	Knowledge	2
10	**State** gain ratio?	Understand	2
11	**State** Gini index?	Understand	3
12	**Explain** tree pruning?	Understand	3
14	**Define** the construction of naïve Bayesian classification?	Understand	2
15	**Explain** the IF-THEN rules for classification?	Understand	3
16	**Explain** Decision Tree Induction?	Understand	3
17	**List** the Attribute Selection Measures?	Knowledge	3
18	**Define** Bayes" Theorem?	Understand	3

	hot dogs	hot dogs	□ row
hamburgers	2,000	500	2,500
hamburgers	1,000	1,500	2,500
□ col	3,000	2,000	5,000

19	**Define** Naïve Bayesian Classification?	Knowledge	3
20	**Explain** K-Nearest-Neighbor Classifiers?	Understand	3
	Part – B (Long Answer Questions)		
1	**Explain** about the classification and prediction? Example with an example?		
2	**Discuss** about basic decision tree induction algorithm?	Understand	2
3	**Explain** briefly various measures associated with attribute selection?	Understand	3
4	**Summarize** how does tree pruning work? What are some enhancements to basic decision tree induction?	Understand	3
5	**Explain** how scalable is decision tree induction? Explain?	Understand	3
6	**Describe** the working procedures of simple Bayesian classifier?	Knowledge	2
7	**Explain** Bayesian Belief Networks?	Understand	2
8	**Discuss** about k-nearest neighbor classifier and case-based reasoning?	Understand	1
9	**Explain** about classifier accuracy? Explain the process of measuring the accuracy of a classifier?	Understand	2
10	**Describe** any ideas can be applied to any association rule mining be applied to classification?	Knowledge	3
11	**Explain** briefly about the Navie Bayesian Classification?	Knowledge	3
12	**Explain** about the major issues regarding classifications and predictions?	Understand	3
13	**Differentiate** classification and prediction methods?	Understand	3
14	**Explain** briefly various measures associated with attribute selection?	Understand	3
15	**Explain** training of Bayesian belief networks?	Understand	3
16	**Explain** how tree pruning useful in decision tree induction? What is a drawback of using a separate set of tuples to evaluate pruning?	Understand	2
17	**Explain** for a given a decision tree, you have the option of (a) converting the decision tree to rules and then pruning the resulting rules, or (b) pruning the decision tree and then con- verting the pruned tree to rules. What advantage does (a) have over (b)?	Understand	2
18	**Compare** the advantages and disadvantages of eager classification (e.g., decision tree, Bayesian, neural network) versus lazy classification (e.g., k-nearest neighbor, case- based reasoning).	Understand	2
19	**Write** an algorithm for k-nearest-neighbor classification given k and n, the number of attributes describing each tuple.	Apply	2
20	**Describe** each of the following clustering algorithms in terms of the following criteria: (i) shapes of clusters that can be determined; (ii) input para- meters that must be specified; and (iii) limitations. (a) k-means (b) k-medoids	Knowledge	3
	Part – C (Problem Solving and Critical Thinking Questions)		
1	**Illustrate** why is tree pruning useful in decision tree induction? Explain the drawback of using a separate set of tuples to evaluate pruning?	Apply	2
2	Given a decision tree, you have the option of (a) converting the decision tree to rules and then pruning the resulting rules, or (b) pruning the decision tree and then converting the pruned tree to rules. **Explain** advantage does (a) have over (b)?	Understand	3
3	Outline the major ideas of naive Bayesian classification. **Explain** why is naïve Bayesian classification called "naive"?	Understand	3
4	**Design** an efficient method that performs effective naive Bayesian classification over an infinite data stream (i.e., you can scan the data stream only once). If we wanted to discover the evolution of such classification schemes (e.g., comparing the classification	Create	3

	scheme at this moment with earlier schemes, such as one from a week ago),Construct modified design would you suggest?		
5	The support vector machine (SVM) is a highly accurate classification method. However, SVM classifiers suffer from slow processing when training with a large set of data tuples. **Explain** how to overcome this difficulty and develop a scalable SVM algorithm for efficient SVM classification in large datasets.	Understand	3
6	It is important to calculate the worst-case computational complexity of the decision tree algorithm. Given data set D, the number of attributes n, and the number of training tuples |D|, S**how** that the computational cost of growing a tree is at most n×|D| × log(|D|).	Understand	3
7	Given a 5 GB data set with 50 attributes (each containing 100 distinct values) and 512 MB of main memory in your laptop, outline an efficient method that constructs decision trees in such large data sets. **Justify** your answer by rough calculation of your main memory usage.	Create	2
8	What is associative classification? Why is associative classification able to achieve higher classification accuracy than a classical decision tree method? **Explain** how associative classification can be used for text document classification.	Understand	2
9	It is difficult to assess classification accuracy when individual data objects may belong to more than one class at a time. In such cases, **Explain** on what criteria you would use to compare different classifiers modeled after the same data.	Understand	2
10	**Describe** each of the following clustering algorithms in terms of the following criteria: (i) shapes of clusters that can be determined; (ii) input para- meters that must be specified; and (iii) limitations. (a) k-means (b) k-medoids (c) CLARA (d) BIRCH (e) ROCK (f) Chameleon (g) DBSCAN	Understand	3
	UNIT-V		
	Part - A (Short Answer Questions)		
1	**Define** Clustering?	Knowledge	3
2	**Illustrate** the meaning of cluster analysis?	Apply	2
3	**Explain** the fields in which clustering techniques are used?	Understand	2
4	**List** out the requirements of cluster analysis?	Knowledge	2
5	**Express** the different types of data used for cluster analysis?	Understand	3
6	**State** interval scaled variables?	Knowledge	3
7	**Define** Binary variables? And what are the two types of binary variables?	Knowledge	3
8	**Define** nominal, ordinal and ratio scaled variables?	Knowledge	3
9	**Illustrate** mean by partitioning method?	Apply	3
10	**Define** CLARA and CLARANS?	Knowledge	3
11	**State** hierarchical method?	Knowledge	2
12	**Differentiate** agglomerative and divisive hierarchical clustering?	Analyze	3
13	**State** K-Means method?	Knowledge	3
14	**Define** Outlier Detection?	Knowledge	2
20	**Define** Chameleon method?	Knowledge	2
	Part - B (Long Answer Questions)		
1	**Discuss** the various types of data in cluster analysis?	Understand	3
2	**Explain** the categories of major clustering methods?	Understand	3

3	**Write** algorithms for k-means and k-medoids? Explain?	Understand	3
4	**Describe** the different types of hierarchical methods?	Understand	3
5	**Demonstrate** about the following hierarchical methods a) BIRCH b) Chamelon	Understand	3
6	**Explain** about semi-supervised cluster analysis?	Understand	3
7	**Explain** about the outlier analysis?	Understand	3
8	**Define** the distance-based outlier? Illustrate the efficient algorithms for mining distance-based algorithm?	Knowledge	3
9	**Explain** about the Statistical-based outlier detection?	Understand	2
10	**Describe** about the distance-based outlier detection?	Knowledge	2
11	**Discuss** about the density-based outlier detection?	Understand	2
12	**Demonstrate** about the deviation-based outlier detection techniques?	Apply	3
13	**Demonstrate** about the BIRCH hierarchical methods?	Apply	3
14	**Demonstrate** about the ROCK(Robust Clustering using links) hierarchical methods?	Apply	3
15	**Explain** about the agglomerative and divisive hierarchical methods?	Understand	3
16	**Demonstrate** how to compute the dissimilarity between objects described by the following types of variables: (a) Numerical (interval-scaled) variables (b) Asymmetric binary variables (c) Categorical variables (d) Ratio-scaled variables (e) Nonmetric vector objects	Apply	2
17	**Apply** the following measurements for the variable age: 18, 22, 25, 42, 28, 43, 33, 35, 56, 28, standardize the variable by the following: (a) Compute the mean absolute deviation of age. (b) Compute the z-score for the first four measurements.	Apply	2
18	**Illustrate** the strength and weakness of k-means in comparison with the k-medoids algorithm. Also, illustrate the strength and weakness of these schemes in comparison with a hierarchical clustering scheme (such as AGNES).	Understand	2
19	**Explain** why is outlier mining important? Briefly describe the different approaches behind statistical-based outlier detection, distanced-based outlier detection, density-based local out- lier detection, and deviation-based outlier detection.	Understand	2
20	**Apply** the given following measurements for the variable age: 28, 32, 15, 42, 28, 43, 30, 32, 55, 26, standardize the variable by the following: (a) Compute the mean absolute deviation of age. (b) Compute the z-score for the first four measurements.	Apply	2
Part – C (Problem Solving and Critical Thinking Questions)			
1	Given the following measurements for the variable age: 48, 12, 25, 42, 28,43,33,35, 56, 28, standardize the variable by the following: **Compute** (a) The mean absolute deviation of age. (b)The z-score for the first four measurements.	Apply	2
2	Given two objects represented by the tuples (22, 1, 42, 10) and (20, 0, 36,8): **Compute** (a) The Euclidean distance between the two objects. (b)The Manhattan distance between the two objects. (c) The Minkowski distance between the two objects, using p = 3.	Apply	3

3	Suppose that the data mining task is to cluster the following eight points(with (x,y) representing location) into three clusters. A1(2, 10), A2(2, 5), A3(8, 4), B1(5, 8),B2(7, 5), B3(6, 4), C1(1, 2), C2(4, 9). The distance function is Euclidean distance. Suppose initially we assign A1, B1, and C1 as the center of each cluster, respectively. **Use** the k-means algorithm to show only (a) The three cluster centers after the first round of execution and (b) The final three clusters	Apply	3
4	**Explain** why is it that BIRCH encounters difficulties in finding clusters of arbitrary shape but OPTICS does not? Can you propose some modifications to BIRCH to help it find clusters of arbitrary shape?	Analyze	3
5	Clustering has been popularly recognized as an important data mining task with broad applications. **Show** one application example for each of the following cases: (a) An application that takes clustering as a major data mining function (b) An application that takes clustering as a preprocessing tool for data preparation for other data mining tasks	Apply	2
6	Clustering has been popularly recognized as an important data mining task with broad applications. **Give example** for each of the following cases: (a) An application that takes clustering as a major data mining function (b) An application that takes clustering as a preprocessing tool for data preparation for other data mining tasks	Understand	3
7	Data cubes and multidimensional databases contain categorical, ordinal, and numerical data in hierarchical or aggregate forms. Based on what you have learned about the clustering methods, **Design** a clustering method that finds clusters in large data cubes effectively and efficiently.	Create	3
8	Human eyes are fast and effective at judging the quality of clustering methods for two- dimensional data. **Design** a data visualization method that may help humans visualize data clusters and judge the clustering quality for three-dimensional data? What about for even higher-dimensional data?	Create	3
9	Given the following measurements for the variable age: 29, 31, 25, 41, 27,43,33,35 56, 28, standardize the variable by the following: **Compute** (a) The mean absolute deviation of age. (b)The z-score for the first three measurements.	Apply	2
10	Given two objects represented by the tuples (21, 2, 41, 11) and (21, 1, 32,6): **Compute** (a) The Euclidean distance between the two objects. (b)The Manhattan distance between the two objects. (c) The Minkowski distance between the two objects, using p = 2.	Apply	2

Prepared by: **HOD, CSE**

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**Cloud Computing**			
Course Code	CS714PE			
Regulation	R18-JNTUH			
Course Structure	Lectures	Tutorials	Practical	Credits
	4	-	-	3
Course Coordinator	**R PRASHANTH Asst Prof**			

I. COURSE OVERVIEW:

Cloud Computing is a large-scale distributed computing paradigm which has become a driving force for information technology over the past several years. The exponential growth data size in scientific instrumentation/simulation and social media has triggered the wider use of cloud computing services.We will explore solutions and learn design principles for building large network-based systems to support both compute and data intensive computing across geographically distributed infrastructure.

II. PREREQUISITES:

Level	Credits	Periods / Week	Prerequisites
UG	3	4	Computer Networks,DBMS

III. COURSE ASSESSMENT METHODS:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 25 marks of 90 minutes duration. Subjective test of shall contain 10 questions, the student has to answer 10 questions, each carrying 1 mark. The long type test is for 15 marks. It consists the student has to answer all the questions and each carry two half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.	70	100

Sessional Marks	University End Exam marks	Total marks
commencement of the semester. These are of problem solving in nature with critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1	I Mid Examination	90 minutes	25
2	I Assignment	-	5
3	II Mid Examination	90 minutes	25
4	II Assignment	-	5
5	External Examination	3 hours	70

V. COURSE OBJECTIVES:

I. To impart fundamental concepts in the area of cloud computing
II. To impart knowledge in applications of cloud computing
III. To introduce the broad perceptive of cloud architecture and model.
IV. To understand the concept of virtualization and design of cloud services.
V. To be familiar with the lead players in a cloud.
VI. To understand the features of Cloud Simulator.
VII. To apply different cloud programming model as per need.
VIII. To learn to design the trusted cloud computing system.

VI. COURSE OUTCOMES:

CO	Course outcome	Blooms taxonomy level
C413.1	Discuss the various paradigm of cloud computing and articulate the main concepts, key technologies, strengths, and limitations of cloud computing	Understand
C413.2	Discuss the various paradigm of cloud computing and articulate the main concepts, key technologies, strengths, and limitations of cloud computing	Create
C413.3	Identify the architecture and infrastructure of cloud computing	Analyse

	suitable for the specified environment	
C413.4	Interpret various data, scalability and cloud services to acquire efficient database for cloud storage.	Analyse
C413.5	Explain the security, privacy, and interoperability of cloud computing with its controlling mechanism	Create

VII HOW PROGRAM OUTCOMES ARE ASSESSE

Program Outcomes		**Level**	**Proficiency assessed by**
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specializationto the solution of complex engineering problems.	S	Assignment, Exercises
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	S	Exercises
PO3	**Design/development of solutions**: Design solutions for complexengineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	H	Exercises
PO4	**Conduct investigations of complex problems**: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	N	----------
PO5	**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.	N	----------
PO6	**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.	N	----------
PO7	**Environment and sustainability**: Understand the impact of theprofessional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need forsustainable development.	N	----------
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	Seminars, Discussions
PO9	**Individual and team work**: Function effectively as an individual,and as a member or leader in diverse teams, and in multidisciplinary settings.	N	----------
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	----------
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	H	Exercises, Discussions
PO12	**Life-long learning**: Recognize the need for, and have thepreparation and ability to engage in independent and life-long learning in the broadest context of technological change.	N	----------

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	Applications of Computing: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	1	Lectures, Assignments
PSO2	Programming Skills: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	2	
PSO3	Make use of computational and experimental tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	

SYLLABUS:

UNIT I

System Modeling, Clustering and Virtualization: distributed system models and enabling technologies, computer clusters for scalable parallel computing, virtual machines and virtualization of clusters and data centers.

UNIT II

Foundations: introduction to cloud computing, migrating into cloud, enriching the integration of service paradigm for cloud era, the enterprise cloud computing paradigm

UNIT III

Infra Structure As Service (IAAS)& Platform And Software Service(PAAS/SAAS): Virtual machine provisioning and migration services, on the management of virtual machines for cloud infrastructure, enhancing cloud computing environments using a cluster as service, secure distributed data storage in cloud computing

Aneka, comet cloud, T-systems, work flow engine for clouds ,understanding scientific applications for cloud environments

UNIT IV

Monitoring, Management And Applications :An Architecture for federated cloud computing ,SLA management in cloud computing, performance prediction for HPC on clouds, best practices in Architecting cloud applications in the AWS cloud, building content delivery networks using clouds, resource cloud mashups.

UNIT V

Governance and case studies: organizational readiness and change management in cloud age, data security in cloud, legal issues in cloud computing, achieving production readiness for cloud services.

Text Books

1. Cloud computing: principles and paradigms by rajkumar buyya, james Broberg and Andrzej M.Goscinski,wiley,2011
2. Distributed and cloud computing , kai Hwang, Geofferyu C.fox, jack J.dongarra, Elsevier, 2012

References

1. Cloud Computing :A practical approach, Anthony T.velte, Toby J.velte, Robert Elsenpeter,Tata McGraw Hill,2011
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University press,2010
3. Cloud computing: implementation ,management and security, john W .Ritting house ,james F. Ransome ,CRC press,rp2012
4. Cloud applications architectures: building Applications and infrastructure in the cloud,George Reese ,O reilly,SPD,rp2011
5. Cloud security and privacy: An Enterprise perspective on Risks and compliance,im Mather, Subra Kumaraswamy,Shahed Latif,O reilly,SPD,rp2011

IX. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No.	Learning Objectives	Topics to be covered	Reference
1-2	To Understand The Different Types Of Systems ,System Models	SYSTEM MODELING,CLUSTURES AND VIRTUALIZATION	T2:10-58
3			
4-5			
6			
8			
17	To Understand Different Types Of Clusters‟, Different Types Of Clusters‟	COMPUTER CLUSTURES	T2:68-168
18			
19			
20			
21			
22	To Define The Definition Of Scalable Computing And Virtualization, Virtual Machines	Scalable Parallel Computing	T2:174-286
23		Computer Clusters For Scalable Parallel Computing	
24		Virtual Machines And Virtualization Of Clusters And Data Centers	
25			
26			
27	To Understand What Is Cloud And Able To Define Cloud And Its Uses	The Enterprise Cloud Computing Paradigm	T1:97-158
37			
40	To Understand The Infrastructure Of Cloud And We Are Accessing That From Cloud	Infrastructure As A Service(Iaas)&Platform And Software As A Service(Paas/Saas)	T1:126-130
43-44		Basics Of Infrastructure As A Service(Iaas)&Platform And Software As A Service(Paas/Saas):	T1:140-144
45		Virtual Machines Provisioning And Migration Services	T1:145-154
46	To Manage The Device Which Are Virtualized	On The Management Of Virtual Machines For Cloud Infrastructures,	T1:152-185
48	To Understand The Data Storage In Cloud	Enhancing Cloud Computing Environments Using A Cluster As A Service ,	T1:193-212
49		Secure Distributed Data Storage In Cloud Computing.	T1:221-242
50		Aneka, Comet Cloud, T-Systems,	T1:252-298
41	To Understand The Applications Of Cloud And Monitoring And Management Of Cloud Applications	Understanding Scientific Applications For Cloud Environments.	T1:345-385
52		Monitoring, Management Applications: An Architecture For Federated Cloud Computing	T1:393-410
53-54		Sla Management In Cloud Computing, Resource Cloud Mashups	T1:413-429
55		Performance Prediction For Hpc On Cloud	T1:437-445
56		Best Practices In Architecting Cloud Applications In The Aws Cloud,	T1:459-542
57		Governance And Case Studies	T1:551-567
58		Organizational Readiness And Change Management In The Cloud Age,	T1:567-572
59		Data Security In The Cloud,	T1:573-588
60		Achieving Production Readiness For Cloud Services	T1:593-612

X. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES:

Program outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
C413.1	3	3	2	2	3	1	0	0	0	0	0	1	3	3	3
C413.2	3	3	2	2	3	1	0	0	0	0	0	1	3	3	3
C413.3	3	3	2	2	3	1	0	0	0	0	0	1	3	3	3
C413.4	3	3	2	2	3	1	0	0	0	0	0	1	3	3	3
C413.5	3	3	2	2	3	1	0	0	0	0	0	1	3	3	3
Total	15	15	10	10	15	5									
Average	**3**	**3**	**2**	**2**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**3**	**3**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	:	**CLOUD COMPUTING**
Course Code	:	CS714PE
Class	:	IV B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2021 – 2022
Course Faculty	:	**R PRASHANTH Asst.Prof**

OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner"s learning process.

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1	**Define** distributed systems	Knowledge	2
2	**Write** about parallel computing	Create	1
3	**Write** about virtual machines	Create	1
4	**Define** single system image	Knowledge	2
5	**Write** about resources sharing in clustures	Create	2
6	**Explain** briefly about HTC	Understand	1
7	**Write** about distributed system models and enabling technologies	Create	1
8	**Explain** in detail about system models and distributed cloud computing	Understand	2
9	**Explain** about Design Principles of Computer Clusters	Understand	2
10	**List** out the design principles of computer clustures	Understand	1
	UNIT – II		
1	What is cloud computing? Enlist and Explain three service models, and four deployment models of cloud computing.	Understand	1
2	Explain the system models for distributed and cloud computing?	Understand	2
3	Explain the architecture of P2P system?	Understand	2
4	Explain architectural design of compute and storage clouds?	Understand	2
5	Explain the infrastructure of Grid computing in detail?	Understand	2
6	Explain any six benefits of Software as Service in Cloud computing?	Understand	2

S. No.	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – III		
1	**Explain** in detail about RVWS design?	Understand	1
2	**What** is ANEKA cloud platform?	Understand	2
3	**Explain** the technologies for data security in cloud computing?	Understand	1
4	**Implement** in detail about hybrid cloud?	Knowledge	2
5	**Explain** the importance of quality and security in clouds?	Knowledge	1
6	**Explain** in detail about hybrid cloud implementation	Understand	2
7	**Draw** a neat sketch for architectural overview	Application	1
8	**Explain** about ANEKA resource provisioning service?	Understand	2
	UNIT - IV		
1	**Write** about SAP systems in detail	Understand	2
2	**List** out the business benefits of cloud computing	Knowledge	2
3	**List** out the business benefits of cloud computing	Knowledge	2
4	**Explain** about SLA management in cloud	Understand	1
5	**Explain** about SLA management in cloud	Understand	2
6	**Draw** a neat sketch for automated policy based management with brief explanation	Application	1
7	**Write** about HPC systems and HPC on clouds	Understand	2
8	**List** out the technical benefits of cloud computing	Knowledge	2
9	**Explain** in detail about decouple your components	Understand	2
	UNIT - V		
1	**Explain** about a framework to comprehend the competitive environment	Understand	1
2	**Explain** about digital identity and data security	Understand	2
3	**Write** about quality of service and value composition	Understand	2
4	**Explain** about common change management models(CMMM)	Understand	2
5	**List** out the cloud contracting models	Knowledge	1
6	**List** out the data privacy and security issues	Knowledge	1
7	**Explain** about management maturity model	Understand	2

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**CLOUD COMPUTING**
Course Code	:	**CS714PE**
Class	:	IV B. Tech I Semester
Branch	:	CSE
Year	:	2021 – 2022
Course Faculty	:	**R PRASHANTH Asst.Prof**

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

S No	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT - I **System Modeling, Clustering And Virtualization**		
	Part - A (Short Answer Questions)		
1	**Define** distributed systems	Remember	1
2	**Write** about parallel computing	Understand	1
3	**Write** about virtual machines	Understand	1
4	**Define** single system image	Understand	2
5	**Write** about resources sharing in clusters	Understand	2
6	**Explain** briefly about HTC	Remember	1
7	**Write** about middleware support for virtualization	Remember	2
8	**Explain** briefly about HPC	Remember	2
9	**Write** about virtual support at os level	Remember	2
10	**List** the disadvantages of extending os level	Remember	2
11	**What** are the basic characteristics of cloud computing?	Understand	2
12	**How** does cloud computing provides on- demand functionality?	Remember	2
13	**Define** multi core CPU?	Remember	1
14	Define GPU?	Remember	2
15	Define anything-as-a-service?	Understand	1

16	Define private cloud, public cloud & hybrid cloud?	Understand	2
17	Difference between distributed and parallel computing?	Understand	2
18	Define cloud provider and cloud broker?	Understand	2
19	List the design objectives of cloud computing?	Remember	2
20	Why should one prefer public cloud over private cloud?	Remember	2
Part - B (Long Answer Questions)			
1	Write about distributed system models and enabling technologies	Remember	1
2	Explain in detail about system models and distributed cloud computing	Analyze	1
3	Explain about Design Principles of Computer Clusters	Evaluate	2
4	List out the design principles of computer clustures	Remember	2
5	Explain about Computer Clusters and MPP Architectures	Understand	2
6	Write about technologies for network based system with suitable diagrams	Remember	2
7	Write about Virtual Clusters and Resource Management	Understand	2
8	Explain the virtualisation structure/Tools and mechanisms	Understand	1
9	Explain the Cluster Architecture in detail?	Understand	1
10	What is cloud computing? Enlist and Explain three service models, and four deployment models of cloud computing	Remember	1
11	Explain the cloud eco system?	Understand	1
12	Explain the NIST cloud computing reference architecture?	Analyze	2
13	Explain the infrastructure of Grid computing in detail?	Analyze	2
14	Explain multithreading model in detail?	Understand	2
15	Explain the architecture of P2P system?	Remember	2
16	Explain the infrastructure of Grid computing in detail?	Remember	1
17	Explain the system models for distributed and cloud computing?	Understand	2
18	Explain architectural design of compute and storage clouds?	Understand	1
19	What is mean by Virtualization Middleware	Understand	1
20	List the design issues in clusters?	Remember	2
Part - C (Problem Solving and Critical Thinking Questions)			
1	What are the three computing paradigms for cloud computing	Analyze	2
2	Draw a neat graph for hype cycle for emerging technologies	Evaluate	2
3	Sketch a three cloud service models in a cloud landscape of major providers	Evaluate	2
4	Explain in detail about evaluation of SOA	Evaluate	2
5	Explain in detail about evaluation of SOA	Remember	2
6	Explain about parallel and distributed programming models	Evaluate	2
7	Discuss GPU clusters for massive parallelism	Remember	2
8	How does cloud architecture overcome the difficulties faced by traditional architecture? What are the three differences that separate out cloud architecture from the tradition one?	Evaluate	2
9	Explain the virtualization for data center automation?	Evaluate	2
10	Explain the concept dynamic deployment of virtual clusters?	Evaluate	2

UNIT - II			
Part – A (Short Answer Questions)			
1	Define cloud?	Remember	1
2	How does cloud computing provides on demand functionality?	Remember	2
3	Define cloud computing?	Understand	2
4	List out characteristics of cloud computing?	Remember	1
5	Define utility computing?	Remember	2
6	List out the features of cloud computing?	Remember	1
7	Define grid computing?	Apply	1
8	What is autonomic computing?	Analyze	1
9	List out the challenges in cloud	Remember	1
10	What is boomi software?	Remember	2
11	List the design goals for generic cloud?	Remember	2
12	List the cloud enabling technologies?	Create	2
13	Explain the QoS factors in cloud?	Evaluate	1
14	Define hardware virtualization?	Remember	2
15	Explain the storage virtualization?	Remember	2
16	Define VM cloning?	Create	1
17	Explain runtime support service?	Evaluate	2
18	Define software stack?	Remember	2
19	List out different layers which define cloud architecture?	Remember	1
20	What is the use of “EUCALYPTUS” in cloud computing?	Evaluate	2
Part - B (Long Answer Questions)			
1	What is cloud computing? Enlist and Explain three service models, and four deployment models of cloud computing.	Understand	2
2	Explain the system models for distributed and cloud computing?	Analyze	2
3	Explain the architecture of P2P system?	Analyze	2
4	Explain architectural design of compute and storage clouds?	Understand	1
5	Explain the infrastructure of Grid computing in detail?	Understand	1
6	Explain any six benefits of Software as Service in Cloud computing?	Understand	2
7	Why is cloud called as eco system? justify	Analyze	2
8	Difference between process virtual machines, host VMMs, native VMMs.	Analyze	1
9	Explain the importance of virtualization	Remember	1
10	“SOA as step forward cloud computing”, Explain?	Understand	2
11	Discuss inter-cloud resource management.	Analyze	2
12	Discuss in detail about global exchange of cloud resources.	Understand	2
13	Mention the name of some large cloud providers and databases?	Understand	2
14	As a infrastructure as a service what are the resources that are provided by it?	Understand	1
15	Explain the different levels of virtualization implementation?	Understand	2

16	Explain the OS level virtualization? List the pros and cons of OS level virtualization?	Understand	2
17	Explain in details the tools and mechanisms for virtualization?	Remember	2
18	Explain the different types of virtualization in detail?	Understand	2
19	Explain the virtualization of CPU, Memory and I/O devices?	Understand	2
20	Explain the virtualization of multi core processor?	Remember	1
Part – C (Problem Solving and Critical Thinking)			
1	Explain cloud computing architecture and cloud components?	Evaluate	2
2	Explain the NIST reference architecture of cloud computing in detail?	Evaluate	2
3	Explain risk from multi tenancy environment. How IDS can be used in environment?	Evaluate	2
4	Discuss SAAS, PAAS, IAAS and compare them?	Evaluate	2
5	Explain Information and Data Model for Virtual machine.	Evaluate	2
6	How does cloud architecture overcome the difficulties faced by traditional architecture? What are the three differences that separate out cloud architecture from the tradition one?	Evaluate	2
7	Explain the infrastructure of Grid computing in detail?	Remember	2
8	Explain multithreading model in detail?	Evaluate	2
9	Mention some open source cloud computing platform databases?	Evaluate	1
10	Explain the difference between cloud and traditional datacenters?	Evaluate	1
UNIT-III Infra Structure As Service (IAAS)& Platform And Software Service			
Part - A (Short Answer Questions)			
1	Define fault tolerance?	Remember	2
2	What is load balancing?	Understand	2
3	Explain in brief about public cloud and infrastructure services	Understand	2
4	Write about Google app engine	Understand	2
5	Sketch the Aneka architecture	Understand	2
6	Draw a neat diagram for Open Nebula high level architecture	Understand	2
7	Write about VM life cycle	Remember	2
8	Explain in brief about private cloud and infrastructure services	Remember	2
9	Write about Microsoft windows azure	Understand	1
10	Define on demand service	Remember	1
11	List the design goals for generic cloud?	Understand	2
12	List the cloud enabling technologies?	Understand	2
13	Explain the QoS factors in cloud?	Remember	2
14	Define hardware virtualization?	Understand	2
15	Explain the storage virtualization?	Remember	2
16	Define VM cloning?	Remember	2
17	Explain runtime support service?	Remember	2
18	Define software stack?	Remember	1
19	Define dynamic resource deployment?	Remember	2
20	Define the provisioning of compute resources?	Remember	2

Part – B (Long Answer Questions)			
1	Explain in detail about RVWS design?	Understand	2
2	What is ANEKA cloud platform?	Remember	2
3	Explain the technologies for data security in cloud computing?	Remember	2
4	Implement in detail about hybrid cloud?	Understand	1
5	Explain the importance of quality and security in clouds?	Evaluate	1
6	Explain in detail about hybrid cloud implementation	Understand	2
7	Draw a neat sketch for architectural overview	Understand	2
8	Explain about ANEKA resource provisioning service?	Evaluate	2
9	Draw a neat a of autonomic cloud bridging	Remember	2
10	List out the importance of quality and security in cloud	Evaluate	2
11	Explain the cloud architecture with suitable block diagram?	Understand	2
12	Explain the layered cloud architecture development?	Understand	2
13	Explain the various design challenges for effective cloud computing environment?	Understand	2
14	Explain the cloud service tasks and trends? Explain the different methods of resource provisioning and platform deployment in detail with a neat diagram?	Understand	2
15	Explain the provisioning of storage resources in detail?	Understand	1
16	What is quality of service (QoS) monitoring in a cloud computing? Enlist and Explain different issues in inter-cloud environments.	Understand	2
17	What is the use of "EUCALYPTUS" in cloud computing?	Understand	1
18	Mention some open source cloud computing platform databases?	Understand	1
19	Mention the name of some large cloud providers and databases?	Understand	2
20	As a infrastructure as a service what are the resources that are provided by it?	Understand	2
Part – C (Problem Solving and Critical Thinking)			
1	Explain in detail about VM provisioning process	Evaluate	2
2	Sketch a neat diagram for a deployment scenario network with	Evaluate	1
3	Explain VM life cycle and VM monitoring	Evaluate	2
4	Write about infrastructure enabling technology	Evaluate	2
5	Explain in detail about automatic and selection process	Evaluate	1
6	List out the technologies for data security in cloud computing	Evaluate	1
7	Explain about scheduling techniques for advance reservation of capacity	Evaluate	1
8	Write about RVWS design in detail	Evaluate	1
9	Explain the cloud architecture with suitable block diagram?	Evaluate	2
10	Explain the layered cloud architecture development?	Evaluate	2
UNIT-IV Monitoring, Management And Applications			
Part – A (Short Answer Questions)			
1	Write about federation	Remember	1
2	Define isolation	Remember	1
3	Explain in brief about the virtual execution environment manager	Remember	1

4	Sketch a neat diagram for hosting of applications on servers	Remember	2
5	Define federation scenarios	Evaluate	2
6	Draw a flow chart of the SLA management in cloud	Remember	2
7	Write about elasticity	Apply	2
8	Write about grid and cloud	Remember	2
9	Explain in brief about the virtual execution environment host	Evaluate	2
10	List out the technical benefits of cloud computing	Understand	1
11	Define BigTable?	Remember	1
12	What is mean by NOSQL?	Apply	1
13	Explain the Google‟s distributed lock service?	Apply	1
14	Explain the Google‟s distributed lock service?	Remember	2
15	Define SQLAzure?	Remember	2
16	Define GFS?	Remember	2
17	Define block replication	Remember	2
18	List the characteristics of HDFS?	Analyze	2
19	Define block replication?	Apply	2
20	Define heart beat in Hadoop?	Analyze	2
Part – B (Long Answer Questions)			
1	Write about SAP systems in detail	Remember	2
2	List out the business benefits of cloud computing	Understand	2
3	List out the business benefits of cloud computing	Remember	2
4	Explain about SLA management in cloud	Understand	2
5	Explain about SLA management in cloud	Remember	2
6	Draw a neat sketch for automated policy based management with brief explanation	Apply	2
7	Write about HPC systems and HPC on clouds	Apply	2
8	List out the technical benefits of cloud computing	Remember	2
9	Explain in detail about decouple your components	Remember	2
10	List out the technical benefits of cloud computing	Evaluate	2
11	Explain in detail about decouple your components	Evaluate	2
12	Explain the dataflow and control flow of MapReduce?	Remember	2
13	Explain the architecture of MapReduce in Hadoop?	Remember	2
14	Explain a user view of Google App Engine with suitable block schematic	Remember	1
15	Explain the structure of BigTable data model?	Remember	1
16	Explain the programming structure ofAmazon EC2?	Remember	1
17	Explain the architecture of Amazon EC2 ?	Remember	2
18	Explain the Microsoft Azure programming support?	Remember	2
19	Discuss the architecture and components of OpenNebula?	Remember	1
20	Explain the architecture of OpenStack system?		
Part – C (Problem Solving and Critical Thinking)			
1	List out the basic principles of cloud computing	Create	2

2	Sketch a neat diagram for reservoir		1
3	Explain about security considerations	Remember	1
4	Write about automated policy based management	Create	2
5	Explain about traditional approaches to SLO management	Evaluate	1
6	Write about amazon web services cloud	Create	2
7	Draw a flow chart of the SLA management in cloud	Evaluate	2
8	Write about elasticity	Evaluate	1
9	Discuss the cloud software environment of Eucalyptus in detail.	Evaluate	2
10	Mention what is Hypervisor in cloud computing and their types?		
UNIT-V Governance and case studies			
Part - A (Short Answer Questions)			
1	List out the strengths of information cards	Evaluate	1
2	Draw a neat sketch of perception of quality	Remember	1
3	Distinguish direct versus indirect distribution	Remember	1
4	Write about cloud service life cycle	Remember	2
5	List out the weakness of information cards	Remember	2
6	Define service strategy	Understand	2
7	Write about acceptance testing	Remember	2
8	What is digital entity	Remember	2
9	Write about service design	Understand	2
10	What is data security	Remember	2
11	What are the security challenges in cloud computing?	Remember	1
12	Define security governance?	Understand	1
13	Explain the security awareness in cloud?	Remember	2
14	Define third party risk management?	Understand	2
15	What are the layers in security architecture design?	Remember	2
16	Define VM security?	Understand	1
17	Explain change management?	Understand	2
18	Define security images?	Understand	2
19	What is mean by vulnerability assessment?	Remember	2
20	Define data shredding technique.	Remember	2
21	What is mean by password assurance testing?	Remember	2
Part - B (Long Answer Questions)			
1	Explain about a framework to comprehend the competitive environment	Understand	1
2	Explain about digital identity and data security	Understand	2
3	Write about quality of service and value composition	Apply	2
4	Explain about common change management models(CMMM)	Remember	1
5	List out the cloud contracting models	Remember	1
6	List out the data privacy and security issues	Create	1
7	Explain about management maturity model	Remember	1

8	Write about acceptance testing	Understand	1
9	Explain the Security challenges in cloud computing in detail?	Understand	1
10	Explain the security architecture in detail?	Understand	1
11	Explain the following a. Security governance b. Security monitoring	Remember	2
12	Explain the Secure Software Development Life Cycle?	Remember	2
13	Explain in detail about Software-as-a-Service security?	Remember	2
14	Explain the application security in detail?	Analyze	1
15	Explain the data security and virtual machine security in detail?	Analyze	1
16	Explain the identity management and access control in detail?	Analyze	1
17	Explain the two fundamental functions, identity management and access control, which are required for secure cloud computing.	Remember	1
18	Explain the following a. Autonomic Security b. Risk management	Analyze	2
19	What are the measures included in GuestOS hardening technique ?	Understand	1
20	How is intrusion detection implemented under SAAS model?	Understand	1
Part – C (Problem Solving and Critical Thinking)			
1	Write about a need for cloud mashups	Evaluate	2
2	Write about cloud contracting models	Evaluate	2
3	Write about quality of service and value composition.	Evaluate	2
4	Explain about common change management models(CMMM)	Evaluate	2
5	Explain about common change management models	Evaluate	2
6	Explain about a framework to comprehend the competitive environment	Evaluate	1
7	Define Distributed Denial-of-service attack	Evaluate	1
8	Which security mechanism provides an effective control for data confidentiality and integrity?	Evaluate	1
9	Define security governance	Evaluate	1
10	EXPLAIN the layers in security architecture design?	Evaluate	1

Prepared By: **HOD, CSE**

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NBA and NAAC with 'A' Grade & Recognized Under Section2(f) & 12(B)of the UGC act,1956

COMPUTER SCIENCE AND ENGINEERING
COURSE DESCRIPTION FORM

Course Title	:	REAL TIME SYSTEMS			
Course Code	:	CS722PE			
Course Structure	:	Lectures	Tutorials	Practicals	Credits
		4	-	-	3
Course Faculty	:	RENUKA Asst.Prof			

I. COURSE OVERVIEW:

The course covers a wide range of software development concepts, abilities, and skills, from analyzing a problem to implementing a solution, also discuss the design patterns in Smalltalk MVC architecture, Express representation invariants, understand their impact on efficiency an66 d ease of implementation, and implement them as runtime assertions. Outlines the differences between structural patterns and behavioral patterns of a model. The course Explains about common design vocabulary. This course helps to determine how to be recognizing a design and they can reduce the amount of refactoring, helps to use primitive techniques such as objects, inheritance, and polymorphism. Describes problems that occur in a design how to resolve them and how to evaluate them.

II. PREREQUISITES:

Level	Credits	Periods/Week	Prerequisites
UG	3	4	Object Oriented Programming concepts, basic notations of design, and basic data structures such as arrays, hash tables, trees and lists.

III. COURSE ASSESSMENT METHODS:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of subjective type and objective type tests. The subjective test is for 25 marks of 90 minutes duration. Subjective test of shall contain 10 questions, the student has to answer 10 questions, each carrying 1 mark. The long type test is for 15 marks. It consists the student has to answer all the questions and each carry two half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion.	70	100

IV. EVALUATION SCHEME:

S.No	Component	Duration	Marks
1	I Mid Examination	90 Minutes	25
2	I Assignment	-	05
3	II Mid Examination	90 Minutes	25
4	II Assignment	-	05
5	External Examination	3 Hours	70

V. COURSE OBJECTIVES:

1. **Demonstration** of patterns related to object oriented design.
2. **Describe** the design patterns that are common in software applications.
3. **Analyze** a software development problem and express it.
4. **Design** a module structure to solve a problem, and evaluate alternatives;
5. **Implement** a module so that it executes efficiently and correctly;
6. **Appreciate** engineering issues in the development of software, such as the importance of addressing the user's concerns, working with limited resources, maintainability and dependability.
7. **Describes** creational, structural and behavioural patterns.
8. **Demonstrates** the Case Study on designing a document editor.

VI. COURSE OUTCOMES:

CO	Course outcome	Blooms taxonomy level
C414.1	Explain real-time concepts such as preemptive multitasking, task priorities, priority inversions and so on	Understand
C414.2	Describe how a real-time operating system kernel is implemented	Create
C414.3	Intercept how tasks are managed and can explain how the real-time operating system implements time management.	Analyse
C414.4	Discuss Inter process communicate using semaphores, mailboxes, and queues.	Analyse
C414.5	Understand real time operating systems like RT Linux, Vx Works, MicroC /OSII, Tiny Os	Create

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**gineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	**H**	Assignment, Exercises
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	**S**	Exercises
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	**S**	Exercises

PO4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	**N**	……..
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	**H**	Design, Exercises
PO6	**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.	**N**	……..
PO7	**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.	**H**	Assignment, Exercises
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	**S**	Seminars, Discussions
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	**H**	Workshop
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	**S**	Seminars, Paper presentations
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	**H**	Design Exercises, Discussions
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	**S**	Exams, Discussions

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	Applications of Computing: Ability to use knowledge in various domains to provide solution to new ideas and innovations.	1	Lectures, Assignments
PSO2	Programming Skills: Identify required data structures, design suitable algorithms, develop and maintain software for real world problems.	2	
PSO3	Make use of computational and experimental tools for creating innovative career paths, to be an entrepreneur and desire for higher studies.	3	

IX. SYLLABUS:

UNIT – I: Introduction

Introduction to UNIX/LINUX, Overview of Commands, File I/O, (open, create, close, lseek, read, write), Process Control (fork, vfork, exit, wait, waitpid, exec).

UNIT - II: Real Time Operating Systems

Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use

UNIT - III: Objects, Services and I/O

Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem

UNIT - IV: Exceptions, Interrupts and Timers

Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.

UNIT - V: Case Studies of RTOS

RT Linux, MicroC/OS-II, Vx Works, Embedded Linux, and Tiny OS.

TEXT BOOKS:

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011

REFERENCE BOOKS:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007,TMH.
2. Advanced UNIX Programming, RichardStevens
3. Embedded Linux: Hardware, Software and Interfacing – Dr. CraigHollabaugh

X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

S.No	Unit No	Subject Topics	Date Planned	Date Conducted
1	I	**Introduction to UNIX/LINUX**		
2		Overview of Commands		
3		File I/O		
4		File I/O		
5		Process Control		
6		Process Control		
7		**PPT**		
8		**Active Learning - 1 Flipped Class Room**		
9		**TEST- I**		
10	II	**Real Time Operating Systems**		
11		Defining RTOS		
12		The Scheduler		
13		Tasks		
14		Semaphores		
15		Message Queue		
16		**PPT**		
17		**Active Learning - 2 Collaborative Learning**		
18		**TEST- II**		
19	III	**Objects, Services and I/O**		
20		Pipes		
21		Event Registers		
22		Signals		
23		Component Configuration		
24		Basic I/O Concepts		
25		I/O Subsystem		
26		**PPT**		
27		**Active Learning 3 Muddest Point**		
28		**TEST- III**		
29	IV	**Exceptions, Interrupts and Timers**		
30		Processing of Exceptions		
31		Real Time Clocks		
32		Programmable Timers		
33		Timer Interrupt Service Routines (ISR)		
34		**PPT**		
35		**Active Learning - 4 Think Pair Share**		
36		**UNIT TEST- IV**		
37	V	**Case Studies of RTOS**		
38		RT Linux		
39		MicroC/OS-II		
40		Vx Works		

41		Embedded Linux, and Tiny OS.		
42		**PPT**		
43		**Active Learning - 5 Stump Your Partner**		
44		**UNIT TEST- V**		

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES*:*

Program outcomes	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
C414.1	3	3	3	3	3	1	0	0	0	0	0	1	2	1	3
C414.2	3	3	3	3	3	1	0	0	0	0	0	1	2	1	3
C414.3	3	3	3	3	3	1	0	0	0	0	0	1	2	1	3
C414.4	3	3	3	3	3	1	0	0	0	0	0	1	2	1	3
C414.5	3	3	3	3	3	1	0	0	0	0	0	1	2	1	3
Total	15	15	15	15	15	5						5	10	5	15
Average	**3**	**3**	**3**	**3**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**2**	**1**	**3**

COMPUTER SCIENCE AND ENGINEERING

ASSIGNMENT

Course Name	REAL TIME SYSTEMS
Course Code	CS722PE
Class	IV B. Tech I Semester
Branch	Computer Science and Engineering
Year	2021 - 22
Course Faculty	RENUKA Asst.Prof

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner‟s learning process.

ASSIGNMENT – I

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I		
1.	Explain different Linux Distribution and which Linux Distribution is better.	Knowledge	2
2.	Discuss different basic linux commands	Understand	2
3.	What are the Typical shall commands of unix	Understand	1
4.	exchange the password associated with individual account name in unix	Knowledge	1
5.	Discuss the various commands associated with directory creation in unix	Apply	2
	UNIT - II		
1.	Explain different Scheduling Algorithms with suitable example	Understand	2
2.	What are the Key Characteristics of an RTOS.	Understand	3
3.	What are the Typical Task Operations	Understand	3
4.	What are the Typical Semaphore Operations?	Understand	3
5.	What are the Typical Message Queue Operations	Understand	2

UNIT – III			
1.	What is Pipe Control Blocks	knowledge	1
2.	Discuss what is Event Register Control Blocks.	Understand	2
3.	With block diagram explain Signal Control Blocks	Understand	1
4.	With neat diagram explain Condition Variable Control Blocks	Understand	2
5.	What are the various Typical Condition Variable Operations.	knowledge	3

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	REAL TIME SYSTEMS
Course Code	:	CS722PE
Class	:	IV B. Tech I Semester
Branch	:	Computer Science and Engineering
Year	:	2021 – 2022
Course Faculty	:	RENUKA Asst.Prof

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PART – A (SHORT ANSWER QUESTIONS)

S No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT – I **INTRODUCTION:WHAT IS A DESIGN PATTERN**		
	PART – A (SHORT ANSWER QUESTIONS)		
1.	Brief describe the History and evaluation of Unix operating system	Knowledge	2
2.	Brief describe the History and evaluation of Unix operating system	Knowledge	1
3.	Explain different Linux Distribution and which Linux Distribution is better?	Analyze	1
4.	Discuss different basic linux commands	Understand	2
5.	Define what is a vi command and its different modes	Knowledge	2
6.	What are the Typical shall commands of unix	Knowledge	1
7.	Discuss how to get help in unix and give suitable example for it	Apply	3
8.	How concatination or how to display the contents of afile.	Understand	4
9.	What are the operations performed for storing the information in unix?	Knowledge	2
10.	With suitable example how can we change change the password associated with individual account name in unix	Knowledge	2
11.	Discuss the various commands associated with directory creation in unix	Knowledge	2
12.	Discuss how manipulating files are done under unixwith suitable example	Understand	4
13.	How to operate on files, but not the data under unix	Analyze	2

14.	What are the commands used for getting information in unix	Understand	4
15.	What are the differenteditors used under linux operating system	Knowledge	2
UNIT – II			
PART – A (SHORT ANSWER QUESTIONS)			
1.	Brief describe the History of Operating Systems and define the evaluation of RTOS	Understand	3
2.	Explain different Scheduling Algorithms with suitable example	Knowledge	2
3.	What are the Key Characteristics of an RTOS	Knowledge	2
4.	Define what is a Task and Task States	Apply	4
5.	What are the Typical Task Operations	Analyze	2

S No	Question	Blooms Taxonomy Level	Course Outcome
6.	Discuss the Typical Task Structure	Knowledge	2
7.	Compare different types of Semaphores and there uses	Knowledge	2
8.	What are the Typical Semaphore Operations?	Knowledge	2
9.	With neat sketch explain Multiple-Task Wait-and-Signal Synchronization	Knowledge	2
10.	With neat sketch explain Single Shared-Resource-Access Synchronization	Knowledge	1
11.	With neat sketch explain Recursive Shared-Resource-Access Synchronization	Knowledge	1
12.	Define what is Message Queues and Message Queue States	Understand	2
13.	How Message Queue Storage is done	Knowledge	2
14.	Discuss the Typical Task Structure	Understand	4
15.	Compare different types of Semaphores and there uses	Understand	4
UNIT – III			
PART – A (SHORT ANSWER QUESTIONS)			
16.	What is Pipe Control Blocks	Knowledge	2
17.	Define different states of Pipe	Knowledge	3
18.	Explain Named and Unnamed Pipes	Understand	3
19.	What are the Typical Pipe Operations?	Knowledge	2
20.	Briefly explain Typical Uses of Pipes	Knowledge	3
21.	Discuss what Event Register Control Blocks are	Knowledge	4
22.	Explain about Typical Event Register Operations	Knowledge	3
23.	Explain what the Typical Uses of Event Registers	Knowledge	2
24.	With block diagram explain Signal Control Blocks	Knowledge	2
25.	What are the different Typical Signal Operations	Knowledge	1
26.	Briefly explain Typical Uses of Signals	Knowledge	3
27.	Comment on Condition Variables	Knowledge	2
28.	With neat diagram explain Condition Variable Control Blocks	Knowledge	1
29.	What are the various Typical Condition Variable Operations	Understand	2
30.	Discuss Typical Uses of Condition Variables	Understand	2

S No	Question	Blooms Taxonomy Level	Course Outcome
17.	**Explain** the applicability and collaborations of a adapter pattern	Understand	2
18.	**Explain** how to decouple the abstraction from its implementation.	Knowledge	4
19.	**Write** and Explain the consequences, applicability and implementation issues of a flyweight patterns.	Understand	2
20.	**Explain** the role of creational patterns in design of the patterns	Knowledge	4
21.	**Distinguish** between abstract class and concrete class	Analyze	2
22.	**Explain** the role of interaction diagrams in design patterns.	Understand	2
23.	**What** are the different issues to be considered while applying the decorator pattern?	Understand	2
24.	**What** relation exists between the different participants involved in composite pattern? Explain it in detail.	Understand	2
25.	**Draw** and Explain the multiple inheritance interface that illustrates relation between different participants in the adapter pattern.	Knowledge	4
	UNIT – IV		
	PART – A (SHORT ANSWER QUESTIONS)		
16.	**Define** behavioral pattern.	Knowledge	2
17.	**Define** behavioral class pattern.	Knowledge	2
18.	**Define** behavioral object pattern.	Knowledge	2
19.	**Define** command pattern.	Knowledge	2
20.	**Sketch** sequence diagram for any example pattern.	Knowledge	3
21.	**Sketch** the structure of server in election commission.	Knowledge	3
22.	**Define** interpreter pattern.	Knowledge	2
23.	**Write** the intentions of mediator pattern.	Apply	3
24.	**Define** mediator pattern.	Knowledge	2
25.	**Sketch** the structure of mediator pattern.	Knowledge	1
26.	**Write** about Chain of Responsibility	Understand	2
27.	**Define** Memento pattern	Knowledge	2
28.	**Define** Observer pattern	Knowledge	2
29.	**Define** Iterator pattern	Knowledge	2
30.	**Sketch** the structure and applicability of Observer pattern	Knowledge	3
	UNIT – V		
	PART – A (SHORT ANSWER QUESTIONS)		
1.	**Write** the intent of memento pattern.	Apply	3
2.	**Sketch** the structure of memento pattern.	Knowledge	3
3.	**Define** the phrase “objects for states”.	Knowledge	3
4.	**Define** state pattern.	Knowledge	2
5.	**Sketch** the structure of state pattern.	Knowledge	3
6.	**List** the situations where state pattern can be used.	Knowledge	2
7.	**Define** table driven approach.	Knowledge	4
8.	**Write** the sample code for Strategy pattern	Understand	2
9.	**Write** about the collaborations of Visitor pattern	Knowledge	2

S No	Question	Blooms Taxonomy Level	Course Outcome
10.	**Explain** about the consequences of Template pattern	Knowledge	3
11.	**Write** about the Pattern community	Knowledge	3
12.	**Explain** about the patterns in software	Knowledge	2
13.	**Write** about the lifecycle of Object Oriented Software	Understand	4
14.	**Explain** how objects are used as arguments	Knowledge	4
15.	**Define** double-dispatch and single-dispatch	Understand	3