J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

STORAGE AREA NETWORKS COURSE PLAN

BIJAYA KUMAR BISWAL
Assistant Professor, CSE

ACADEMIC YEAR 2013-14

	COURSE PLAN	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering

COURSE DETAILS:

Name Of The Programme: B.Tech Batch:: 2010
Designation: B. Tech-IV Year
Year : 2013-2014 Semester: II
Department: CSE
Title of The Subject: Storage Area Networks Subject Code: SAN
No of Students: 133

	COURSE PLAN	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering

1. TARGET

a) Percentage Pass 100 %

b) Percentage I class 90%

2. COURSE PLAN

(Please write how you intend to cover the contents: i.e., coverage of Units by lectures, guest lectures, design exercises, solving numerical problems, demonstration of models, model preparation, or by assignments, etc.)

3. METHOD OF EVALUATION

3.1. ☐ Continuous Assessment Examinations (CAE 1, CAE 2)

3.2. ☐ Assignments / Seminars

3.3. ☐ Mini Projects

3.4. ☐ Quiz

3.5. ☐ Term End Examination

3.6. ☐ Others

4. List out any new topic(s) or any innovation you would like to introduce in teaching the subject in this Semester.

Signature of HOD
Date:

Signature of Faculty
Date:

	GUIDELINES TO STUDY THE SUBJECT	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal

Designation: Assistant Professor

Department: Computer Science & Engineering

Guidelines for Preparing the Course:

Course Description:
The storage area network (SAN) infrastructure facilitates storage consolidation, data sharing, server clustering, LAN-free and server-less backup across heterogeneous host server platforms. This course focuses on the planning and implementation considerations associated with establishing that SAN infrastructure. Functions provided by SAN fabric components, such as Fibre Channel host bus adapters (HBAs), Fibre Channel switches and directors, and SCSI to Fibre Channel protocol converters are discussed, and the interdependencies of these components are examined. Mechanisms to implement resource access control for data access integrity among heterogeneous hosts in a storage networking environment are also examined. Examine products and strategies associated with managing the explosive growth of business data across the enterprise in today's networking economy. Learn the basic concepts and terminology associated with Storage Area Networks (SAN), Network Attached Storage (NAS), Internet Small Computer System Interface (iSCSI), and map the promise of SANs to the complications of managing islands of information among heterogeneous environments with disparate operating systems, data formats, user interfaces, and limited integration of products from assorted vendors.

Course Objectives:
1. Understand Storage Area Networks characteristics and components. 2. Describe the challenges associated with data center networking and the need for switch network convergence. 3. Storage Area Networks including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center. 4. Describe the concept of RAID and different RAID levels and their suitability for different application environments. 5. Learn Fibre Channel protocols and how SAN components use them to communicate with each other. 6. Describe files sharing operations on NAS and IP-SAN of the different network. 7. Understand the different networked storage options for different application environments. 8. Describe the business continuity and disaster recovery in a storage infrastructure. 9. Describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities. 10. Identify key areas to monitor in a data center for different components in a storage

	COURSE OBJECTIVES	2013-14
		Regulation: R11

infrastructure.

11. Describe different type process and file-level virtualization technologies.

Learning Outcomes:

1. Identify and describe the functions to build data center networking for switch network.
2. Discuss different types of logical and physical components of a storage infrastructure.
3. Describe the different types of RAID implementations and their benefits.
4. Understand the importance of Fibre Channel protocols and how to communicate with each other.
5. Describe the benefits of the different network storage options for different application environments.
6. Identify single points of failure in a storage infrastructure and list solutions.
7. Describe the different role in providing disaster recovery and business continuity capabilities.
8. Identify and analyzes the common threats in each domain.

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
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On completion of this Subject / Course the student shall be able to:

S.No.	Objectives	Outcomes
1.	Understand the value of data business and data management.	1
2.		

	Understand the physical components of a disk drive and their functions.	2, 3
3.	Identify the hardware and software components of the host environment.	2
4.	Discuss different RAID levels and their suitability for different application environments.	4
5.	Understand the different storage systems used in data centres.	7
6.	Explain the different terminology used with Fibre Channel over Ethernet.	5
7.	Identify the single points of failure in a storage infrastructure and list solutions to mitigate these failures.	8
8.	Discuss different backup and recovery topologies.	9
9.	Identify the Key metrics to monitor for different components in a storage Infrastructure.	10
10.	Discuss Virtualization technologies and processes.	11

Signature of Faculty
Date:

Note: For each of the OBJECTIVE indicate the appropriate OUTCOMES to be achieved.
Kindly refer Page 16, to know the illustrative verbs that can be used to state the objectives.

	COURSE OUTCOMES	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering

The expected outcomes of the Course / Subject are:

S.No.	General Categories of Outcomes	Specific Outcomes of the Course
A.	An ability to apply knowledge of mathematics, science, and engineering	understanding of concepts that underlie computer science
B.	An ability to design and conduct experiments, as well as to analyze and interpret data	Identify and analyze user needs to design effective
C.	An ability to design a system, component, or process to meet desired needs within realistic Constraints such as economic, environmental, social, political, ethical, health and safety, Manufacturability and sustainability	storage area design consider the provisioning of storage
D.	An ability to function on multi-disciplinary teams	multiple-server environment
E.	An ability to identify, formulate, and solve engineering problems	Overcomes these problems by moving storage resources
F.	An understanding of professional and ethical responsibility	Prepare to conduct successful penetration and ethical hacking
G.	An ability to communicate effectively	SAN base on Fibre Channel communication
H.	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	Server centric information processing
I.	A recognition of the need for, and an ability to engage in life-long learning	SAN supports communication between the central storage and management of personal and learning *data*
J.	A knowledge of contemporary issues	Knowledge highlighting thought leadership in the data center
K.	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	User tools to solve engineering problems

Objectives – Outcome Relationship Matrix (Indicate the relationships by ☒ mark).

Outcomes / Objectives	A	B	C	D	E	F	G	H	I	J	K
1.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10.	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

	COURSE SCHEDULE	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

S. No.	Description	Duration (Date)		Total No. of Periods
		From	To	
1.	Introduction to Storage Technology	09-12-2013	16-12-2013	06
2.	Storage Systems Architecture	17-12-2013	24-12-2013	06
3.	Concept of RAID	30-12-2013	07-01-2014	09
4.	Introduction to Networked Storage	08-01-2014	06-02-2014	08
5.	Information Availability & Monitoring	07-02-2014	18-02-2014	08
6.	Managing Datacenter	19-02-2014	22-02-2014	08
7	Securing Storage	28-02-2014	20-03-2014	10
8	Storage Virtualization	24-03-2014	02-04-2014	05

Total No. of Instructional periods available for the course: 50 Hours / 60 Periods

	SCHEDULE OF INSTRUCTIONS UNIT - I	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
1	09-12-2013	1	Introduction to Storage Area Networks	1	TB1
2	09-12-2013	2	Understand Storage Area Networks characteristics and data creation	1	TB1
3	10-12-2013	3	Data storage and data management	1	TB1
4	11-12-2013	4	Solutions available for data storage	1	TB1, RB1
5	16-12-2013	5	Core elements of a data center infrastructure	1, 2	TB1
6	16-12-2013	6	Role of each element in supporting business activities	1,2	TB1, RB1

Text Book:

TB1: EMC Corporation, Information Storage and Management, Wiley.

Reference:

RB1: Robert Spalding, “Storage Networks: The Complete Reference“, Tata McGraw Hill Osborne, 2003.

RB2: Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
3. MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - II	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
7	17-12-2013	7	Hardware and software components of the host environment	2, 3	TB1
8	17-12-2013	8	Key protocols and concepts used by each component	2, 3	TB1
9	18-12-2013	9	Physical and logical components of a connectivity environment	2, 3	TB1
10	23-12-2013	10	Major physical components of a disk drive and their function	2,3	TB1
11	23-12-2013	12	logical constructs of a physical disk	3	TB1
12	24-12-2013	13	Access characteristics, and performance Implications	3	TB1

Signature of Faculty
Date

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	SCHEDULE OF INSTRUCTIONS UNIT - III	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
13	30-12-2013	14	Concept of RAID and its components	4	TB1
14	30-12-2013	15	RAID levels and their suitability	4	TB1, RB1
15	31-12-2013	16	Different application environments for RAID	4	TB1, RB1
16	31-12-2013	17	RAID 0, RAID 1 and RAID 3	4	TB1
17	01-01-2014	18	RAID 4, RAID 5 and RAID 6	4	TB1
18	06-01-2014	19	RAID 0+1 and RAID 1+0	4	TB1
19	06-01-2014	20	Compare and contrast integrated	3,4	TB1, RB1
20	07-01-2014	21	Different modular storage systems	3	TB1, RB1
21	07-01-2014	22	High-level architecture and working of an intelligent storage system	3	TB1, RB1

Signature of Faculty
Date

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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - IV	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
22	08-01-2014	23	Evolution of networked storage	3	TB1, RB2
23	22-01-2014	25	Architecture, components, and topologies of FC-SAN	5	TB1, RB2
24	28-01-2014	26	NAS, and IP-SAN	6	TB1, RB2
25	29-02-2014	27	Describe how CAS fulfils the need	5	TB1, RB2
26	04-02-2014	29	Understand the appropriateness of the different networked storage	3,5	TB1, RB2
27	06-02-2014	30	Different application Environments	3,5	TB1, RB2

Signature of Faculty
Date

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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - V	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
28	07-02-2014	32	List reasons for planned/unplanned outages	7,8	TB1, RB2
29	10-02-2014	33	Impact of downtime	7	TB1, RB2
30	11-02-2014	35	Differentiate between business continuity (BC) and disaster recovery (DR)	8	TB1, RB2
31	12-02-2014	37	RTO and RPO, Identify single points of failure in a storage infrastructure	8	TB1, RB2
32	18-02-2014	38	list solutions to mitigate these failures	7,8	TB1, RB2

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - VI	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
33	19-02-2014	39	Architecture of backup/recovery	8	RB1, RB2
34	20-02-2014	41	Different backup/recovery topologies	9	RB1, RB2
35	21-02-2014	42	Replication technologies and their role	9	RB1, RB2
36	21-02-2014	43	Information availability and business continuity	8	RB1, RB2
37	22-02-2014	45	Remote replication technologies and their role in providing disaster recovery	9	RB1, RB2
38	22-02-2014	46	Business continuity capabilities	9	RB1, RB2

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - VII	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
39	28-02-2014	47	Identify key areas to monitor in a data center	10	RB1, RB2
40	03-03-2014	49	Industry standards for data center monitoring and management	10	RB1, RB2
41	04-03-2014	51	Key metrics to monitor for different components in a storage infrastructure	3, 10	RB1, RB2
42	05-03-2014	52	Key management tasks in a data center	3, 10	RB1, RB2
43	11-03-2014	53	Information security	10	RB1, RB2
44	12-03-2014	54	Critical security attributes for information systems	10	RB1, RB2
45	19-03-2014	55	Storage security domains	10	RB1, RB2
46	20-03-2014	56	List and analyzes the common threats in each domain	10	RB1, RB2

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
2. ADDITIONAL TOPICS COVERED, IF ANY, MAY ALSO BE SPECIFIED **BOLDLY**.
MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	SCHEDULE OF INSTRUCTIONS UNIT - VIII	2013-14 Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Sl. No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcome Nos.	References (Text Book, Journal…) Page No___ to ___
47	24-03-2014	57	Introduction to Storage Virtualization	11	RB1, RB2
48	25-03-2014	58	Block-level and file-level	11	RB1, RB2
49	26-03-2014	59	Virtualization technologies	11	RB1, RB2
50	02-04-2014	60	Virtualization processes	11	RB1, RB2

Signature of Faculty
Date

Note: 1. ENSURE THAT ALL TOPICS SPECIFIED IN THE COURSE ARE MENTIONED.
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MENTION THE CORRESPONDING COURSE OBJECTIVE AND OUT COME NUMBERS AGAINST EACH TOPIC.

	COURSE COMPLETION STATUS	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Department: Computer Science & Engineering

Actual Date of Completion & Remarks, if any

Units	Remarks	Nos. of Objectives Achieved
Unit 1	No	1,2
Unit 2	No	2,3
Unit 3	No	4
Unit 4	No	3,5,6
Unit 5	No	5,7,8
Unit 6	No	8,9
Unit 7	No	3,10
Unit 8	No	11

Signature of Dean of School
Date:

Signature of Faculty
Date:

NOTE: AFTER THE COMPLETION OF EACH UNIT MENTION THE NUMBER OF OBJECTIVES ACHIEVED.

	TUTORIAL SHEETS - I	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Date:03-01-2014

This Tutorial corresponds to Unit Nos.: I and II

Time:10;00 A.M

Q1. Explain information Storage with examples.

Q2. What are the core elements of a data center.

Q3. Explain different types of file system.

Q4. Differentiate between memory and compute virtualization.

Q5. Write difference disk drive components.

Q6. What are the requirements for storage based application.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the objectives to which these questions / Problems are related.

Signature of Dean of School
Date:

Signature of Faculty
Date:

	TUTORIAL SHEETS - II	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty: Bijaya Kumar Biswal
Designation: Assistant Professor
Department: Computer Science & Engineering
The Schedule for the whole Course / Subject is: Storage Area Networks

Date: 21-02-2014

This Tutorial corresponds to Unit Nos.: III, IV and V

Time:10.00 A.M

Q1. What are RAID implementation methods.

Q2. Differentiate between contrast integrated and modular storage.

Q3. What is FC SAN topologies and explain.

Q4. Differentiate between business continuity and disaster recovery.

Q5. What are the key areas to monitor in a data center.

Q6. What is the critical security attributes for information systems

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the objectives to which these questions / Problems are related.

Signature of Dean of School
Date:

Signature of Faculty
Date:

	TUTORIAL SHEETS - III	2013-14
		Regulation: R11

FACULTY DETAILS:

Name of the Faculty:: Bijaya Kumar Biswal
Designation: Assistant Professor
Department:: Computer Science & Engineering

Date: 02-04-2014

This Tutorial corresponds to Unit Nos.: VI,VII and VIII

Time: 10.00 A.M

Q1. What are the single points of failure in a storage infrastructure.

Q2. Define different backup/recovery topologies.

Q3. What is the role in providing disaster recovery.

Q4. What is the key areas to monitor in a data center.

Q5. Define the list and analyzes the common threats in each domain.

Q6. What are the file-level virtualization technologies and processes.

Please write the Questions / Problems / Exercises which you would like to give to the students and also mention the objectives to which these questions / Problems are related.

Signature of Dean of School
Date:

Signature of Faculty
Date:

	ILLUSTRATIVE VERBS FOR STATING INSTRUCTIONAL OBJECTIVES	2013-14
		Regulation: R11

These verbs can also be used while framing questions for Continuous Assessment Examinations as well as for End – Semester (final) Examinations.

ILLUSTRATIVE VERBS FOR STATING **GENERAL OBJECTIVES**

Know Comprehend	Understand Apply	Analyze Design	Generate Evaluate

ILLUSTRATIVE VERBS FOR STATING **SPECIFIC OBJECTIVES:**

A. Cognitive Domain

1	2	3	4	5	6
Knowledge	**Comprehension Understanding**	**Application** of knowledge & comprehension	**Analysis** of whole w.r.t. its constituents	**Synthesis** combination of ideas/constituents	**Evaluation** judgement
Define	Convert	Change	Breakdown	Categorize	Appraise
Identify	Defend	Compute	Differentiate	Combine	Compare
Label	Describe (a	Demonstrate	Discriminate	Compile	Conclude
List	procedure)	Deduce	Distinguish	Compose	Contrast
Match	Distinguish	Manipulate	Separate	Create	Criticize
Reproduce	Estimate	Modify	Subdivide	Devise	Justify
Select	Explain why/how	Predict		Design	Interpret
State	Extend	Prepare		Generate	Support
	Generalize	Relate		Organize	
	Give examples	Show		Plan	
	Illustrate	Solve		Rearrange	
	Infer			Reconstruct	
	Summarize			Reorganize	
				Revise	

B. Affective Domain		**C. Psychomotor Domain (skill development)**				
Adhere	Resolve	Bend	Dissect	Insert	Perform	Straighten
Assist	Select	Calibrate	Draw	Keep	Prepare	Strengthen
Attend	Serve	Compress	Extend	Elongate	Remove	Time
Change	Share	Conduct	Feed	Limit	Replace	Transfer
Develop		Connect	File	Manipulate	Report	Type
Help		Convert	Grow	Move	precisely Reset	Weigh
Influence		Decrease	Handle	Operate	Run	
Initiate		Demonstrate	Increase	Paint	Set	

	LESSON PLAN **Unit-1**	2013-14 Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject code: SAN

Unit: I

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
1	Introduction to Storage Area Networks	50 Min	TB1	Black Board
2	Data created and understand the value of data	50 Min	TB1	Black Board
3	data storage and data management	50 Min	TB1	Black Board
4	Solutions available for data storage	50 Min	TB1, RB1	Black Board
5	Core elements of a data center infrastructure	50 Min	TB1	PPT
6	Role of each element in supporting business activities	50 Min	TB1, RB1	PPT

On completion of this lesson the student shall be able to (Outcomes)

1. Understand the value of data business and data management.
2. Understand Storage Area Networks characteristics and components.

	ASSIGNMENT **Unit-I**	2013-14
		Regulation: R11

Assignment / Questions

A1- What is SAN Storage area network and design to transfer data, from server to clients.

A2- Different of technologies are used for SAN.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN **Unit-II**	2013-14 Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: II

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
7	Hardware and software components of the host environment	50 Min	TB1	Black Board
8	Key protocols and concepts used by each component	50 Min	TB1	Black Board
9	Physical and logical components of a connectivity environment	50 Min	TB1	Black Board
10	Major physical components of a disk drive and their function	50 Min	TB1	Black Board
11	logical constructs of a physical disk	50 Min	TB1	Black Board
12	Access characteristics, and performance Implications	50 Min	TB1	Black Board

On completion of this lesson the student shall be able to

1. Understand the physical components of a disk drive and their functions.

2. Identify the hardware and software components of the host environment.

	ASSIGNMENT **Unit-II**	2013-14
		Regulation: R11

Assignment / Questions

A3- What are Physical and logical components of a connectivity environment.

A4- What are the keys protocols in storage area network.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-III	2013-14
		Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: III

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
13	Concept of RAID and its components	50 Min	TB1	Black Board
14	RAID levels and their suitability	50 Min	TB1, RB1	Black Board
15	Different application environments for RAID	50 Min	TB1, RB1	Black Board
16	RAID 0, RAID 1 and RAID 3	50 Min	TB1	Black Board
17	RAID 4, RAID 5 and RAID 6	50 Min	TB1	Black Board
18	RAID 0+1 and RAID 1+0	50 Min	TB1	Black Board
19	Compare and contrast integrated	50 Min	TB1, RB1	Black Board
20	Different modular storage systems	50 Min	TB1, RB1	Black Board
21	High-level architecture and working of an intelligent storage system	50 Min	TB1, RB1	Black Board

On completion of this lesson the student shall be able to (Outcomes)

1. Understand the concept of RAID and different RAID levels and their suitability.

2. Understand the concept RAID implementations and their benefits.

	ASSIGNMENT **Unit-III**	2013-14
		Regulation: R11

Assignment / Questions

A5. Define different RAID levels and their suitability for different application environments.

A6. Define the concept of RAID and its components.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN **Unit-IV**	2013-14 Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: IV

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
22	Evolution of networked storage	**50 Min**	TB1, RB2	Black Board
23,24	Architecture, components, and topologies of FC-SAN	**50 Min**	TB1, RB2	Black Board
25	NAS, and IP-SAN	**50 Min**	TB1, RB2	PPT
26	Describe how CAS fulfils the need	**50 Min**	TB1, RB2	Black Board
27,28	Understand the appropriateness of the different networked storage	**50 Min**	TB1, RB2	Black Board
29	Different application Environments	**50 Min**	TB1, RB2	Black Board

On completion of this lesson the student shall be able to (Outcomes)

1. Understand the importance of Fibre Channel protocols and how to communicate.
2. Learn Fibre Channel protocols and theirs components.

	ASSIGNMENT **Unit-IV**	2013-14
		Regulation: R11

Assignment / Questions

A7. Why Fiber channel is dedicated high performance channel.

A8. Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN **Unit-V**	2013-14 Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: V

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
30,31	List reasons for planned/unplanned outages	**50 Min**	TB1, RB2	Black Board
32	Impact of downtime	**50 Min**	TB1, RB2	Black Board
33,34	Differentiate between business continuity (BC) and disaster recovery (DR)	**50 Min**	TB1, RB2	Black Board
35,36	RTO and RPO, Identify single points of failure in a storage infrastructure	**50 Min**	TB1, RB2	Black Board
37	list solutions to mitigate these failures	**50 Min**	TB1, RB2	Black Board

On completion of this lesson the student shall be able to (Outcomes)

1. Understand the different networked storage options for different application environments.

2. Understand the different backup and recovery topologies and their role.

	ASSIGNMENT **Unit-V**	2013-14
		Regulation: R11

Assignment / Questions

A9. Differentiate between business continuity (BC) and disaster recovery (DR).

A10. Define planned and unplanned outages in SAN.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-VI	2013-14
		Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: VI

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
38	Architecture of backup/recovery	50 Min	RB1,RB2	Black Board
39,40	Different backup/recovery topologies	50 Min	RB1,RB2	Black Board
41	Replication technologies and their role	50 Min	RB1,RB2	Black Board
42	Information availability and business continuity	50 Min	RB1,RB2	Black Board
34,44	Remote replication technologies and their role in providing disaster recovery	50 Min	RB1,RB2	Black Board
45	Business continuity capabilities	50 Min	RB1,RB2	Black Board

On completion of this lesson the student shall be able to (Outcomes)

1. Identify key areas to monitor in a data center for different components.

2. Understand the different networked storage options for different application environments.

	ASSIGNMENT **Unit-VI**	2013-14
		Regulation: R11

Assignment / Questions

A11. Define different backup and recovery topologies.

A12. Define remote replication technologies and their role.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN **Unit-VII**	2013-14 Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: VII

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
46	Identify key areas to monitor in a data center	**50 Min**	RB1,RB2	Black Board
47,48	Industry standards for data center monitoring and management	**50 Min**	RB1,RB2	Black Board
49,50	Key metrics to monitor for different components in a storage infrastructure	**50 Min**	RB1,RB2	Black Board
51	Key management tasks in a data center	**50 Min**	RB1,RB2	Black Board
52	Information security	**50 Min**	RB1,RB2	Black Board
53	Critical security attributes for information systems	**50 Min**	RB1,RB2	Black Board
54	Storage security domains	**50 Min**	RB1,RB2	Black Board
55,56	List and analyzes the common threats in each domain	**50 Min**	RB1,RB2	Black Board

On completion of this lesson the student shall be able to

1. Understand different components in a storage security domains.

2. Understand files sharing operations of the different network.

	ASSIGNMENT **Unit-VII**	2013-14
		Regulation: R11

Assignment / Questions

A13. What are the key metrics to monitor for different components.

A14. Identify key areas to monitor in a data center, Industry standards for data center monitoring and Management.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.

	LESSON PLAN Unit-VIII	2013-14
		Regulation: R11

Name of the Faculty: Bijaya Kumar Biswal

Subject: Storage Area Networks Subject Code: SAN

Unit: VIII

INSTRUCTIONAL OBJECTIVES:

Session No	Topics to be covered	Time	Ref	Teaching Method
57	Introduction to Storage Virtualization	50 Min	RB1,RB2	Black Board
58	Block-level and file-level	50 Min	RB1,RB2	Black Board
59	Virtualization technologies	50 Min	RB1,RB2	Black Board
60	Virtualization processes	50 Min	RB1,RB2	Black Board

On completion of this lesson the student shall be able to

1. Understand different type process and file-level virtualization technologies.

2. Understand block-level and file-level storage.

	ASSIGNMENT **Unit-VIII**	2013-14 Regulation: R11

Assignment / Questions

A15. Critical security attributes for information systems, Storage security domains.

A16. What are file-levels virtualization technologies and processes.

Signature of Faculty

Note: Mention for each question the relevant objectives and outcomes.