CMR Institute of Technology, Bangalore			
Department(s): Computer Science & Engineering			
Semester: 02	Section(s): M.Tech(CSE)	Lectures/week: 04	
Subject: Managing Big Data		Code: 17SCS21	
Course Instructor(s): PV Reddy			
Course duration: 17 Feb 2018 – 08 June 2018			
Course Site: https://sites.google.com/a/cmrit.ac.in/managing-big-data/			

Course Objectives

- Define big data for business intelligence
- Analyze business case studies for big data analytics
- Explain managing of Big data Without SQL
- Develop map-reduce analytics using Hadoop and related tools

Prerequisites

- Probability distributions and random variables
- Object Oriented Modeling Concepts
- Operation research

Lesson Plan				
			Portions coverage	
Lecture #	**Book & Sections**	Topics	Teaching Aids	% of Syllabus Covered
1-10	TB1:Ch1	**Module-1** **UNDERSTANDING BIG DATA**: What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data – big data technologies – introduction to Hadoop – open source technologies – cloud and big data –mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				
- https://www.youtube.com/watch?v=AoqBwMc9_yY - https://www.youtube.com/watch?v=7D1CQ_LOizA - https://www.youtube.com/watch?v=7D1CQ_LOizA				
11-20	?	**Module-2** **NOSQL DATA MANAGEMENT:** Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph	Chalk and Talk Video	20

		databases – schema less databases – materialized views – distribution models – shading — version – map reduce – partitioning and combining – composing map-reduce calculations.	Lectures for some topics	

Links to some useful online lectures:
➢ https://www.youtube.com/watch?v=qI_g07C_Q5I

21-30	TB1 Ch2, Ch3, Ch4	**Module – 3** BASICS OF HADOOP: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression– serialization – Avro – file-based data structures.	Chalk and Talk	10

Links to some useful online lectures:
➢ https://www.youtube.com/watch?v=xWgdny19yQ4
➢ https://www.youtube.com/watch?v=UUUEHjtbVQ0
➢ https://www.youtube.com/watch?v=WHncMILyVYs

31-40	TB1: Ch6	**Module-4** MAPREDUCE APPLICATIONS: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN –failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:
➢ https://www.youtube.com/watch?v=9hfGiNmRMxs
➢ https://www.youtube.com/watch?v=HHv2pkIJjR0

41-50	TB1 Ch11, Ch 12	**Module-5** HADOOP RELATED TOOLS: Hbase – data model and implementations – Hbase clients– Hbase examples –praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.	Chalk and Talk	10

Links to some useful online lectures:
➢ https://www.youtube.com/watch?v=T34umCQAmAw
➢ https://www.youtube.com/watch?v=Yw4hcSR-DGU
➢ https://www.youtube.com/watch?v=_HLoH_PgrLk
➢ https://www.youtube.com/watch?v=B_HTdrTgGNs
➢

Text Books	
1	Tom White: Hadoop: The Definitive Guide, Third Edition, O'Reilley, 2012.
2	Eric Sammer, Hadoop Operations, O'Reilley, 2012.

	Reference Books
1.	Vignesh Prajapati, Big data analytics with R and Hadoop, SPD 2013.
2.	E. Capriolo, D. Wampler, and J. Rutherglen, Programming Hive, O'Reilley, 2012.
3.	Lars George, HBase: The Definitive Guide, O'Reilley, 2011.
4.	Alan Gates, Programming Pig, O'Reilley, 2011

Syllabus for Internal Assessment Tests (IAT[*])

IAT #	Syllabus
IAT-1	Class # 01 – 18
IAT-2	Class # 19–37
IAT-3	Class # 38–52

*See calendar of events for IAT schedule.

Course Outcomes
By the end of this course, students will be able to
1. Describe big data and use cases from selected business domains
2. Explain NoSQL big data management
3. Install, configure, and run Hadoop and HDFS.
4. Perform map-reduce analytics using Hadoop
5. Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics

**Based on table 01, 02, 03 in appendix, following are the Course outcomes.

	Course Outcomes	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Describe big data and use cases from selected business domains	1	1	2	0	0	0	0	0	0	0	0	0	0
CO2	Explain NoSQL big data management	2	1	2	0	0	0	0	0	0	0	0	0	2
CO3	Install, configure, and run Hadoop and HDFS	3	1	2	0	3	2	0	0	0	0	0	0	0
CO4	Perform map-reduce analytics using Hadoop	4	3	3	3	2	0	0	0	0	0	0	0	2
CO5	Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics	5	2	2	2	2	3	0	0	0	0	0	0	2

Note: Assignments, study material, Question bank and other course related content would be posted on site mentioned above.

Appendix

Table 01: Cognitive Levels

Cognitive Levels	
Cognitive level	**Revised Blooms Taxonomy Keywords**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

Table 02: Program Outcomes (PO) and Program Specific Outcomes (PSO)

Program Outcomes (PO), Program Specific Outcomes (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
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.
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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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.

Table 03: Correlation Levels

Correlation Levels	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

CMR Institute of Technology, Bangalore			
Department(s): Computer Science & Engineering			
Semester: M.Tech 2nd	Section(s): CSE	Lectures/week: 04	
Subject: Advances in Computer Networks		Code: 17SCS22	
Course Instructor(s): Swetha K V			
Course duration: 17 Feb 2018 – 8 June 2018			
Course Site: https://sites.google.com/a/cmrit.ac.in/swetha/			

Course Objectives

➢ Discuss with the basics of Computer Networks.

➢ Compare various Network architectures.

➢ Discuss fundamental protocols.

➢ Define and analyze network traffic, congestion, controlling and resource allocation.

Prerequisites

➢ Basic knowledge of computer networks

➢ Data Communication

Lesson Plan				
Lecture #	**Book & Sections**	**Topics**	**Portions coverage**	
			Teaching Aids	% of Syllabus Covered
1-16	TB1: 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 TB2: 4	**MODULE – 1** **Foundation:** Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.	Chalk and Talk Video Lectures for some topics	
Links to some useful online lectures:				
➢ https://www.youtube.com/watch?v=tUj8HUGaGH0				

17-31	TB1: 3.1,3.2	**MODULE – 2** **Internetworking I:** Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels.	Chalk and Talk Video Lectures for some topics	

Links to some useful online lectures:

- https://www.youtube.com/watch?v=Ga9U-Ohlo10
- https://www.youtube.com/watch?v=xTOyZ6TWQdM
- https://www.youtube.com/watch?v=4BfL0UHrzDY&t=825s

32-42	TB1: 3.3, 4.1.1,4.1.3 TB2: 13.1 to 13.18 , 18.	**MODULE – 3** **Internetworking- II:** Network as a Graph, Distance Vector (RIP), Link State (OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems (BGP), IP Version 6 (IPv6), Mobility and Mobile IP	Chalk and Talk	

Links to some useful online lectures:

- https://www.youtube.com/watch?v=dmS1t2twFrI
- https://www.youtube.com/watch?v=iR8ve5tTWAA

43-55	TB1: 5.1, 5.2.1 to 5.2.8, 6.2, 6.3	**MODULE – 4** **End-to-End Protocols:** Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery	Chalk and Talk Video Lectures for some topics	

Links to some useful online lectures:

- https://www.youtube.com/watch?v=wQ4_N73duO0
- https://www.youtube.com/watch?v=6MyBum2Njls

56-62	TB1: 6.4 TB2: 23.1 to 23.16, 24, 25, 27.1	**MODULE – 5** **Congestion Control and Resource Allocation** Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion	Projector, Seminars	

	to 27.8	Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP,POP,IMAP,MIME), World Wide Web (HTTP), Network Management (SNMP)		

Text Books	
1.	Larry Peterson and Bruce S Davis "Computer Networks :A System Approach" 5th Edition , Elsevier -2014
2.	Douglas E Comer, "Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI – 2014
Reference Books	
1.	Uyless Black, "Computer Networks, Protocols , Standards and Inte rfaces" 2 nd Edition - PHI.
2.	Behrouz A Forouzan, "TCP /IP Protocol Suite" 4 th Edition – Tata McGraw-Hill.

Syllabus for Internal Assessment Tests (IAT[*])

IAT #	Syllabus
IAT-1	Class # 01 – 31
IAT-2	Class # 32 - 50
IAT-3	Class # 51 – 62

*See calendar of events for IAT schedule.

Course Outcomes
By the end of this course, students will be able to
1. List and classify network services and architectures, explain why they are layered and define performance metrics.
2. Describe the concept of switching and bridging
3. Apply knowledge of various routing protocols
4. Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery etc.
5. Explain congestion control and avoidance concepts and mechanisms.
6. Identify and explain various network applications and protocols they use.

**Based on table 01, 02, 03 in appendix, following are the Course outcomes.

	Course Outcomes	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	List and classify network services and	1	3	3	2	2	0	2	0	0	2	2	2	3

	architectures, explain why they are layered and define performance metrics.													
CO2	Describe the concept of switching and bridging	2	3	3	2	2	0	0	0	0	3	2	2	3
CO3	Apply knowledge of various routing protocols	3,4	3	2	2	1	2	0	0	0	3	1	0	3
CO4	Explain develop effective communication mechanisms using techniques like connection establishment, queuing theory, recovery etc.	4	3	3	2	1	0	0	0	0	2	1	0	3
CO5	Explain congestion control and avoidance concepts and mechanisms.	5	3	3	2	1	2	0	0	0	2	1	0	3
CO6	Identify and explain various network applications and protocols they use.	3,5	3	2	2	1	2	2	1	0	2	1	2	3

Note: Assignments, study material, Question bank and other course related content would be posted on site mentioned above.

Appendix

Table 01: Cognitive Levels

Cognitive Levels	
Cognitive level	**Revised Blooms Taxonomy Keywords**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

Table 02: Program Outcomes (PO) and Program Specific Outcomes (PSO)

Program Outcomes (PO), Program Specific Outcomes (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.

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.
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.
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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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.

Table 03: Correlation Levels

Correlation Levels	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

CMR Institute of Technology, Bangalore			
Department(s): Computer Science & Engineering			
Semester: 02	Section(s): 0		
Advanced Algorithms		17SCS23	Lectures/week: 04
Course Instructor(s): Sherly Noel			
Course duration: 17 Feb., 2018 – 08 Jun 2018			

Course Objectives
➢ Define the graph search algorithms.   ➢ Explain network flow and linear programming problems.   ➢ Interpret hill climbing and dynamic programming design techniques.   ➢ Develop recursive backtracking algorithms.   ➢ Define NP completeness and randomized algorithms
Prerequisites
➢ Different sorting techniques   ➢ Analysis of algorithms   ➢ Graph problems

LESSON PLAN

Lecture #	Book & Sections	Topics	Portions coverage	
			Teaching Aids	% of Syllabus Covered
1013	TB1: 3.1 – 3.2 4.3 – 4.6 17.1 – 17.3	**Review of Analysis Techniques:** Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- https://www.youtube.com/watch?v=aGjL7YXI31Q
- http://www.geeksforgeeks.org/analysis0of0algorithms0set03asymptotic0notations/

Lecture #	Book & Sections	Topics	Teaching Aids	%
14023	TB1: 24.1 – 24.3 26.1 – 26.3 30.1 – 30.3	**Graph Algorithms:** Bellman 0 Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford0Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- https://www.youtube.com/watch?v=hmIrJCGPPG4&t=2s
- https://www.youtube.com/watch?v=dp0Ortfx1f4

Lecture #	Book & Sections	Topics	Teaching Aids	%
24033	TB1 31.1 – 31.9	Number0Theoretic Algorithms : Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization	Chalk and Talk	20

Links to some useful online lectures:

- https://www.youtube.com/watch?v=20tdwLqyaKo
- https://www.youtube.com/watch?v=_IwMX1zwcUE

Lecture #	Book & Sections	Topics	Teaching Aids	%
34043	TB1 32.1 – 32.4	**String0Matching Algorithms:** Naïve string Matching; Rabin 0 Karp algorithm; String matching with finite automata; Knuth0Morris0Pratt algorithm; Boyer – Moore algorithms.	Chalk and Talk video Lectures for some topics	20

Links to some useful online lectures:

- https://www.youtube.com/watch?v=d3TZpfnpJZ0
- https://www.youtube.com/watch?v=KG44VoDtsAA

Lecture #	Book & Sections	Topics	Teaching Aids	%
44052	TB2 4.104.8	**Probabilistic and Randomized Algorithms:** Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

- https://www.youtube.com/watch?v=Nn_Eq700Rk4&t=3s

Text Books

1.	T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice0Hall of India, 2010
2.	Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.
	Reference Books
3.	Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

Syllabus for Internal Assessment Tests (IAT) [*]

IAT #	Syllabus
IAT-1	Class # 01 – 23
IAT-2	Class # 24– 43
IAT-3	Class # 44– 52

* : See calendar of events for the schedules of IATs.

Course Outcomes
By the end of this course, students will be able to
1. Design and apply iterative and recursive algorithms.
2. Design and implement optimization algorithms in specific applications.
3. Design appropriate shared objects and concurrent objects for applications.

COGNITIVE LEVELS	
Cognitive level	**REVISED BLOOMS TAXONOMY KEYWORDS**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PROGRAM OUTCOMES (PO), PROGRAM SPECIFIC OUTCOMES (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.	
PO4	**Conduct investigations of complex problems:** Use research0based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	
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.	
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.	
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.	
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	
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.	
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.	
PO12	**Life0long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life0long learning in the broadest context of technological change.	

	CORRELATION LEVELS
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

Course Outcomes		Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Design and apply iterative and recursive algorithms.	1,2,3, 4,5	2	2	0	1	0	0	0	0	1	1	0	1
CO2	Design and implement optimization algorithms in specific applications.	1,2,3, 4,5	2	2	1	1	0	0	0	0	1	1	0	1
CO3	Design appropriate shared objects and concurrent objects for applications.	1,2,3, 4,5	2	2	1	1	0	0	0	0	1	1	0	1

Note : From time to time, assignments will be posted on

https://sites.google.com/a/cmrit.ac.in/advanced-algorithm/

CMR Institute of Technology, Bangalore			
Department(s): Computer Science & Engineering			
Semester: 02	Section(s):	Lectures/week: 04	
Subject: INTERNET OF THINGS		Code: 17SCS24	
Course Instructor(s): D. Komagal Meenakshi			
Course duration: 17 Feb 2018 – 08 June 2018			
Course Site: https://sites.google.com/a/cmrit.ac.in/Internet of Things/			

Course Objectives

➢ Define And Explain Basic Issues, Policy And Challenges In The IOT

➢ Illustrate Mechanism And Key Technologies In IOT

➢ Explain The Standard Of The IOT

➢ Explain Resources In The IOT And Deploy Of Resources Into Business

➢ Demonstrate Data Analytics For IOT

Pre requisites

➢ Artificial intelligence

➢ Data communications

➢ Computer networks

➢ Microprocessor and microcontroller

Lesson Plan				
Lecture #	**Book & Sections**	**Topics**	**Portions coverage**	
			Teaching Aids	% of Syllabus Covered
1-10	TB1 1,2,3	**Module -1** What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IOT Definitions, IOT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.	Chalk and Talk Video Lectures for some topics	20
Links to some useful online lectures:				

		➤ https://www.youtube.com/watch?v=ug7e2LBQgN4 ➤ https://www.youtube.com/watch?v=UKDbyWExa0E&list=PL5MBT9NtX7ZOB4d8DhU-HJzBZKbL3xcb9 ➤ https://www.youtube.com/watch?v=bglem3yFQPg		
11-22	TB1 4,5	**Module -2** Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M,Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zig bee IP(ZIP),IPSO	Chalk and Talk PPT, Video Lectures for some topics	20

Links to some useful online lectures:

➤ https://www.youtube.com/watch?v=zveRq0wCSKM
➤ https://www.youtube.com/watch?v=SDJVFr4VUHA

23-33	TB1 6,7	**Module – 3** Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity :IPv6 Technologies for the IoT:Overview and Motivations.Address Capabilities,IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes,Quality of Service in IPv6, Migration Strategies to IPv6.	Chalk and Talk PPT, Video Lectures for some topics	20

Links to some useful online lectures:

➤ https://www.youtube.com/watch?v=h8xPUfTpyGU
https://www.youtube.com/watch?v=4u0Pkm4fpPw

34-42	TB2 2.1- 2.4 2.8-2.9	**Module-4** Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.	Chalk and Talk Video Lectures for some topics	20

Links to some useful online lectures:

➤ https://www.youtube.com/watch?v=xTyPSPzD8-M
➤ https://www.youtube.com/watch?v=cE8DLQce1fg

43-52	TB2 10	**Module-5** Data Analytics for IoT – Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.	Chalk and Talk	20

Links to some useful online lectures:

➤ https://www.youtube.com/watch?v=u_AxyzcTsEg
➤ https://www.youtube.com/watch?v=6MPMW2oiz6E

Text Books

	1.	Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", Wiley, 2013.
	2.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach" Universities Press., 2015
Reference Books		
1.		Michael Miller," The Internet of Things", First Edition, Pearson, 2015.
2.		Claire Rowland,Elizabeth Goodman et.al.," Designing Connected Products", First Edition,O'Reilly, 2015.

Syllabus for Internal Assessment Tests (IAT[*])

IAT #	Syllabus
IAT-1	Class # 01 – 19
IAT-2	Class # 20– 36
IAT-3	Class # 37– 52

*See calendar of events for IAT schedule.

Course Outcomes
By the end of this course, students will be able to
1. Develop schemes for the applications of IOT in real time scenarios
2. Manage the Internet resources
4. Model the Internet of things to business
5. Understand the practical knowledge through different case studies
6. Understand data sets received through IoT devices and tools used for analysis

**Based on table 01, 02, 03 in appendix, following are the Course outcomes.

	Course Outcomes	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Develop schemes for the applications of IOT in real time scenarios	1,2	2	3	3	1	-	3	1	-	-	1	-	3
CO2	Manage the Internet resources	2,3	2	2	1	1	2	1	1	1	2	2	-	2
CO3	Model the Internet of things to business	1,2	2	3	1	1	3	2	1	-	1	2	-	1
CO4	Understand the practical knowledge through different case studies	4	2	2	3	-	-	1	1	-	-	-	-	1
CO5	Understand data sets received through IoT devices and tools used for analysis	5	2	2	3	-	2	3	-	2	-	3	-	2

Note: Assignments, study material, Question bank and other course related content would be posted on site mentioned above.

Appendix

Table 01: Cognitive Levels

Cognitive Levels	
Cognitive level	**Revised Blooms Taxonomy Keywords**
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

Table 02: Program Outcomes (PO) and Program Specific Outcomes (PSO)

Program Outcomes (PO), Program Specific Outcomes (PSO)	
PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.
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.
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.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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.

Table 03: Correlation Levels

Correlation Levels	
0	No Correlation
1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High

CMR Institute of Technology, Bangalore			
Department(s): Computer Science & Engineering			
Semester: 02	Section(s): Mtech	Lectures/week: 04	
Subject: Information and Network Security		Code: 17SCS253	
Course Instructor(s): D.Gopika			
Course duration: 16 feb 2018 – 8 june 2018			
Course Site: https://sites.google.com/a/cmrit.ac.in/information-and-network-security/			

Course Objectives

- ➢ Explain standard algorithms used to provide confidentiality, integrity and authenticity.
- ➢ Distinguish key distribution and management schemes.
- ➢ Deploy encryption techniques to secure data in transit across data networks
- ➢ Implement security applications in the field of Information technology

Pre requisites

1. Basics Concepts of Networking (OSI, TCP/IP), Basic understanding of Encoding, Encryption concepts
2. Knowledge of typical IT infrastructure and its usage. Operational skills would be preferable.

Lesson Plan				
Lecture #	**Book & Sections**	**Topics**	**Portions coverage**	
			Teaching Aids	% of Syllabus Covered
1-8	TB1 Chapter 2 ,3	**Classical Encryption Techniques** Symmetric Cipher Model, Cryptography ,Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, MonoalphabeticCipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure,stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example,results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of then DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.	Chalk and Talk Video Lectures for some topics	20

9-16	TB1 Chapter 4,5	**Public-Key Cryptography and RSA:** Principles of public-key cryptosystems. Publickey cryptosystems. Applications for public-key cryptosystems, requirements for publickey cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols,man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic,abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange,Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.	Chalk and Talk Video Lectures for some topics	20

17-21	TB1 Chapter 6, 7	**Key Management and Distribution:** Symmetric key distribution using Symmetricencryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage,Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme,distribution of public keys, public announcement of public keys, publicly availabledirectory, public key authority, public keys certificates, X-509 certificates. Certificates,X-509 version 3, public key infrastructure. **User Authentication:** Remote userAuthentication principles, Mutual Authentication, one way Authentication, remote userAuthentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation , Kerberos version 4, Kerberos version 5, Remoteuser Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.	Chalk and Talk	20

22-30	TB1 Chapter 8,9	**Wireless network security:** Wireless security, Wireless network threats, Wireless **8 Hours**network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE	Chalk and Talk Video Lectures for some topics	20

		802.11i pseudorandom function. **Web Security Considerations:** Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer: SSL** Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** VersionNumber, Message Authentication Code, Pseudorandom Functions, Alert Codes, CipherSuites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell(SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol		

Links to some useful online lectures:

➢ https://www.youtube.com/watch?v=dYQMzyfFrTE

| 31-36 | TB1 Chapter 10,11 | **Electronic Mail Security:** Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. | Chalk and Talk | 20 |

Links to some useful online lectures:

➢ https://www.youtube.com/watch?v=pZIIaWhfhpQ

Text Books	
1.	William Stallings,Cryptography and Network Security, Pearson 6th edition.
Reference Books	
7.	V K . Pachghare ,Cryptography and Information Security.

Syllabus for Internal Assessment Tests (IAT[*])

IAT #	Syllabus
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IAT-2	Class # 20– 34
IAT-3	Class # 35– 52

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Course Outcomes
By the end of this course, students will be able to
Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
Identify the security issues in the network and resolve it.
Evaluate security mechanisms using rigorous approaches, including theoretical.

**Based on table 01, 02, 03 in appendix, following are the Course outcomes.

	Course Outcomes	Modules covered	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	**1**	1	0	1	0	1	0	2	1	1	0	0	0
CO2	Identify the security issues in the network and resolve it.	**1,2,3**	1	1	3	0	2	2	1	1	0	0	1	1
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical	**3,4,5**	1	1	0	0	0	0	0	0	0	0	0	0

Note: Assignments, study material, Question bank and other course related content would be posted on site mentioned above.

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L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
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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.
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.
PSO1	Design, implement and maintain business applications in a variety of languages using libraries and frameworks.
PSO2	Develop and simulate wired and wireless network protocols for various network applications using modern tools.
PSO3	Apply the knowledge of software and design of hardware to develop embedded systems for real world applications.
PSO4	Apply knowledge of web programming and design to develop web based applications using database and other technologies

Table 03: Correlation Levels

Correlation Levels	
0	No Correlation

1	Slight/Low
2	Moderate/ Medium
3	Substantial/ High