BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC701</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses: Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">INTERNET OF THINGS – THEORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the IoT architecture, applications and it's enabling technologies.
2. Understand the IoT System Management.
3. Understand the IoT Design Methodology.
4. Learn Python Programming for Raspberry.
5. Understand Cloud Storage Models, Web Application Framework and Web Services for IoT.

UNIT I: INTRODUCTION TO INTERNET OF THINGS (IoT) 10 Hours

Definition and Characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels and Deployment Templates. Domain Specific IoT - Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT II: IoT AND M2M 09 Hours

M2M, Difference between IoT and M2M, SDN and NFV for IoT, Need for IoT Systems Management, Simple Network Management Protocol, Network Operator Requirements, IoT System Management with NETCONF-YANG.

UNIT III: IoT DESIGN METHODOLOGY AND IoT SYSTEMS 10 Hours

Purpose and Requirements Specification, Process Specification, Information Model Specification, Service Specification, IoT Level Specification, Functional View Specification, Operational Level Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring. Logical Design using Python – Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes, Python Packages of Interest for IoT.

UNIT IV: IoT PHYSICAL DEVICES AND ENDPOINTS **09 Hours**

Basic Building Blocks of an IoT device, About Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Controlling LED, Interfacing LED and Switch, Interfacing Light Sensor.

UNIT V: IoT PHYSICAL SERVERS AND CLOUD OFFERINGS **10 Hours**

Introduction to Cloud Storage Models and Communication APIs, Python Web Application Framework – Django, Django Architecture, Development with Django, Designing RESTful Web API, Amazon Web Services for IoT.

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", University Press, 2015.

REFERENCE BOOKS:

1. Raj Kamal, Internet of Things – Architecture and Design Principles, McGraw Hill, 2017.
2. Peter Waher, "Learning Internet of Things", PACKT Publishing, 2015.
3. Adrian McEwen and Hakim Cassimally, "Designing Internet of Things", John Wiley and Sons, 2014.

e-BOOKS/ONLINE RESOURCES:

1. https://www.riverpublishers.com/pdf/ebook/RP9788793519046.pdf
2. http://www.internet-of-things-research.eu/pdf/Digitising_the_Industry_IoT_IERC_2016_Cluster_eBook_978-87-93379-82-4_P_Web.pdf
3. http://www.buyya.com/papers/IoT-Book2016-C1.pdf
4. http://www.mforum.ru/arc/iot-book_compressed_MForum.pdf
5. http://madsg.com/wp-content/uploads/2015/12/Designing_the_Internet_of_Things.pdf

MOOCs:

1. https://www.edx.org/micromasters/curtinx-internet-of-things-iot
2. https://www.mooc-list.com/tags/iot
3. https://www.coursera.org/specializations/internet-of-things
4. https://www.my-mooc.com/en/categorie/internet-of-things
5. https://www.engineering.com/Education/EducationArticles/ArticleID/13506/Interested-in-IoT-These-MOOCs-Might-Be-for-You.aspx

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Demonstrate the knowledge of IoT architecture and design.

CO2: Analyse the need of IoT System Management and Apply.
CO3: Design an IoT System using Design Methodology
CO4: Develop Applications using Raspberry Pi and Python.
CO5: Test connectivity using AWS IoT Test service provided by Amazon.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPC702</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">MACHINE LEARNING – THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VII CSE/ISE</td></tr>
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COURSE OBJECTIVES:

This course will enable students to

1. Understanding the importance of concepts of machine learning algorithms.
2. Exploring the significance of decision tree learner in machine learning.
3. Identifying the concepts and working of artificial neural networks.
4. Recognizing the principles of Bayesian learning.
5. Ascertaining the concepts of hypothesis, instance based learning & reinforcement learning.

UNIT I: INTRODUCTION TO MACHINE LEARNING **09 Hours**

Introduction, Well posed learning problems, Designing a learning system: Choosing training experience, Choosing target function, Choosing a representation for target function, Choosing a function approximation algorithm, The final design, Perspective and Issues in Machine Learning. Concept Learning: Concept Learning Task, Concept learning as search, Find-S algorithm, Version Space and Candidate Elimination algorithm, Inductive Bias.

UNIT II: DECISION TREE LEARNING **10 Hours**

Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm: The best attribute classifier, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Avoiding data overfitting, Post rule pruning. Incorporating continuous-valued attributes, Alternative measures for selecting attributes, Handling training examples with missing attribute values, Handling attributes with different costs.

UNIT III: ARTIFICIAL NEURAL NETWORKS **10 Hours**

Introduction: Biological motivation. Neural network representations, Appropriate problems for neural network learning, Perceptrons: Representational power of perceptrons, The perceptron training rule, Illustration of Perceptron training rule, Gradient Descent and Delta Rule, Multilayer networks and Backpropagation algorithm: Differentiable threshold unit, The Backpropagation algorithm, Learning in Arbitrary Acyclic Networks, Derivation of the Backpropagation rule.

UNIT IV: BAYESIAN LEARNING **09 Hours**

Introduction, Bayes Theorem, Bayes Theorem and Concept Learning: Brute-Force Bayes Concept Learning, MAP hypothesis and Consistent Learners; Maximum likelihood and least-squared error hypothesis, Maximum likelihood hypothesis for predicting probabilities, Minimum description length principle, Naïve Bayes classifier, Bayesian Belief Networks, The Expectation Maximization algorithm.

UNIT V: EVALUATING HYPOTHESIS, INSTANCE BASED AND REINFORCEMENT LEARNING **10 Hours**

Estimating hypothesis accuracy: Sample error and true error, Confidence interval for discrete-valued hypothesis; Basics of Sampling Theory: Error estimation and estimating Binomial Proportions, The Binomial Distribution, Mean and Variance, Estimators, Bias and Variance, Confidence Intervals; Two-sided and One-sided Bounds. Instance Based Learning: Introduction, k-nearest neighbour learning, Locally weighted regression, Radial Basis Functions, Case Based Reasoning. Reinforcement Learning: Introduction, The learning task, Q learning, Temporal difference learning, Relationship to Dynamic Programming.

TEXT BOOKS:

1. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

REFERENCE BOOKS:

1. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, 2nd Edition, 2010.
2. An Introduction to Machine Learning, Kubat, Miroslav, Springer Verlag, 2015.

e-BOOKS/ONLINE RESOURCES:

1. http://ai.stanford.edu/~nilsson/mlbook.html.
2. http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html.
3. http://web4.cs.ucl.ac.uk/staff/D.Barber/pmwiki/pmwiki.php?n=Brml.Online.

MOOCs:

1. https://www.coursera.org/learn/machine-learning.
2. https://medium.com/@amarbudhiraja/MOOCs-for-machine-learning-5a2f2c6cdcfe.
3. https://onlinecourses.nptel.ac.in/noc19_cs35/preview.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Realizing the importance of basic machine learning concepts.
CO2: Understanding the principles of decision tree learning.
CO3: Distinguish between different types of neural network learners.
CO4: Examining the significance of Bayesian learning and its applications.
CO5: Analysing the significance of reinforcement algorithms towards real world problems.

SCHEME OF EXAMINATION:

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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC705**					
Category	Engineering Science Courses : Professional Core					
Course title	**INTERNET OF THINGS - LABORATORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	0	0	3	0	1.5	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable students to

1. Learn the features of Raspberry Pi and Arduino MCU boards.
2. Learn how to program the Raspberry Pi and Arduino MCU boards.
3. Demonstrate various experiments on Raspberry Pi and Arduino MCU boards.
4. Use IoT enabling technologies to design an IoT System.
5. Apply the MQTT protocol for IoT system Design.

DESCRIPTION:

Design, develop, and implement the specified programs for the following problems using Raspberry Pi and Arduino MCU boards.

LAB PROGRAMS

1. Learn the basics of Arduino MCU boards, features and pinouts of Arduino UNO, differentiate between READ and WRITE pins, install and configure the Arduino IDE, and basics of soldering.
2. Arduino program to blink an LED and implement a traffic signal system using digitalWrite() and pinMode() functions.
3. Arduino program to vary the intensity of LED based on the reading of Light Dependent Resistor (LDR) using analogRead() and analogWrite() functions.
4. Arduino program to toggle LED by pressing a button and to implement a switch debounce circuit to prevent glitches in user input.
5. Arduino program to implement a serial communication event.
6. Arduino program to implement a temperature and humidity sensor and switch ON an LED if the temperature is too hot.
7. Arduino program to drive a DC motor and a stepper motor.
8. Arduino program to implement an ultrasonic sensor to measure distance to an obstacle and "buzz" when too close to object.
9. Arduino program to implement a 16x2 LCD alphanumeric display and display temperature and current date and time.

10. Arduino program to implement a GSM module and send SMS using some carrier to a cellphone number.
11. Learn the basics of Raspberry Pi, features, pinout and configuration.
12. Program to implement MQTT protocol and publish some data.

COURSE OUTCOMES:

The student at the end of the course, will be able to

CO1: Demonstrate the usage of Raspberry Pi and Arduino MCU boards.
CO2: Implement various experiments on Raspberry Pi and Arduino MCU boards for IoT system design.
CO3: Develop Applications using Raspberry Pi, Arduino MCU boards and Python.
CO4: Test connectivity using AWS IoT Test service provided by Amazon.
CO5: Implement other application protocols and publish data.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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<table>
<tr><td>Course Code</td><td colspan="6">18CIPC706</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Core</td></tr>
<tr><td>Course title</td><td colspan="6">MACHINE LEARNING - LABORATORY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="2">Semester - VII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td></td><td>0</td><td>0</td><td>3</td><td>0</td><td>1.5</td><td></td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="3">Total Max. Marks: 100</td><td>Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

This course will enable students to

1. Understand the applications of machine learning algorithms on different datasets.
2. Implement the machine learning algorithms in any programming language of choice.
3. Apply the concepts of Artificial Neural Networks for some applications.
4. Understanding the importance of concepts of machine learning algorithms.
5. Exploring the significance of decision tree learner in machine learning.

NOTE:

1. The data sets for the laboratory experiments can be downloaded from public repositories (https://archive.ics.uci.edu/ml/datasets.html) or can be constructed by the students themselves.
2. The programs can be implemented in either Python or Java programming language.
3. For experiments from 1 to 6 and 10 no build-in functions/APIs are to be used from either Python/Java.

LAB EXPERIMENTS

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the Naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply K-Means algorithm to cluster a set of data stored in a .CSV file. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Realizing the importance of basic machine learning concepts.
CO2: Understanding the principles of decision tree learning.
CO3: Distinguish between different types of neural network learners.
CO4: Examining the significance of Bayesian learning and its applications.
CO5: Analyzing the significance of reinforcement algorithms towards real world problem.

SCHEME OF EXAMINATION:

Continuous Internal Evaluation (CIE) Laboratory - (50 Marks)	**Marks**	**Semester End Evaluation (SEE) Laboratory - (100 Marks)**	**Marks**
Performance of the student in the laboratory, every week	20	Write up	20
Test at the end of the semester	20	Execution	60
Viva voce	10	Viva voce	20
Total	**50**	**Total**	**100**

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks. *****

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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPC707**					
Category	Engineering Science Courses : Professional Core					
Course title	**PRELIMINARY PROJECT**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	0	0	6	0	3	
CIE Marks: 50			Total Max. Marks: 50			
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. To select a problem applying relevant knowledge and skills acquired during the program.
2. To carry out literature survey to identify and present the problem formulation.
3. To finalize the specification of the project work, prepare project plan and methodology, considering professional, cultural and societal factors.
4. To develop experimental planning and select appropriate techniques and tools to conduct experiments to evaluate and critically examine the outcomes.
5. To prepare synopsis and preliminary report for approval of topic selected.
6. To develop oral and written communication skills to effectively convey the technical content.

GUIDELINES:

1. The preliminary project work starts at the beginning of 7th semester with the formation of team consisting of 2 to 4 students.
2. The topic of the project work should be finalized by the team in consultation with the project guide.
3. The project work is carried out on-campus/off-campus along with the course work.
4. The project team shall update the guide, on the progress of work, once in a week.
5. A project report and a presentation on the work shall be prepared.

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Identify a real life/engineering problem, utilize prior knowledge and conduct extensive survey, in addressing the problem and generating abstract design.

CO2: Plan, monitor and manage project schedule, resources and work assignments to ensure timely completion.

CO3: Perform professionally as a team member, accepting responsibility, taking initiative and providing leadership necessary to ensure progress of project.

CO4: Use formal and informal communications with team members and guide, make presentations and prepare technical document.

CO5: Provide methodology for solution within the context of legal framework addressing the societal and environmental concerns and upholding ethical issues.

Rubrics for CIE:

1. Introduction and justification of topic : 10%
2. Literature survey and conclusion : 30%
3. Objectives and scope of project work : 30%
4. Methodology to be adopted : 20%
5. Presentation of contents to project work : 10%

NOTE: The percentage mentioned above indicates marks allocation.

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PROFESSIONAL ELECTIVE - IV

BANGALORE UNIVERSITY
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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE74A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**HIGH PERFORMANCE COMPUTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the key factors affecting the performance of computer science and engineering applications.
2. Develop ability to map applications to high-performance computing systems.
3. Design hardware/software for achieving performance on real-world applications.
4. Learn the usage of parallel algorithms and parallel programming.
5. Develop ability to achieve better performance.

UNIT I: COMPUTATIONAL SCIENCE AND ENGINEERING INTRODUCTION **10 Hours**

Computational Science and Engineering Applications; characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, Locality: temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies (drawn from multiscale, multi discipline applications).

UNIT II: HIGH-END COMPUTER SYSTEMS **10 Hours**

Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared memory Symmetric Multiprocessors, Vector Computer, Distributed Memory Computers, Supercomputers and Peta scale Systems, Application Accelerators/Reconfigurable Computing, Novel computers: Stream, multithreaded and purpose-built.

UNIT III: PARALLEL ALGORITHMS **09 Hours**

Parallel models: ideal and real frameworks, Basic Techniques: Balanced Tress, Pointer Jumping, Divide and conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Tress, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques.

UNIT IV: PARALLEL PROGRAMMING **10 Hours**

Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P,

Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays).

UNIT V: ACHIEVING PERFORMANCE **09 Hours**

Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, using existing libraries, tools, and frameworks.

REFERENCES:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Welsey, 2003.
2. David A. Bader (Ed.), Chapman & Hall "Petascale Computing: Algorithms and Applications", CRC Computational Science Series, 2007.
3. Grama, A. Gupta, G. Karypis, V. Kumar, "An Introduction to Parallel Computing, Design and Analysis of Algorithms" 2nd Edition, Addison-Wesley, 2003.
4. G.E. Karniadakis, R.M. Kirby II, "Parallel Scientific Computing in C++ and MPI: A Seamless Approach to Parallel Algorithms and their Implementation", Cambridge University Press, 2003.
5. Wilkinson and M. Allen, "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers", 2nd Edition, Prentice Hall, 2005.
6. Peter Pacheco, *An Introduction to Parallel Programming*, Morgan Kaufmann, 2011, ISBN 978-0123742605.

e-BOOKS/ONLINE RESOURCES:

1. https://www.oreilly.com/library/view/introduction-to-parallel/0201648652/
2. https://www.cambridge.org/core/books/parallel-scientific-computing-in-c-and-mpi/B9F38F023D507F1CCEB06ED755171FA9
3. https://www.crcpress.com/Petascale-Computing-Algorithms-and-Applications/Bader/p/book/9781584889090

MOOCs:

1. https://www.mooc-list.com/course/high-performance-scientific-computing-coursera
2. https://www.futurelearn.com/courses/high-performance-computing-cloud

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Acquainted with the fundamental programming techniques for high performance computer architectures.

CO2: Able to design, implement and benchmark parallel programs on shared-memory and distributed-memory systems.

CO3: Understand the various paradigms of high performance computing and their potential

for performance and programmability.

CO4: Write algorithms that yield good performance on high-performance architectures.

CO5: Able to estimate and evaluate the performance of various machine architectures.

SCHEME OF EXAMINATION:

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B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE74B**					
Category	Engineering Science Courses : Professional Elective					
Course title	**MOBILE COMPUTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand Wireless Transmission Technologies and its applications.
2. Learn various Technologies such as SDMA, FDMA, TDMA, CDMA, GSM, DECT and TERA.
3. Compare IEEE 802.11 and Bluetooth.
4. Overview the different Routing Protocols in Mobile Network Layer.
5. Analyse Traditional TCP, Classical TCP, TCP over 2.5/3G Wireless networks and various wireless application protocols.

UNIT I: INTRODUCTION TO MOBILE COMPUTING & WIRELESS TRANSMISSION **09 Hours**

Introduction to Mobile Computing: Applications, Vehicles, Emergencies, Business, Replacement of wired networks, Infotainment and more, Location dependent services, Mobile and wireless devices, A short history of wireless communication, A market for mobile communications, Some open research topics, A simplified reference model. Wireless transmission: Frequencies for radio transmission, Regulations, Signal propagation, Path loss of radio signals, Additional signal propagation effects, Multi-path propagation, Multiplexing, Space division multiplexing, Frequency division multiplexing, Time division multiplexing, Code division multiplexing, Modulation, Amplitude shift keying, Frequency shift keying, Phase shift keying, Advanced frequency shift keying, Advanced phase shift keying, Multi-carrier modulation, Spread spectrum, Direct sequence spread spectrum, Frequency hopping spread spectrum, Cellular systems.

UNIT II: MEDIUM ACCESS CONTROL & TELECOMMUNICATIONS SYSTEMS **10 Hours**

Medium Access Control: Motivation for a specialized MAC, Hidden and exposed terminals, Near and far terminals, SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access, CDMA, Spread Aloha multiple access, Comparison of S/T/F/CDMA, Telecommunications systems: GSM, Mobile services, System architecture, Radio interface,

Protocols, Localization and calling, Handover, Security, New data services, DECT, System architecture, Protocol architecture.

UNIT III: WIRELESS LAN **10 Hours**

Infrared V/s radio transmission, Infrastructure and ad-hoc network, IEEE 802.11, System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, 802.11b, 802.11a, HIPERLAN, Historical: HIPERLAN 1, HiperLAN2, Bluetooth, User scenarios, Architecture, Radio layer, Baseband layer, Link manager protocol, L2CAP, Security, SDP, Profiles, IEEE 802.15.

UNIT IV: MOBILE NETWORK LAYER **09 Hours**

Mobile IP, Goals, assumptions and requirements, Entities and terminology, IP packet delivery, Agent discovery, Registration, Tunneling and encapsulation, Optimizations, Reverse tunneling, IPv6, IP micro-mobility support, Dynamic host configuration protocol, Mobile ad-hoc networks, Routing, Destination sequence distance vector, Dynamic source routing, Alternative metrics, Overview ad-hoc routing protocols.

UNIT V: MOBILE TRANSPORT LAYER & SUPPORT FOR MOBILITY **10 Hours**

Mobile Transport Layer: Traditional TCP, Congestion control, Slow start, Fast retransmit/fast recovery, Implications of mobility, Classical TCP improvements, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction-oriented TCP, TCP over 2.5/3G wireless networks, Performance enhancing proxies. Support for Mobility: System architecture, Wireless application protocol (version 1.x), Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML Script, Wireless telephony application, Push architecture, Push/pull services.

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, Addison-Wesley. II Edition, 2004.

REFERENCES:

1. Raj Kamal, “Mobile Computing”, Oxford University Press, 2007.
2. Ashok Talukder, RoopaYavagal, and Hasan Ahmed, “Mobile Computing, Technology, Applications and Service Creation”, II Edition, Tata McGraw Hill, 2010.
3. Hansmann, Merk, Nicklous, Stober, “Principles of Mobile Computing”, Springer, II Edition, 2003.

e-BOOKS/ONLINE RESOURCES:

1. https://nptel.ac.in/resources.php
2. https://www.tutorialspoint.com/mobile_computing/mobile_computing_useful_resources.htm
3. https://onlinelibrary.wiley.com/journal/15308677

MOOCs:

3. https://nptel.ac.in/course.php
4. https://www.coursera.org

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Understand Wireless Transmission Technologies and applications.
CO2: Learn various Mobile Technologies.
CO3: Compare IEEE 802.11 and Bluetooth technologies.
CO4: Understand the working of different Mobile routing protocols in Network layer.
CO5: Investigate the recent developments in wireless computing.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
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Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE74C**					
Category	Engineering Science Courses: Professional Elective					
Course title	**SOCIAL NETWORK ANALYSIS - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the concept of semantic web and related applications.
2. Absorb knowledge representation using ontology.
3. Analyse the Evaluation method on Web Social Networks Extraction.
4. Understand the concepts of Semantic-Based Social Network Analysis and Case studies.
5. Acquire knowledge of visualization and applications of social networks.

UNIT I: INTRODUCTION **09 Hours**

Introduction to Semantic Web: Limitations of current Web, Development of Semantic Web, Emergence of the Social Web. Social Network analysis: Development of Social Network Analysis, Key concepts and measures in network analysis. Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities, Web-based networks, Applications of Social Network Analysis.

UNIT II: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION **10 Hours**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation, Ontology languages for the Semantic Web: Resource Description Framework, Web Ontology Language, Modelling and aggregating social network data: State-of-the-art in network data representation, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced representations.

UNIT III: DEVELOPING, EVALUATION OF WEB SOCIAL NETWORKS EXTRACTION **10 Hours**

Building Semantic Web applications with social network features, the generic architecture of Semantic Web applications, Sesame, Elmo, GraphUtil, and Flink: the social networks of the Semantic Web community, the features of Flink, System design, and open academia: distributed, semantic-based publication management, the features of open academia, System design. Evaluation of web-based social network extraction: Differences between survey methods and electronic data extraction, Context of the empirical study, Data collection,

Preparing the data, optimizing goodness of fit, Comparison across methods and networks, Predicting the goodness of fit, Evaluation through analysis.

UNIT IV: ONTOLOGIES, SEMANTIC-BASED SOCIAL NETWORK ANALYSIS

10 Hours

Context, Methodology, Data acquisition, Representation, storage and reasoning, Visualization and Analysis, Results, Descriptive analysis, Structural and cognitive effects on scientific performance. Ontologies are us: emergent semantics in folksonomy systems: A tripartite model of ontologies, Ontology enrichment. Case studies: Ontology emergence in del.icio.us, Community-based ontology extraction from Web pages, Evaluation.

UNIT V: VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

09 Hours

Graph theory: Graph Traversals and Distances, Graph Distance, Centrality, Power, and Bottlenecks, Cliques, Clusters and Components: Components and Subgraphs, Subgraphs—Ego Networks, Triads, Cliques, Hierarchical Clustering, Triads, Network Density, and Conflict.

TEXT BOOKS:

1. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
2. Social Network Analysis for Startups, Maksim Tsvetovat and Alexander Kouznetsov, oreilly 2011.

REFERENCE BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, 2008.

e-BOOKS/ONLINE RESOURCES:

1. http://www.dce.edu.in/question-bank/cs6010-sna-add-qb.pdf
2. https://ocw.mit.edu/courses/sloan-school-of-management/15-599-workshop-in-it-collaborative-innovation-networks-fall-2011/lecture-notes/MIT15_599F11_lec04.pdf

MOOCs:

1. http://openscienceasap.org/education/courses/social-network-analysis/.
2. https://www.my-mooc.com/en/mooc/sna/.
3. https://www.classcentral.com/course/coursera-social-network-analysis-338.
4. https://www.coursera.org/courses?query=social%20network%20analysis.

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Develop semantic web related applications.
CO2: Apply the knowledge using ontology.

CO3: Compare the various methods on Web Social Networks.
CO4: Apply various case studies on Semantic-Based Social Network Analysis.
CO5: Analyse the concepts of visualization and applications of social networks.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	18CSPE74D					
Category	Engineering Science Courses: Professional Elective					
Course title	**DIGITAL IMAGE PROCESSING-Theory**					
Scheme and Credits	No. of Hours/Week					Semester – VII CSE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 3 Hrs
Prerequisites (if any): NIL						

Course Objectives:
The course will enable the students to

1. Define the fundamental concepts in image processing
2. Evaluate techniques followed in image enhancements in spatial domain
3. Compare spatial and frequency domain enhancement techniques
4. Illustrate image segmentation
5. Implement Image compression algorithms

UNIT I: Introduction **09 Hours**
Fundamental Steps in Digital Image Processing, Components of an ImageProcessing System, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

UNIT II : Image Enhancement in The Spatial Domain: **10 Hours**
Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of SpatialFiltering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

UNIT III: Image Enhancement in Frequency Domain **10 Hours**
Introduction to Fourier Transform and the Frequency Domain, Smoothing Frequency Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering

UNIT IV: Image Segmentation **09 Hours**
Detection of Discontinuities, Edge linking and Boundary Detection, Thresholding, Region-Based Segmentation

UNIT V: Image Compression **10 Hours**
Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image Compression Standards

TEXTBOOKS:

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd edition,2008.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.

REFERENCE BOOKS:

1. Milan Sonka," Image Processing, Analysis and Machine Vision", Thomson Press India Ltd, 4th Edition.
2. S. Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, TMH, 2015

e-BOOKS/ONLINE RESOURCES:

1. Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition, Pearson Education, 2009.

MOOCs:

1. http://www.nptelvideos.in/2012/12/digital-image-processing.html
2. http://in.mathworks.com/discovery/digital-image-processing.html?s_tid=srchtitle

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Ability to understand fundaments of digital image processing and its applications

CO2: Ability to apply spatial domain, frequency domain and filtering techniques for image enhancement.

CO3: Ability to analyze various noise models.

CO4: Ability to conduct practical experiments on basic operations, filtering and various transformations on images.

CO5: Ability to design and develop Image Processing system for real-world applications.

SCHEME OF EXAMINATION:

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PROFESSIONAL ELECTIVE - V

BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE75A**					
Category	Engineering Science Courses : Professional Elective					
Course title	**CLOUD COMPUTING - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand cloud characteristics and types of clouds.
2. Understand cloud services and solutions.
3. Know about cloud offerings and management.
4. Understand virtualization technologies.
5. Understand the relevance of Cloud, SOA and Benchmarks.

UNIT I: INTRODUCTION **09 Hours**

Essentials - Benefits - Business and IT Perspective - Cloud and Virtualization - Cloud Services Requirements - Cloud and Dynamic Infrastructure - Cloud Computing Characteristics - Cloud Adoption. Cloud Models - Cloud Characteristics - Measured Service - Cloud Models - Security in a Public Cloud - Public versus Private Clouds - Cloud Infrastructure Self Service.

UNIT II: CLOUD SERVICES AND SOLUTIONS **09 Hours**

Gamut of Cloud Solutions - Principal Technologies - Cloud Strategy - Cloud Design and Implementation using SOA - Conceptual Cloud Model - Cloud Service Defined. Cloud Solutions - Introduction - Cloud Ecosystem - Cloud Business Process Management - Cloud Service Management - Cloud Stack - Computing on Demand (CoD) – Cloud sourcing.

UNIT III: CLOUD OFFERINGS AND CLOUD MANAGEMENT **10 Hours**

Cloud Offerings - Information Storage, Retrieval, Archive and Protection - Cloud Analytics - Testing under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Cloud Management - Resiliency - Provisioning - Asset Management - Cloud Governance - High Availability and Disaster Recovery - Charging Models, Usage Reporting, Billing and Meeting.

UNIT IV: CLOUD VIRTUALIZATION TECHNOLOGY **10 Hours**

Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization for x86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements - Storage virtualization - Storage Area Networks - Network-Attached storage - Cloud Server Virtualization - Virtualized Data Centre.

UNIT V: CLOUD, SOA AND INFRASTRUCTURE BENCHMARKING 10 Hours

SOA and Cloud - SOA Defined - SOA and IaaS - SOA-based Cloud Infrastructure Steps - SOA Business and IT Services. OLTP Benchmark - Business Intelligence Benchmark - e-Business Benchmark - ISV BenchMarks Cloud Performance Data Collection and Performance Monitoring Commands Benchmark Tools.

TEXT BOOKS:

1. Kumar Saurabh, "Cloud Computing: Insights into New-Era Infrastructure", Wiley India, 2011.

REFERENCE BOOKS:

1. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Recursive Press, 2013.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice)", O'Reilly, 2009.

e-BOOKS/ONLINE RESOURCES:

1. https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf
2. https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf

MOOCs:

1. https://www.mooc-list.com/course/cloud-computing-applications-part-1-cloud-systems-and-infrastructure-coursera
2. https://www.mooc-list.com/course/cloud-computing-concepts-part-2-coursera

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Identify different types of clouds and services.
CO2: Interpret cloud solutions.
CO3: Demonstrate cloud offerings and management.
CO4: Implement Storage and Server Virtualization.
CO5: Apply SOA principles for cloud design and identify types of benchmarking.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

<table>
<tr><td>Course Code</td><td colspan="6">18CIPE75B</td></tr>
<tr><td>Category</td><td colspan="6">Engineering Science Courses : Professional Elective</td></tr>
<tr><td>Course title</td><td colspan="6">BIG DATA - THEORY</td></tr>
<tr><td rowspan="3">Scheme and Credits</td><td colspan="5">No. of Hours/Week</td><td rowspan="3">Semester - VII CSE/ISE</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>SS</td><td>Credits</td></tr>
<tr><td>2</td><td>2</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>CIE Marks: 50</td><td colspan="2">SEE Marks: 50</td><td colspan="2">Total Max. Marks: 100</td><td colspan="2">Duration of SEE: 03 Hours</td></tr>
<tr><td colspan="7">Prerequisites (if any): NIL</td></tr>
</table>

COURSE OBJECTIVES:

The course will enable the students to

1. Understand big data for business intelligence.
2. Illustrate business case studies for big data analytics.
3. Discuss NoSQL big data management.
4. Demonstrate map-reduce analytics using Hadoop.
5. Compare Hadoop related tools such as Pig, Cassandra and Hive for big data analytics.

UNIT I: INTRODUCTION TO BIG DATA **09 Hours**

Definition, Characteristics, Evolution and Challenges of Big data, need for Big data, Data warehouse environment v/s Hadoop environment, Introduction to Big data analytics, Classification of analytics, Importance of big data analytics and data science, terminologies used in big data environment, industry examples of big data.

UNIT II: NoSQL and MongoDB **09 Hours**

NoSQL: Introduction, Types of NoSQL Databases, Importance of NoSQL, Advantages of NoSQL, NoSQL versus RDBMS, Use of NoSQL in Industry, SQL versus NoSQL, NewSQL, MongoDB: Introduction, need for MongoDB, terms used in RDBMS and MongoDB, Datatypes in MongoDB, MongoDB query language.

UNIT III: HADOOP **10 Hours**

Introduction, features and advantages of Hadoop, Hadoop versus SQL, Importance of Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, History, overview and Use cases of Hadoop, Hadoop distribution, Hadoop Distributed File System (HDFS), Processing data with Hadoop, Managing resources and applications with Hadoop YARN, Interacting with Hadoop Ecosystem.

UNIT IV: MAPREDUCE AND CASSANDRA **10 Hours**

MAPREDUCE: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression, Job scheduling, task execution, MapReduce types, input formats, output formats. Cassandra: Introduction, features of Cassandra, CQL data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) operations, Collections, Using a counter, Time To Live (TTL), Alter commands, Import and Export, Querying System tables, Examples.

UNIT V: HIVE AND PIG **10 Hours**

Hive: Introduction, history and recent releases of Hive, Hive features, Hive integration and workflow, Hive data units, Architecture, data types, File format, Hive Query Language (HQL), RCFile Implementation, SERDE, Used-Defined Functions (UDF). Pig: Introduction, features, the anatomy of Pig, Pig on Hadoop, Pig philosophy, Use cases for Pig: ETL processing, Overview of Pig Latin, Data types in Pig, Running and Execution modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex data types, Piggy bank, UDF, Parameter Substitution, Diagnostic operator, Word count example using Pig, Pig versus Hive.

TEXT BOOKS:

1. Seema Acharya, Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd, 2018.

REFERENCES:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
4. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
6. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
7. Alan Gates, "Programming Pig", O'Reilley, 2011.

e-BOOKS/ONLINE RESOURCES:

1. http://en.wikipedia.org/wiki/Big_data
2. http://bigdatauniversity.com
3. http://en.wikipedia.org/wiki/Data_science
4. http://www.mongodb.com/nosql-explained
5. http://nosql-database.org
6. http://hadoop.apache.org
7. http://tutorialspoint.com/mongodb

MOOCs:

1. www. edureka.co/big-data/course
2. Big data Computing, https://onlinecourses.nptel.ac.in/noc19_cs33
3. Big data, https://nptel.ac.in/courses/106104135/48

COURSE OUTCOMES:

The students at the end of the course, will be able to
CO1: Describe big data and use cases from selected business domains.
CO2: Discuss the business case studies for big data analytics.
CO3: Explain NoSQL big data management.
CO4: Perform map-reduce analytics using Hadoop.
CO5: Use Hadoop related tools such as Cassandra, Pig and Hive for big data analytics.

SCHEME OF EXAMINATION:

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CIPE75C**					
Category	Engineering Science Courses: Professional Elective					
Course title	**ADVANCED COMPUTER ARCHITECTURE - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE/ISE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): NIL						

COURSE OBJECTIVES:

The course will enable the students to

1. Understand the milestones of modern computer models, system attributes, types of memory and vector computers.
2. Identify the basic principles of programs and network properties for parallelism.
3. Comply the hardware technologies like ISA, bus system and shared memory.
4. Examines the linear and non-linear pipeline and super scalar architecture.
5. Summarize solutions for parallel programming, cache coherence, threading and processing.

UNIT I: PARALLEL COMPUTER MODELS **09 Hours**

Computer Development Milestones, Elements of Modern Computers, Evolution of Computer Architecture, System Attributes to Performance, Shared-Memory Multiprocessors, Distributed-Memory Multicomputer, A Taxonomy of M1MD Computers, Vector Supercomputers, SIMP Supercomputers.

UNIT II: PROGRAM AND NETWORK PROPERTIES **10 Hours**

Conditions of Parallelism: Data and Resource Dependences, Hardware and Software Parallelism, the Role of Compilers. Program Partitioning and Scheduling: Grain Sizes and Latency, Grain Packing and Scheduling, Static Multiprocessor Scheduling. Program Flow Mechanisms: Control Flow versus Data Flow, Demand-Driven Mechanisms, Comparison of Flow Mechanisms. System Interconnect Architectures: Network Properties and Routing, Static connection networks, Dynamic Connection Networks.

UNIT III: HARDWARE TECHNOLOGIES **10 Hours**

Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC Scalar Processors, RISC Scalar Processors. Superscalar and Vector Processors: Superscalar Processors, The VLIW Architecture, Vector and Symbolic Processors. Backplane Bus Systems: Backplane Bus Specification, Addressing and Timing Protocols, Arbitration, Transaction, and Interrupt, the IEEE Futurebus+ Standards. Shared-Memory Organizations: Interleaved Memory Organization, Bandwidth and Fault Tolerance, Memory Allocation Schemes.

UNIT IV: PIPELINING AND SUPERSCALAR TECHNOLOGIES 09 Hours

Linear Pipeline **Processors:** Asynchronous and Synchronous Models, Clocking and Timing Control, Speedup, Efficiency, and Throughput. Nonlinear Pipeline Processors: Reservation and Latency Analysis, Collision-Free Scheduling, Pipeline Schedule Optimization. Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques. Arithmetic Pipeline Design: Computer Arithmetic Principles, Static Arithmetic Pipelines, Multifunctional Arithmetic Pipelines.

UNIT V: PARALLEL AND SCALABLE ARCHITECTURES 10 Hours

Multiprocessor System Interconnects: Hierarchical Bus Systems, Crossbar Switch and Multiport Memory, Multistage and Combining Networks. Cache Coherence and Synchronization Mechanisms: The Cache Coherence Problem, Snoopy Bus Protocols, Directory-Based Protocols. Vector Processing Principles: Vector Instruction Types, Vector-Access Memory Schemes. Principles of Multithreading**:** Multithreading Issues and Solutions Parallel Programming Models: Shared-Variable Model, Message-Passing Model, Data-Parallel Model.

TEXT BOOKS:

1. Kai Hwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability McGraw Hill 2005.

REFERENCE BOOKS:

1. David E Culler, J P Singh, Anoop Gupta, Parallel Computer Architecture, Harcoust Asia and Morgan Kaufmann, 1998.
2. Advanced Computer Architecture and Parallel Processing, Kai Hwang Faye A Briggs McGrawHill book Company, 1st edition 2017.
3. John L. Hennessy, David A. Patterson Computer Architecture A Quantitative Approach, 5th Edition ELSEVIER 2011.

e-BOOKS/ONLINE RESOURCES:

1. Advanced Computer Architecture
2. https://www.mheducation.co.in/9789339220921-india-advance-computer-architect
3. Parallel Computer Architecture
4. https://www.elsevier.com/.../parallel-computer-architecture/culler/978-1-55860-343-1
5. Computer Architecture A Quantative Approach
6. https://booksite.elsevier.com/9780123838728/

MOOCs:

1. https://www.classcentral.com/tag/computer-architecture
2. https://www.mooc-list.com/tags/computer-architecture

3. https://swayam.gov.in/courses/4730-july-2018-computer-architecture

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe the evolution of parallel Computer models like computer architecture Multiprocessors, multicomputer and super computers.

CO2: Develop and analyse the parallel programing conditions along with the network properties like partitioning, scheduling.

CO3: Design and Implement processor, memory, and bus hardware technologies.

CO4: Formulates the basic pipeline architecture, superscalar architecture feature by Improving the speed while avoiding different types of hazards

CO5: Creates parallel programming techniques and explore the multiprocessor interconnects cache memory coherence problem with solution and synchronous Mechanism.

SCHEME OF EXAMINATION:

<table>
<tr><td rowspan="2">CIE – 50 Marks</td><td>Test I (Any Three Units) - 20 Marks</td><td>Quiz I – 5 Marks</td><td>25 Marks</td><td rowspan="2">Total: 50 Marks</td></tr>
<tr><td>Test II (Remaining Two Units) - 20 Marks</td><td>Quiz II – 5 Marks</td><td>25 Marks</td></tr>
<tr><td rowspan="3">SEE – 100 Marks</td><td colspan="2">Q1 (Compulsory): MCQs or Short answer type questions for 15 Marks covering entire syllabus.</td><td>15 Marks</td><td rowspan="3">Total: 100 Marks</td></tr>
<tr><td colspan="2">Q2 & Q3 from Units which have 09 Hours are compulsory.</td><td>17 * 2 = 34 Marks</td></tr>
<tr><td colspan="2">Q4 or Q5, Q6 or Q7 and Q8 or Q9 from Units which have 10 Hours shall have Internal Choice.</td><td>17 * 3 = 51 Marks</td></tr>
</table>

Note: SEE shall be conducted for 100 Marks and the Marks obtained is scaled down to 50 Marks.

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BANGALORE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING, UVCE, BENGALURU
B.Tech. PROGRAMME IN COMPUTER SCIENCE AND ENGINEERING

Course Code	**18CSPE75D**					
Category	Engineering Science Courses : Professional Elective					
Course title	**NETWORK MANAGEMENT - THEORY**					
Scheme and Credits	No. of Hours/Week					Semester - VII CSE
	L	T	P	SS	Credits	
	2	2	0	0	3	
CIE Marks: 50	SEE Marks: 50		Total Max. Marks: 100			Duration of SEE: 03 Hours
Prerequisites (if any): 1. Computer Networks						

COURSE OBJECTIVES:

This course will enable the students to

1. Understand the fundamentals of interoperable network management.
2. Understand general concepts and architecture behind standards based network management.
3. Discuss advanced Remote Monitoring, and Management Information Base.
4. Discuss different Network Management Applications.
5. Explore Broadband Network Management.

UNIT I: DATA COMMUNICATIONS AND NETWORK MANAGEMENT OVERVIEW **09 Hours**

Network management Goals, architecture and perspectives. Review of information network and technology: Topology, node Components, Transmission technology.

UNIT II: SNMPv1 **09 Hours**

SNMPv1: Basic foundations, Standards, models and languages, network management organization and standards, SNMP model, organisation model, information models. SNMP Communication Models and functional models.

UNIT III: SNMPv2, REMOTE MONITORING AND MIB **10 Hours**

SNMPv2, System Architecture, Structure of Management Information, Management Information Base, protocols. Remote Monitoring, and Management Information Base, Case study. Network Management Tools: Network statistics measurement system, MIB Engineering, NMS Design and system.

UNIT IV: NETWORK MANAGEMENT APPLICATIONS **10 Hours**

Configuration Management, Fault Management, Performance Management, Event Correlation Techniques, Security Management, Accounting Management, Report Management, policy-based Management, service level Management.

UNIT V: BROADBAND NETWORK MANAGEMENT **10 Hours**

Broadband Network and services, MPLS network management. Broadband Access Networks, ADSL, ADSL Management, PON, PON Management, Broadband Wireless Network: Broadband Wireless Access Networks, Mobile Wireless Network, Satellite Networks.

TEXT BOOKS:

1. M. Subramanian, "Network management: principles and practice", Adison- Wesley, 2010.
2. J. Burke, "Network management concepts and practice, A Hands-on approach", Pearson Education, 2009.

REFERENCES:

1. Dharma Prakash Agrawal & Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India Edition, 2nd Ed., 2007
2. Stephen B. Morris, "Network Management, MIBs and MPLS", Pearson Education, 2003, rp 2008.
3. Anurag Kumar, D.Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Elsevier, 2004.
4. Benoit Claise and Ralf Wolter, "Network Management: Accounting and Performance Strategies", Pearson Education, 2007, rp2008.

e-BOOKS/ONLINE RESOURCES:

1. http://ceit.aut.ac.ir/~siabi/NSM/320Network%20Management%20Principles%20and%20Practice%20-%202nd%20Edition%20(2010)_2.pdf
2. https://nptel.ac.in/courses/IITMADRAS/Computer_Networks/pdf/Lecture41_SNMP.pdf

MOOCs:

1. https://www.coursera.org/courses?query=networking
2. https://nptel.ac.in/courses/106105081/37
3. https://www.perpetual-solutions.com/training-courses/175,7/snmp

COURSE OUTCOMES:

The students at the end of the course, will be able to

CO1: Describe basic concepts of Network Management.

CO2: Analyse SNMPv1 concepts and architecture behind standards based network

Management.

CO3: Summarize SNMPv2 and Remote Monitoring, and MIB.

CO4: Design Network Management Applications concepts.

CO5: Analyse and apply Broadband Network Management.

SCHEME OF EXAMINATION:

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