Semester- 1

Advanced Engineering Mathematics			
Course Code	22MAT11	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives: This Course will enable students to

- Study an insight into advanced engineering mathematics through linear algebra
- Develop proficiency in calculus of variations.
- Understand probability theory that serve as an essential tool for applications of engineering sciences.
- Compute quantitative parameters for function of single and multiple random variables and random process.

Module-1

Linear Algebra-I

Introduction to vector spaces and sub-spaces, definitions, illustrative example. Linearly independent and dependent vectors- Basis-definition and problems. Linear transformations-definitions. Matrix form of linear transformations-Illustrative examples.

(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-2

Linear Algebra-II

Computation of eigen values and eigen vectors of real symmetric matrices- Given's method. Orthogonal vectors and orthogonal bases. Gram-Schmidt orthogonalization process.

(Reference Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-3

Calculus of Variations : -

Concept of functional-Eulers equation**.** Functional dependent on first and higher order derivatives, Functional on several dependent variables. Isoperimetric problems-variation problems with moving boundaries.

(Reference Books: 2) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-4

Probability Theory:- Review of basic probability theory. Definitions of random variables and probability distributions, probability mass and density functions, expectation, moments, central moments, characteristic functions, probability generating and moment generating functions- illustrations. Poisson, Gaussian and Erlang distributions-examples.

(Text Book: 2 & Reference Books: 4) (RBT Levels: **L1 & L2)**

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-5

Engineering Applications on Random processes: - Classification. Stationary, WSS and ergodic random process. Auto- correlation function-properties, Gaussian random process. (Text Book: 2 & Reference Books:4) (RBT Levels: **L1 & L2)**.	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. David C.Lay, Steven R.Lay and J.J.McDonald: Linear Algebra and its Applications, 5th Edition, Pearson Education Ltd.,2015
2. Scott L.Miller, DonaldG. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition,2013

Reference Books:

1. Gilbert Strang: Introduction to Linear Algebra, 5th Edition, Wellesley-Cambridge Press.,2016
2. Elsgolts, L.:"Differential Equations and Calculus of Variations", MIR Publications,3rd Edition, 1977.
3. Richard Bronson: "Schaum's Outlines of Theory and Problems of Matrix Operations", McGraw-Hill, 1988.
4. T. Veerarajan "Probability, Statistics and Random Process", 3rd Edition, Tata Mc-Graw HillCo., 2016.

Web links and Video Lectures (e-Resources):

1. http://nptel.ac.in/courses.php?disciplineId=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://ocw.mit.edu/courses/mathematics/
4. www.wolfram.com

Course outcome (Course Skill Set):

At the end of the course the student will be able to :

Sl. No.	Description
CO1	Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
CO2	Apply the technique of singular value decomposition for data compression, least square approximation in solving inconsistent linear systems.
CO3	Utilize the concepts of functional and their variations in the applications of communication systems, decision theory, synthesis and optimization of digital circuits.
CO4	Learn the idea of random variables (discrete/continuous) and probability distributions in analyzing the probability models arising in control systems and system communications
CO5	Analyze random process through parameter-dependent variables in various random processes.

Program Outcome of this course:

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
6	Professional skills to carry out work independently or collaboratively in a multidisciplinary environment.	PO6

Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1		×		×		
CO2		×		×		
CO3		×		×		
CO4		×		×		
CO5		×		×		

IoT Architecture and Protocols			
Course Code	22ISS12	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This Course will enable students to

- Understand the Overview of IoT-Architecture and the devices used for IoT.
- Describe the IoT reference model and various protocols.
- Study IoT Data Link Layer & Network Layer Protocols
- Know Transport & Session Layer Protocols
- Identify Service Layer Protocols & Security

Module-1

Overview: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-2

Reference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-3

IoT Data Link Layer & Network Layer Protocols: PHY/MAC Layer(IEEE 802.11, IEEE 802.15), Wireless HART,Z- Wave, Bluetooth Low Energy, Zigbee Smart Energy, Network Layer-IPv4, IPv6, 6LoWPAN, DHCP, ICMP, CORPL, CARP
(**Reference** : Web Resources) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-4

Transport & Session Layer Protocols: Transport Layer (TCP, MPTCP, UDP, SCTP)-(TLS, DTLS) – Session Layer- HTTP, CoAP, XMPP, MQTT
(**Reference** : Web Resources) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module 5

Service Layer Protocols & Security: Service Layer - ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC802.15.4 6LoWPAN, Overview of Application Layer
(**Reference**: Web Resources) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

PRACTICAL COMPONENT OF IPCC

Sl. NO.	Experiments
1	Study of 6LoWPAN protocol
2	Study of HTTP Protocol
3	Analysis of CoAP in an IoT environment
4	Testing MQTT based IoT based Protocol or Experimental study of IoT based topologies on MQTT topologies
5	Simulation of Bluetooth Low Energy and Zigbee Smart Energy

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of IPCC:

1. Two Tests each of **20 Marks**
2. Two assignments each of **10 Marks/One Skill Development Activity of 20 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

CIE for the practical component of IPCC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical

component of IPCC, the total marks of all questions should not be more than the 20 marks.

- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

Suggested Learning Resources:

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Reference Books:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
3. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- Approach)", 1st Edition, VPT, 2014.

Web links and Video Lectures (e-Resources):

http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

Course outcome (Course Skill Set):

At the end of the course the student will be able to :

Sl. No.	Description
CO1	Understand the Overview of IoT-Architecture and the devices used for IoT
CO2	Demonstrate the IoT reference model and various protocols.
CO3	Present IoT Data Link Layer & Network Layer Protocols
CO4	Identify Transport & Session Layer Protocols
CO5	Recognize Service Layer Protocols & Security

Program Outcome of this course:

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
6	Professional skills to carry out work independently or collaboratively in a multidisciplinary environment	PO6

Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	×					
CO2	×	×	×	×		
CO3	×	×	×	×		
CO4	×	×	×	×		
CO5	×	×	×	×		

Principles of Sensors, Signal Conditioning and IoT			
Course Code	22ISS13	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives: This Course will enable students to

- Outline Instrumentation & measurement system and Sensors.
- Gain knowledge on various Signal conditioning techniques for different sensor transduction.
- Understand non-idealities of amplifiers, reduction of noise, and improvement of system performance.
- Gain knowledge on type of sensors used in modern digital systems.
- Get acquainted about Microcontrollers for IoT.

Module-1

Introduction: Sensor-Based Measurement Systems, General Concepts and Terminology, Sensor Classification, General Input-Output Configuration Primary Sensors, Materials for sensors, Micro sensor Technology.
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-2

Signal conditioning circuits for resistive sensors: Potentiometers, Wheatstone Bridge Balance and deflection measurements, Signal conditioning circuits: for capacitive sensors, inductive sensors, electromagnetic sensors and self-generating sensors..
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	. Chalk and talk/PPT/NPTEL Videos/ web content

Module-3

Signal Amplifiers: Non-idealities of Op-Amp, Effect of Non-idealities, Differential Amplifier, Trans-impedance Amplifier, Cascaded Amplifiers, CMRR, Performance Analysis of Amplifiers, Instrumentation amplifier, Charge amplifier, Programmable gain amplifier, Switched capacitor amplifier.
(Text Book: 1 & 2) (RBT Levels: **L1, L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-4

Digital and Intelligent Sensors, Position Encoders, Resonant Sensors, Direct Sensor -Microcontroller Interfacing, Communication Systems for Sensors, Intelligent Sensors. Sensors Based on Semiconductor Junctions, Fiber-Optic Sensors, Ultrasonic-Based Sensors, Biosensors.
(Text Book: 1) (RBT Levels: **L1, L2 & L3)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-5

Microcontrollers for IoT: ESP8266, Node MCU, TI-C3200, Access point and station point mode, HTTP, MQTT, transmission and receiving, Intel-Gallileo boards. Single board computers: Raspberry pi board, porting Raspbian, sensor interface examples, Python programming for cloud access, sensor systems using Arduino boards. Cloud interfacing: Interfacing and data logging with cloud: Thing speak, Things board, Blync platform.
(Reference Books: 3 & 4) (RBT Levels: **L1, L2 & L3)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. Pallás- Areny Ramon, Webster, John G.(2012):Sensors and Signal Conditioning, 2nd Edition.
2. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education, 2018. ISBN: 978-93-325-4991-3
3. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2014, 4thed., Springer, New York.

Reference Books:

1. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland.
2. Sergey Y. Yurish,"Digital Sensors and Sensor Systems: Practical Design", 2011, 1st ed., IFSA Publishing, New York.
3. Jonathan W Valvano, "Introduction to ARM Cortex –M3 Microcontrollers", 2012, 5th ed., Create Space publishing, New York.
4. Muhammad Ali Mazidi, Shujen Chen, Sarmad Naimi, Sepehr Naimi, "TI ARM Peripherals Programming and Interfacing: Using C Language", 2015, 2nd ed., Mazidi and Naimi publishing, New York.

Web links and Video Lectures (e-Resources):

- https://youtu.be/bHILcgtR0Sc
- https://youtu.be/m9mSzWiH1RQ
- https://youtu.be/IIf7zH5cIX8
- https://youtu.be/uku6PpRdt4w
- https://youtu.be/5fCrpBADTBE.

Skill Development Activities Suggested:

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

Course outcome (Course Skill Set):

At the end of the course the student will be able to :

Sl. No.	Description
CO1	Understand the Instrumentation & measurement system and Sensors.
CO2	Apply the knowledge on Signal conditioning techniques for different sensor transduction
CO3	Design amplifiers for the improvement of system performance.
CO4	Understand the interfacing of sensors used in modern digital systems
CO5	Apply the knowledge of Microcontrollers for IoT applications.

Program Outcome of this course:

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
6	Professional skills to carry out work independently or collaboratively in a multidisciplinary environment	PO6

Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	×					×
CO2	×	×	×			×
CO3	×	×	×			×
CO4	×	×	×			×
CO5	×	×	×			×

Cloud Architecture and Management			
Course Code	22ISS14	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives: This Course will enable students to

- Learn the basics and types of computing.
- Understand the architecture and services of Cloud computing.
- Familiarize with the types and taxonomy of virtualization.
- Analyze the capacity planning and platform as a service.
- Describe the tools and technologies used to manage and secure cloud services

Module-1

Overview of Cloud computing: Defining Cloud Computing, Cloud Types - The NIST model , The Cloud Cube Model, Deployment models, Service models, Characteristics of Cloud Computing-Paradigm shift, Benefits of cloud computing, Disadvantages of cloud computing, Measuring the Cloud's Value
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-2

Cloud Architecture and Services: Cloud Computing Stack- Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud, Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Identity as a Service (IDaaS), Compliance as a Service (CaaS)
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	. Chalk and talk/PPT/NPTEL Videos/ web content

Module-3

Virtualization: Virtualization Technologies, Load Balancing and Virtualization- Advanced load balancing, The Google cloud, Hypervisors- Virtual machine types, Machine Imaging, Porting Applications.
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-4

Capacity Planning: Capacity Planning, Baseline and Metrics-Baseline measurements, System metrics, Load testing, Resource ceilings, Server and instance types, Network Capacity, Scaling
Platform as a Service: Defining Services-Salesforce.com versus Force.com: SaaS versus PaaS, Application development, PaaS Application Frameworks- Drupal, Eccentex AppBase 3.0, Long Jump, Square space, Wave Maker, Wolf Frameworks.
(Text Book:1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-5

Cloud Management: Administrating the Clouds- Management responsibilities, Lifecycle management, Cloud Management Products, Emerging Cloud Management Standards.
Cloud Security: Securing the Cloud- The security boundary, Security service boundary, Security mapping, Securing Data- Brokered cloud storage access, Storage location and tenancy, Encryption, Auditing and compliance.
(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

Suggested Learning Resources:

Text Books:

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010

Reference Books:

1. Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, ",Cloud Computing: Principles and Paradigms", Wiley, 2011
2. Nikos Antonopoulos, Lee Gillam, "Cloud Computing: Principles, Systems and Applications", Springer, 2012. Ronald L. Krutz, Russell Dean Vines,"Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley-India, 2010.

Web links and Video Lectures (e-Resources):

NPTEL Video Lectures:

- https://www.youtube.com/watch?v=NzZXz3fJf6o&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J.
- https://www.youtube.com/watch?v=fZ3D6HQrWzs&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J&index=4
- https://www.youtube.com/watch?v=R4spydpBbYk&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J&index=6
- https://www.youtube.com/watch?v=Dr6MSqRFaZQ&list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J&index=12

WEB Links:

- https://www.javatpoint.com/cloud-computing-tutorial
- https://www.tutorialspoint.com/cloud_computing/index.htm

Skill Development Activities Suggested

- The students with the help of the course teacher can take up relevant technical – activities which will enhance their skill.

Course outcome (Course Skill Set):

At the end of the course the student will be able to :

Sl. No.	Description
CO1	Describe the types of computing paradigms.
CO2	Explain the architecture and services of Cloud Computing.
CO3	Explain the concept of Virtualization and hypervisors as a prime Enabling Technology of Cloud Computing.
CO4	Compare different metrics related to cloud capacity
CO5	Differentiate Service such as Saas and Paas

Program Outcome of this course:

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
6	Professional skills to carry out work independently or collaboratively in a multidisciplinary environment	PO6

Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	×					×
CO2	×	×	×			×
CO3	×	×	×			×
CO4	×	×	×			×
CO5	×	×	×			×

Python for IoT			
Course Code	22ISS15	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives: The students will be able to,

1. **Learn basics of python**
2. **Understand arrays, classes and objects in python**
3. **Understand network programming using python and SQL**
4. **Analyze how to use MQTT in the python**
5. **Understand the concept of programming for IoT devices**

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Module-1	
Introduction to python, Variables, expressions and statements, Conditional execution, Functions, Iteration, Strings, Files, Lists, Dictionaries, Tuples, Regular Expressions (Text Book:1) (RBT Levels: **L1 & L2).**	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content
Module-2	
Arrays, Classes and objects, Classes and functions, Classes and methods, Introducing the Flask microservices framework (Text Book: 1& 3) (RBT Levels: **L1 & L2).**	
Teaching-Learning Process	. Chalk and talk/PPT/NPTEL Videos/ web content
Module-3	
Networked programs Using Web Services, Using databases and SQL, Networking with MQTT, python, and Mosquito MQTT broker (Text Book: 3) (RBT Levels: **L1 & L2).**	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content
Module-4	
Getting started with python and IoT Technical requirement (Text Book: 3) (RBT Levels: **L1 & L2)**	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content
Module-5	
Practical Electronics for interfacing with Physical world, IoT Playground :practical examples to interact with physical world (Text Book: 3) (RBT Levels: **L1 & L2).**	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

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Suggested Learning Resources:

Text Books:

1. Charles R. Sperance, "Python for Everybody: Exploring Data Using Python 3", 1 Edition, Create Space Independent Publishing Platform,
2. Brandon Rhodes, John Goerzen, "Foundations of Python Network Programming", 2014, 3rd ed. edition Apress Publisher
3. Gary Smart," Practical Python Programming for IoT", Packt publishing
4. Tim Cox , Dr. Steven Lawrence Fernandes , Sai Yamanoor, Srihari Yamanoor , Prof. Diwakar Vaish "Learning path Getting started with python for Internet of things" 2019, Packt publishing
5. Allen B. Downey, 'Think Python: How to Think like a Computer Scientist", 2nd Edition, Green Tea Press, 2015

Web links and Video Lectures (e-Resources):

NPTEL Video Lectures:

- **https://onlinecourses.nptel.ac.in › noc19_cs65**
- **https://onlinecourses.nptel.ac.in › noc22_cs53**

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description
CO1	Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO2	Demonstrate proficiency in Arrays, Classes and objects used in python
CO3	Evaluate network programming using python and SQL
CO4	Demonstrate use of MQTT
CO5	Analyse Python programming used for IoT devices

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
6	Professional skills to carry out work independently or collaboratively in a multidisciplinary environment.	PO6

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	×	×	×			
CO2	×	×	×			
CO3	×	×	×			
CO4	×	×	×		×	×
CO5	×	×	×			×

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Research Methodology and IPR			
Course Code	22RMI16	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives: This Course will enable students to

- Give an overview of the research methodology and explain the technique of defining a research problem
- Explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
- Discuss various research designs and their characteristics.
- Outline the details of research and sampling designs, measurement and scaling techniques and also different methods of data collections.
- Investigate several parametric tests of hypotheses and Chi-square test.
- Explain the art of interpretation and the art of writing research reports.
- Describe various forms of the intellectual property, its relevance, business impact in the changing global business environment and to discuss leading International Instruments.

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration

(Text Book: 1)(RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs

Teaching-Learning Process	. Chalk and talk/PPT/NPTEL Videos/ web content

Module-3

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

(Text Book: 1) (RBT Levels: **L1 & L2)**.

Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Module-4	
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. **Chi-square Test:** Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. (Text Book: 1) (RBT Levels: **L1 & L2)**.	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content
Module-5	
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **Intellectual Property:** The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organization (WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. (Text Book: 1& 3) (RBT Levels: **L1 & L2)**.	
Teaching-Learning Process	Chalk and talk/PPT/NPTEL Videos/ web content

Assessment Details (both CIE and SEE):

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Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
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4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books:

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International 4th Edition,2018
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) SAGE PublicationsL3rd Edition, 2011.
3. Study Material(For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

Reference Books:

1. Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.
2. Conducting Research Literature Reviews: From the Internet to Paper, Fink A Sage Publications, 2009.

Course outcome (Course Skill Set):

At the end of the course the student will be able to :

Sl. No.	Description
CO1	Understand an overview of the research methodology and Literature review.
CO2	Analyze various research designs and their characteristics and different methods of data collections.
CO3	Evaluate several parametric tests of hypotheses and Chi-square test.
CO4	Enhance the art of interpretation and the art of writing research reports.
CO5	Demonstrate various forms of the intellectual property and its business impact in the changing global business environment

Program Outcome of this course:

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
6	Professional skills to carry out work independently or collaboratively in a multidisciplinary environment.	PO6

Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1				×	×	×
CO2				×	×	×
CO3				×	×	×
CO4				×	×	×
CO5				×	×	×

Laboratory on Sensors, Signal Conditioning and IoT			
Course Code	22ISSL17	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:2:0	SEE Marks	50
Credits	02	Exam Hours	03

Course objectives: This Course will enable students to

- Introduce the concept of design and development using IoT
- Study the IoT protocols for communication
- Expose students to IoT and its implementations
- Demonstrate IoT systems using Arduino platform with open source clouds

Sl. No.	Experiments
1	Write a program to sense the Temperature and Pressure using Arduino/Raspberry Pi
2	Write a program to indicate the water level using Arduino/Raspberry Pi
3	Write a program to compute the wind speed using proximity sensor and Arduino/Raspberry Pi
4	Write a program to detect the rainfall level and Moisture Content using Arduino/Raspberry Pi
5	Write a program to detect the Motion using Arduino/Raspberry Pi
6	Write a program to display the distance the object is placed from the sensor using Arduino/Raspberry Pi
7	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1sec for every 2 sec
8	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
	Demonstration Experiments (For CIE)
9	To interface Bluetooth with Arduino/Raspberry Pi to send sensor data to smart phone using Bluetooth
10	To interface sensor with Arduino/Raspberry Pi to subscribe the MQTT broker for temperature data and print it.
11	To interface sensor Arduino/Raspberry Pi to upload and retrieve Temperature and Humidity data to Thingspeak cloud.
12	To interface and control servo motor with Arduino/Raspberry Pi.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand the concept of IoT and its working
- Learn and apply IoT protocols for communication
- Implement IoT based application
- Validate IoT systems using Arduino/Raspberry pi with open source cloud platform

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Program Outcome of this course:

Sl. No.	Description	POs
1	Adequate knowledge of fundamentals on sensors, signal conditioning and IoT	PO1
2	Ability to design, implement, analyse, interpret data and synthesis of information	PO2
3	Ability to analyse a problem critically using scientific approach, relevant IT tools and techniques	PO3
4	Appropriate research skills for solving new problem and present a substantial technical report	PO4
5	Ability to work ethically and carry out the work with social responsibility	PO5
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Mapping of COS and POs:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	×		×			
CO2	×	×	×			
CO3	×	×	×			
CO4	×	×	×		×	×