

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	Principles of Sensors and Signal Conditioning				
Subject Code	MCSIOT20S101				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

1. To provide in depth knowledge in physical principles applied in sensing, measurement and a comprehensive understanding on how measurement systems are designed, calibrated, characterised, and analysed.
2. To introduce the students to sources and detectors of various Optical sensing mechanisms and provide in-depth understanding of the principle of measurement, and theory of instruments and sensors for measuring velocity and acceleration.
3. To give a fundamental knowledge on the basic laws and phenomena on which operation of sensor transformation of energy is based.
4. To impart a reasonable level of competence in the design, construction, and execution of mechanical measurements strain, force, torque and pressure.

Course Outcomes:

- CO1.** Use concepts in common methods for converting a physical parameter into an electrical quantity.
CO2. Choose an appropriate sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc.
CO3. Design and develop sensors using optical methods with desired properties.
CO4. Evaluate performance characteristics of different types of sensors.
CO5. Locate different types of sensors used in real life applications and paraphrase their importance.

Unit	Syllabus	Periods
UNIT-I	Sensor fundamentals and characteristics Sensor Classification, Performance and Types, Error Analysis characteristics.	15
UNIT-II	Optical Sources and Detectors Electronic and Optical properties of semiconductor as sensors, LED, Semiconductor lasers, Fiber optic sensors, Thermal detectors, Photo multipliers, photoconductive detectors, Photo diodes, Avalanche photodiodes, CCDs.	10

UNIT-III	Intensity Polarization and Interferometric Sensors Intensity sensor, Micro bending concept, Interferometers, Mach Zehnder, Michelson, FabryPerot and Sagnac, Phase sensor: Phase detection, Polarization maintaining fibers.	15
UNIT-IV	Strain, Force, Torque and Pressure sensors Strain gages, strain gage beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, optoelectronic pressure sensors, vacuum sensors. Design of signal conditioning circuits for strain gauges, piezo, capacitance and optoelectronics sensors.	15
UNIT-V	Position, Direction, Displacement and Level sensors Potentiometric and capacitive sensors, Inductive and magnetic sensor, LVDT, RVDT, eddy current, transverse inductive, Hall effect, magneto resistive, magne to strictive sensors. Fiber optic liquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor. Signal condition circuits for reactive and self-generating sensors.	10
TEXT BOOKS: <ol style="list-style-type: none"> Jacob Fraden, “Hand Book of Modern Sensors: physics, Designs and Applications”, 2015, 3rd edition, Springer, New York. Jon. S. Wilson, “Sensor Technology Hand Book”, 2011, 1st edition, Elsevier, Netherland. 		
REFERENCE BOOKS: <ol style="list-style-type: none"> GerdKeiser, ”Optical Fiber Communications”, 2017, 5th edition, McGraw-Hill Science, Delhi. John G Webster, “Measurement, Instrumentation and sensor Handbook”, 2017, 2nd edition, CRC Press, Florida. Eric Udd and W.B. Spillman, “Fiber optic sensors: An introduction for engineers and scientists”, 2013, 2nd edition, Wiley, New Jersey. Bahaa E. A. Saleh and Malvin Carl Teich, “Fundamentals of photonics”, 2012, 1st edition, John Wiley, New York. 		

SYLLABUS

INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	IoT Fundamentals and Architecture				
Subject Code	MCSIOT20S102				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

1. Introduce evolution of internet technology and need for IoT.
2. Discuss on IoT reference layer and various protocols and software.
3. Train the students to build IoT systems using sensors, single board computers and open source IoT platforms.
4. Make the students to apply IoT data for business solution in various domain in secured manner.

Course Outcomes:

- CO1.** Identify the IoT networking components with respect to OSI layer.
CO2. Build schematic for IoT solutions.
CO3. Design and develop IoT based sensor systems.
CO4. Select IoT protocols and software.
CO5. Evaluate the wireless technologies for IoT.

Unit	Syllabus	Periods
UNIT-I	Evolution of IoT Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer.	15
UNIT-II	Introduction to IoT components Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardwares, Examples of IoT infrastructure.	10
UNIT-III	IoT protocols and softwares MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP, XMPP and gateway protocols.	15

UNIT-IV	IoT point to point communication technologies IoT Communication Pattern, IoT protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, Lifi,Widi).	15
UNIT-V	Introduction to Cloud computation and Big data analytics Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Introduction to big data analytics and Hadoop.	10
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, “Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model”, Springer Open, 2016. 2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine to Machine to INTERNET OF THINGS”, Elsevier Publications, 2014. 3. 		
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The INTERNET OF THINGS: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008. 2. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally “INTERNET OF THINGS A Hands-on-Approach” Arshdeep Bahga & Vijay Madisetti, 2014. 3. Asoke K Talukder and Roopa R Yavagal, “Mobile Computing,” Tata McGraw Hill, 2010. 4. Barrie Sosinsky, “Cloud Computing Bible”, Wiley-India, 2010 . 5. RonaldL. Krutz, Russell Dean Vines,Cloud Security: A Comprehensive Guide to Secure Cloud Computing,Wiley-India, 2010. 		

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INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	Flexible and Wearable Sensors				
Subject Code	MCSIOT20S103				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

1. To provide the overview of flexible electronics technology and the issues with materials processing for thin film electronics.
2. To expose the students for the materials selection and patterning methods for thin film electronics development.
3. To describe the process involved in transferring the flexible electronics from foils to textiles and also the challenges, opportunities and the future of wearable devices.
4. To expose the students to the design, challenges of wearable sensors employed for sensing the physical and biological parameters and the process involved in the conversion of conducting and semiconducting fibers to smart textiles.

Course Outcomes:

After completion of course, students would be able to:

CO1. Realize the technology developments in the flexible electronics technology.

CO2. Ability to identify the suitable materials and its processing for the development of thin film Electronics.

CO3. Ability to design the pattern and develop with suitable patterning methods.

CO4. Realize the process involved in the transformation of electronics from foils to textiles.

CO5. Acquire the design knowledge for developing wearable sensors for physical and chemical Parameters.

Unit	Syllabus	Periods
UNIT-I	Overview of flexible electronics technology History of flexible electronics - Materials for flexible electronics: degrees of flexibility, substrates, backplane electronics, front plane technologies, encapsulation - Fabrication technology for flexible electronics - Fabrication on sheets by batch processing, fabrication on web by Roll-to Roll processing - Additive printing.	15

UNIT-II	Amorphous and nano-crystalline silicon materials and Thin film transistors Fundamental issues for low temperature processing - low temperature amorphous and nanocrystal line silicon - characteristics of low temperature dielectric thin film deposition - low temperature silicon nitride and silicon oxide characteristics - Device structures and materials processing - Device performance - Contacts for the device - Device stability.	10
UNIT-III	Materials and Novel patterning methods for flexible electronics Materials considerations for flexible electronics: Overview, Inorganics semiconductors and dielectrics, organic semiconductors and dielectrics, conductors - Print processing options for device fabrication: Overview, control of feature sizes of jet printed liquids, jet printing for etch mask patterning, methods for minimizing feature size, printing active materials.	15
UNIT-IV	Flexible electronics from foils to textiles Introduction -Thin film transistors: Materials and Technologies - Review of semiconductors employed in flexible electronics - Thin film transistors based on IGZO - Plastic electronics for smart textiles - Improvements and limitations.	15
UNIT-V	Wearable haptics World of wearables - Attributes of wearables - Textiles and clothing: The meta wearable - Challenges and opportunities - Future of wearables - Need for wearable haptic devices - Categories of wearable haptic and tactile display.	10

TEXT BOOKS:

1. Michael J. McGrath, Cliodhna Ni Scanail, Dawn Nafus, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", 201, 1st Edition , Apress Media LLC, New York.
2. William S. Wong, Alberto Salleo, Flexible Electronics: Materials and Applications, 2011, 1st Edition, Springer, New York

REFERENCE BOOKS:

1. Edward Sazonov, Michael R. Newman, "Wearable Sensors: Fundamentals, Implementation and Applications", 2014, 1st Edition, Academic Press, Cambridge.
2. Kate Hartman, "Make: Wearable Electronics: Design, prototype, and wear your own interactive garments", 2014, 1st Edition, Marker Media, Netherlands.
3. Guozhen Shen, Zhiyong Fan, "Flexible Electronics: From Materials to Devices", 2015, 1st Edition, World Scientific Publishing Co, Singapore.
4. Yugang Sun, John A. Rogers, "Semiconductor Nanomaterials for Flexible Technologies: From Photovoltaics and Electronics to Sensors and Energy Storage (Micro and Nano Technologies)", 2011, 1st Edition, William Andrew, New York.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	Micro and Nano Fluidics				
Subject Code	MCSIOT20S104				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. Introduce and discuss the fundamental physics of micro and nano scale fluids and their hydrodynamics.
2. Comprehend techniques of miniaturization, methods and tools to create microfluidic architectures and discuss various existing microfluidic devices.
3. Discuss and identify the usage of microfluidics in various lab-on-chip and bioreactor applications.
4. Investigate and compare microfabrication techniques to design vasculature and 3D micro channels.

Course Outcomes:

After completion of course, students would be able to:

- CO1** .Identify and understand the fundamental physics of micro and nano scale fluids and their hydrodynamics. Comprehend the basics of miniaturization, methods and tools to create microfluidic architectures.
- CO2**. Recognise and interpret the working principle of various existing microfluidic devices.
- CO3**. Describe various microfluidic lab-on-chip applications.
- CO4**. Acquaint with various bioreactor based microchips.
- CO5**. Investigate and compare various microfabrication techniques to design vasculature and 3D micro channels with existing techniques.

Unit	Syllabus	Periods
UNIT-I	Fundamentals for Microscale and Nanoscale Flow Fluids and nonfluids, properties of fluids, classification of fluids, Newtonian and Non Newtonian fluids, pressure driven flow, reynolds number , Electro kinetic phenomena, Electric double layer, debye length, coupling species transport and fluid mechanics, Micro channel Resistance, Shear stress, capillary flow, flow through porous media, Diffusion, surface tension, contact angle and Wetting.	15

UNIT-II	Hydrodynamics Introduction to surface, surface charge, surface energy, Thermodynamics of surfaces, Fluids in Electrical fields, The Navier Stokes equation, Boundary and Initial conditions problems.	10
UNIT-III	Fabrication methods and techniques Patterning, Photolithography, Micromachining, micromolding, Soft lithography, PDMS properties, Fabrication of microfluidics channels.	15
UNIT-IV	Microfluidic Devices Droplet Microfluids, Active Flow control, Microvalves, Electrically actuated microvalves, Micromixers, Combinational Mixers, Elastomeric Micromixers.	15
UNIT-V	Bioreactors on Microchips Enzyme assay and inhibition, Chemical synthesis in microreactors, Sequential reaction and Parallel reaction in micro reactors, chemical separation, liquid chromatography.	10

TEXT BOOKS:

1. Clement Kleinstreuer, "Microfluidics and Nanofluidics: Theory and Selected Applications", 2013, 1st ed., John Wiley & Sons, New Jersey.
2. Shaurya Prakash, Junghoon Yeom, "Nanofluidics and Microfluidics: Systems and Applications", 2014, 1st ed., William Andrew; Norwich, New York.
- 3.

REFERENCE BOOKS:

1. Albert Folch, "Introduction to BioMEMS", 2012, 1st ed., CRC Press, United Kingdom.
2. Patrick Tabeling, "Introduction to Microfluidics", 2011, Reprint ed., Oxford University Press, Great Britain.
3. Xiujun James Li, Yu Zhou , "Microfluidic Devices for Biomedical Applications", 2013, 1st ed., Wood head Publishing, Cambridge.
4. Terrence Conlisk. A, "Essentials of Micro- and Nanofluidics: With Applications to the Biological and Chemical Sciences", 2012, 1st ed., Cambridge University Press, New York.

SYLLABUS
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Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	Chemical and Environmental Sensor				
Subject Code	MCSIOT20S105				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

1. To extend engineering principles to electrochemical sensor development with a clear understating of oxidation and reduction of an electrolytic cell.
2. To propound the conception of ion selective and enzyme stabilized electrodes for the detection of chemical and biomolecules.
3. To be expedient in applying specific interaction methods in the recognition of ion selective gases using metal oxide based sensors.
4. Ability to analyze the modes of vibration and develop the suitable mass and thermal sensitive sensors.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Realize the need for half-cell and to analyze potential developed in any electrochemical cell. Apply the same for ion selective measurement.
- CO2.** Be familiar with a wide range of chemical sensing methods and material characteristics to be applied in biosensors.
- CO3.** Ability to design gas sensors for commercial and industrial applications.
- CO4.** Gain knowledge of nano materials for biological and medical applications
- CO5.** Able to discuss, develop and apply site specific antigen-antibody sensors design for most common diseases like metabolic disorders Evaluate process design criteria for gas treatment and air quality analysis.

Unit	Syllabus	Periods
UNIT-I	Electrochemistry Thermodynamics, , Enthalpy, Entropy, Gibbs free Energy, Law of Mass Action, simple Galvanic Cells, Electrode – Electrolyte Interface, Fluid Electrolytes, Dissociation of Salt, Solubility Product, Ion Product, pH Value, Ionic Conductivity, Ionic Mobility, Phase Diagrams.	15

UNIT-II	Transduction Principles Transduction Elements- Electrochemical Transducers-Introduction Potentiometry and Ion Selective Electrodes: The Nernst Equation Voltametry and amperometry, conductivity, FET, Modified Electrodes, Thin-Film Electrodes and Screen-Printed electrodes, photometric sensors.	10
UNIT-III	Chemical Sensing Elements Ionic recognition, molecular recognition-chemical recognition agent, spectroscopic recognition, biological recognition agents. Immobilization of biological components, performance factors of Urea Biosensors, Amino Acid Biosensors, Glucose Biosensors and Uric Acid, factors affecting the performance of sensors.	15
UNIT-IV	Potentiometric and Amperometric Sensors Potentiometric- Ion selective electrodes- pH linked, Ammonia linked, CO ₂ linked, Silver sulfide linked, Iodine selective, amperometric -bio sensors and gas sensors, Amperometric enzyme electrodes: substrate and enzyme activity, Detection mode and transduction method, mediated and modified electrodes, pH glass and ion selective electrodes, solid state and redox electrodes.	15
UNIT-V	Optical Biosensor and Immunosensors Biosensor Fiber optic biosensor, Fluorophore and chromophore based biosensor, Bioluminescence and M.TECH (MTS) Page 33 chemiluminescence based biosensors, Non labled and labled immune sensors, Microbial Biosensors: electrochemical, photomicrobial, Microbial thermistor. Application of microbial biosensors in glucose, ammonia, acetic acid, alcohol, BOD, methane sensing.	10

TEXT BOOKS:

1. Brian R Eggins, "Chemical Sensors and Biosensors", (Part of AnTS Series), 2010, 1st edition, John Wiley Sons Ltd, New York.
2. Peter Grundler, "Chemical Sensors: Introduction for Scientists and Engineers", 2011, 1st edition, Springer, New York.
3. R.G.Jackson, "Novel Sensors and Sensing", 2012, 1st edition, Philadelphia Institute of Physics.
4. Florinel-Gabriel Banica "Chemical Sensors and Biosensors: Fundamentals and Applications" 2012, 1st edition, Wiley-Blackwell, New Jersey.
5. M. Campbell, "Sensor Systems for Environmental Monitoring: Volume Two: Environmental Monitoring", 2011, 1st Edition, Springer, New York.

REFERENCE BOOKS:

1. Janata, Jiri, "Principles of Chemical sensors", 2014, 2nd edition, Springer, New York.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	Cloud and Fog Computing				
Subject Code	MCSIOT20S106				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. Introduce cloud computing and enabling technologies.
2. Explore the need for fog and edge computation.
3. Impart the knowledge to log the sensor data and to perform further data analytics.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Deploy their data in the cloud for simple applications.
- CO2.** Apply the analytics in cloud to extract information.
- CO3.** Appreciate and deploy fog data processing layers.
- CO4.** Integrate sensor data to cloud through fog computation layers.
- CO5.** Understand and implement edge computation.

Unit	Syllabus	Periods
UNIT-I	Cloud Computing basics and enabling technologies Basics of cloud computing-Need for clouds- concepts and models: Roles and boundaries – Cloud characteristics – Cloud delivery models – Cloud deployment models. Broadband Networks and Internet Architecture – Data Center Technology – Virtualization Technology.	15
UNIT-II	Cloud Virtualisation Server oriented – Virtual Machines (IaaS), Modern Serverless Configurations- Functions/ (PaaS) Lambda functions – App, Biz function, logics, data ingestion (elasticity, scalability – on demand) DB services, Analytics services (SaaS).	10

UNIT-III	Cloud Application Development in Python Python for Cloud: Amazon Web Services – Google Cloud – Windows Azure. Python for MapReduce.	15
UNIT-IV	Federated Cloud Service Management and IoT Cloud Service management (federated) –Cloud Life Cycle-service and management-Cloud architectures -Self organizing cloud architectures.	15
UNIT-V	Fog computing Need for Fog computation, Fog data processing layers – Security and Identity Management – Business process integration – Big data interfaces – Wireless sensors and actuators, Fog in 5G, Architecture Harmonization Between Cloud Radio Access Networks and Fog Networks, Fog applications.	10

TEXT BOOKS:

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, “Cloud Computing: Concepts, Technology & Architecture”, Arcitura Education, 2013. M.TECH (MTS) Page 37.
2. Arshdeep Bahga, Vijay Madiseti, “Cloud Computing: A Hands-on Approach”, 2013.
3. Ovidiu Vermesan, Peter Friess, “INTERNET OF THINGS – From Research and Innovation to Market Deployment”, River Publishers, 2014.
4. Michael Missbach, Thorsten Staerk, Cameron Gardiner, Joshua McCloud, Robert Madl, Mark Tempes, George Anderson, “SAP on Cloud”, Springer, 2016.
5. John Mutumba Bilay , Peter Gutsche, Mandy Krimmel, Volker Stiehl , “SAP Cloud Platform Integration: The Comprehensive Guide”, Rheinweg publishing, 2nd edition, 2019

REFERENCE BOOKS:

1. Honbo Zhou, “The INTERNET OF THINGS in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. S.-C. Hung et al.: Architecture Harmonization Between Cloud RANs and Fog Networks, IEEE Access: The Journal for rapid open access publishing, Vol.3, pp: 3019 – 3034, 2015.

SYLLABUS
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Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	IoT Security and Trust				
Subject Code	MCSIOT20S107				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. Appreciate the need for cyber security laws and methods.

Course Outcomes:

After completion of course, students would be able to:

CO1. Design and implement cryptography algorithms using C programs.

CO2. Solve network security problems in various networks.

CO3. Build security systems using elementary blocks.

CO4. Build Trustable cloud based IoT systems.

CO5. Solve IoT security problems using light weight cryptography.

Unit	Syllabus	Periods
UNIT-I	Fundamentals of encryption for cyber security. Cryptography – Need and the Mathematical basics- History of cryptography, symmetric ciphers, block ciphers, DES – AES. Public-key cryptography: RSA, Diffie-Hellman Algorithm, Elliptic Curve Cryptosystems, Algebraic structure, Triple Data Encryption Algorithm (TDEA) Block cipher.	15
UNIT-II	IoT security framework IOT security frame work, Security in hardware, Bootprocess, OS & Kernel, application, run time environment and containers. Need and methods of Edge Security, Network Security: Internet, Intranet, LAN, Wireless Networks, Wireless cellular networks, Cellular Networks and	10

	VOIP.	
UNIT-III	Elementary blocks of IoT Security & Models for Identity Management Vulnerability of IoT and elementary blocks of IoT Security, Threat modeling – Key elements. Identity management Models and Identity management in IoT, Approaches using User-centric, Device-centric and Hybrid.	15
UNIT-IV	Identity Management and Trust Establishment Trust management lifecycle, Identity and Trust, Web of trust models. Establishment: Cryptosystems – Mutual establishment phases – Comparison on security analysis. Identity management framework.	15
UNIT-V	Access Control in IoT and light weight cryptography Capability-based access control schemes, Concepts, identity-based and identity-driven, Light weight cryptography, need and methods , IoT use cases.	10

TEXT BOOKS:

1. John R. Vacca, “Computer and Information Security Handbook”, Elsevier, 2013.
2. Parikshi Narendra Mahalle , Poonam N. Railkar, “Identity Management for INTERNET OF THINGS”, River Publishers, 2015.
3. William Stallings, “Cryptography and Network security: Principles and Practice”, 5th Edition, 2014, Pearson Education, India.
4. Maryline Laurent, Samia Bouzefrane, “Digital Identity Management”, Elsevier, 2015.
5. Joseph Migga Kizza, “Computer Network Security”, Springer, 2005.
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REFERENCE BOOKS:

1. Christof Paar and Jan Pelzl, “Understanding Cryptography – A Textbook for Students and Practitioners”, Springer, 2014.
2. Behrouz A. Forouzan : Cryptography & Network Security – The McGraw Hill Company, 2007.
3. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: “Private Communication in a public World”, PTR Prentice Hall, Second Edition, 2002.
4. Alasdair Gilchrist, “IoT security Issues”, Oreilly publications, 2017.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	3	-	-	3
Subject Name	IoT Applications and Web development				
Subject Code	MCSIOT20S108				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To acquire specific scripting knowledge to develop interactive applications.
2. To understand the basics of android application development.
3. To apply the programming skills in developing application pertaining to Industrial, medical, agricultural, etc.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Design dynamic web forms to acquire and process user & sensor data.
CO2. Interactive forms using Java Script with a focus on INTERNET OF THINGS.
CO3. Implement mobile application using android SDK.
CO4. Solve the need for smart systems in a distributed environment.
CO5. Understand the IoT architecture and building blocks for various domains.

Unit	Syllabus	Periods
UNIT-I	Markup Language Introduction to Markup language, HTML document structure, HTML forms, Style (CSS), Multiple CSS stylesheets, DHTML, Tools for image creation and manipulation, User experience design, IoT development using charts.	15

UNIT-II	Scripting Language Introduction to JavaScript, Functions, DOM, Forms, and Event Handlers, Object Handlers, Input validation, J2ME, application design using J2ME , IoT development using Real time rules, platforms, alerts.	10
UNIT-III	Android Programing Framework Mobile app development: Android Development environment, Simple UI Layouts and layout properties, GUI objects, Event Driven Programming, opening and closing a Database.	15
UNIT-IV	Industrial Internet Application IIoT Fundamentals and Components, Industrial Manufacturing, Monitoring, Control, Optimization and Autonomy, Introduction to Hadoop and big data analytics.	15
UNIT-V	Applications in IoT enabled Smart Cities Energy Consumption Monitoring, Smart Energy Meters, Home automation, Smart Grid and Solar Energy Harvesting, Intelligent Parking, Data lake services scenarios.	10

TEXT BOOKS:

1. John Dean, Web Programming with HTML5, CSS and JavaScript, 2018.
2. Jones and Bartlett Publishers Inc., ISBN-10: 9781284091793.
3. Di Marzio J. F., Beginning Android Programming with Android Studio, 2016, 4th ed., Wiley, ISBN-10: 9788126565580.

REFERENCE BOOKS:

1. Fadi Al-Turjman, Intelligence in IoT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849.
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial INTERNET OF THINGS: Create a powerful industrial IoT infrastructure using Industry 4.0, 2018, Packt Publishing.
3. Subhas Chandra Mukhopadhyay, Smart Sensing Technology for Agriculture and Environmental Monitoring, 2012, Springer, ISBN-10: 3642276377.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	0	-	4	2
Subject Name	Python for IOT				
Subject Code	MCSIOT20S109				
Paper	English				
	Hindi				
Max. Marks	50				

List of Experiments

1. Write a program to demonstrate basic data type in python.
2. A program to compute distance between two points taking input from the user Write a program add.py that takes 2 numbers as command line arguments and prints its sum.
3. Write a Program for checking whether the given number is an even number or not. Using a for loop.
4. Write a Program to demonstrate list and tuple in python. Write a program using a for loop that loops over a sequence. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
5. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
6. Find the sum of all the primes below two million. By considering the terms in the Fibonacci sequence whose values do not exceed four million, WAP to find the sum of the even-valued terms.
7. Write a program to count the numbers of characters in the string and store them in a dictionary data structure Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure.
8. Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure.
9. Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file? Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file.
10. Write a program to count frequency of characters in a given file.
11. Write a program to print each line of a file in reverse order. Write a program to compute the number of characters, words and lines in a file.
12. Write a program to compute the number of characters, words and lines in a file.
13. Write function to compute gcd, lcm of two numbers.
14. Write a program to implement Merge sort. Write a program to implement Selection sort, Insertion sort.

SYLLABUS
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Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	2	-	-	-
Subject Name	English for Research Paper Writing(AE*)				
Subject Code	MCSER20S110				
Paper	English				
	Hindi				
Max. Marks	-				

Course Objective:

After completing this module, you should be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time Submission.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Students will heighten their awareness of correct usage of English grammar in writing and speaking.
- CO2.** Students will improve their speaking ability in English both in terms of fluency and Comprehensibility.
- CO3.** Students will give oral presentations and receive feedback on their performance.
- CO4.** Students will increase their reading speed and comprehension of academic articles.
- CO5.** Students will improve their reading fluency skills through extensive reading.

Unit	Syllabus	Periods
UNIT-I	Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	10
UNIT-II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction.	15
UNIT-III	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	10

UNIT-IV	key skills needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature, skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills are needed when writing the Conclusions.	15
UNIT-V	Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.	10

TEXT BOOKS:

1. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
2. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London,2011.

REFERENCE BOOKS:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books).
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	2	-	-	2
Subject Name	Research Methodology and IPR				
Subject Code	MMAT20S111				
Paper	English				
	Hindi	-			
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. Students will able to Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Understand research problem formulation.
- CO2.** Analyze research related information.
- CO3.** Follow research ethics.
- CO4.** Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- CO5.** Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

Unit	Syllabus	Periods
UNIT-I	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.	15

UNIT-II	Effective literature studies approaches, analysis Plagiarism, Research ethics.	10
UNIT-III	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	15
UNIT-IV	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.	15
UNIT-V	Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. : New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	10

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step-by-Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.

REFERENCE BOOKS:

1. Mayall, "Industrial Design", McGraw Hill,1992.
2. Niebel, "Product Design", McGraw Hill,1974.
3. Asimov, "Introduction to Design", Prentice Hall,1962.
4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age",2016.
5. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

SYLLABUS**INTERNET OF THINGS**

Class	M.TECH./IOT	L	T	P	C
Semester/Year	I/I	-	-	4	2
Subject Name	Principles of Sensors and Signal Conditioning Lab				
Subject Code	MCSIOT20S112				
Paper	English				
	Hindi				
Max. Marks	50				

List of Experiments

1. Introduction to the ARDUINO microcontroller.
2. RC filters.
3. Study about IR obstacle sensor.
4. Study about gas sensor.
5. Study about fire sensor.
6. Study about relay shield.
7. Study about Bluetooth relay shield.
8. Study about LCD and keypad-screw shield.
9. To study about heart beat sensor.
10. To study about Photo resistor, LED, and Transistor.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	2
Subject Name	Data Acquisition				
Subject Code	MCSIOT20S201				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To explore the fundamentals of data acquisition using sensors, NI data acquisition hardware, and Lab VIEW.
2. To teach the basics of hardware selection, including resolution and sample rate, and the foundation of sensor connectivity, including grounding and wiring configurations.
3. To provide knowledge on using the NI-DAQmx driver to measure, generate, and synchronize data acquisition tasks and analyze the data in MATLAB/ LabVIEW.
4. To impart adequate knowledge on programming finite and continuous acquisitions, as well as best practices in hardware/software timing, triggering, and logging.
5. To give hands-on experience configures and programming NI data acquisition hardware using NI-DAQmx and Lab VIEW.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Develop PC-based data acquisition and signal conditioning.
- CO2.** Understand how to control the analog input, analog output, counter/timer, and digital I/O subsystems of a DAQ device.
- CO3.** Perform different types of data acquisition and identify the correct sensor for their measurements develop integrated, high-performance data acquisition systems that produce accurate measurements.
- CO4.** Acquire data from sensors, such as thermocouples and strain gages, using NI DAQ hardware and analyses the results in LabVIEW and MATLAB.
- CO5.** Apply advanced understanding of LabVIEW and the NI-DAQmx API to create applications.

Unit	Syllabus	Periods
UNIT-I	LabVIEW Graphical Programming, NI DAQmx, Data acquisition Toolbox to read data into MATLAB and Simulink and write data into DAQ device. Acquire and generate analog signals.	15
UNIT-II	Acquire and generate non-clocked digital data .Measure frequency, pulse width and count pulses using NI devices.	12
UNIT-III	Generate Pulse Width Modulated signal, Acquire and generate audio signals.	12
UNIT-IV	Simultaneous and synchronized data acquisition, Simulink data acquisition.	10
UNIT-V	Arduino based multi-channel data acquisition, Remote data acquisition with NI WSN Gateway and nodes, CC3200 (WiFi).	10

TEXT BOOKS:

1. Behzad Ahzani “Data Acquisition using LabVIEW” Packt Publishing, 2017.
2. Data Acquisition Toolbox – User’s Guide, Math Works, 2016.

REFERENCE BOOKS:

1. Lab VIEW: A Developer's Guide to Real World Integration edited by Ian Fair weather, Anne Brumfield, 2011, CRC Press.
2. DSP for Matlab and LabVIEW: Fundamentals of discrete signal processing, Morgan and Claypool Publishers, 2009
3. Maurizio Di Paolo Emilio, “Data Acquisition Systems- Fundamentals to Applied Design”, Springer, 2013.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	Control Systems				
Subject Code	MCSIOT20S202				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To impart knowledge on performance specification, limitations and structure of controllers.
2. To impart knowledge on design of controllers using root-locus and frequency domain techniques.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Realize the need of control system and its recent developments. Able to model the system and simulate the model.
- CO2.** Analyze the behavior of the first and second order systems in time domain and frequency domain.
- CO3.** Analyze the system stability based on time domain, frequency domain and root locus techniques.
- CO4.** Identify the need for incorporating the three term controller based on the customized requirement of the control action.
- CO5.** Analyze the systems behavior in digital domain and develop digital control algorithm for the corrective action.

Unit	Syllabus	Periods
UNIT-I	Basic Control System Terminology and Classification of control System, Examples of control System, Transfer Function of Linear Control System, Block Diagram Representation, Signal flow Graph Techniques. Mathematical Modelling of Electrical Network: AC and DC Servomotors, Error Detector, Stepper Motor, Optical Encoder, Linearization.	15

UNIT-II	Sensitivity of control Systems, Effects of Feedback on gain and time constant, pole location, bandwidth, Sensitivity, Stability, Disturbance signal, Control over System Dynamics by use of Feedback. Time Response Analysis- Standard Test Signals, Time Response of 1st Order System, Model of Prototype DC Position Control System, Time Response of Prototype 2nd Order System, Performance Specification of 2nd Order System, Steady-State Errors and Error Constants, Effects of Additions of Poles and Zeros to Open Loop and Closed Loop System, Design Specification of 2nd Order System and Higher-Order System, Performance Indices, Optimal Control System.	10
UNIT-III	Time Domain Stability Analysis- Concept of Stability of Linear Systems, Effects of Location of Poles on Stability, Necessary Conditions for Stability, Routh-Hurwitz Stability Criteria, Relative Stability Analysis, Root Locus Concept, Guidelines for Sketching Root-Locus, Frequency Domain Stability Analysis- Performance Specification in Frequency Domain, Co-relation between frequency Domain and Time Domain, Bode Plot, Minimum-Phase and Non-Minimum Phase System, Polar Plots, Inverse Polar Plot, Nyquist Stability Criterion, Assessment of Relative Stability (Phase Margin, Gain Margin and Stability), Constant-M and N Circle, Nichols Chart.	15
UNIT-IV	Approaches to System Design, Types of Compensation, Design of Phase-Lag, Phase Lead and Phase Lead-Lag Compensators in Time and Frequency Domain, Proportional, Derivative, Integral and PID Compensation.	15
UNIT-V	Concept of State, State Variables and State Model, State Space Representation of Systems, Block Diagram for State Equation, Transfer Function Decomposition, Solution of State Equation, Transfer Matrix, Relationship between State Equation and Transfer Function, Controllability and Observability.	10

TEXT BOOKS:

1. Katsuhiko Ogata, "Modern Control Engineering", 2010, 5th ed., Prentice Hall, New Jersey USA.
2. M. Gopal "Modern Control System Theory", 2014, 2nd ed. New Age International, New Delhi, India.

REFERENCE BOOKS:

1. B. C Kuo : Automatic Control System, Prentice Hall of India, New Delhi.
2. Nagrath and Gopal : Control System Engineering, New Age International Publishers.
3. Samarjit Ghose : Control Systems Theory and Applications, Pearson Education
4. Distefano; Feedback and Control System (Schaum); TMH
5. B. S. Manke : Linear Control System (with MATLAB Application), Khanna Publishers.
6. Ogata : Modern Control Engineering, PHI.
7. AK Mandal : An introduction to Control Engineering – Modeling, Analysis and Design, New Age International Publishers.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	Micro Systems & Hybrid Technology System os				
Subject Code	MCSIOT20S203				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To introduce the fundamental concepts of MEMS based sensors and actuators.
2. To acquaint the students with various materials and material properties for Microsystem designing.
3. To provide comprehensive understanding of various micromachining techniques and expose the students to design, simulation and analysis software.
4. Enhancing the basics of thick film and hybrid technologies for sensor development.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Identify and understand the fundamental concepts and background of MEMS and Microsystems.
CO2. Familiar with the basics of various sensors and actuators.
CO3. The students were acquainted with various materials for Microsystem designing.
CO4. Determine and compare the scaling effects in miniaturizing devices.
CO5. Recognize and interpret various micromachining techniques and design, analysis and applications of various MEMS devices micromachining tools and techniques.

Unit	Syllabus	Periods
UNIT-I	Introduction to MEMS and Microsy MEMS and Microsystems, Miniaturization, Benefits of Microsystems, Typical MEMS and Microsystems products, Evolution of Micro fabrication and Applications.	15
UNIT-II	Introduction to Sensors and Actuator Various domains and classification of transducers: electrostatic, piezoelectric, thermal. Sensing principles: electrostatic, resistive, chemical etc. SAW devices. Micro actuators, Design of Micro accelerometers, Engineering Science for Microsystem design and fabrication.	10

UNIT-III	Materials for Microsystems Silicon, Silicon compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric materials, Polymers, Shape Memory Alloys, ferroelectric and rheological materials.	15
UNIT-IV	Scaling Effects in Microsystems Introduction to Scaling, Scaling laws, Scaling in Geometry, Scaling in Rigid body dynamics, Scaling in Electromagnetic, Electrostatic, magnetic, optical and Thermal domains. Scaling in Fluid mechanics.	15
UNIT-V	Micromachining Technologies Overview of silicon processes techniques, Photolithography, Ion Implantation, and Diffusion, Chemical Vapor Deposition, Physical vapor Deposition, Epitaxy, Etching, Bulk micromachining, Surface Micromachining, LIGA and other techniques.	10
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. G.K. Ananthasuresh, K J Vinoy, S Gopala krishnan, KN Bhatt, V K Aatre," Micro and smart systems", 2012, 1st ed., Wiley, New York. 2. Tai-Ran Hsu, "MEMS & Microsystem, Design and Manufacture", 2017, 1st ed., McGraw Hill India, New Delhi. 		
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. Mahalick NP, "MEMS", 2017, 1st ed., Tata McGraw Hill, New Delhi 2. Wolfgang Menz, Jürgen Mohr, Oliver Paul, "Microsystem Technology", 2011, 2nd ed., Wiley, New York. 3. Banks H.T. Smith R.C. and Wang Y.Smart, 'Material Structures – Modeling, Estimation and Control', 2011, 1st ed., John Wiley & Sons, NewYork. 4. Massood Tabib – Arar, 'Microactuators – Electrical, Magnetic Thermal, Optical, Mechanical, Chemical and Smart structures', 2014, 1st ed., Kluwer Academic publishers, New York. 		

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	RF and Microwave Sensors				
Subject Code	MCSIOT20S204				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To introduce the students with different RF and Microwave sensors.
2. To familiarize antenna design with a good understanding of their parameters and applications.
3. To introduce comprehensive knowledge of wearable antenna.
4. To explore and understand basics of RFID technology.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Select a proper antenna design to be used in the RF spectral region.
- CO2.** Model specific radiation pattern and evaluate them in different domains.
- CO3.** Correlate the principle behind different radar systems and determine various applications based on the radar systems.
- CO4.** Apply the basic knowledge in the measurement of RF radiation.
- CO5.** Gain knowledge about the RFID technology.

Unit	Syllabus	Periods
UNIT-I	RF Sensors Microwave Antenna-Introduction, types of Antenna, fundamental parameters of antennas, radiation mechanism, Fresnel and Fraunhofer regions. Antenna for communication and Antenna for sensing, radiometer and radar.	15
UNIT-II	Antenna for personal area communic Concepts of Printed Antennas, Broadband Microstrip Patch Antennas, Antennas for Wearable Devices, Design Requirements, Modeling and Characterization of Wearable Antennas, WBAN Radio Channel Characterization and Effect of Wearable Antennas, Domains of Operation, Sources on the Human Body, Compact Wearable Antenna for different applications.	10

UNIT-III	Radar Introduction to RADAR, RADAR range equation, MTI and pulse Doppler RADAR, Tracking RADAR, SAR pulse RADAR, CW RADAR.	15
UNIT-IV	Applications of Radar Automotive, remote sensing, agriculture, medicine, detection of buried objects, NDT, defense factors affecting the performance of RADAR, RADAR transmitters, Receivers.	15
UNIT-V	Radiometers Radiative transfer theory, SMMR, Types of radiometers - and Bolometers, Applications in automotive, agriculture, medicine, weather forecasting.	10

TEXT BOOKS:

1. Finkenzeuer Klaus, "RFID Handbook", 2011, 3rd edition, John Wiley and Sons, New Jersey.
2. Constantine A. Balanis, "Antenna Theory Analysis and Design", 2016, 4th edition, John Wiley and Sons, New Jersey.

REFERENCE BOOKS:

1. B. Hoffman - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice ", 5th edition, Springer, New York, 2012.
2. Lillesand & Kiefer, "Remote Sensing and Image Interpretation", 2011, 6th edition, John Wiley and Sons, New Jersey.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	Biomedical Sensors				
Subject Code	MCSIOT20S205				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. Introduce the students to different types of electrodes used in bio potential recording.
2. To facilitate the students in recognizing electrode configuration and issues related with the electrode relative motions.
3. To expose the students to perceive the need for bio amplifiers and their characteristics needed to be design for various bandwidth and frequency response.
4. Review the cardiac, respiratory and muscular physiological systems. Study the designs of several instruments used to acquire signals from living systems.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Realize the need for reusable electrodes and understands the method of implementation.
CO2. Will be familiar with electrode placements for various bio potential recording as per the voltage range.
CO3. Capable of understanding the design principles of bio-amplifiers and drawback related with noises.
CO4. Gain knowledge for implementing different types of physiological parameter measurement using appropriate sensors.
CO5. Able to discuss, develop and apply site specific chemical sensors design and imaging techniques for typical issues.

Unit	Syllabus	Periods
UNIT-I	Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode-skin interface, half-cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.	15

UNIT-II	Bio signal characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. EEG-procedure, signal artefacts, signal analysis, evoked potential, EMG- procedure and signal analysis, Nerve conduction study.	10
UNIT-III	Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation.	15
UNIT-IV	Temperature measurement: core temperature-surface temperature- invasive. Blood flow measurement: skin blood- hot film anemometer- Doppler sonography- electromagnetic sensor - blood pressure measurement: noninvasive- hemodynamic invasive. Spirometry- sensors for pressure pulses and movement- ocular pressure sensor- acoustic sensors in hearing aid, in blood flow measurement, sensors for bio-magnetism, tactile sensors for artificial limbs, sensors in ophthalmoscopy, artificial retina.	15
UNIT-V	Blood gas and pH sensor, electrochemical sensor, transcutaneous, optical fiber sensor, mass spectrometer, optical oximetry, pulse oximetry, ear oximetry.	10

TEXT BOOKS:

1. J. G. Webster, J. G. Webster ,“Medical Instrumentation; Application and Design”, John Wiley & Sons, Inc., New York, 4th Edition, 2015.

REFERENCE BOOKS:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 3rd edition, 2014.
2. John Enderle, Joseph Bronzino, “Introduction to Biomedical Engineering”, Academic Press, 3rd Edition, 2011.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	Multi-disciplinary Product Development				
Subject Code	MCSIOT20S206				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To develop the students for integrative thinking on good engineering practices.
2. To emphasis the students from shifting their mindset from theoretical to practical multi-disciplinary skills through installing the know-how of actual practice in industry field.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** To demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.
- CO2.** To value the voice of the customer in getting the feedback.
- CO3.** To demonstrate an understanding of quality in a product or service through tools.
- CO4.** To improve the design of the product in accordance with the quality standards .
- CO5.** To apply various strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.

Unit	Syllabus	Periods
UNIT-I	The way to measure value by what a customer is willing to pay. It is used as critical input for product function requirement development. No product can satisfy all the customers. Market Segmentation shows the methodology to target a specific customer group for product positioning.	15
UNIT-II	Voice of customer: A disciplined approach to directly collecting feedback and input from customers. Used throughout the Engineering and Marketing process.	10

UNIT-III	Critical to Quality and Quality function. Deployment: Specify and quantify customer needs. Flow down those customer needs in each step of product development.	15
UNIT-IV	Integrate statistics into quality continuous improvement operation model. Design for Six Sigma used throughout the product development process in order to improve the correction of the first design delivery.	15
UNIT-V	Sample design Principles: As little design as possible to satisfy customer expectations and eliminating any unnecessary complexity helps maximize business benefit.	10

TEXT BOOKS:

1. Tempelman, Shercliff, Van Eyben, "Manufacturing and Design, Elsevier, 1st edition, 2014.
2. Art Weinstein, "Handbook of Market Segmentation: Strategic Targeting for Business and Technology Firms, Third Edition (Haworth Series in Segmented, Targeted, and Customized Market 3rd ed. Routledge, Taylor and Francis group, 2004.

REFERENCE BOOKS:

1. Michael Lamoureux, "The e-Sourcing Handbook: A Modern Guide to Supply and Spend Management Success, Lasta publishing, 2008.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	Deep Learning- An Approach to Artificial Intelligence				
Subject Code	MCSIOT20S207				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. To introduce the fundamental theory and concepts of machine learning and artificial intelligence.
2. To provide a comprehensive foundation to artificial neural networks, neuro-modeling, and their applications to pattern recognition.
3. To explore the learning paradigms of supervised and unsupervised shallow/deep neural networks.
4. To provide exposure to the recent advances in the field of and facilitate in depth discussions on chosen topic.
5. To impart adequate knowledge on deep learning frameworks and their applications to solving engineering problems.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** To introduce the fundamental theory and concepts of machine learning and artificial intelligence
- CO2.** To provide a comprehensive foundation to artificial neural networks, neuro-modeling, and their applications to pattern recognition.
- CO3.** To explore the learning paradigms of supervised and unsupervised shallow/deep neural networks.
- CO4.** To provide exposure to the recent advances in the field of and facilitate in depth discussions on chosen topic.
- CO5.** To impart adequate knowledge on deep learning frameworks and their applications to solving engineering problems.

Unit	Syllabus	Periods
UNIT-I	Supervised and unsupervised learning, parametric vs non-parametric models, parametric models for classification and regression- Linear Regression, Logistic Regression, Naïve Bayes classifier, simple non-parametric classifier-K-nearest neighbour, support vector machines.	15

UNIT-II	Clustering- distance based- K-means, density based, association rule mining, validation techniques-cross validations, feature selection and dimensionality reduction, principal component analysis-Eigen values, Eigen vectors, Orthogonality- challenges motivating deep learning.	10
UNIT-III	ANN as a technique for regression and classification, structure of an artificial neuron, activation functions- linear activation, sigmoid and softmax. Feedforward neural networks- shallow model- single layer perceptron, multi-layer perceptron as complex decision classifier- learning XOR-Gradient based learning, Backpropagation algorithm, risk minimization, loss function, regularization, heuristics for faster training and avoiding local minima.	15
UNIT-IV	Feed forward neural networks- deep model- output units and hidden units, training deep models- hyper parameters and validation sets-cross validation, capacity, overfitting and under fitting, bias vs variance trade off, cross validation - vanishing gradient problem, new optimization methods (adagrad, adadelta, rmsprop, adam), regularization methods (dropout, batch normalization, dataset augmentation), early stopping.	15
UNIT-V	Convolution operation- kernel and feature map, sparse connectivity, equivariance through parameter sharing, pooling function for invariant representation, convolution and pooling as strong prior, convolution with stride, effect of zero padding, single-channel and multi-channel data types used in ConvNet, variants of basic convolution- locally connected, tiled ConvNet- spatial separable and depth wise separable convolutions, fully connected layers, ConvNet architecture- layer patterns, layer sizing parameters, case studies- LeNet, Alex Net.	10

TEXT BOOKS:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press
2. Josh Patterson and Adam Gibson, "Deep Learning- A Practitioner's Approach" O'Reilly Media Inc., 2017, USA.

REFERENCE BOOKS:

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2011.
2. Rich E and Knight K, "Artificial Intelligence", 2011, 2nd ed., TMH, New Delhi.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	3	-	-	3
Subject Name	Automotive Sensors & in-Vehicle Networking				
Subject Code	MCSIOT20S208				
Paper	English				
	Hindi				
Max. Marks	100				

Course Objective:

After completing this module, you should be able to:

1. Acquaint with the basic automotive parts and the need for sensor integration in different automotive systems.
2. Discuss the basics of various Power train sensors and associated systems for proper vehicle dynamics and stability in Automotive systems.
3. Comprehend various sensors for vehicle body management and discuss various sensors and technologies for passenger convenience, safety and security systems.
4. Acquaint various communication standards and protocols followed within the automotive systems.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Identify and understand the basic automotive parts and the requirement of sensors and their integration in different automotive systems.
- CO2.** Discuss and identify the basics of various Power train sensors.
- CO3.** Comprehend and analyses various systems like ABS, ESP, TCS, etc. for understanding vehicle dynamics and stability.
- CO4.** Comprehend the various sensors for vehicle body management, convenience & security systems.
- CO5.** Identify various technologies developed for passenger convenience, Air Bag deployment and Seat Belt Tensioner System, etc with the students.

Unit	Syllabus	Periods
UNIT-I	Power-train, Combustion Engines, Transmission, Differential Gear, Braking Systems. Introduction to Modern Automotive Systems and need for electronics in Automobiles, Application areas of electronics in the automobiles, Possibilities and challenges in the automotive industry, Enabling technologies and Industry trends.	15
UNIT-II	λ sensors, exhaust temperature sensor, NOx sensor, PM sensor, fuel quality sensor, level sensor, torque sensor, speed sensor, mass flow sensor, manifold pressure sensor. Wheel speed sensors/direction sensors, steering position sensor (multi turn), acceleration sensor (inertia measurement), brake pneumatic pressure sensor, ABS sensor, electronic stability sensor.	10
UNIT-III	Gas sensors (CO ₂), Temperature/humidity sensor, air bag sensor, key less entering sensor, radar sensors. Tire pressure monitoring systems, Two wheeler and Four wheeler security systems, parking guide systems, anti-lock braking system, future safety technologies, Vehicle diagnostics and health monitoring, Safety and Reliability, Traction Control, Vehicle dynamics control, Accelerators and tilt sensors for sensing skidding and anti-collision, Anti-collision techniques using ultrasonic Doppler sensors.	15
UNIT-IV	Principal Sensor Functions, Distributed Front Air Bag sensing systems, Single-Point Sensing systems, Side-Impact Sensing, and Future Occupant Protection systems.	15
UNIT-V	Electromechanical Seat, Seat Belt Height, Steering Wheel, and Mirror Adjustments, Central Locking Systems, Tire Pressure Control Systems, Electromechanical Window Drives, etc.	10

TEXT BOOKS:

1. Automotive Electrics, Automotive Electronics: Systems & Components, 2014, 5th Edition, BOSCH.
2. John Turner, Automotive Sensors, 2010, 1st Edition, Momentum Press, New York.

REFERENCE BOOKS:

1. Automotive Sensors Handbook, 8th Edition, 2011, BOSCH.
2. Jiri Marek, Hans-Peter Trah, Yasutoshi Suzuki, Iwao Yokomori, Sensors for Automotive Technology, 2010, 4th Edition, Wiley, New York.

SYLLABUS
INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	-	-	4	2
Subject Name	Programming and Scripting languages				
Subject Code	MCSIOT20S209				
Paper	English				
	Hindi				
Max. Marks	50				

List of Experiments:

1. Introduction to basics of R programming language.
2. To study about R language for calculator.
3. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets.
4. Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset.
5. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
6. Find the data distributions using box and scatter plot.
7. Find the outliers using plot.
8. Find the correlation matrix.
9. Import a data from web storage. Name the dataset and now do Logistic Regression to find out relation between variables that are affecting the admission of a student in a institute based on his or her GRE score, GPA obtained and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).
10. Apply multiple regressions, if data have a continuous Independent variable. Apply on above dataset.
11. Install relevant package for classification.
12. b. Choose classifier for classification problem.
13. Evaluate the performance of classifier.

SYLLABUS

INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	-	-	4	2
Subject Name	Mini Project				
Subject Code	MCSIOT20S210				
Paper	English				
	Hindi				
Max. Marks	50				

Syllabus:

- Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.
- End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals 'contribution.
- Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

SCHOOL OF ENGINEERING

SYLLABUS

INTERNET OF THINGS

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	2	-	-	-
Subject Name	Stress Management by Yoga				
Subject Code	MCSYM20S211				
Paper	English				
	Hindi				
Max. Marks					

Course Objective:

After completing this module, you should be able to:

1. To achieve overall health of body and mind.
2. To overcome stress.

Course Outcomes:

After completion of course, students would be able to:

- CO1.** Develop healthy mind in a healthy body thus improving social health also.
CO2. Improve efficiency.

Unit	Syllabus	Periods
UNIT-I	Definitions of Eight parts of yog. (Ashtanga)	10
UNIT-II	Yam and Niyam. Do`s and Don`t sin life. i) Ahinsa, satya, astheya, bramhacharyaandaparigraha ii) Shaucha, santosh, tapa, swadhyay,ishwarpranidhan	10
UNIT-III	Asanand Pranayam i) Various yog poses and their benefits for mind &body ii)Regularization of breathing techniques and its effects-Types ofpranayam	10

REFERENCE BOOKS:

1. Yogic Asanas for Group Tarining-Part-I”: Janardan Swami Yoga bhyasi Mandal, Nagpur.
2. Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

SYLLABUS**INTERNET OF THINGS**

Class	M.TECH./IOT	L	T	P	C
Semester/Year	II/I	-	-	4	2
Subject Name	Data Acquisition				
Subject Code	MCSIOT20S212				
Paper	English				
	Hindi				
Max. Marks	50				

List of Experiments

1. To study about introduction to MATLAB.
2. Study about basic matrix operation.
3. Study about to solve linear equation.
4. Study about to solve difference equation.
5. Study about determination of root of polynomial.
6. Introduction to WEKA.
7. Implementation of measures of proximity
8. Introduction to exploratory data analysis using R.
9. Learning and implementing K-means clustering.
10. Learning naive and decision trees classifier in WEKA.