GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. Internet of Things

Course / Subject Code : BE040AI011

Course / Subject Name : Introduction to Internet of Things (IoT)

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	Core Courses

Prerequisite:	The students should be having knowledge of Basics of Electronics, Analog Electronics, and Electronics Measurements.
Rationale:	Internet of Things (IoT) is going to play the key role in the upcoming years during the technological revolution taking place in the field of Engineering and Technology. It will be really advantageous for students to learn this subject for making their selves compatible with the upcoming technological era and to be a future ready Engineer. This course will provide students knowledge of IoT fundamentals, Protocols, Sensors and Actuators used in field of IoT.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Restate basic concepts of IoT, Distinguish different components of IoT
02	Discuss different applications of IoT by case studies of real world
03	Determine various sensing techniques for real world physical quantities and apply them in various IoT applications
04	Illustrate different actuators used in IoT applications and their interfacing

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	0	30	45	120	04	70	0	0	30	50	150

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = EndSemester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction to IoT-Concepts and Terminology of The Internet of Things (IoT), History of IoT, Applications, Requirements of IoT, M2M/IoT standards, Components of IoT, IoT Enabling, Technologies – Gateways, Local & Global Connectivity, IOT Platforms, Business Inferences IoT Building blocks – Architecture, Sensing, Connectivity, Gateways, Processing, Software, Power, IOT Reference Architectures, Business Models, Challenges in IOT.	16	38
2.	Modern trends in IOT – Wearable, industrial standards, Open Data Management & API. Case studies connected use cases in Real-life/Thematic areas – Smart Homes/Buildings, Smart Cities, Smart Village, Smart Agriculture, Smart Industry, Smart Medical care, Smart Automation. Ethical issues.	6	15
3.	Sensor Fundamentals: How Sensors Work, Analog and Digital Sensors, Pull-Up/Down resistors and Examples of sensors and working principles, A/D Conversion: A brief Introduction to sampling theory, A/D conversion, Acceleration, Temperature, pressure, force, Humidity, Distance, Light, Orientation, Sound, Electric Current, displacement, speed, flow.	12	27
4.	Actuators, Relay Switch, process control valves, power electronics devices: SCR, DIAC, TRIAC, Power MOSFET, IGBT, DC motor: Introduction and Speed control, Servo motors and Position Controlling. Unipolar and Bipolar Stepper Motor, Stepper motor driver Interface.	11	20
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**35**	**35**	**10**	**5**	**5**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Rahul Dubey, "An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications", Cengage India Publication.
2. Raj Kamal, "Internet of Things: Architecture and Design Principles, Mc Graw Hill Education.
3. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.
5. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies
6. Rangan & Mani "Instrumentation: Devices and Systems", McGraw Hill
7. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009
8. D.V.S. Murty, "Transducers and Instrumentation", Prentice Hall India

(b) Open source software and website:

1. Arduino IDE
2. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3. https://www.electronicshub.org/arduino-project-ideas
4. https://playground.arduino.cc/Projects/Ideas/

Suggested Course Practical List:

1. Getting started with Arduino and Node MCU with ESP8266 and ESP32 in the Arduino IDE.
2. Introduction to various user interface devices & its interfacing using Arduino:
   a. Push Button
   b. LED
   c. Buzzer
   d. LCD
3. Introduction to various sensors & its interfacing using Arduino:
   a. Temperature Sensor
   b. PIR Motion Sensor

c. Moisture Sensor
d. Infrared Sensor
e. Ultrasonic Sensor
f. Accelerometer
g. Load Cell

4. Introduction to various Actuators & its interfacing using Arduino:
   a. Relay
   b. DC Motor
   c. Servo Motor
   d. Stepper Motor
5. Setup of ESP32 or ESP8266 as Wi-Fi Client and Wi-Fi Access point using Arduino IDE.

List of Laboratory/Learning Resources Required:

1. DC Power Supply/ Batteries
2. Function Generator
3. CRO/DSO
4. Multimeter
5. Discrete components like bread board, switches, LEDs, Buzzers, single lead wires(connectors), Arduino, Raspberry Pi. ESP32, ESP8266.
6. Open source softwares : Arduino IDE
7. Learning resources : NPTEL website.

List of suggested activities for Problem Based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numerical based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.

4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding-based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self-learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 25 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.

13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software

Note:

- All the suggested activity should be related to the subject.
- The number of hours are suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
- Rubrics for the evaluation can be prepared by the faculty.
- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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