

AGENDA

Board of Studies

Electronics & Communication Engineering
IKGPTU Main Campus, Kapurthala

Study Scheme for Minor Degree in
Artificial Intelligence & Internet of Things
for Students of
B.Tech. Electronics & Communication Engineering
(2019 Onwards)



I K GUJRAL PUNJAB TECHNICAL UNIVERSITY

Main Campus, Kapurthala-144603 (PB)

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Objective: After getting minor degree in said subject graduates will be able to develop Android Apps for IOT Applications that involve use of Artificial Intelligence and Deep Learning

Forewords & Pre-requisites: Department of ECE is offering minor degree in *Artificial Intelligence & Internet of Things*. The curriculum has been designed with equal emphasis on theory and practical knowledge:

1. Students with **at least 7.0 SPGA** can opt for minor degree in third semester. Students will pay applicable examination fee as per university rules.
2. Students have to undertake all courses (20 Credits) to earn this minor degree as per approved study scheme only.
3. UG students any department can opt for Minor Degree in Artificial Intelligence & Internet of Things. Following prerequisite knowledge is must for aspiring students:
 - (i) Before 4th Sem, student must undertake some course dealing with conceptual understanding of Electronic Devices and Digital Circuits
 - (ii) Before 5th Sem students must know concepts of Object-Oriented Programming using any programming languageStudents will have to submit documentary proof of passing the pre-requisite course before the commencement of respective semester.
4. Examination and other applicable charges as per university norms will be paid by the students as and when applicable.

MINOR DEGREE - STUDY SCHEME

Artificial Intelligence & Internet of Things

S. No.	Sem	Course Code	Course Name	L	P	Int	Ext	Crd
1.	3	UC-AIIT-3A	Web Application Development	4	-	50	50	4
2.	4	UC-AIIT-4A	Internet of Things & Applications	4	-	50	50	4
3.	5	UC-AIIT-5A	Android Development with Kotlin	4	-	50	50	4
4.	6	UC-AIIT-6A	Introduction to Artificial Intelligence	4	-	50	50	4
5.	7	UC-AIIT-7A	Android Machine Learning with TensorFlow	4	-	50	50	4

Total	350	350	20
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UC-AIIT-3A	Web Application Development	L	T	P	Int	Ext	Crd
		4	0	0	50	50	4

Course Outcomes: At the end of this course, students shall be able to

- CO1** Understand working with HTML elements to create webpages
- CO2** Apply concepts of HTML & CSS to design attractive websites
- CO3** Create dynamic webpages with JavaScripting
- CO4** Interface webpages with MySQL databases using PHP

Module 1: HTML

Introduction to HTML; HTML document structure; HTML tags: head, title, style, meta, script, body, br, hr, link, img, ul, ol, li, p, b, i, and a tags, etc; HTML color codes; Layout tags: table, div, iframe, span; HTML Forms & Input tags: text, password, textarea, checkbox, hidden, file, radio, submit button, Passing data between pages.

Module 2: Style Sheets

Introduction to CSS; Inline, Internal and External CSS styling; CSS file structure; Backgrounds & Colors; CSS tags & properties to style text, images, form elements, tables, divs; vertical and horizontal navigational menus; Need of responsive websites; Application Bootstrap CSS framework.

Module 3: Java Script

Introduction to JavaScript; Basic syntax; Variables; Data types; Statements; Operators; Functions; Arrays; Objects; dialog boxes; JavaScript DOM.

Module 4: PHP and MySQL

Introduction to PHP; Data types; Variables; Decision and looping in PHP; String; Functions; Array; Form processing; Cookies and Sessions; Introduction to SQL; PHP-MySQL Connection; MYSQL operations through PHP: Select, Insert, Update, Delete.

Text Books:

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", PHI
2. Rajkamal, "Internet and Web Technology", Tata McGraw Hill
3. Richard Blum, "PHP, MySQL & JavaScript All-in-One For Dummies", Wiley India

UC-AIIT-4A	Internet of Things & Applications	L	T	P	Int	Ext	Crd
		4	0	0	50	50	4

Course Outcomes: At the end of this course, students shall be able to

- CO1** Write sketches/program in Arduino IDE
- CO2** Understand and use Arduino boards and shields
- CO3** Use NodeMCU & ESP32 in IoT applications
- CO4** Install & configure IoT enabled switch boards and home appliances

Module 1: Arduino IDE & Programming

IoT: Application areas and challenges; Arduino IDE; Arduino serial monitor; Program structure; Data types; Variable & constants; Operators; Control statements; Loops; Functions; Strings and Arrays; Simple programs for blinking & fading LED, Reading analog voltage, etc.

Module 2: Arduino Boards, Sensor & Shields

Arduino board descriptions: Uno, Nano and Mega; Sensors boards for humidity, temperature, ultrasonic and motion detection; Arduino shields: Pinout, datasheet & working with relays, DC, servo & stepper motors, joystick and LCD shields.

Module 3: NodeMCU & ESP32

Introduction to NodeMCU board; Pinout diagram; Simple programs with NodeMCU; Key features of ESP32; Comparison between NodeMCU & ESP32; Pinout diagram and description; Wireless data logging and control with ESP32.

Module 4: Smart Lights & Devices

Why home automation; Applications of IoT in home automation; Features of WiFi enabled switch boards; Connecting WiFi switch boards & other home appliances with smart speakers; IoT for home security.

Text Books / Study Material:

1. Internet of Things by Arshdeep Bahga & Vijay Madisetti, ISBN:978 0996025515
2. Internet of Things with Arduino Cookbook by Marco Schwartz (<https://createspace.com>)
3. The Internet of Things by Samuel Greengard, MIT Press
4. <https://www.arduino.cc/>
5. <https://learn.sparkfun.com/>
6. Datasheets - ESP32 and NodeMCU

UC-AIIT-5A	Android Development with Kotlin	L	T	P	Int	Ext	Crd
		4	0	0	50	50	4

Course Outcomes: At the end of this course, students shall be able to

- CO1** Understand and program
- CO2** Understand and use Arduino boards and shields
- CO3** Use NodeMCU & ESP32 in IoT applications
- CO4** Install & configure IoT enabled switch boards and home appliances

Module 1: Get Started with Kotlin

Kotlin Basics: Introduction to Kotlin; Benefits of using Kotlin; Use Kotlin REPL to practice basic expressions; Control flow statements in Kotlin; Null safety with Kotlin; **Functions:** Creating and calling functions with default and named arguments; Writing concise and compact functions; Passing functions as arguments to other functions; Writing simple lambdas; **Classes & Objects:** Introduction to object-oriented programming in Kotlin; Classes and objects in Kotlin; Constructors, Visibility modifiers; Subclasses and inheritance; Interfaces; Data classes; Singleton class enums; Pairs, triples and collections in Kotlin; Extensions in Kotlin

Module 2: Introduction to Android

Build your first Android app: Installing Android Studio; Creating an Android app project; Deploying the app to an emulator or a device; Building an Android app that contains images and a click handler; Modifying views within the layout of an app; Adding libraries to module gradle file; **Layouts:** Creating layouts in Android Studio using XML and the Layout Editor; Adding interactivity to your app; Working with ConstraintLayout; Data binding basics; **App Navigation:** Creating Fragments; Defining NavController, navigation graphs, navigational paths; Functionality of Back and Up buttons; Defining the options menu; Creating a navigational drawer; Using the Safe Args plugin and passing of arguments; Starting an external Activity; **Activity and Fragment Lifecycles:** Understanding Activity and Fragment Lifecycles; Exploring logging options in your app; Using the Android Lifecycle library; Exploring configuration changes

Module 3: Android App Architecture

UI Layer: Using the recommended Android App Architecture; Using the Lifecycle, ViewModel, and ViewModelFactory classes; Adding LiveData and LiveData observers; Adding Data Binding with ViewModel and LiveData; Adding LiveData transformations; **Persistence Layer:** Overview of Room Persistence Library, Introduction to coroutines; **Advanced RecyclerView use cases:** Introduction to RecyclerView Fundamentals; Implementing data binding with RecyclerView; Using GridLayout with RecyclerView; Interacting with RecyclerView items; Adding headers in RecyclerView;

Module 4: Internet Connection & App Design

Connect to the Internet: Connecting to a web service with the Retrofit library; Parsing a JSON response with the Moshi library; Using coroutines with Retrofit; Loading and displaying images from the Internet; Filtering data from the Internet; **Repository pattern and WorkManager:** Adding an offline cache and repository; Implementing WorkManager; Working with background workers and periodic WorkerRequest; **App UI Design:** Introduction to basic

app design; Understanding Styles and Themes; Implementing Material Design; Designing for everyone

Books / Study Material:

1. *Learn Kotlin for Android Development*, Peter Spath, Apress. 2019
2. <https://developer.android.com/courses>
3. <https://codelabs.developers.google.com/?cat=android>
4. <https://developer.android.com/kotlin>
5. <https://kotlinlang.org/docs/reference/>

UC-AIIT-6A	Introduction to Artificial Intelligence	L	T	P	Int	Ext	Crd
		4	0	0	50	50	4

Course Outcomes: At the end of this course, students shall be able to

- CO1** Comprehend fundamentals of soft computing and problem complexities
- CO2** Understand and write basic machine learning algorithms using ANN
- CO3** Understand and apply fundamentals of fuzzy logic to solve engineering problems
- CO4** Apply knowledge Genetic Algorithms to evolve solutions for engineering problems

Module 1: Introduction

Soft computing Vs hard computing; Computational complexity; NP hard problems; Hill climbing algorithm; Knowledge representation; Heuristics and metaheuristics; Introduction to machine learning and deep learning.

Module 2: Artificial Neural Networks

History of development in neural networks; Artificial neural terminology; Basic neural models; ANN topologies; Feedforward and Backpropagation Networks; Types of learning: Supervised, Competitive, Unsupervised & Reinforced learning; Basic learning laws: Hebb's rule, Delta rule, widrow and Hoff LMS learning rule, correlation learning rule instar and ouster learning rules; Radial Basis function neural networks.

Module 3: Fuzzy Logic Systems

Introduction to fuzzy logic; Fuzzy vs Crisp set; Linguistic variables; Membership functions; Fuzzy set operations; If-Then fuzzy rules; Fuzzy inference engines; Defuzzification techniques; Fundamental applications of fuzzy logic; Design step of fuzzy logic systems.

Module 4: Optimization Algorithms

Local and global optimization; Biological and artificial evolution; Fitness evaluation; Genetic Algorithms: Terminologies, Encoding, Selection, Crossover, Mutation; Elite solutions; Multi-objective optimization; Testbed of benchmark optimization functions; No free lunch theorem; Traveling salesman problem.

References:

1. Fuzzy Logic: Intelligence, Control and Information by **Yen & Langari**, Pearson
2. Introduction to artificial neural Networks by **Jacek M Zaurada**, Jaico Publishing
3. Introduction to Genetic Algorithms by **S. N. Sivanandam & S. N. Deepa** Springer
4. Genetic Algorithms by **Goldberg** Pearson Education India

UC-AIIT-7A	Android Machine Learning with TensorFlow	L	T	P	Int	Ext	Crd
		3	0	0	40	60	3

Course Outcomes: At the end of this course, students shall be able to

- CO1** Write Python code for machine learning
- CO2** Understand fundamental concepts of machine and deep learning
- CO3** Understand TensorFlow work environment for deep learning
- CO4** Develop android apps based on deep learning

Module 1: Python

Introduction; Variables & Datatypes; Lists; List functions; Loop and conditional statements; Tuples and dictionaries; File handling; Numpy–Arrays, Functions, Operators; Pandas; Matplotlib;

Module 2: Machine Learning & Deep Learning

Introduction; Machine Learning, Classification and Regression; Unsupervised, Reinforcement Learning; Deep Learning.

Module 3: TensorFlow

Introduction; Constants and shaping; Rank and numpy; Matrix multiplication and Ragged Tensors; Operations; Generating Random Values; Saving Variables using Checkpoints.

Module 4: Deep Learning based Android Application

Creating Android Application for the Machine learning model; Concrete function example; Saved model example; Predicting fuel efficiency of automobiles; Handwritten digit recognition; Rock-Paper-Scissor problem.

Text Books:

1. François Chollet, “Deep Learning with Python”, Manning Shelter Island, USA
2. Anirudh Koul, Siddha Ganju, Meher Kasam, “Practical Deep Learning for Cloud, Mobile, and Edge”, O'Reilly Media, Inc.
3. Karthikeyan NG, Arun Padmanabhan, Matt R. Cole, “Mobile Artificial Intelligence Projects”, Packt Publishing
4. <https://www.udemy.com/course/machine-learning-for-android-developer-using-tensorflow-lite/>