Syllabus

TY B. Tech Electronics Engineering

(Third Year: Semester V-VI)

From
Academic Year 2022-23
(Revision-1)

Approved by FOET __/__/2021 and AC __/__/2021

TY B. Tech /ETRX/Revision 1.0

K J Somaiya College of Engineering, Mumbai-77

(A Constituent College of Somaiya Vidyavihar University)

Course Code	Course Title					
116U06O521	The Arduino Platform and C programming					
	TH		P	TUT		Total
Teaching Scheme (Hrs.)	3		0	0		3
Credits Assigned	2		0	0		2
Examination Scheme	Marks					
	CA		ESE	TW	O	P&O	Total
	ISE	IA					
	30	20	--	--	--	--	50

Course prerequisites:
Elements of Electrical and Electronics Engineering (2UHC107)

Course Objectives:
This course aims at developing students' ability to build hands-on things without having special electronics skills such as soldering. The course focuses on one of the currently trending advanced Arduino boards. There are many embedded systems that can be developed using the Arduino microcontroller board and students taking this subject will be able to learn and use this kit and make the most out of it. At the end of course the student is expected to make a project using the Arduino board. This course will help students in developing their projects.

Course Outcomes
At the end of successful completion of the course the student will be able to
CO1: Understand hardware details of Arduino
CO2: Use embedded C programming with Arduino
CO3: Learn to interface the Arduino with peripheral devices
CO4: Understand the different communication protocols of Arduino
CO5: Skills to develop various projects using Arduino

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Arduino**		**10**	**CO1**
	1.1	Types of Arduino boards, Comparison of different Arduino boards.		
	1.2	Arduino Uno R3 processing board: Schematic details.		
	1.3	ATmega 328 Hardware: Features, Memory, Port system, Internal scheme.		
	1.4	ATmega 2560 Hardware: Feature, Memory, Port system.		
2	**Programming with Arduino**		**10**	**CO2**
	2.1	C data types for Arduino		
	2.2	C program elements: Header and source files, preprocessor directives		
	2.3	C program elements: Libraries, Functions, data structures, modifiers, statements, loops, pointers		
3	**Interfacing with Arduino**		**10**	**CO3**
	3.1	Interfacing display, actuators, and sensors		
	3.2	Interfacing diagram		
	3.3	Code using libraries		
4	**Communication protocol using Arduino**		**10**	**CO4**
	4.1	Wired communication (SPI, I2C, UART)		
	4.2	Wireless communication (ESP8266, Bluetooth)		
5	**Applications of Arduino**		**05**	**CO5**
	5.1	Home security, smart home, etc. using Arduino		
	5.2	Robotic automation using Arduino e.g., robotic arm		
	5.3	Webservers using Arduino		
Total			**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with	Edition and Year of Publication

			country	
1.	Steven F. Barrett	*Arduino Microcontroller Processing for Everyone!*	Morgan & Claypool Publishers, USA	Third Edition, Year 2013
2.	Michael Margolis	*Arduino cookbook*	O'Reilly Media, USA	Second Edition, Year 2012
3.	Jack J Purdum	*Beginning C for Arduino, Second Edition: Learn C Programming for the Arduino 2nd ed. Edition*	Apress	2nd edition, Year 2015
4.	Jeremy Blum	*Exploring Arduino: Tools and Techniques for Engineering Wizardry*	Wiley	2nd edition, Year 2019
5.	Simon Monk	*Programming Arduino: Getting Started with Sketches*	McGraw-Hill Education	2nd edition, Year 2016

Course Code	Course Title					
116U06O522	3D Printing Technology					
	TH		P	TUT	Total	
Teaching Scheme(Hrs.)	3		0	0	3	
Credits Assigned	2		0	0	2	
Examination Scheme	Marks					
	CA		ESE	TW	O	P&O	Total
	ISE	IA					
	30	20	--	--	--	--	50

Course prerequisites: Elements of Electrical and Electronics Engineering

Course Objectives: The objective of this course is to make students understand the basic principles involved in 3D printing. The students are expected to learn new trends in the emerging technology of 3D printing such as SLA, prusa, RepRap technology and additive manufacturing. Another objective is to make students learning 3D printing technology software and optimization of printing.

Course Outcomes

At the end of successful completion of the course the student will be able to

CO1: Understand the basics of 3D printing
CO2: Implement 3D printer hardware
CO3: Decide on the components required for 3D printer to work
CO4: Design 3D object and configure it using slicer
CO5: Know what are the features available with Commercial 3D printers

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to 3D printing**		**10**	**CO1**
	1.1	Types of 3D printers, Comparison of different 3D printers		
	1.2	Fused deposition modeling (FDM), Stereolithography (SLA)		
	1.3	Digital Light Processing (DLP), Selective Laser Sintering (SLS)		
	1.4	Selective laser melting (SLM), Laminated object manufacturing (LOM), Digital Beam Melting (EBM)		
2	**3D printer parts**		**10**	**CO2**
	2.1	Extruder, Printer bed, Hot-end		
	2.2	3D Printing Materials: PLA, ABS, PVA, Flexible		
	2.3	Printer assembly, Effects of different printer temperatures, Effects of different nozzles, Effects of different extrusion rates		
3	**Electronics in 3D printers**		**10**	**CO3**
	3.1	Driver boards, Arduino Mega, Power supply		
	3.2	Stepper motors and drivers, Heat bed and Sensors used with 3D printers		
4	**3D Printer software**		**10**	**CO4**
	4.1	Slicing software: Cura, Repetier, Slic3r, MakerBot Print		
	4.2	3D design software: AutoCAD, Solidworks, ThinkerCAD, FreeCAD, SketchUp		
	4.3	Basic G-code programming		
5	**Commercial 3D printers**		**05**	**CO5**
	5.1	Replicator, Ultimaker 3d printers and their types		
	5.2	Prusa i3 and other open-source RepRap printers, Anet Printers, Creality Printers, Delta Printer		
	5.3	Other 3D printers: Da Vinci, Flash forge etc.		
		Total	**45**	

Recommended Books:

Sr.	Name/s of Author/s	Title of Book	Name of Publisher	Edition and Year

No.			with country	of Publication
1.	Richard Horne, Kalani Kirk Hausman	*3D Printing For Dummies*	John Wiley & Sons, USA	1st Edition, 2017
2.	Anna Kaziunas France	*Make: 3D Printing: The Essential Guide to 3D Printers*	Maker Media, USA	1st Edition, 2013
3.	Richard Salinas	*3D Printing with RepRap Cookbook*	Packt Publishing, UK	1st Edition, 2014
4	Floyd Kelly	*3D Printing: Build Your Own 3D Printer and Print Your Own 3D Objects*	Que Publishing, UK	1st Edition, 2014
5	John M. Jordan	*3D Printing*	MIT press, USA	1st Edition, 2019

Course Code	Course Title			
116U06O523	Linear Algebra for Machine Learning			
	TH	P	TUT	Total
Teaching Scheme(Hrs.)	03	--	--	03
Credits Assigned	02	--	--	02

Examination Scheme	Marks							
	CA		ESE	TW	O	P	P&O	Total
	ISE	IA						
	30	20	--	--	--	--	--	50

Course prerequisites:
Mathematics

Course Objectives: This course aims to provide the perfect mathematical background required by an engineer to understand and develop basic and advanced level of machine learning algorithms. Linear algebra is mathematics of data.

Course Outcomes:
At the end of successful completion of the course the student will be able to
CO1: Understand vectors and software needed for implementation.
CO2: Perform matrix operations in linear algebra.
CO3: Understand matrix factorization.
CO4: Understand statistics and linear regression
CO5: Apply mathematical tools for solving real life problems.

Module No.	Unit No.	Details	Hrs.	CO
1	**Foundation for the course**			
	1.1	Introduction, Spatial Vectors, Vector Spaces	08	CO1
	1.2	Linear mapping, Inner product spaces		
	1.3	Introduction to software tool and setting up the environment for implementation		
2	**Algebra of Matrices**			
	2.1	Vector Norms, Matrix arithmetic and operations, Sparse matrix in machine learning, System of linear equations, Gauss Elimination, Gauss Seidel, Eigen values and eigen vectors	08	CO2
	2.2	Software implementation		
3	**Factorization**			
	3.1	Matrix Decomposition: Gram-Schmidt Orthogonalization, LU, QR, Cholesky, Eigen decomposition	12	CO3
	3.2	Singular Value Decompostion		
	3.3	Software implementation		
4	**Statistics**			
	4.1	Multivariate statistics: Mean, Variance, Covariance, correlation	10	CO4
	4.2	Principal Component Analysis, Linear regression and its variants		
	4.3	Software implementation		

5	**Application of Linear Algebra in Machine Learning**			
	5.1	Case studies based on images, linear regression, PCA, SVD and Deep learning	07	**CO5**
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Jason Brownlee	*Basics of Linear Algebra for Machine Learning: Discover the Mathematical Language of Data in Python*	Machine Learning Mastery	1st Edition, 2018
2.	Seymour Lipschutz	*Schaum's Outlines: Linear Algebra*	Mc Gram Hill Education	3rd Edition, 2001
3.	Marc Peter Deisenroth A. Aldo Faisal Cheng Soon Ong	*Mathematics for Machine Learning*	Cambridge University Press	1st Edition, 2019

Course Code	Course Title					
116U06O524	Sensor Technology and Applications in Automation					
	TH		P	TUT		Total
Teaching Scheme(Hrs.)	3		0	0		3
Credits Assigned	2		0	0		2
Examination Scheme	Marks					
	CA		ESE	TW	O	P&O	Total
	ISE	IA					
	30	20	--		--	--	50

Course prerequisites:
Nil

Course Objectives:
The objective of the course is to impart knowledge of different sensors used in an automated system.

Course Outcomes
At the end of successful completion of the course the student will be able to
CO1: Understand sensors used in different environments
CO2: Study sensors for distance measurement
CO3: Study sensors for chemical and agriculture applications
CO4: Study sensors for biological applications
CO5: Interfacing sensors for specific applications

Module No.	Unit No.	Details	Hrs.	CO
1	**Introduction to Environment, Sensing and Transduction**		**10**	**CO1**
	1.1	**Types of Environments :** Industrial, Agricultural, Space, Under-Water/Sea, Nuclear, Ambient-Environment		
	1.2	**Types of Sensors :** 0D, 1D, 2D, 3D, 4D Sensors , Active - Passive, Contact- Non-Contact, Wearable- Non-Wearable, Digital-Analog, Angular- Linear, Encoded- Incremental Sensors		
	1.3	**Sensor Specification :** Static, Dynamic, Characteristics, Types of Sealing , Packaging		
2	**Electrical / Electro-Mechanical Sensors and Transducers**		**12**	**CO2**
	2.1	**Displacement / Level Sensors :** Contact - non-contact type level sensors, capacitive level sensors, inductive level sensors, ultrasonic range sensors, radiation based level sensors, digital displacement sensors (X,Y,Z Axis), variable resistance sensors (angular, linear displacement)		
	2.2	**Optical / Light Sensor :** Optical displacement sensor, zone distance sensor, color sensors		
	2.3	**Flow Sensors / Transducers:** Hot-wire anemometers, differential-pressure low-meter, Doppler effect flow-meters, electro-magnetic flow-meter, transit-time delay flow-meter, specifications of flowmeters and interfacing		
	2.4	**Proximity / Limit Sensors :** Inductive and capacitive proximity sensors, photoelectric proximity switches, ultrasonic proximity switches, mechanical Limit switches , specifications of proximity switches, interfacing of proximity sensors		
	2.5	**Temperature Sensors :** RTD, thermocouple, thermistor, Non-contact temperature sensors, infra-red sensors		
3	**Environmental / Chemical / Agricultural Sensors / Transducers**		**07**	**CO3**
	3.1	Gas sensors, wind direction- velocity sensors, smoke detection / sensing, fire - heat detections		
	3.2	Soil moisture sensors, soil-micronutrients sensing, soil temperature sensors, soil-pH sensing, humidity sensors		
4	**Biological / Biomedical Sensors**		**08**	**CO4**
	4.1	**Body-Parameter Sensors:** Respiration rate, heart-rate, body-temperature, blood-flow sensors, body-perspiration sensors		

	4.2	**Other Parameter Sensors:** Alcohol sensor, glucose sensors		
	4.3	**System Introductions:** ECG-measurement, EMG-measurement , EEG-measurement, FMRI, MRI, NMR, Dialysis		
5	**Integrating Sensors and Processing Units for Industrial Automations**		**08**	**CO5**
	5.1	**Encoders applications**: encoder, types, selection, theory, wiring, applications, interfacing with controllers and PLC - HMI system, working on real models		
	5.2	Types of sensors in robots, external sensors (exterocepters), force/torque sensors, tactile sensors, proximity sensors, range sensors, machine vision sensors, velocity sensors, internal sensors (proprioceptors)		
	5.3	**Sensors in home automation**: Level sensor, movement sensor, temperature sensor, LDR (light dependent relay), gas and smoke detectors, parking sensors, door gate sensors, elevator sensors		
	5.5	**Advanced Sensing Technology:** Smart sensors, IoT based sensing, MEMS sensors		
		Total	**45**	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	Seung Bok Choi, Prasad Yarlagadda, Mohammad Abdullah-Al-Wadud	*Sensors, Mechatronics and applications*	Trans Tech Publications Ltd	1st edition 2013
2.	Jacob Fraden	*Handbook of Modern Sensors: Physics, Designs, and Applications*	Springer, USA	5th edition 2015
3.	Randy Frank	*Understanding Smart Sensors*	Artech House Publications	2nd edition 2000
4.	Krzystof Iniewski	*Smart Sensors for Industrial Applications*	CRC Press, UK	1st edition 2013