

HONOURS AND MINORS CURRICULUM

Honours in Embedded systems - Curriculum									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
VI	Honours	ECH4376	Google IT Automation with Python – I	2	0	2	3	0	3
VI	Honours	ECH4377	Google IT Automation with Python – II	2	0	2	3	0	3
VII	Honours	ECH4461	Embedded systems design verification and test	3	0	0	3	0	3
VII	Honours	ECH4462	Embedded software testing	3	0	0	3	0	3
TOTAL				10	0	4	12	0	12

L-Lecture T-Tutorial P-Practical C-Credit S-Self-study TCH-Total contact hours

Minors in Biomedical Engineering - Curriculum									
SEM	COURSE CATEGORY	COURSE CODE	NAME OF THE COURSE	L	T	P	C	S	TCH
VI	Minors	ECM4376	Basic Human Anatomy and Physiology	3	0	0	3	0	3
VI	Minors	ECM4377	Bio-Sensors and Signal Processing	3	0	0	3	0	3
VII	Minors	ECM4461	Biomedical Nanotechnology	3	0	0	3	0	3
TOTAL				9	0	0	9	0	9

L-Lecture T-Tutorial P-Practical C-Credit S-Self-study TCH-Total contact hours

Honours in Embedded systems

COURSE TITLE	GOOGLE IT AUTOMATION WITH PYTHON - I				CREDITS	3								
COURSE CODE	ECH4376	COURSE CATEGORY	Honours	L-T-P-S	2-0-2-0									
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3									
ASSESSMENT SCHEME														
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE									
15%	15%	10%	5%	5%	50%									
Course Description	This course covers the basic foundations to write simple programs in Python using the most common structures.													
Course Objective	<ol style="list-style-type: none"> 1. To familiarize the students with basic Python structures: strings, lists, and dictionaries 2. To write simple python scripts using the basic syntax 3. To develop simple problem statement and write program to solve them 4. To manage files and formulate regular expressions in Python 5. To write programs for simple real time problems 													
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Interpret the basic Python structures: strings, lists, and dictionaries 2. Write short Python scripts to perform automated actions and create Python objects 3. Solve simple problem statement using Python 4. Implement regular expressions (regex), and process text files 5. Develop a simple project by incorporating files, regex, and data manipulation 													
Prerequisites:														
CO, PO AND PSO MAPPING														
CO	PO -1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO -10	PO- 11	PO- 12	PSO- 1	PSO-2
CO-1	-	2	2	1	3	3	-	-	2	-	1	3	1	2
CO-2	-	2	1	2	3	3	-	2	2	2	2	3	1	3
CO-3	-	3	2	2	3	3	-	-	2	-	1	3	1	3
CO-4	-	1	2	2	3	3	-	-	2	-	1	3	1	2
CO-5	-	3	3	2	3	3	1	2	3	2	1	3	1	3
1: Weakly related, 2: Moderately related and 3: Strongly related														

MODULE 1: Basics of Python Programming		(9L)
Basic Python Syntax - Basic Python Syntax introduction - Data Types – Variables Expressions, Numbers, and Type Conversions - Defining Functions - Returning Values - The Principles of Code Reuse - Code Style - Comparing Things - Branching with if Statements - else Statements - elif Statements Loops - Introduction to Loops - What is a while loop? - More while Loop Examples - Why Initializing Variables Matters - Infinite Loops and How to Break Them - What is a for loop? - More for Loop Examples - Nested for Loops – Recursion		CO-1 BTL-3
MODULE 2: Strings, List and Dictionaries		(9L)
Strings, Lists and Dictionaries - Basic Structures Introduction - String - Parts of a String - Creating New Strings - More String Methods - Formatting Strings - List - Modifying the Contents of a List - Lists and Tuples - Iterating over Lists and Tuples - List Comprehensions - Dictionary - Iterating over the Contents of a Dictionary - Dictionaries vs. Lists		CO-2 BTL-3
MODULE 3: Object Oriented Programming		(9L)
Object-oriented programming - Classes and Objects in Python - Defining New Classes - Instance Methods - Constructors and Other Special Methods - Documenting Functions, Classes, and Methods - About Jupyter Notebooks – Inheritance – Composition - Python Modules		CO-3 BTL-3
MODULE 4: Files and Regular Expressions		(9L)
Managing Files with Python - Programming with Files - Reading Files - Iterating through Files - Writing Files - Working with Files - More File Information – Directories - CSV file - Reading CSV Files - Generating CSV - Reading and Writing CSV Files with Dictionaries Regular Expressions - Regular Expressions - Basic Matching with grep - Simple Matching in Python - Wildcards and Character Classes - Repetition Qualifiers - Escaping Characters - Regular Expressions in Action - Capturing Groups - More on Repetition Qualifiers - Extracting a PID Using regexes in Python - Splitting and Replacing		CO-4 BTL-3
MODULE 5: Data management and Testing		(9L)
Managing Data and Processes - Managing Data and Processes - Reading Data interactively - Standard Streams - Environment Variables - Command-Line Arguments and Exit Status - Running System Commands in Python - Obtaining the Output of a System Command - Advanced Subprocess Management - Filtering Log Files with Regular Expressions - Making Sense out of the Data Testing in Python - Testing in Python - Manual Testing and Automated Testing - Unit Tests - Writing Unit Tests in Python - Edge Cases - Additional Test Cases - Black Box vs. White Box - Other Test Types - Test-Driven Development - The Try-Except Construct - Raising Errors - Testing for Expected Errors		CO-5 BTL-3

Bash Scripting - Bash Scripting - Basic Linux Commands - Redirecting Streams - Pipes and Pipelines - Signalling Processes - Creating Bash Scripts - Using Variables and Globs - Conditional Execution in Bash - While Loops in Bash Scripts- For Loops in Bash Scripts - Advanced Command Interaction - Choosing Between Bash and Python	
TEXT BOOKS	
1.	Eric Matthes, (2019), <i>Python Crash Course, A Hands-On, Project-Based Introduction To Programming</i> , 2 nd edition, pp. 1-544.
2.	Mark Lutz, (2013), <i>Learning Python 5ed: Powerful Object-Oriented Programming</i> , 5 th edition, pp. 1-1600.
REFERENCE BOOKS	
1.	Paul Barry. (2016). <i>Head First Python 2e: A Brain-Friendly Guide</i> , 2nd Edition, pp.1-624.
2.	Allen Downey, Jeff Elkner and Chris Meyers. (2002), <i>How to Think Like a Computer Scientist Learning with Python</i> , Green tea press, 1 st edition, pp. 1-280
E BOOKS	
1.	https://greenteapress.com/thinkpython/thinkCSpy/thinkCSpy.pdf
MOOC	
1.	https://www.coursera.org/learn/python-operating-system?specialization=google-it-automation

COURSE TITLE	GOOGLE IT AUTOMATION WITH PYTHON - II										CREDITS	3		
COURSE CODE	ECH4377			COURSE CATEGORY			Honours			L-T-P-S	2-0-2-0			
Version	1.0			Approval Details						LEARNING LEVEL	BTL-3			
ASSESSMENT SCHEME														
First Periodical Assessment	Second Periodical Assessment			Seminar/ Assignments/ Project			Surprise Test / Quiz			Attendance	ESE			
15%	15%			10%			5%			5%	50%			
Course Description	This course introduces the Git and GitHub, the various troubleshooting and debugging techniques, how to carry out the configuration management for large-scale machines and to automate and manage cloud instances. In addition to it, it deals with automating real-world tasks with python.													
Course Objective	<ol style="list-style-type: none"> 1. To familiarize the students with the version control tool, use and interact with GitHub, collaborate with others through remote repositories. 2. To implement the appropriate strategies to solve real-world IT problems, by analysing the root cause of problems in IT infrastructure 3. To apply the automation techniques to manage fleet of computers 4. To use Application Programming Interfaces (APIs) to interact with web services 5. To implement data serialization to send messages between running programs 													
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Summarize the version control tool, use and interact with GitHub, collaborate with others through remote repositories. 2. Analyze real-world IT problems and implement the appropriate strategies to solve those problems, demonstrate techniques to quickly find and solve the root cause of problems in IT infrastructure 3. Apply automation to manage fleet of computers 4. Implement Python external libraries for real time tasks. 5. Interpret data serialization to send messages between running programs 													
Prerequisites: GOOGLE IT AUTOMATION WITH PYTHON - I														
CO, PO AND PSO MAPPING														
CO	PO -1	PO- 2	PO- 3	PO- 4	PO- 5	PO- 6	PO- 7	PO- 8	PO- 9	PO -10	PO- 11	PO- 12	PSO- 1	PSO-2

CO-1	-	2	3	1	3	3	-	2	2	-	-	3	1	2
CO-2	-	1	3	1	3	3	-	2	2	2	1	3	1	3
CO-3	-	2	3	2	3	3	-	2	2	-	-	3	1	3
CO-4	-	2	3	2	3	3	-	2	2	-	-	3	1	2
CO-5	-	2	3	2	3	3	1	2	3	2	1	3	1	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Introduction to Git and GitHub

(9L)

Introduction to Version Control - Version Control - Keeping Historical Copies - Diffing Files - Applying Changes - Practical Application of diff and patch - What is version control? - Version Control and Automation

Using Git locally - Using Git Locally - Skipping the Staging Area - Getting More Information About Our Changes - Deleting and Renaming Files - Undoing Changes Before Committing - Amending Commits – Rollbacks - Identifying a Commit - Creating New Branches - Working with Branches – Merging - Merge Conflicts

Working with Remotes - Working with Remotes - Basic Interaction with GitHub - Working with Remotes - Fetching New Changes - Updating the Local Repository - The Pull-Merge-Push Workflow - Pushing Remote Branches **Collaboration** – Collaboration - A Simple Pull Request on GitHub - The Typical Pull Request Workflow on GitHub - Updating an Existing Pull Request - Squashing Changes - The Code Review Workflow - How to Use Code Reviews in GitHub - Managing Collaboration - Tracking Issues - Continuous Integration

CO-1
BTL-3

MODULE 2: Troubleshooting and Debugging Techniques

(9L)

Troubleshooting concepts - Troubleshooting Concepts - Problem Solving Steps - Silently Crashing Application - Creating a Reproduction Case - Finding the Root Cause - Dealing with Intermittent Issues - Intermittently Failing Script - Binary search - Applying Binary Search in Troubleshooting - Finding Invalid Data

Slowness – Slowness – use of resources by computers - Possible Causes of Slowness - Slow Web Server - Writing Efficient Code - Using the Right Data Structures - Expensive Loops - Keeping Local Results - Slow Script with Expensive Loop - Parallelizing Operations - Slowly Growing in Complexity - Dealing with Complex Slow Systems - Using Threads to Make Things Go Faster

Crashing Programs - Crashing Programs - Systems That Crash - Understanding Crashing Applications - Internal Server Error - Accessing Invalid Memory - Unhandled Errors and Exceptions - Debugging a Segmentation Fault - Debugging a Python Crash - Crashes in Complex Systems - Communication and Documentation During Incidents

CO-2
BTL-3

Managing Resources - Managing Resources - Memory Leaks and How to Prevent Them - Managing Disk Space - Network Saturation - Dealing with Memory Leaks - Getting to the Important Tasks - Prioritizing Tasks - Estimating the Time Tasks Will Take - Communicating Expectations - Dealing with Hard Problems - Proactive Practices - Planning Future Resource Usage - Preventing Future Problems		
MODULE 3: Configuration Management and the Cloud		(9L)
Automating with Configuration Management - Automating with Configuration Management - The Driving Principles of Configuration Management Deploying Puppet - Deploying Puppet - Applying Rules Locally - Managing Resource Relationships - Organizing Your Puppet Modules - Puppet Nodes - Puppet's Certificate Infrastructure - Setting up Puppet Clients and Servers - Modifying and Testing Manifests - Safely Rolling out Changes and Validating Them Automation in the Cloud - Automation in the Cloud - Cloud Services Overview - Scaling in the Cloud - Evaluating the Cloud - Migrating to the Cloud - Spinning up VMs in the Cloud - Creating a New VM Using the GCP Web UI - Customizing VMs in GCP - Templating a Customized VM - Cloud Scale Deployments -Orchestration - Cloud Infrastructure as Code Managing Cloud Instances at Scale - Storing Data in the Cloud - Load Balancing - Change Management - Understanding Limitations - Getting Started with Monitoring - Getting Alerts When Things Go Wrong - Service-Level Objectives - Basic Monitoring in GCP - Recovering from Failure		CO-3 BTL-3
MODULE 4: Manipulating Images and Interacting with Web Services		(9L)
Built-In Libraries vs. External Libraries - API - PIL for Working with Images Web Applications and Services - Data Serialization - Data Serialization Formats - More About JSON - The Python Requests Library - Useful Operations for Python Requests - HTTP GET and POST Methods		CO-4 BTL-3
MODULE 5: Automating Real-World Tasks with Python		(9L)
Automatic Output Generation – Introduction - Introduction to Python Email Library - Adding Attachments - Sending the Email Through an SMTP Server - Introduction to Generating PDFs - Adding Tables to our PDFs - Adding Graphics to our PDFs		CO-5 BTL-3
TEXT BOOKS		
1.	Bobby Iliev (2020). <i>Introduction to Git and Github</i> 1 st Edition, pp.1-135.	
REFERENCE BOOKS		
1.	Paul Barry. (2016). <i>Head First Python 2e: A Brain-Friendly Guide</i> , 2nd Edition, pp.1-624.	
2.	Allen Downey, Jeff Elkner and Chris Meyers. (2002), <i>How to Think Like a Computer Scientist Learning with Python</i> , Green tea press, 1 st edition, pp. 1-280	
E BOOKS		

1.	https://github.com/bobbyiliev/introduction-to-git-and-github-ebook
MOOC	
1.	https://www.coursera.org/learn/configuration-management-cloud?=-
2.	https://www.coursera.org/learn/automating-real-world-tasks-python?specialization=google-it-automation
3.	https://www.coursera.org/learn/introduction-git-github

COURSE TITLE	EMBEDDED SYSTEMS DESIGN VERIFICATION AND TEST			CREDITS	3
COURSE CODE	ECH4461	COURSE CATEGORY	Honours	L-T-P-S	3-0-0-0
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description
This course will topics related to model, design, and implementation of structural representations of embedded systems. In addition to it, the systems are tested and the performance of the systems are also studied.

Course Objective

1. To familiarize the Embedded Systems Design Flow and its specifications
2. To perform Scheduling in Embedded Systems
3. To carry out verification of real time embedded systems using software tools
4. To explain the basic of digital testing and also the testing of embedded system hardware
5. To comprehend the testing for advanced faults in Real time Embedded Systems.

Course Outcome

Upon completion of this course, the students will be able to

1. Describe the Embedded Systems Design Flow and its specifications along with the hardware-software co-design.
2. Enumerate the various Scheduling in Embedded Systems.
3. Verify real time embedded systems using software tools.
4. Elucidate the basic of digital testing and the testing of embedded system hardware.
5. Interpret the testing for advanced faults in Real time Embedded Systems.

Prerequisites: Digital Design and Computer Architecture

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	-	-	-	-	-	-	1	-	2	2	3
CO-2	2	2	-	3	-	1	-	-	-	-	-	2	2	3
CO-3	2	3	1	3	2	2	2	1	-	-	1	2	2	3
CO-4	2	2	3	-	2	-	2	-	-	-	-	2	2	3

CO-5	2	3	2	2	2	2	1	1	1	-	1	2	2	3
1: Weakly related, 2: Moderately related and 3: Strongly related														
MODULE 1: Introduction, Modeling, Hardware-Software Co-Design Principles and Details of Hardware Design (9L)														
Introduction to Embedded Systems Design Flow, Formal specification and Modeling Strategies -I , Formal specification and Modeling Strategies – II, Hardware Software Co-Design , Architectural Design of Hardware - I , Architectural Design of Hardware – II													CO-1	BTL-3
MODULE 2: Introduction To Scheduling In Embedded Systems (9L)														
System and Task level Timing Analysis, Uni-processor Real-time Scheduling, Multiprocessor Real-time Scheduling, Resource Allocation Strategies in Automotive Systems, Energy-aware and Fault-tolerant Real-time Scheduling													CO-2	BTL-3
MODULE 3: Introduction to Formal Verification and System Verification for Embedded System (9L)														
Introduction and Basic Operations on Temporal Logic, Syntax and Semantics of CTL, Equivalence between CTL Formulas , Model Checking Algorithm , Software Verification , Verification of real time systems hardware													CO-3	BTL-3
MODULE 4: Testing : Introduction to Digital Testing and Embedded System Hardware Testing (9L)														
Introduction to Digital VLSI Testing , Automatic Test Pattern Generation (ATPG), Scan Chain based Sequential Circuit Testing, Software-Hardware Co-validation Fault Models and High Level Testing for Complex Embedded Systems ,Testing for embedded cores ,Bus and Memory Testing													CO-4	BTL-3
MODULE 5: Testing : Advances in Embedded System Hardware Testing and Testing for Embedded Software Systems (9L)														
Testing for advanced faults in Real time Embedded Systems , BIST for Embedded Systems, Concurrent Testing for Fault tolerant Embedded Systems, Interaction Testing between Hardware and Software , Software testing for Reconfigurable hardware													CO-5	BTL-3
TEXT BOOKS														
1.	Bushnell and Agrawal, (2005), <i>Essentials of Electronic Testing for Digital, Memory & Mixed-Signal Circuits</i> , Kluwer Academic Publishers, pp. 1-690.													
REFERENCE BOOKS														
1.	S. R Sabapathi, (2017) <i>Test engineering for Electronics Hardware-</i> Qmax Publications, 1st Edition, pp. 1-94													
2.	M. Huth and M. Ryan,(2004), <i>Logic in Computer Science modeling and reasoning about systems</i> , Cambridge University Press, 2 nd Edition, pp.1-443													
3.	Peter Marwedel, P. Marwedel, (2011), <i>Embedded System Design</i> , Springer, pp. 1-237													
MOOC														
1.	https://nptel.ac.in/courses/106/103/106103182/													

COURSE TITLE	EMBEDDED SOFTWARE TESTING			CREDITS	3
COURSE CODE	ECH4462	COURSE CATEGORY	Honours	L-T-P-S	3-0-0-0
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description
The course covers the fundamentals of Embedded software testing and life cycle. It also covers about dynamic, model based and coverage testing. The test management and testing for real-time cases is also studied.

- Course Objective**
1. To study the concepts of Testing and the Software testing life cycle.
 2. To learn the dynamic Testing tools.
 3. To familiarize with the Code Reviews and Static analysis tools.
 4. To learn the techniques of Software Integration
 5. To study the concept of Configuration Management.

- Course Outcome**
- Upon completion of this course, the students will be able to
1. Summarize the concepts related to embedded software testing.
 2. Enumerate Embedded software test life cycle, V-model and comprehend the different types of testing methods
 3. Elucidate static analysis and metrics in software testing
 4. Interpret top-down, bottom-up integration and testing from use cases
 5. List the steps involved in test management and configuration management

Prerequisites:

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO-1	PSO-2
CO-1	3	-	2	-	3	-	-	1	-	1	-	1	2	3
CO-2	3	-	2	-	3	-	-	1	-	2	-	2	2	3
CO-3	3	1	2	1	3	1	-	1	-	-	-	2	2	3
CO-4	3	-	2	2	3	-	-	1	-	-	-	2	2	3
CO-5	3	-	2	-	3	-	-	1	1	-	2	2	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: FUNDAMENTALS OF EMBEDDED SOFTWARE TESTING (9L)	
Introduction, Concepts of Testing, TEmb method, Test cases and test procedures, Principles of embedded software testing, creating a test harness, Commercial test tools. Software testing life cycle: multiple V-model, nested multiple V-model, master test planning, activities, testing by developers, testing by independent test team	CO-1 BTL-3
MODULE 2: TESTING METHODS (9L)	
Dynamic Testing: Structured basis testing, Equivalence Partitions, Boundary Value Analysis, Problems with polymorphic code, Model-Based Testing: Synthesis- versus Analysis models, Generating tests from state diagrams Coverage Testing: White-box, grey and black box tests, Coverage measures – Statement, Branch, Condition, Path and others, Coverage testing tools	CO-2 BTL-3
MODULE 3: STATIC ANALYSIS AND CODE REVIEWS (9L)	
Code Reviews: Benefits of reviews, Review process, Checklists Static Analysis: Static analysis concepts, the use of the compiler for static analysis, Static analysis tools, coding standards Metrics: need for metrics, Using metrics to manage and control testing, Metrics for test	CO-3 BTL-3
MODULE 4: SOFTWARE INTEGRATION (9L)	
Software Integration: Importance of planning your integration, Top-down vs Bottom-up Integration, Practical integration models Testing from Use Cases: Introduction to use cases, calculating test cases, Structured Basis testing for use cases, Generating test cases from use cases Regression Testing: Purpose of regression tests, the build process	CO-4 BTL-3
MODULE 5: Test management (9L)	
Configuration Management: Configuration items, Version control, Change Management, CM tools Test Management: The test process, how the test process relates to the software V-model, “Design by contract”, Test-driven development, agile development processes	CO-5 BTL-3
TEXT BOOKS	
1.	Paul Ammann, Jeff Offutt, (2008), <i>Introduction To Software Testing</i> , Cambridge University Press, 1 st edition, pp. 1-326
MOOC	
1.	https://nptel.ac.in/courses/117/106/117106112/

Minors in Biomedical Engineering

COURSE TITLE	BASIC HUMAN ANATOMY AND PHYSIOLOGY					CREDITS	3					
COURSE CODE	ECM4376	COURSE CATEGORY			Minors	L-T-P-S	3-0-0-0					
Version	1.0	Approval Details				LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME												
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project			Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%			5%	5%	50%					
Course Description	This course describes the basic understanding of the various parts of the human body, their anatomical position and their functions											
Course Objective	<ol style="list-style-type: none"> 1. To know about the Functional organization of human body Cell and Blood Composition & Functions of blood. 2. To learn about ECG and its importance. Structure of heart and Neurons . 3. To learn about the Respiratory System and structure of the skeleton . 4. To study about the digestive and excretory system . 5. To learn about the Physiology of ear and eyes and endocrine Glands 											
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Relate basic human body functions and life processes 2. Enumerate the major components of cardiac and nervous system and describe briefly their physiological functions 3. Elucidate the major components of respiratory and muscular system and describe briefly their physiological functions 4. Identify the major components of digestive and excretory system and describe briefly their anatomical locations, structures and their physiological functions 5. Describe the functions of eye, ear, and endocrine glands . 											
Prerequisites: NIL												
CO, PO AND PSO MAPPING												
CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12
CO-1	2	-	-	-	-	1	-	-	-	-	-	2
CO-2	2	-	-	2	-	1	-	-	-	2	-	2

CO-3	2	-	-	2	-	1	-	-	-	1	1	2
CO-4	2	-	-	-	-	1	-	-	-	-	-	2
CO-5	2	-	-	2	-	1	-	-	-	1	1	2
1: Weakly related, 2: Moderately related and 3: Strongly related												
MODULE 1: CELL												(9L)
Structure of Cell – Organelles and description – Function of each component of the cell – Membrane potential –Action Potential – Generation and Conduction – Electrical Stimulation. Blood Cell – Composition – Origin of RBC – Blood Groups – Estimation of RBC, WBC and Platelet.												CO-1 BTL-2
MODULE 2: CARDIAC AND NERVOUS SYSTEM												(9L)
Heart, Major blood vessels – Cardiac Cycle – ECG – Blood Pressure – Feedback Control for Blood Pressure –Nervous Control of Heart - Cardiac output – Coronary and Peripheral Circulation – Structure and function of Nervous tissue – Neuron - Synapse - Reflexes - Receptors -Brain -Brainstem -Spinal cord – Reflex action – Velocity of Conduction of Nerve Impulses - Electro Encephalograph – Autonomic Nervous System.												CO-2 BTL-3
MODULE 3: RESPIRATORY SYSTEM AND MUSCULAR SKELETAL SYSTEM												(9L)
Physiological aspects of respiration – Trachea and lungs - Exchange of gases – Regulation of Respiration - Disturbance of respiration function - Pulmonary function test - Muscles - tissue - types - structure of skeletal muscle - types of muscle and joints.												CO-3 BTL-3
MODULE 4: DIGESTIVE AND EXCRETORY SYSTEM												(9L)
Organisation of GI System, Digestion and absorption – Movements of GI tract – Intestine - Liver - Pancreas - Structure of Nephron – Mechanism of Urine formation – Urine Reflex – Skin and Sweat Gland – Temperature regulation.												CO-4 BTL-3
MODULE 5: EYE, EAR, ENDOCRINE GLANDS												(9L)
Optics of Eye – Retina – Photochemistry of Vision – Accommodation - Neurophysiology of vision – EOG.Physiology of internal ear – Mechanism of Hearing – Auditory Pathway, Hearing Tests - Endocrine glands.												CO-5 BTL-3
TEXT BOOKS												
1.	H. S. Ravi Kumar Patil, H. K. Makari, H. Gurumurthy, S. V. Sowmya (2013), <i>Text Book of Human Physiology</i> I K International Publishing House Pvt. Ltd, pp. 1 – 224.											
2.	Ranganathan, T.S. (2000), <i>Text Book of Human Anatomy</i> , S.Chand &Co. Ltd., Delhi, pp. 1- 796.											
REFERENCE BOOKS												

1.	Roberto Osti., (2016), <i>Basic Human Anatomy</i> , The Monacelli Press, LLC, Delhi, pp. 1-304
2.	Arthur.C.Guyton, John E Hall (2000), <i>Textbook of Medical Physiology</i> , W.B. Saunders Company, 10 th edition, pp. 1-1064.
E BOOKS	
1.	https://cleowilson.com/download-medical-books-human-anatomy-9th-edition-pdf/
MOOC	
1.	https://www.coursera.org › ... › Health › Basic Science
2.	https://oli.cmu.edu › courses › anatomy-physiology-i-ii...

COURSE TITLE	BIO- SENSORS AND SIGNAL PROCESSING						CREDITS	3				
COURSE CODE	ECM4377	COURSE CATEGORY			Minors	L-T-P-S	3-0-0-0					
VERSION	1.0	Approval details				LEARNING LEVEL	BTL-3					
ASSESSMENT SCHEME												
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project			Surprise Test / Quiz	Attendance	ESE					
15%	15%	10%			5%	5%	50%					
Course Description	The course introduces mathematical concepts of Signal Processing in time domain and frequency domain. The course covers the basic types of digital signals & systems through mathematical description and block-diagram system approach. It describes the different types of biosensors applied to different biomedical fields and measurement of various parameters, Biosensing Technology and its applications.											
Course Objective	<ol style="list-style-type: none"> 1. To understand the DFT and its computation 2. To design and analyse the FIR filters 3. To Analyze and design IIR digital filters. 4. To Identify and analyse the bio-signals. 5. To Understand special techniques like Heart rate variability Analysis 											
Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Compute DFT for biosignals 2. Design IIR digital filters using impulse invariance and bilinear transform 3. Design FIR digital filters using frequency sampling and window techniques 4. Analyse various bio signals 5. Summarize the special techniques like Heart rate variability Analysis 											
Prerequisites: SIGNAL PROCESSING												
CO, PO AND PSO MAPPING												
CO	PO 1	PO-2	PO-3	PO -4	PO -5	PO-6	PO -7	PO-8	PO-9	PO 10	PO11	PO-12
CO-1	3	2	2	1	-	-	-	-	-	1	-	1

CO-2	3	2	3	2	2	-	-	-	-	-	-	1
CO-3	3	2	2	1	2	1	-	-	-	-	-	1
CO-4	-	-	1	-	1	2	-	-	-	1	-	1
CO-5	1	1	1	1	1	1	-	-	-	1	-	1
1: Weakly related, 2: Moderately related and 3: Strongly related												
MODULE 1: TIME SIGNALS AND SYSTEMS												(9L)
Sampling of Analogue signals – aliasing – standard discrete time signals – classification – discrete time systems – Linear time invariant stable casual discrete time systems – classification methods – linear and circular convolution – difference equation representation – DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms.											CO-1 BTL-3	
MODULE 2: INFINITE IMPULSE RESPONSE DIGITAL FILTER												(9L)
Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – pre warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.											CO-2 BTL-3	
MODULE 3: FINITE IMPULSE RESPONSE DIGITAL FILTERS												(9L)
Symmetric and Antisymmetric FIR filters – Linear phase FIR filters – Design using Frequency sampling technique – Window design using Hamming, Hanning and Blackmann Windows – Concept of optimum equiripple approximation – Realisation of FIR filters – Transversal, Linear phase and Polyphase realization structures.											CO-3 BTL-3	
MODULE 4: ANALYSIS OF BIO –SIGNALS												(9L)
Removal of artifacts-ECG ,Event detection –ECG,P wave, QRS Complex, T wave, correlation analysis of ECG signals ,Averaging of signals-PCG,ECG and EMG.											CO-4 BTL-3	
MODULE 5: SPECIAL TOPICS IN BSP												(9L)
Heart rate variability Analysis .Analysis of PCG signals, Analysis of Time variant systems, Fixed segmentation –STFT, ACF, SEM and GLR.											CO-5 BTL-3	
TEXT BOOKS												

1.	John G. Proakis and Dimitris G.Manolakis, (2007), <i>Digital Signal Processing, Algorithms and Applications</i> , PHI of India Ltd., New Delhi, 3rd Edition, pp. 1-1084.
2.	Sanjit K.Mitra (2010), <i>Digital Signal Processing, A Computer Based Approach</i> , Tata McGraw-Hill, New Delhi, 4 th edition, pp. 1- 992.
E BOOKS	
1.	https://www.academia.edu/28449859/J_G_Proakis_D_G_Manolakis_Digital_signal_processing_Principles_algorithms_and_applications_pdf
MOOC	
1.	https://uttyler.instructure.com/courses/22295

COURSE TITLE	BIOMEDICAL NANOTECHNOLOGY			CREDITS	3
COURSE CODE	ECM4461	COURSE CATEGORY	Minors	L-T-P-S	3-0-0-0
Version	1.0	Approval Details		LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course describes the application of Nanotechnology in Biomedical domain.
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Course Objective	<ol style="list-style-type: none"> 1. To familiarize about Nanomaterials 2. To get a deep insight about Nanotechnology 3. To learn about the various applications of nanomaterials in treatment. 4. To familiarize with Nanotechnology, Nanopharmacology, nanomaterials and Nanotoxicology 5. To summarize the various application in bionanotechnology
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Course Outcome	<p>Upon completion of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. Summarize about the nanomaterials. 2. Familiarize with the different nanotechnologies. 3. Elucidate the applications of nanomaterials and nanotechnology. 4. Interpret the need for nanotechnology in present day patient care. 5. Describe the applications of nanobiotechnology in various health domains
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Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	P O-4	P O-5	P O-6	P O-7	PO-8	PO-9	PO-10	PO-11	PO-12
CO-1	3	-	1	-	-	1	-	-	-	1	-	2
CO-2	3	-	1	-	3	1	1	-	-	2	-	2
CO-3	3	2	1	-	-	1	-	-	-	-	-	2
CO-4	3	-	1	-	2	1	2	-	-	-	-	2
CO-5	3	-	1	-	3	1	2	-	-	1	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: INTRODUCTION TO NANOMATERIALS (9L)	
Introduction to nano, Nano-biomimicry, Synthesis of nanomaterials by physical and chemical methods, Synthesis of nanomaterials by biological methods, Characterization of nanomaterials	CO-1 BTL-3
MODULE 2: INTRODUCTION TO NANOTECHNOLOGY AND CARBON NANOTUBES (9L)	
DNA nanotechnology, Protein & glycol nanotechnology, Lipid nanotechnology, Bio-nanomachines, Carbon nanotube and its bio-applications	CO-2 BTL-3
MODULE 3: NANOTECHNOLOGY IN DIAGNOSIS (9L)	
Nanomaterials for cancer diagnosis, Nanomaterials for cancer therapy, Nanotechnology in tissue engineering, Nano artificial cells, Nanotechnology in organ printing.	CO-3 BTL-3
MODULE 4: NANOMATERIALS (9L)	
Nanotechnology in point-of-care diagnostics, Nanopharmacology & drug targeting, Cellular uptake mechanisms of nanomaterials, In vitro methods to study antibacterial and anticancer properties of nanomaterials, Nanotoxicology	CO-4 BTL-3
MODULE 5: BIONANOTECHNOLOGY (9L)	
Development of nanobiotechnology - timelines and progress, overview - Biosensors ; different classes - molecular recognition elements, transducing elements. - Applications of molecular recognition elements in nanosensing of different analytes - Application of various transducing elements as part of nanobiosensors. - Miniaturized devices in nanobiotechnology	CO-5 BTL-3
TEXT BOOKS	
1.	Malsch N.H., (2005), <i>Biomedical Nanotechnology</i> , CRC Press. Pp. 1 -209
REFERENCE BOOKS	
1.	Mirkin, C.A. and Niemeyer, C.M., (2007), <i>Nanobiotechnology II: More Concepts and Applications</i> , Wiley-VCH. Pp.
2.	Kumar, C. S. S. R., Hormes, J. and Leuschner C., <i>Nanofabrication Towards Biomedical Applications: Techniques, Tools, Applications, and Impact</i> , WILEY - VCH Verlag GmbH & Co. pp. 1-460.
3.	Lamprecht, A., (2009) <i>Nanotherapeutics: Drug Delivery Concepts in Nanoscience</i> , Pan Stanford Publishing Pte. Ltd. Pp.1 -293.
MOOC	
1.	https://nptel.ac.in/courses/102/107/102107058/