



**KPR Institute of  
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MAR 2022 - MAR 2023

INDIA

# **V Semester – Open Electives Syllabi**

## **B.E. / B.Tech. Programme Regulations – 2021(Revised)**



**REGULATIONS – 2021 (Revised)**  
**B.E. / B.Tech. Programme**  
**V SEMESTER – OPEN ELECTIVES**  
**SYLLABI**

SL. NO.	COURSE CODE	COURSE TITLE
<b>DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE</b>		
1.	U21ADX03	Artificial Intelligence: Principles and Techniques
2.	U21ADX04	Ethics and Data Science
<b>DEPARTMENT OF BIOMEDICAL ENGINEERING</b>		
1.	U21BMX03	Biomedical Visualization
2.	U21BMX04	Food as Medicine
<b>DEPARTMENT OF CHEMICAL ENGINEERING</b>		
1.	U21CHX03	Environmental Impact Assessment
2.	U21CHX04	Industrial Wastewater Treatment
<b>DEPARTMENT OF CIVIL ENGINEERING</b>		
1.	U21CEX03	Remote Sensing and GIS
2.	U21CEX04	Waste Management
<b>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</b>		
1.	U21CSX03	Computational Thinking
2.	U21CSX04	Blockchain Fundamentals
<b>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AI&amp;ML)</b>		
1.	U21AMX02	AI fundamentals
2.	U21AMX03	Joy of Programming
<b>DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS</b>		
1.	U21CBX03	IT for Managers
2.	U21CBX04	Security Analysis and Portfolio Management
<b>DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING</b>		
1.	U21ECX03	Arduino Programming
2.	U21ECX04	Electronic Waste Management and Sustainable Practices

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING		
1.	U21EEX03	Energy Technology
2.	U21EEX04	Home Automation
DEPARTMENT OF INFORMATION TECHNOLOGY		
1.	U21ITX03	Digital transformation
2.	U21ITX04	Human resource Management
DEPARTMENT OF MECHANICAL ENGINEERING		
1.	U21MEX03	Industrial Safety
2.	U21MEX04	Additive Manufacturing and 3D printing
DEPARTMENT OF MECHATRONICS ENGINEERING		
1.	U21MIX03	MEMS & NEMS
2.	U21MIX04	Robotics process Automation
SCIENCE & HUMANITIES		
1.	U21MAX01	Mathematical Modelling and Simulation
CENTRE FOR INNOVATION, INCUBATION AND ENTREPRENEURSHIP DEVELOPMENT		
1.	U21CAX01	Entrepreneurship Development and Startup
2.	U21CAX03	Entrepreneurship Development
GENERAL ENGINEERING		
1.	U21GEX03	Indian Folklore, Stage and Drama
2.	U21GEX04	Indian Food, Agriculture and Architecture



## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

## SEMESTER V

U21ADX03	ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES	Category: OEC				
		L	T	P	E	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- CO1: Formulate a problem and build intelligent agents (Understand)
- CO2: Apply appropriate searching techniques to solve a real-world problem (Apply)
- CO3: Understand the problem and infer new knowledge using suitable knowledge representation schemes (Understand)
- CO4: Explain planning and apply learning algorithms on real world problems (Understand)
- CO5: Understand the advance techniques in Artificial Intelligence (Understand)

## CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	-	-	-	-	-	-	1		
CO2	3	2	2	1	2	-	-	-	-	-	-	1		
CO3	3	2	2	1	2	-	-	-	-	-	-	1		
CO4	3	2	2	1	3	-	-	-	-	-	-	1		
CO5	3	2	2	1	3	-	-	-	-	-	-	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

## SYLLABUS:

## UNIT I INTRODUCTION

9

Introduction – Future of Artificial Intelligence – Characteristics of Intelligent Agents – Structure of Agents – Problem Solving Agents – Search Strategies: Uninformed – Informed

## UNIT II PROBLEM SOLVING METHODS

9

Local Search Algorithms and Optimization Problems – Searching with Nondeterministic Actions – Searching with Partial Observations – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games.



**UNIT III REPRESENTATION OF KNOWLEDGE**

9

First Order Logic – Syntax and Semantics of First-Order Logic – Unification and Lifting – Forward Chaining – Backward Chaining – Knowledge Representation: Ontological Engineering – Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories – Reasoning with Default Information.

**UNIT IV PLANNING**

9

Planning: Definition of Classical Planning – Algorithms for Planning as State-Space Search – Planning Graphs – Planning and Acting in the Real World: Time, Schedules, and Resources – Hierarchical Planning – Planning and Acting in Nondeterministic Domains – Multiagent Planning.

**UNIT V APPLICATIONS**

9

AI applications: Natural Language Processing – Robot – Perception.

**Contact Periods:**

Lecture: 45 Periods    Tutorial: – Periods    Practical: – Periods    Project: 1 Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, 4<sup>th</sup> Edition, 2020.

**REFERENCES:**

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc., 1<sup>st</sup> Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", 5<sup>th</sup> Edition, Springer, 2003.

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
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## SEMESTER V

U21ADX04	ETHICS AND DATA SCIENCE	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To understand the importance of Ethics in Data Science
- To learn the principles of Data Ethics
- To learn Ethical Practices in Data Science

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Describe professional ethics in Data Science (Understand)

CO2: Infer the norms promote the aims of research, such as knowledge, truth, and avoidance of error (Understand)

CO3: Illustrate the security and usability of data (Understand)

CO4: Utilize the evaluating models for bias and fairness (Understand)

CO5: Describe to secure the privacy, availability and integrity of data (Understand)

## CO-PO MAPPING:

POs \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	3	-	-	-	1		
CO2	3	2	2	1	2	-	-	3	-	-	-	1		
CO3	3	2	2	1	2	-	-	2	-	-	-	1		
CO4	3	2	2	1	2	-	-	2	-	-	-	1		
CO5	3	2	2	1	2	-	-	3	-	-	-	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

## SYLLABUS:

**UNIT I INTRODUCTION AND PHILOSOPHICAL FRAMEWORKS FOR ASSESSING FAIRNESS 9**

Foundations of ethics – Early theories of fairness (Utilitarianism etc.) – Contemporary theories of fairness – Significance of ethics in data science – Ethics vs. law/compliance/public relations – Cultural relativism – “Professional” ethics in data science – Individuals vs. collectives.

**UNIT II RESEARCH ETHICS 9**

Data driven research – Methods of collection of data – Different types of data – Qualitative and quantitative – Overview of ethical issues in data-driven organizations – Doing ethical data analysis – Responsible use of research data – Plagiarism – Fake data and fabrication of data – Creation of data base.



**UNIT III DATA OWNERSHIP, PRIVACY AND ANONYMITY**

Understanding the difference between data ownership – Data privacy and data anonymity –  
 Understanding the idea behind data surveillance – Data privacy vs. data security.

**UNIT IV ALGORITHMIC FAIRNESS**

Discrimination and algorithms – Obscure and un-intentional bias displayed by the algorithms – Ethics  
 of data scraping and storage – Mosaic data – Found data – Designed data.

**UNIT V POLICIES ON DATA PROTECTION**

EU's general data protection rules (GDPR) – Digital India policy – Personal data protection bill –  
 2019 ("PDP Bill") – Ethical issues on data privacy in context with India, case studies.

**Contact Periods:**

Lecture: 45 Periods    Tutorial: – Periods    Practical: – Periods    Project: – Periods  
 Total: 45 Periods

**TEXT BOOKS:**

1. DJ Patil, Hilary Mason, and Mike Loukides "Ethics and Data Science", 1<sup>st</sup> Edition, O'Reilly Media Inc, 2018.
2. Michael J. Quinn "Ethics for the Information Age", 7<sup>th</sup> Edition, Pearson, 2016.


**REFERENCES:**

1. Kord Davis, "Ethics of Big Data: Balancing Risk and Innovation", 1<sup>st</sup> Edition, O'Reilly Media Inc, 2012.
2. Bill Franks, "97 Things About Ethics Everyone in Data Science Should Know", O'Reilly Media Inc, 2020.

**EVALUATION PATTERN:**

EVALUATION PATTERN:					End Semester Examinations
Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
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U21BMX03	BIOMEDICAL VISUALIZATION	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To understand fundamental concepts of biomedical visualization
- To explain principles, image interpretation and visualization techniques of biomedical data
- To illustrate the significance and advancements of biomedical visualization in the field of health and medicine

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

**CO1:** Understand the principles, scope and different techniques in biomedical visualization (Understand)

**CO2:** Infer the principles and interpret images from various medical imaging modalities (Understand)

**CO3:** Execute visualization techniques for biomedical data (Apply)

**CO4:** Implement interactive visualizations in the field of biomedicine (Apply)

**CO5:** Explain advancements in biomedical visualization (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-		
CO2	3	-	-	-	-	-	-	-	-	-	-	-		
CO3	3	3	2	1	-	-	-	-	-	-	-	-		
CO4	3	3	2	1	-	-	-	-	-	-	-	-		
CO5	3	-	-	-	-	-	-	1	-	-	-	-		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION TO BIOMEDICAL VISUALIZATION 9**

Definition and scope – 2D and 3D visualizations – Static and dynamic visualizations – Spatial and temporal visualizations – Interactive and immersive visualizations

**UNIT II FUNDAMENTALS OF MEDICAL IMAGING 9**

Principles and image interpretation of: X-ray – Magnetic Resonance Imaging – Computed Tomography scanning – Ultrasound imaging – Nuclear medicine imaging

**UNIT III VISUALIZATION TECHNIQUES FOR BIOMEDICAL DATA 9**

Exploratory Data Analysis (EDA) – Data preprocessing – Distribution analysis – Histogram visualization – Scatter plots – Correlation visualization

**UNIT IV INTERACTIVE VISUALIZATION IN BIOMEDICINE**

9

Human-computer interaction principles – Iterative development processes – Brushing – Linking – Interactive filtering – Query based exploration – Zooming – Panning – Case studies

**UNIT V ADVANCEMENTS IN BIOMEDICAL VISUALIZATION**

9

Virtual reality for preoperative planning and intraoperative guidance – Haptic feedback and tactile interactions in virtual environments – Super resolution microscopy – Ethical considerations in data visualization

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. João Manuel R. S. Tavares, Christoph Bourauel, Liesbet Geris, Jos Vander Slot, "Computer Methods, Imaging and Visualization in Biomechanics and Biomedical Engineering II", Springer, 1<sup>st</sup> edition, 2022
2. Diego Gallo, Giuseppe Izu, Diana Massai (auth.), Rui Lima, Yohsuke Imai, Takuji Ishikawa, Mónica S. N. Oliveira, "Visualization and Simulation of Complex Flows in Biomedical Engineering", Springer, 1<sup>st</sup> edition, 2014

**REFERENCES:**

1. Charles D. Hansen, Min Chen, Christopher R. Johnson, Arie E. Kaufman, Hans Hagen (eds.), "Scientific Visualization: Uncertainty, Multifield, Biomedical, and Scalable Visualization", Springer, 1<sup>st</sup> edition, 2014

**EVALUATION PATTERN:**

EVALUATION PATTERN:					End Semester Examinations
Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60		
Total				40	
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

  
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## SEMESTER V

U21BMX04	FOOD AS MEDICINE	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To understand fundamental concepts of nutrients in foods
- To explain healthy eating and lifestyle habits
- To illustrate the role of food in promoting health and preventing disease, including dietary patterns and gut-brain connection

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Recall the fundamental concepts related to nutrients in foods (Remember)

CO2: Explain the key concepts related to healthy eating and lifestyle habits (Understand)

CO3: Illustrate role of medicinal herbs and spices in promoting health and preventing disease (Understand)

CO4: Interpret a dietary pattern based on the requirement of the individuals (Apply)

CO5: Summarize the connection between the gut and the brain, and how this relationship can impact mental and physical health (Understand)

## CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	-	-	-	-	2		
CO2	-	-	-	-	-	1	2	-	-	-	-	2		
CO3	-	-	-	-	-	1	2	-	-	-	-	2		
CO4	-	-	-	-	-	1	2	-	-	-	-	2		
CO5	-	-	-	-	-	1	2	-	-	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

## SYLLABUS:

## UNIT I NUTRIENTS AND HEALTH

9

Introduction — Nutrients in Foods and their sources — Pre- & Pro-biotics, Phytochemicals and Antioxidants in Foods — Metabolism

## UNIT II HABITS FOR HEALTH

9

Body Mass Index — Benefits of Breakfast — Water — Guidelines for calorie intake — Strategies for healthy digestion — Balancing blood sugar

## UNIT III MEDICINAL VALUES OF FOOD

9

Medicinal herbs and spices — Importance of Dairy foods — Plant and Animal foods — Food to limit and avoid



**UNIT IV DIET AND CHRONIC DISEASES**

The FAME plate – Dietary patterns to manage: cardiovascular diseases – diabetes – cancer – Malnutrition and obesity

**UNIT V FOOD AND THE BRAIN**

Food for seasons – Sustainable and Equitable food systems – Gut – Brain Connection – Addiction – Mindful Eating Technique – Culinary therapy

**Contact Periods:**

Lecture: 45 Periods

Tutorial: – Periods

Practical: – Periods

Project: – Periods

Total: 45 Periods

**TEXT BOOKS:**

1. Julie Briley, ND & Courtney Jackson, ND, "Food As Medicine Everyday", NUNM Press, 2016
2. Daine Kraft, "The A-Z Guide to Food as Medicine" 2<sup>nd</sup> Edition, CRC Press, 2016


**REFERENCES:**

1. Kathleen Hefferon, "Let Thy Food Be Thy Medicine: Plants and Modern Medicine", Oxford University Press, Inc., 2012

**EVALUATION PATTERN:**

EVALUATION PATTERN:					
Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60		
Total					
				40	
				100	

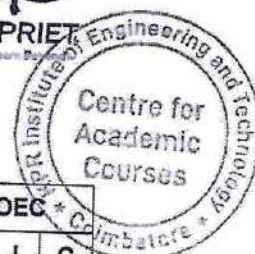
\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

  
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## DEPARTMENT OF CHEMICAL ENGINEERING

## SEMESTER V



U21CHX03	ENVIRONMENTAL IMPACT ASSESSMENT	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To impart the knowledge and skills to identify, assess and mitigate the environmental impacts
- To provide the knowledge of social impacts on development projects
- To know about the importance of environmental impact assessment

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

CO1: Explain the concept of environmental impact assessment (Understand)

CO2: Gain knowledge on various components and assessment techniques of EIA (Understand)

CO3: Understand environmental management plan (Understand)

CO4: Elaborate socioeconomic assessment plans (Understand)

CO5: Apply the knowledge of EIA monitoring through various industrial exposure (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	1	2	1	-	-	-	1		
CO2	1	2	-	-	-	1	2	1	-	-	-	1		
CO3	1	2	-	-	-	1	2	1	-	-	-	1		
CO4	1	2	-	-	-	1	2	1	-	-	-	1		
CO5	1	2	-	-	-	1	2	1	-	-	-	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION**

9

Impacts of development on environment – Rio principles of sustainable development goals – Environmental Impact Assessment – Objectives – Historical development – Types – Notification – Legal frameworks

**UNIT II ENVIRONMENTAL ASSESSMENT**

9

Screening and Scoping – Drafting of terms of reference – Baseline monitoring – Prediction and Assessment of Impact on land, water, air, noise – Matrices – Networks – Checklists methods.

**UNIT III ENVIRONMENTAL MANAGEMENT PLAN**

9

Plan for mitigation of adverse impact on land, water, air, noise – Environmental monitoring plan – EIA report preparation – Public hearing – Environmental clearance



**UNIT IV SOCIO ECONOMIC ASSESSMENT**

9

Baseline monitoring of socio-economic environment – Identification of project affected personal – Rehabilitation and Resettlement plan – Economic valuation of environmental impacts – Cost benefit analysis

**UNIT V MONITORING STUDIES AND APPLICATIONS**

9

Environmental monitoring – Guidelines – Policies – Planning of monitoring programs – Environmental management plan – Post project audit – Case studies

**Contact Periods:**

Lecture: 45 Periods      Tutorial: - Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. Daniel P. Lawrence, "Environmental Impact Assessment", 2<sup>nd</sup> edition, Wiley Blackwell, New Jersey, 2003
2. Anjaneyulu Y and Manickam V, "Environmental Impact Assessment Methodologies", 3<sup>rd</sup> edition, BS Publications, 2020


**REFERENCES:**

1. Henk A. Becker and Frank Vanclay, "The International Handbook of Social Impact Assessment", 2<sup>nd</sup> edition, Edward Elgar Publishing, United Kingdom, 2003
2. Judith Petts, "Handbook of Environmental Impact Assessment", Vol I and II, Blackwell Science Newyork, 1998

**EVALUATION PATTERN:**

EVALUATION PATTERN:					
Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

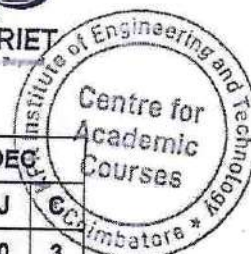
\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

  
 Dr. S. Balasubramanian, M.Tech., Ph.D.  
 Professor & Head  
 Department of Chemical Engineering  
 KPR Institute of Engineering & Technology  
 Arasur, Coimbatore - 641 407



## SEMESTER V

U21CHX04	INDUSTRIAL WASTEWATER TREATMENT	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To know about the basics of biological water treatment methods
- To know about the applications of biological water treatment methods
- To understand about various equipment used in waste water treatment

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Understand the biochemical fundamentals and its application (Understand)  
 CO2: Analysis of modelling of ideal suspended growth reactors (Analyze)  
 CO3: Design and evaluation of suspended growth processes (Apply)  
 CO4: Analyse the modelling of ideal attached growth reactors (Analyze)  
 CO5: Apply the concepts of bioreactor for water treatment (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	1	1	-	1		
CO2	3	1	1	-	-	-	-	1	1	1	-	1		
CO3	3	1	1	-	-	-	-	1	1	1	-	1		
CO4	3	1	1	-	-	-	-	1	1	1	-	1		
CO5	3	1	1	1	-	-	-	-	1	1	-	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:**

<b>UNIT I INTRODUCTION TO BIOCHEMICAL OPERATIONS</b>	<b>9</b>
Classification of biochemical operations – Fundamentals of biochemical operations	
<b>UNIT II TRADITIONAL BIOLOGICAL TREATMENT</b>	<b>9</b>
Theory – Modelling of ideal suspended growth reactors – Modelling suspended growth systems – Aerobic growth of heterotrophy in a single continuous stirred tank reactor receiving soluble substrate – Multiple microbial activities in a single continuous stirred tank reactor	
<b>UNIT III APPLICATION OF TRADITIONAL BIOLOGICAL TREATMENT</b>	<b>9</b>
Suspended growth reactors – Design and evaluation of suspended growth processes – Activated sludge – Biological nutrient removal – Aerobic digestion – Anaerobic processes – Lagoons	

**UNIT IV BIOREACTORS FOR WATER TREATMENT**

9

Modelling of ideal attached growth reactors – Bio-film modeling – Aerobic growth of biomass in packed towers – Aerobic growth of heterotrophs in rotating disc reactors – Fluidized bed biological reactors

**UNIT V APPLICATIONS OF BIOREACTORS FOR WATER TREATMENT**

9

Attached growth reactors – Trickling filter – Rotating biological contactor – Submerged attached growth bioreactors

**Contact Periods:**

Lecture: 45 Periods

Tutorial: - Periods

Practical: – Periods

Project: – Periods

Total: 45 Periods

**TEXT BOOKS:**

1. Grady Jr C L, Dalggar G T, Love N G and Filipe C D, "Biological Wastewater Treatment", 1<sup>st</sup> edition, CRC Press, 2016
2. Patwardhan A D, "Industrial Wastewater Treatment", 1<sup>st</sup> edition, PHI Learning Pvt. Ltd, 2017


**REFERENCES:**

1. Andreoli C.V, Von Sperling M, and Fernandes F, Sludge treatment and disposal. 1<sup>st</sup> edition, IWA publishing, 2007
2. Nicholas P.C, "Handbook of Water and Wastewater Treatment Technologies", 1<sup>st</sup> edition, Press. USA, Boston, Washington, 2002

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

  
 Dr. S. Balasubramanian, M.Tech., Ph.D.  
 Professor & Head  
 Department of Chemical Engineering  
 KPR Institute of Engineering & Technology  
 Arasur, Coimbatore - 641 407



**DEPARTMENT OF CIVIL ENGINEERING**  
**SEMESTER V**



U21CEX03	REMOTE SENSING & GIS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To give an overview about the basic concepts and principles of various components of remote sensing
- To introduce the different components of GIS and about map projection and coordinate system
- To provide details of spatial structures

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Select the type of remote sensing technique or data for required purpose (Understand)  
 CO2: Identify the earth surface features from satellite images (Understand)  
 CO3: Classify the maps, coordinate systems and projections (Understand)  
 CO4: Explain the GIS data structures and data models (Understand)  
 CO5: Make use of spatial and attribute data and study the errors in maps (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	1	-	-	-	-	-	-	2		
CO2	3	2	-	-	1	-	-	-	-	2	-	2		
CO3	3	-	-	-	-	-	-	-	-	-	-	2		
CO4	3	-	-	-	-	-	-	-	-	-	-	2		
CO5	3	2	-	-	1	-	-	-	-	2	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I REMOTE SENSING SYSTEM**

9

Elements of EMR – Wavelength regions – Energy interaction in atmosphere – Absorption – Scattering – Atmospheric windows – Terrestrial interaction – Spectral reflectance curves – Active and passive remote sensing – Types of platforms – Orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – Types of resolutions – Planck's blackbody law – Displacement law and emissivity effects

**UNIT II SATELLITE DATA PRODUCT AND INTERPRETATION OF SATELLITE IMAGERIES**

9

Types of data product – Software and hardware requirement for data processing – Elements of visual image interpretation – Digital Image processing techniques, Landuse / landcover



classification

**UNIT III GEOGRAPHIC INFORMATION SYSTEMS**

9

Map and map scale – Types of map, Digital Cartography and Evolution of GIS, Components of GIS – Coordinate system – Map projection – Datums, ellipsoids, geoids, Type of data – spatial and non-spatial data, various sources of data – Georeferencing

**UNIT IV SPATIAL DBMS**

9

Introduction, data storage, database structures – data models – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster vs Vector Models – TIN and GRID data models

**UNIT V DATA INPUT AND OUTPUT**

9

Scanner – Raster Data Input – Raster Data File Formats – Vector Data Input – Digitiser – Raster and Vector overlay method – Reclass, Recode, Types of output data, Map layout, source of errors, types of errors, elimination, accuracies – Introduction to web GIS – OGC and web services – Multimedia GIS – 3D GIS – Data quality and standards – Applications of GIS and RS

**Contact Periods:**

Lecture: 45 Periods	Tutorial: – Periods	Practical: – Periods	Project: – Periods
Total:			45 Periods

**TEXT BOOKS:**

1. Chang K. T., "Introduction to Geographical Information Systems", Tata McGraw Hill, 1<sup>st</sup> edition, 2015
2. Jensen, John R., "Remote Sensing of the Environment", An Earth Resource Perspective, 2<sup>nd</sup> edition, Prentice Hall, New Jersey, 2013


**REFERENCES:**

1. Prescott, Harley and Klein, "Microbiology", 10<sup>th</sup> edition, McGraw Hill, 2017

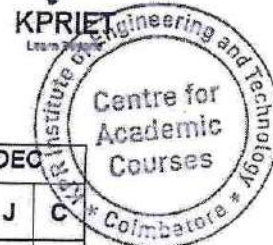
**EVALUATION PATTERN:**

EVALUATION PATTERN:					End Semester Examinations
Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

  
 Head of the Department  
 Department of Civil Engineering  
 KPR Institute of Engineering & Technology  
 Anna Nagar, Coimbatore - 641 407

**DEPARTMENT OF CIVIL ENGINEERING**  
**SEMESTER V**



U21CEX04	WASTE MANAGEMENT	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To understand the solid waste management, recent trends in global solid waste processing
- To demonstrate the recent technologies, in handling of the wastes such as hazardous, biomedical, electronic waste
- To explain the wastewater management and its treatment processes

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

CO1: Demonstrate the municipal solid waste management (Understand)

CO2: Infer on hazardous waste management (Understand)

CO3: Outline on biomedical waste management (Understand)

CO4: Illustrate the management of E-waste (Understand)

CO5: Summarize the management on wastewater (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	3	3	1	-	-	1	-		
CO2	2	2	-	-	-	3	3	1	-	-	1	-		
CO3	2	2	-	-	-	3	3	1	-	-	1	-		
CO4	2	2	-	-	-	3	3	1	-	-	1	-		
CO5	2	2	-	-	-	3	3	1	-	-	1	-		
Correlation levels:      1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)														

**SYLLABUS:****UNIT I      MUNICIPAL SOLID WASTE MANAGEMENT**

9

Municipal solid wastes – Introduction, sources and characteristics – Generation – Collection – Transport – Treatment – Disposal in landfills – Leachate – Solid waste impact on environment and human health – Recent trends in global solid waste processing technologies – Solid waste handling rules

**UNIT II      HAZARDOUS WASTES**

9

Hazardous wastes – Introduction, sources and characteristics – Generation – Collection – Transport – Treatment and disposal – Legislation on management – Handling of hazardous wastes



**UNIT III BIOMEDICAL WASTE**

9

Biomedical wastes – Introduction, Sources – Characterization – Types – Impact of biomedical waste on environment – Global scenario – Methods of treatment and disposal – Ethical aspects and legal implications

**UNIT IV ELECTRONIC WASTE**

9

Electronic wastes – Introduction, Sources – Characterization – Types – Impact of e-waste on environment – E-waste management – Control measures – Treatment and disposal system of e-waste

**UNIT V WASTE WATER MANAGEMENT**

9

Wastewater. – Introduction, generation and characteristics – Effluent standards – Layout of sewage treatment plant – Sewage disposal – Sludge treatment and disposal – Recent advances

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

- Gerard Kiely, "Environmental Engineering", 2<sup>nd</sup> edition, McGraw Hill Education (India) Pvt Ltd., 2013
- Sincero A. P and Sincero G. A, "Environmental Engineering", 1<sup>st</sup> edition, A Design Approach by Prentice Hall of India, 2014


**REFERENCES:**

- Garg. S. K, "Environmental Engineering (Vol.II) Sewage disposal and Air Pollution Engineering", 2<sup>nd</sup> edition, Khanna Publishers, 2008
- Peavy. H. S, Rowe. D.R, and Tchobanoglous. G, "Environmental Engineering", 3<sup>rd</sup> edition, McGraw-Hill international edition, 1985
- Simeon Dulo Solid, "Waste Management", 1<sup>st</sup> edition, VDM Verlag publication, 2010.

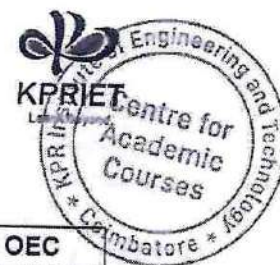
**EVALUATION PATTERN:**

EVALUATION PATTERN:					End Semester Examinations
Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	
Total				40	60
				100	

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 Head of the Department  
 Department of Civil Engineering  
 KPR Institute of Engineering & Technology  
 Anna, Coimbatore-641407

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**  
**SEMESTER V**



U21CSX03	COMPUTATIONAL THINKING	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To formulate problems in a way that enables the use of a computer to solve them
- To logically organize and analyze data using various techniques
- To identify, analyze and implement possible solutions with the goal of achieving the most efficient and effective combination of steps and resources

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Explain the basic principles of Computational thinking (Understand)  
 CO2: Examine the data organization and processing using Python (Apply)  
 CO3: Make use of the basic algorithm tracing techniques (Apply)  
 CO4: Employ the basics of an operating system, networking, database management system, API and XML (Apply)  
 CO5: Determine the efficiency of algorithms (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	2		
CO2	3	2	2	2	1	-	-	-	-	-	-	2		
CO3	3	2	2	2	1	-	-	-	-	-	-	2		
CO4	3	2	2	2	2	-	-	-	-	-	-	3		
CO5	3	2	3	1	-	-	-	-	-	-	-	3		
Correlation levels:      1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)														

**SYLLABUS:****UNIT I      PRINCIPLES OF COMPUTATIONAL THINKING**

9

Programming – Algorithmic thinking – Bitwise and Boolean algebra – Compiler vs interpreter – Pseudo coding – Problem definition – Data collection – Problem decomposition – Abstraction – Flowcharting – Name binding – Selection – Repetition – Modularization – Sample exercise problems and deriving solutions

**UNIT II      DATA ORGANIZATION & PROCESSING USING PYTHON**

9

Operators – Variables and Data types – Loops and conditions – Nested loop – Strings – Euclid's algorithm – Arrays – Functions – Recursion



**UNIT III REVERSE ENGINEERING & SOLUTIONS**

Algorithm Tracing Technique (simulating execution) – Best practices – keeping it simple – documentation style – idioms – DRY code – naming conventions – and comments – Debugging – Anticipating output from pseudo code

9

**UNIT IV APPLIED COMPUTATIONAL THINKING**

Operating systems basics – Networking basics – Database Management System (DBMS) – SQL – No SQL – JSON – API – XML

9

**UNIT V EFFICIENCY ANALYSIS AND BENCHMARKING**

Algorithm efficiency – Time complexity in programs – Mathematical preliminaries – Asymptotic analysis – Recurrence relations – Algorithm design paradigms – Divide and conquer algorithms – Dynamic programming – and Greedy algorithms

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. David Riley and Kenny Hunt, "Computational thinking for the modern solver", 1<sup>st</sup> Edition, Chapman & Hall/CRC, 2014
2. Karl Beecher, "Computational Thinking: A beginner's guide to problem solving and programming", 1<sup>st</sup> Edition, BCS, The Chartered Institute for IT, 2017

**REFERENCES:**


1. Paul Curzon and Peter William Mcowan, "Power Of Computational Thinking, The: Games, Magic And Puzzles To Help You Become A Computational Thinker", Kindle Edition, World Scientific Publishing Europe Ltd, 2017
2. Fabrizio Luccio, Paolo Ferragina, "Computational Thinking: First Algorithms, Then Code", 1<sup>st</sup> Edition, Springer, 2018
3. Jane Krauss, Kiki Protsman, "Computational Thinking and Coding for Every Student: The Teacher's Getting-Started Guide" 1<sup>st</sup> Edition, SAGE Publications, 2016

**EVALUATION PATTERN:**

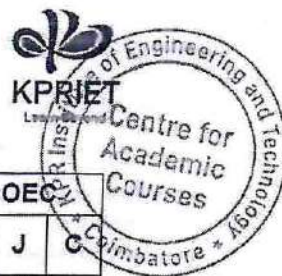
EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.


 Dr. N. Yuvaraj, B.Tech., M.E., Ph.D.  
 Professor and Head  
 Department of Computer Science and Engineering  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407

## SEMESTER V



U21CSX04	BLOCKCHAIN FUNDAMENTALS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To understand the history, types and applications of blockchain
- To acquire knowledge about cryptography and consensus algorithms
- To design and deploy blockchain based applications

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Discuss the foundations of blockchain technologies (Understand)  
 CO2: Outline the different blockchain consensus (Understand)  
 CO3: Describe the foundations of bitcoin and cryptocurrency (Understand)  
 CO4: Utilize the concepts of Ethereum and Hyperledger fabric (Apply)  
 CO5: Derive an appropriate solution to the given use cases (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	2		
CO2	2	1	1	1	-	-	-	-	-	-	-	2		
CO3	2	1	1	1	2	-	-	-	-	-	-	2		
CO4	3	2	2	2	2	-	-	-	-	-	-	3		
CO5	3	2	2	2	1	3	3	-	-	-	-	3		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION TO BLOCKCHAIN**

9

Introduction – Advantage over conventional distributed database – Blockchain Network – Mining Mechanism – Distributed Consensus – Merkle Patricia Tree – Transactions and Fee – Anonymity – Reward – Chain Policy – Private and Public blockchain

**UNIT II BLOCKCHAIN 1.0**

9

Blockchain Architecture – Block – Hash – Distributer P2P – Structure of Blockchain, – Nakamoto consensus – Proof of Work – Proof of Stake – Proof of Burn – Difficulty Level – Sybil Attack – Energy utilization and alternate

**UNIT III BLOCKCHAIN 2.0**

9

Basic crypto currency – Creation of coins, Payments and double spending – FORTH – the precursor for Bitcoin scripting – Bitcoin Scripts – Bitcoin P2P Network – Transaction in Bitcoin network – Block Mining – Block propagation and block relay, Consensus introduction, Distributed



consensus in open environments-Consensus in a Bitcoin network

#### UNIT IV BLOCKCHAIN 3.0

Ethereum network – EVM – Transaction fee – Mist Browser – Ether – Gas – Solidity – smart contracts – Truffle Design and issue Crypto currency – Mining – DApps – DAO – Architecture of Hyperledger fabric v1.1 – Introduction to hyperledger fabric v1.1 – chain code

#### UNIT V USECASES OF BLOCKCHAIN

Blockchain usecases in Financial sector – Business sector – Government & Public Sector – Healthcare Use Cases– IoT – Retail Fashion & sports and supply chain

#### Contact Periods:

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

#### TEXT BOOKS:

1. Bashir Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", 2<sup>nd</sup> Edition, Packt Publishing Ltd, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction" 2<sup>nd</sup> Edition, Princeton University Press, 2016
3. Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", 1<sup>st</sup> Edition, Create Space Independent Publishing Platform, 2017

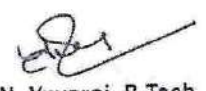
#### REFERENCES:

1. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Kindle Edition, Packt Publishing Limited, 2018
2. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 1<sup>st</sup> Edition, O'Reilly Media Inc, 2015

#### EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
Dr. N. Yuvaraj, B.Tech., M.E., Ph.D.  
Professor and Vice

Department of Computer Science and Engineering  
KPR Institute of Engineering and Technology  
Coimbatore - 641 407

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AIML)**  
**SEMESTER V**



U21AMX02	AI FUNDAMENTALS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To provide students with a solid foundation in the basics of AI, machine learning, and deep learning
- To enable students to understand the potential applications of AI in various industries
- To provide students with hands-on experience in implementing machine learning algorithms and deep learning models
- To develop an understanding of ethical considerations around the development and implementation of AI

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

CO1: Understand the basics of Artificial Intelligence (Understand)

CO2: Recognize the considerations of Machine Learning (Understand)

CO3: Learn Deep Learning and its libraries (Understand)

CO4: Interpret various Natural Language Processing models (Understand)

CO5: Understand the ethical considerations of AI on society (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	-	-	-	-	-	-	-	-	-		
CO2	2	2	2	-	-	3	-	-	-	-	-	-		
CO3	2	2	2	-	-	2	-	-	-	-	-	-		
CO4	-	2	2	-	-	3	-	2	2	-	2	-		
CO5	-	2	2	-	-	3	-	2	2	-	2	-		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION TO AI**

9

Overview of AI – What is data – What makes an AI company – What machine learning can and cannot do – AI Applications – AI techniques – AI tools

**UNIT II MACHINE LEARNING**

9

Supervised learning – Unsupervised Learning – Reinforcement learning – Suitable demonstrations

**Dr. S. Karthikeyan, M.E., Ph.D.**  
Head of the Department  
Department of CSE(AI and ML)  
KPR Institute of Engineering and Technology  
Coimbatore - 641 407.



**UNIT III DEEP LEARNING 9**

Introduction – Neural Networks – Convolutional Neural Networks – Recurrent Neural Networks – Deep Learning libraries

**UNIT IV NATURAL LANGUAGE PROCESSING 9**

Introduction – Text pre-processing – Feature extraction – Sentiment analysis – Named entity recognition – Suitable demonstrations

**UNIT V AI ETHICS 9**

AI ethics overview – Ethical considerations in AI – Techniques for integrating ethical considerations in AI development – Social impacts of AI

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
 Total: 45 Periods

**TEXTBOOKS:**

1. Prateek Joshi, "Artificial Intelligence with Python", 1<sup>st</sup> edition, Packt publishing, 2017
2. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 1<sup>st</sup> edition, O'Reilly Media, 2019


**REFERENCES:**

1. Jeff Heaton, "Artificial Intelligence for Humans: Fundamental Algorithms", 1<sup>st</sup> edition, Heaton Research Inc., 2013
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3<sup>rd</sup> edition, Pearson, 2009
3. Coursera course: <https://www.coursera.org/learn/ai-for-everyone>

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60		
Total					200
					40
					60
					100

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

  
 Dr. S. Karthikeyan, M.E., Ph.D.  
 Head of the Department  
 Department of CSE(AI and ML)  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407.

Dr. S. Karthikeyan, M.E., Ph.D.  
 Head of the Department  
 Department of CSE(AI and ML)  
 KPR Institute of Engineering and Technology  
 Coimbatore

## DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AIML)

## SEMESTER V

U21AMX03	JOY OF PROGRAMMING	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3



## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To introduce students to the basics of programming languages and paradigms
- To equip students with foundational knowledge in programming concepts such as variables, data types, and operator
- To promote effective communication skills by requiring students to present their programming solutions

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Understand the fundamentals python programming (Understand)

CO2: Describe object-oriented concepts using java (Understand)

CO3: Explain the knowledge of data structures and its algorithms (Understand)

CO4: Summarize database concepts, use of SQL for querying and manipulating data (Understand)

CO5: Interpret data science, data visualization and basics of machine learning (Understand)

## CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	-	-	-	-	-	-	-	-	-		
CO2	2	2	-	-	-	2	-	-	-	-	-	-		
CO3	2	2	-	-	-	2	-	-	-	-	-	-		
CO4	-	2	-	-	-	2	-	2	2	-	2	-		
CO5	-	2	-	-	-	2	-	2	2	-	2	-		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

## SYLLABUS:

## UNIT I PROGRAMMING IN PYTHON


9

Overview of programming languages and paradigms – Basic concepts of programming: Variables, Data types, Operators, Expressions, and Statements – Control Structures

## UNIT II OBJECT-ORIENTED PROGRAMMING USING JAVA

9

Basic concepts of object – Oriented programming: Objects, Classes, Inheritance, Polymorphism, Encapsulation, Abstraction, and Information hiding – Multi Threading – Exception Handling


  
 Dr. S. Karthikeyan, M.E., Ph.D.
   
 Head of the Department
   
 Department of CSE(AI and ML)
   
 KPR Institute of Engineering and Technology
   
 Coimbatore - 641 407.



**UNIT III DATA STRUCTURES AND ALGORITHMS**

9

Concepts: Arrays – Linked lists – Stack and queue – Searching and sorting algorithms – Recursion and backtracking

**UNIT IV DATABASES AND SQL**

9

Basic concepts of databases – Database management systems – Introduction to SQL: Querying and manipulating data – Basic concepts of NoSQL databases

**UNIT V INTRODUCTION TO DATA SCIENCE**

9

Basic concepts of data science – Data analytics – Data visualization using python libraries – Matplotlib and Seaborn – Basic concepts of machine learning and predictive analytics

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXTBOOKS:**

1. Tony Gaddis, "Starting Out with Python", 4<sup>th</sup> edition, Pearson, 2019
2. Kathy Sierra and Bert Bates, "Head First Java", 2<sup>nd</sup> edition, O'Reilly Media, 2021
3. Carlos Coronel, Steven Morris, and Peter Rob, "Database Systems: Design, Implementation, and Management", 12<sup>th</sup> edition, Cengage Learning, 2016


**REFERENCES:**

1. Joel Grus, "Data Science from Scratch: First Principles with Python", 1<sup>st</sup> edition, O'Reilly Media, 2015
2. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures and Algorithms in Java", 6<sup>th</sup> edition, Wiley, 2019

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

  
**Dr. S. Karthikeyan, M.E., Ph.D.**  
 Head of the Department  
 Department of CSE(AI and ML)  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407.

Dr. S. Karthikeyan, M.E., Ph.D.  
 Head of the Department  
 Department of CSE(AI and ML)  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407.

**DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS**  
**SEMESTER - V**



U21CBX03	IT FOR MANAGERS	Category# OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To understand how to apply IS concepts and components to meet the informational needs of managers
- To gain various IS development methodologies and innovative process models
- To know different types of IS and IT applications to business needs

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1:** Describe the informational needs of managers and the components, types and characteristics of information systems (Understand)
- CO2:** Apply various IS development methodologies and innovative process models (Apply)
- CO3:** Evaluate transaction processing systems, decision support systems, and expert systems (Apply)
- CO4:** Utilize the applications of ERP, CRM, SCM, E-Commerce, and M-Commerce in business (Apply)
- CO5:** Identify the managerial issues in information systems management and identify the latest trends in MIS (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	3	-	-	-	-	2	2		
CO2	3	2	2	2	1	3	-	-	-	-	2	2		
CO3	3	3	3	3	1	3	-	-	-	-	2	2		
CO4	3	3	3	3	2	3	-	-	-	-	2	2		
CO5	3	3	3	3	1	3	-	-	-	-	2	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I FOUNDATIONS OF IS**

9

Introduction to Information Systems– Informational needs of managers – Components of Information Systems viz – Hardware– Software – Database – Networks – Human Resources – Elements of IS – Characteristics of IS – Types of IS for managers – TPS – DSS – EIS

- R. Devi Priya

**Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,**  
**Professor & Head**  
**Department of Computer Science and Business Systems**  
**KPR Institute of Engineering and Technology**  
**Arasur, Coimbatore - 641 407**



**UNIT II SDLC AND VARIOUS METHODS**

9

Systems Development Life Cycle – Various methodologies of IS development – Agile and Continuous Delivery Models – Design and Implementation of Innovative Process models

**UNIT III VARIOUS FORMS OF IS**

9

Transaction Processing Systems – Decision Support Systems – GDSS– Executive Information Systems and Expert Systems

**UNIT IV IS AND IT'S VARIOUS APPLICATIONS**

9

IT applications in business–ERP– CRM– SCM – E-Commerce – M-Commerce

**UNIT V MANAGERIAL ISSUES IN IS**

9

Emerging issues in managing Information Systems in business – Systems Security – Technological obsolescence – Change Management – IT infrastructure Management – Latest Trends in Management Information system

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: - Periods      Project: – Periods

Total : 45 Periods

**TEXT BOOKS:**

1. Maria Pomffyova, "Management of Information Systems", 4<sup>th</sup> Edition, IntechOpen, 2018
2. Ken J.Sousa, EddyOzz, "Management Information system", 7<sup>th</sup> Edition, Course Technology, 2014.


**REFERENCES:**

1. GeorgeM. Marakas, James A. O'Brien, "Introduction to Information systems", 16<sup>th</sup> Edition, McGraw hill Education, 2012
2. A.P Goyal, "Management Information Systems", 4<sup>th</sup> Edition, Oxford University Press, 2014

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.



Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,  
Professor & Head  
Department of Computer Science and Business Systems  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,  
Professor & Head  
Department of Computer Science and Business Systems  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

## SEMESTER - V



U21CBX04	SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To gain the evaluation of investment instruments and apply security valuation techniques
- To understand the fundamental and technical analysis for capital allocation
- To know the effective portfolio management strategies and to evaluate performance

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

**CO1:** Describe investment instruments, risk, and returns and apply security valuation methods (Understand)

**CO2:** Compare and contrast fundamental and technical analysis techniques for security valuation and determine capital allocation (Understand)

**CO3:** Utilize the efficient market hypothesis in security analysis and portfolio management (Understand)

**CO4:** Construct efficient portfolios and value securities using portfolio theory and capital market Theory (Apply)

**CO5:** Implement portfolio management strategies and evaluate portfolio performance with quantitative metrics (Apply)

## CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	2	-	-	-	-	3	2		
CO2	3	2	-	2	-	2	-	-	-	-	3	2		
CO3	3	2	-	2	-	2	-	-	-	-	3	2		
CO4	3	2	-	2	-	2	-	-	-	-	3	2		
CO5	3	2	-	2	-	2	-	-	-	-	3	2		
Correlation levels:      1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)														

*R. Devi Priya*

Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,  
Professor & Head  
Department of Computer Science and Business Systems  
KPRI Institute of Engineering and Technology  
Arasur, Kolhapur

**Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,**  
**Professor & Head**  
**Department of Computer Science and Business Systems**  
**KPRI Institute of Engineering and Technology**  
**Arasur, Kolhapur - 641 407**



**SYLLABUS:****UNIT I INVESTMENT, RISK AND RETURN & VALUATION OF SECURITIES 9**

Concepts of investment – Sources of investment information– Investment Instruments – Investment cycle – Concept of total risk – factors contributing to total risk – default risk – interest rate risk – market risk – management risk – purchasing power risk – systematic and unsystematic risk – Bond and fixed income – instruments valuation – valuation of equity and preference shares.

**UNIT II FUNDAMENTAL AND TECHNICAL ANALYSIS 9**

Concept of intrinsic value– Objectives and beliefs of fundamental analysts – Economy – Industry Company framework – Economic analysis and forecasting– Technical analysis – Points and figures chart– bar chart– RSA– RSI– Moving average analysis – MACD – Japanese Candlesticks – Capital allocation between risky and risk free assets – Utility analysis.

**UNIT III EFFICIENT MARKET HYPOTHESIS 9**

Market mechanism – testable hypothesis about market efficiency – implications of efficiency market hypothesis for security analysis and portfolio management.

**UNIT IV PORTFOLIO THEORY AND CAPITAL MARKET THEORY 9**

Markowitz portfolio theory– Risk and risk aversion – Efficient Frontier and Utility – Capital Market Theory – Capital Market Line (CML) & Separation Theorem – Market Portfolio – Security Market Line (SML) – Capital Asset Pricing Models – CAPM and Arbitrage pricing theories.

**UNIT V PORTFOLIO MANAGEMENT STRATEGIES AND PERFORMANCE EVALUATION 9**

Passive Vs Active management – Passive strategies and active strategies of Portfolio Management – Asset Allocation Strategies– Portfolio Evaluation Measures – Sharpe ratio– Treynor ratio and Jensen's Alpha – Portfolio monitoring and revision.

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
 Total: 45 Periods

**TEXT BOOKS:**

1. Herbert B. Mayo, "Investments – An introduction", 12<sup>th</sup> Edition, Cengage Learning, 2021.
2. Frank K. Reilly, Keith C. Brown, "Investment Analysis and Portfolio Management", 10<sup>th</sup> Edition, Cengage Learning, 2018.

**REFERENCES:**

1. ZviBodie, Alex Kane, Alan Marcus, Pitabas Mohanty, (2017), "Investments", 10<sup>th</sup> Edition, McGraw-Hill, 2017.
2. Prasanna Chandra, Investment Analysis and Portfolio Management, 5<sup>th</sup> Edition, McGraw Hill, 2017.



**Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,**  
**Professor & Head**

Department of Computer Science and Business Systems  
**KPR Institute of Engineering and Technology**  
 Arasur, Coimbatore - 641 407

Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,  
 Professor & Head  
 Department of Computer Science and Business Systems  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407

**EVALUATION PATTERN:**

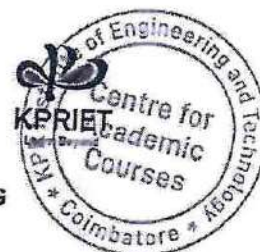
Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60		
Total				40	
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.



Dr. R. DEVI PRIYA B.E., M.E., Ph.D.,  
 Professor & Head  
 Department of Computer Science and Business Systems  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407





**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**  
**SEMESTER V**

U21ECX03	ARDUINO PROGRAMMING	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To study the Arduino development boards and IDE
- To learn the communication between peripherals
- To understand the operations of sensors in real time applications

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Summarize the various development boards of Arduino families (Understand)  
 CO2: Explain the fundamentals of Arduino programming (Understand)  
 CO3: Develop simple applications using suitable sensors (Apply)  
 CO4: Illustrate the performance of communication protocols (Understand)  
 CO5: Build the real-time applications using Arduino (Analyze)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	-	-	2		
CO2	2	-	-	-	2	-	-	-	2	-	-	2		
CO3	3	2	2	-	2	-	-	-	2	-	-	2		
CO4	2	-	-	-	-	-	-	-	2	-	-	2		
CO5	3	3	2	-	2	-	-	-	2	-	-	2		
Correlation levels:      1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)														

**SYLLABUS:****UNIT I      ARDUINO BOARD CHARACTERISTICS**

9

Arduino families– Uno, Leonardo, Ethernet, Mega 2560 – Shields – motor, wireless SD, Ethernet, Wi-Fi, GSM – IDE tool

**UNIT II      PROGRAMMING LANGUAGE**


9

Variables and data types – Control structures – Functions – I/O, time, mathematical, constants, interrupts – Standard libraries – Simulation using Arduino IDE

**UNIT III      SENSORS AND MOTORS**

9

Humidity sensor – Temperature sensor – Water detector/sensor – PIR sensor – Ultrasonic sensor – Magnetic relay switches – Servo motors – Stepper motors

  
**Head of the Department,**  
 Electronics & Communication Engineering,  
 KPR Institute of Engineering and Technology,  
 Arasur, Coimbatore - 641 407.

**UNIT IV PERIPHERAL COMMUNICATION**

9

UART communications – SPI bus – configuration, communications, SPI library – I2C protocol, master and slave communications – Ethernet on Arduino – Arduino Wi-Fi channels

**UNIT V DISPLAY AND APPLICATIONS**

9

Liquid crystal – Liquid crystal library, writing text, cursor commands, text orientation, scrolling, custom text – LED display – Water level management system – Home automation – Automatic irrigation system – Industry automation

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. Simon Monk, "Programming Arduino – Getting Started with Sketches", 2<sup>nd</sup> edition, Tata Mc Graw Hill, 2016
2. James A. Langbridge, "Arduino Sketches tools and techniques for programming" wizardry Wiley, 1<sup>st</sup> edition, 2015


**REFERENCES:**

1. Massimo Banzi, Michael Shiloh, Make: "Getting Started with Arduino: The Open Source Electronics Prototyping Platform", 3<sup>rd</sup> edition, LLC, 2015
2. Richard Blum, "Arduino Programming in 24 hours", 3<sup>rd</sup> edition, Pearson Education, 2016.
3. Brock Craft, "Arduino Projects for Dummies", 2<sup>nd</sup> edition, John Wiley & Sons Inc, 2013
4. John Boxall, "Arduino Workshop – A Hands-On Introduction with 65 Projects", 1<sup>st</sup> edition, William Pollock, 2013

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
 Head of the Department,  
 Electronics & Communication Engineering,  
 KPR Institute of Engineering and Technology,  
 Arasur, Coimbatore - 641 407.



## SEMESTER V

U21ECX04	ELECTRONIC WASTE MANAGEMENT AND SUSTAINABLE PRACTICES	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To understand the importance of e-waste management
- To learn various e-waste handling mechanisms for proper disposal and recycling
- To study the sustainable practices and methodologies of e-waste management

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Explain the environmental impacts of e-waste (Understand)

CO2: Classify various materials used in e-waste management hierarchy (Understand)

CO3: Summarize different processes involved in e-waste management and handling (Understand)

CO4: Implement the appropriate e-waste management and sustainable practices (Apply)

CO5: Apply the principles of emerging technologies for e-waste management (Apply)

## CO-PO MAPPING:

POs Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	2	2	-	-	2	-	2		
CO2	2	-	-	-	-	2	2	-	-	2	-	2		
CO3	2	-	-	-	-	2	2	-	-	2	-	2		
CO4	3	2	2	-	-	2	2	-	-	2	-	2		
CO5	3	2	2	-	-	2	2	-	-	2	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

## SYLLABUS:

## UNIT I OVERVIEW OF E-WASTE MANAGEMENT

9

Introduction – Driving factors for E-waste – Types of contaminants in E-waste – Treatment strategies of E-waste – Recycling, biological treatment, advanced methods

## UNIT II IMPACT OF MATERIALS IN E-WASTE MANAGEMENT

9

Materials used in electronics – Soldering and the move to lead-free assembly – Printed circuit board materials – Encapsulants of electronic components – Indium tin oxide and LCD screens

## UNIT III DUMPING, BURNING AND LANDFILL

9

Waste inputs to different management options – Landfill – Pollution from landfills, landfill gas, leachate and landfill-site construction – Burning – Incineration, mass burn, energy from waste, advanced thermal processing, pollution from incineration

Head of the Department,  
Electronics & Communication Engineering,  
KPR Institute of Engineering and Technology,  
Arasur, Coimbatore, 641 107

**UNIT IV IMPROVING SUSTAINABILITY OF E-WASTE MANAGEMENT**

9

Introduction – Concept of sustainability in E-waste management, systems approach and sustainability, systemic approach toward improving sustainability – Waste electronic and electrical equipment management in developing countries – Systemic design of solutions

**UNIT V INTEGRATED APPROACH TO E-WASTE MANAGEMENT**

9

Emerging technologies – Comminution, dry capture technologies, design of recycling and inverse management – Sector based eco-design – Fasteners, design methodology and resource efficiency, constraints on materials selection

**Contact Periods:**

Lecture: 45 Periods

Tutorial: – Periods

Practical: – Periods

Project: – Periods

Total: 45 Periods

**TEXT BOOKS:**

1. Majeti Narasimha Vara Prasad, Meththika Vithanage, Anwesha Borthakur, "Handbook of Electronic Waste Management" Butterworth-Heinemann: Elsevier, 1<sup>st</sup> edition, 2020
2. A.K.Hargi, "Waste Management: Research Advances to Convert Waste to Wealth", Nova Science Publishers, 1<sup>st</sup> edition, 2010


**REFERENCES:**

1. John Pichtel, "Waste Management Practices-Municipal, Hazardous and Industrial", CRC Press, 2<sup>nd</sup> edition, 2014
2. Fowler B, "Electronic Waste – Toxicology and Public Health Issues", Elsevier, 1<sup>st</sup> edition, 2007
3. Isa Baud, Johnan Post and Christine Furedy, "Solid Waste Management and Recycling", Kluwer Academic Publishers, 1<sup>st</sup> edition, 2004
4. Nicholas P. Cheremisinoff, "Handbook of Solid Waste Management and Waste Minimization Technologies", Elsevier, 2003

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60		
Total					200
					40
					60
					100

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
**Head of the Department,**  
 Electronics & Communication Engineering,  
 KPR Institute of Engineering and Technology,  
 Arasur, Coimbatore - 641 407.



**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**  
**SEMESTER V**



U21EEX03	ENERGY TECHNOLOGY	Category: OEG				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To acquire the knowledge of general aspect energy sources
- To understand the energy conscious concepts
- To understand the concept of capital cost of energy management system

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Explain about renewable energy resources and its importance (Understand)  
 CO2: Understand the process of photovoltaic power generation (Understand)  
 CO3: Interpret the process of power generation using wind energy sources (Understand)  
 CO4: Summarize the role of bio energy in power generation (Understand)  
 CO5: Infer the fundamentals of other available renewable energy sources (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	-	-	-	1		
CO2	3	2	1	-	1	-	-	-	-	-	-	1		
CO3	3	2	1	-	1	-	-	-	-	-	-	1		
CO4	3	2	1	-	1	-	-	-	-	-	-	1		
CO5	3	2	1	-	1	-	-	-	-	-	-	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I ENERGY**

9

Global energy scenario – Classification of energy sources – Energy scenario in India – Growth of energy sector – Planning in India – Importance of renewable energy sources – Environmental impact of fossil fuels – Efficiency and Security

**UNIT II SOLAR ENERGY**

9

Basic concepts – Concentrating and non-concentrating collectors – Solar water heater – Photo voltaic technology – Solar cells – Characteristics of PV systems – Standalone photovoltaic system

*K. Hey*  
**Head of the Department,**  
 Electrical & Electronics Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407.

**UNIT III WIND ENERGY**

9

Wind speed and power relation components – Turbine types – Turbine rating – Choice of generators and site selection – Wind energy forecasting – Variable speed operation – Maximum power operation

**UNIT IV BIO ENERGY**

9

Bio-mass and bio-gas: principles of bio-conversion – Bio-gas digester types – Floating dome – Fixed dome – Algae biomass – Large scale culture and harvest methodologies – Open raceway ponds

**UNIT V ENERGY MANAGEMENT**

9

Energy conservation – Act: Energy management importance – Duties and responsibilities – Energy audit – Types – Methodology

**Contact Periods:**

Lecture: 45 Periods	Tutorial: – Periods	Practical: – Periods	Project: – Periods
			Total: 45 Periods

**TEXT BOOKS:**

1. Kothari, "Renewable Energy Sources and Emerging Technologies", 2<sup>nd</sup> edition, PHI Learning Pvt. Ltd., 2013
2. Khan B.H., "Non-Conventional Energy Resources", 2<sup>nd</sup> edition, Tata McGraw Hill Education, 2017


**REFERENCES:**

1. Sukhatme S.P. and Nayak J.K., "Solar Energy", 3<sup>rd</sup> edition, Tata McGraw Hill, 2017
2. Burton T., "Wind Energy Handbook", 2<sup>nd</sup> edition, John Wiley and Sons, 2011
3. Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", 2<sup>nd</sup> edition, John Wiley and Sons, 2011

**EVALUATION PATTERN:**

EVALUATION PATTERN:					End Semester Examinations
Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
 Head of the Department,  
 Electrical & Electronics Engineering,  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407



## SEMESTER V

U21EEX04	HOME AUTOMATION	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- To acquire the knowledge on working principle of various sensors
- To understand the concepts of controllers and communication protocols
- To apply the programming knowledge to establish home automation system

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

- CO1: Classify the working principle of various sensors (Understand)  
 CO2: Illustrate the function of controllers and relay (Understand)  
 CO3: Interpret the concept of communication protocols and IoT (Understand)  
 CO4: Recall the Arduino programming language (Understand)  
 CO5: Develop the real time home automation application sources (Apply)

## CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1		
CO2	3	2	1	-	-	-	-	-	-	-	-	1		
CO3	3	2	1	-	-	-	-	-	-	-	-	1		
CO4	3	2	1	-	2	-	-	-	-	-	-	1		
CO5	3	2	2	1	2	1	-	-	-	-	2	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

## SYLLABUS:

## UNIT I TYPES OF SENSORS

9

Construction, working principle and application: Infrared motion sensor, LDR sensor, ultrasonic sensor, temperature sensor, oxygen sensor, gas sensor, rain sensor and touch sensor

## UNIT II CONTROLLERS AND RELAY

9

Arduino Uno, Node MCU and Raspberry Pi controller: Construction, pin details, board descriptions and applications – Construction and working principle of relay

*K. P. K.*  
 Head of the Department,  
 Electrical & Electronics Engineering,  
 KPR Institute of Engineering and Technology,  
 Arasur, Coimbatore - 641 407.

**UNIT III COMMUNICATION PROTOCOLS AND IoT**

Importance of protocols – Inter and intra system protocols – HTTP protocol – Bluetooth – Wireless Fidelity (WiFi) – Basics of Internet of Things (IoT) – IoT architecture

**UNIT IV ARDUINO PROGRAMMING**

Basics of Arduino software – Arduino coding: Code structure, data types, statement operators, control statements, looping statements, input/output control and sample coding for lamp and motion control – Basics of Tinker cad simulation

**UNIT V APPLICATIONS**

Interfacing of sensors with controller – Fire alarm system – Gas leakage detection system – Burglar alarm system – Arduino Uno and Node MCU: Lamp, motion and temperature control using Bluetooth and WiFi

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. Halit Eren, John G. Webster, "Measurement, Instrumentation, and Sensors Handbook", 2<sup>nd</sup> edition, CRC Press, 2017
2. Simon Monk, "Programming Arduino Getting Started with Sketches", 2<sup>nd</sup> edition, McGraw-Hill Education, 2011
3. Dr. Umesh Dutta, Nilansh Khurana, Devdutt, "The Internet of Things Using NODEMCU", 1<sup>st</sup> edition, Blue Rose Publishers, 2021


**REFERENCES:**

1. Volker Ziemann, "A Hands-On Course in Sensors Using the Arduino and Raspberry Pi", 1<sup>st</sup> edition, CRC Press, 2018
2. Donald Norris, "The Internet of Things: Do-It-Yourself Projects with Arduino, Raspberry Pi, and Beagle Bone Black", 1<sup>st</sup> edition, McGraw-Hill Education, 2015
3. Simon Monk, "Arduino + Android Projects for the Evil Genius", 1<sup>st</sup> edition, McGraw-Hill Tab Electronics, 2011

**EVALUATION PATTERN:**

EVALUATION PATTERN:					
Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60		
				200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

  
 Head of the Department,  
 Electrical & Electronics Engineering  
 KPR Institute of Engineering and Technology,  
 Arasur, Coimbatore - 641 407.



**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**SEMESTER V**



U21ITX03	DIGITAL TRANSFORMATION	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- NIL

**COURSE OBJECTIVES:**

- Understand the concept and importance of digital transformation.
- Engaging the students in projects and assignments that illustrate the various pillars of digital transformation.
- Understand with case studies the strategy and implementation of a digital transformation and marketing

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Understand core IT technologies and business models behind digital transformation (Understand)
- CO2: Understand digital transformation in organizations perspective (Understand)
- CO3: Redesigning, rebuilding organizations to create digital transformation (Understand)
- CO4: Skills to incorporate disruption in business planning (Apply)
- CO5: Determine the potential of technology advancements and the opportunities for revenue generation (Understand)

**CO-PO MAPPING:**

Pos Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	2	-	-	-	1	-	-	1		
CO2	1	-	2	-	-	-	-	-	1	-	-	1		
CO3	1	2	2	-	-	-	-	2	1	-	-	1		
CO4	1	2	2	-	2	-	-	-	1	-	-	2		
CO5	1	2	2	-	2	-	-	-	1	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION**

9

Digital Transformation, Digital business models, Pitfalls of digital transformation, Choosing business ideas, Domains of digital transformation

**UNIT II EMPLOYEE AND TEAM DIGITAL READINESS**

9

Employee digital readiness, Drivers of employee digital readiness, Consequences of employee digital readiness, Fostering digital readiness at the employee and team level, Four domains of digital business projects

Dr. T. SIVAKUMAR M.E., Ph.D.,  
Associate Professor & Head i/c  
Department of Information Technology  
KPR Institute of Engineering and Technology

KPRIET  
KPR Institute of Engineering and Technology  
Coimbatore

**UNIT III DATA-DRIVEN DECISION MAKING**

Benefits of data driven decision making, Example of data-driven decision-making, Practice data-driven decision-making in business, Wrapping up data-driven decision making

**UNIT IV DEVELOPING DIGITAL REQUIREMENTS**

Applying Product Thinking, Improving in Multiple Dimensions, Changing Requirements Mindset, Digital Tools, Case Studies: AB InBev, Walmart, Ford

**UNIT V DIGITAL MARKETING AND E-COMMERCE**

Active Websites and Blogs, Essentials of Email Marketing, Affiliate Marketing, Search engine optimization and search engine marketing, Electronic commerce, Trends in digital marketing, Case studies: Social media marketing, Startups

**Contact Periods:**

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. Bob Black "Digital Transformation: A Guide for Managers", BCS, The Chartered Institute for IT, 1<sup>st</sup> Edition, 2020
2. Pankaj Jalote, "Delivering Digital Transformation: A Manager's Guide to the Digital Revolution", De Gruyter Oldenbourg, 1<sup>st</sup> Edition, 2019


**REFERENCES:**

1. Claus T. Jensen, "Digital Transformation for Dummies", John Wiley & Sons, Special Edition, 2020
2. David L. Rogers, "The Digital Transformation PlayBook", Columbia University, 1<sup>st</sup> Edition, 2021

**EVALUATION PATTERN:**

EVALUATION PATTERN:					
Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	
Total				40	
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

  
**Dr. T. SIVAKUMAR M.E., Ph.D.,**  
 Associate Professor & Head /c  
 Department of Information Technology  
 Institute of Engineering and Technology  
 Phone - 641 407

Dr. T. SIVAKUMAR M.E., Ph.D.,  
 Associate Professor & Head /c  
 Department of Information Technology  
 Institute of Engineering and Technology  
 Phone - 641 407



**DEPARTMENT OF INFORMATION TECHNOLOGY**  
**SEMESTER V**



U21ITX04	HUMAN RESOURCE MANAGEMENT	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- Knowledge of the main sources of information and opinion on management and human resource management
- Improve ability and self-assurance in locating/interacting with mentors and creating networks of support within organizations
- Understand HR concepts and domain knowledge in order to take better decisions

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Comprehend the fundamental concepts of human resource management (Understand)  
 CO2: Recognise an individual's behaviour in an organization (Understand)  
 CO3: Examine the leadership styles and powers that can be exhibited in an organization (Understand)  
 CO4: Create, evaluate, and use sophisticated training tactics and requirements to offer training programmes (Apply)  
 CO5: Ability to manage and implement employee issue, safety and Health Measures (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	3	3		
CO2	2	2	-	-	-	-	-	2	-	-	3	3		
CO3	3	2	-	-	-	-	-	3	-	-	3	3		
CO4	3	3	-	-	-	-	-	2	-	-	3	3		
CO5	2	3	-	-	-	-	-	3	-	-	3	3		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION**

9

Nature and scope of human resource management, Evolution of HRM, Challenges of HRM, HR profession and HR department, Functions of HRM, Global perspective of HR

**UNIT II HUMAN RESOURCE PLANNING**

9

Human resource development – Evolution of HRD - Relationship with HRM - Human resource development functions - Roles and competencies of HRD professionals - Employee behaviour – External and internal influence – Motivation as internal influence – Learning and HRD – Learning strategies and styles

*Dr. T. Sivakumar*  
**Dr. T. SIVAKUMAR M.E., Ph.D.,**  
 Associate Professor & Head Vc  
 Department of Information Technology  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407

*Dr. T. Sivakumar*  
 Associate Professor & Head Vc  
 Department of Information Technology  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407

**UNIT III PERFORMANCE EVALUATION**

9

Evaluating HRD programs - Models and frame work of evaluation - Assessing the impact of HRD programs - Human resource development applications - Fundamental concepts of socialization - realistic job review - Career management and development

**UNIT IV TRAINING AND DEVELOPMENT**

9

Need and Importance of training and development - Training need analysis and techniques - Design training programme - Methods of training - Training evaluation - Executive development - Concept of career development

**UNIT V EMPLOYEE RELATIONS**

9

Ethics and employee rights and discipline - Labor relations and collective bargaining - Employee safety and health - Managing global human resources - Managing human resources in small and entrepreneurial firms

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project: – Periods  
 Total: 45 Periods

**TEXT BOOKS:**

1. Gary Dessler, "Human Resource Management", 17<sup>th</sup> Edition, Pearson, 2021
2. PravinDurai, "Human Resource Management", 3<sup>rd</sup> Edition, Pearson, 2020


**REFERENCES:**

1. Luis R. Gomez-Mejia, David B. Balkin, Robert L. Cardy "Managing Human Resources", 9<sup>th</sup> Edition, Pearson, 2020
2. K Aswathappa, Sadhna Dash, "Human Resource Management - Text and Cases", 9<sup>th</sup> Edition, McGraw Hill, 2021

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

  
**Dr. T. SIVAKUMAR M.E., Ph.D.,**  
 Associate Professor & Head /c  
 Department of Information Technology  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407

“GATEWAY TO KNOWLEDGE”  
 “A path to success is paved with knowledge”  
 “Knowledge is the key to success”  
 “Knowledge is the key to success”



**DEPARTMENT OF MECHANICAL ENGINEERING**  
**SEMESTER V**



U21MEX03	INDUSTRIAL SAFETY	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To impart knowledge on safety engineering fundamentals and safety management practices
- To impart knowledge on various safety measures and the government acts for industrial safety
- To provide insight about various safety monitoring techniques

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

CO1: Discuss the modern safety concepts, policies, audit and analysis in the industries (Understand)

CO2: Explain the impact of chemical hazardous substances in the industries (Understand)

CO3: Explain about various protective measures taken to protect noise pollution (Understand)

CO4: Identify and implement appropriate safety monitoring techniques used in the industry for enhancing the safety of worker (Apply)

CO5: Explain the various regulations and industrial safety act (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	1	3	-	-	-	-	1	-	-
CO2	3	-	-	-	-	1	3	-	-	-	-	1	-	-
CO3	3	-	-	-	-	1	3	-	-	-	-	1	-	-
CO4	3	-	-	-	-	1	3	-	-	-	-	1	-	-
CO5	3	-	-	-	-	1	3	-	-	-	-	1	-	-

**SYLLABUS:****UNIT I CONCEPTS AND TECHNIQUES**

9

Evolution of modern safety concept – Safety policy – Safety Organization – Line and staff functions for safety – Safety Committee – Budgeting for safety – Incident Recall Technique (IRT) – Disaster control – Job Safety Analysis (JSA) – Safety survey – Safety inspection – Safety sampling – Safety Audit

**UNIT II CHEMICAL HAZARDS**

9

Chemical exposure – Toxic materials – Ionizing Radiation and Non-ionizing Radiation – Industrial Hygiene – Industrial Toxicology – Case study

28/6/23  
**Dr. S. RAMESH BABU, M.E., Ph.D.**  
Professor & Head,  
Department of Mechanical Engineering  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

**UNIT III ENVIRONMENTAL CONTROL**

9

Industrial Health Hazards – Environmental Control – Industrial Noise – Noise measuring instruments – Control of Noise – Vibration – Personal Protection

**UNIT IV SAFETY PERFORMANCE MONITORING**

9

Reactive and proactive monitoring techniques – Permanent total disabilities – Permanent partial disabilities – Temporary total disabilities – Calculation of accident indices – Frequency rate – Severity rate, frequency severity incidence – Incident rate – Accident rate – Safety "t" score – Safety activity rate – Problems

**UNIT V SAFETY REGULATIONS AND EDUCATION**

9

Explosions – Disaster management – catastrophe control – Hazard control – Safety education and training – Factories Act – Safety regulations Product safety – Case studies

**Contact Periods:**

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. John V. Grimaldi, Rollin H. Simon "Safety Management", 5<sup>th</sup> edition, AITB S Publishers, 2022
2. A.K. Gupta, "Industrial Safety Management", 1<sup>st</sup> edition, University Science Press, 2009

**REFERENCES:**

1. R K Jain, "Industrial Safety, Health and Environment Management Systems", 1<sup>st</sup> edition, Khanna Publisher, 2008
2. Pratibha Bansal, Anupama Prashar, "Industrial Safety and Environment", 1<sup>st</sup> edition S. K. Kataria & Sons Publishers, 2013
3. Harsimran Singh Sodhi, Doordarshi Singh, "A Text Book on Industrial Safety", 3<sup>rd</sup> edition, Lambert Academic Publisher, 2019

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.


  
 28/6/23

**Dr. S. RAMESH BABU, M.E., Ph.D.**  
 Professor & Head,  
 Department of Mechanical Engineering  
 KPR Institute of Engineering and Technology  
 Araalur, Coimbatore - 641 437



## SEMESTER V

U21MEX04	ADDITIVE MANUFACTURING AND 3D PRINTING	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

## PRE-REQUISITES:

- Nil

## COURSE OBJECTIVES:

- Know the principles, methods, areas of usage, possibilities and limitations of the additive manufacturing technologies
- Familiarize with the characteristics of various materials that are used in additive Manufacturing
- Discuss the various applications of additive manufacturing

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to

CO1: Explain the fundamentals of additive manufacturing (Understand)

CO2: Discuss on reverse engineering (Understand)

CO3: Illustrate the liquid and solid based AM systems (Understand)

CO4: Explain the laser based additive manufacturing process (Understand)

CO5: Important knowledge on the application of various AM process (Understand)

## CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-

## SYLLABUS:

## UNIT I INTRODUCTION

9

Overview – History – Need–Classification – Additive Manufacturing Technology in product development – Materials for Additive Manufacturing Technology

## UNIT II REVERSE ENGINEERING

9

Basic Concept – 3D Scanning Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology – Part Orientation and support generation – Model Slicing – Tool path Generation – Applications and Case Studies of Reverse Engineering

Dr. S. RAMESH BABU, M.E., Ph.D.  
Professor & Head,  
Department of Mechanical Engineering  
KPR Institute of Engineering and Technology  
Arasur, Coimbatore - 641 407

**UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS**

9

Classification – Stereolithography Apparatus (SLA) – Principle – Process – Advantages – Fused Deposition Modeling – Principle – Process – Advantages

**UNIT IV LASER BASED ADDITIVE MANUFACTURING SYSTEMS**

9

Selective Laser Sintering – Principle – Process – Advantages – Three-Dimensional Printing – Principle process – Advantages – Laser Engineered Net Shaping (LENS) – Applications

**UNIT V APPLICATIONS OF ADDITIVE MANUFACTURING PROCESS**

9

Customized implants and prosthesis: Design and development – Bio – Additive Manufacturing – Computer Aided Tissue Engineering (CATE) – Applications of 3D Printing in Aerospace – Automotive – Manufacturing and Architectural Engineering

**Contact Periods:**

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods  
Total: 45 Periods

**TEXT BOOKS:**

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", 3<sup>rd</sup> edition, World Scientific Publishers, 2010
2. Douglas Bryden, "CAD and Prototyping for Product Design", 2<sup>nd</sup> edition Laurence King Publishing, 2014

**REFERENCES:**

1. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", 3<sup>rd</sup> edition CRC Press, 2012
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", 4<sup>th</sup> edition Springer, 2014
3. Gebhardt A., "Rapid prototyping", 4<sup>th</sup> edition, Hanser Gardener Publications, 2011
4. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", 3<sup>rd</sup> edition CRC press, 2010

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.



**Dr. S. RAMESH BABU, M.E., Ph.D.**  
 Professor & Head,  
 Department of Mechanical Engineering  
 KPR Institute of Engineering and Technology  
 Arasur, Coimbatore - 641 407



**DEPARTMENT OF MECHATRONICS ENGINEERING**  
**SEMESTER V**



U21MIX03	MEMS & NEMS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To learn about the basic concepts of MEMS and NEMS
- To familiarizes the concept of fabrication, manufacturing and packaging of Microsystem
- To know the applications of Micro and Nano product for various applications

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1: Interpret the basics of micro sensors and micro actuators (Understand)  
CO2: Identify the suitable fabrication process of microsystem (Understand)  
CO3: Develop the micro systems for various applications (Apply)  
CO4: Elucidate the function of nanoscale materials (Understand)  
CO5: Infer the concept of Nano-electronic devices (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2		
CO2	3	2	2	2	-	-	-	-	-	-	-	2		
CO3	3	2	2	2	-	-	-	-	-	-	-	2		
CO4	3	2	2	2	-	-	-	-	-	-	-	2		
CO5	3	2	2	2	-	-	-	-	-	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I MICROSYSTEMS, MICROSENSORS AND ACTUATORS** 9

Overview - Microsystems - Working principle of Microsystems - Micro sensors - Micro actuation techniques - Micropump - Micromotors - Microvalves - Microgrippers.

**UNIT II MICROSYSTEM FABRICATION** 9

Substrates - Single crystal silicon wafer formation - MEMS materials - Photolithography - Ion implantation - Diffusion - Oxidation - CVD - Physical Vapor Deposition - Deposition by epitaxy - Etching process.

**UNIT III MICROSYSTEM MANUFACTURING AND DESIGN** 9

Bulk Micromanufacturing - Surface Micromachining - LIGA - SLIGA. Micro system packaging - Materials - Die level - Device level - System level - Packaging techniques -

*[Signature]*  
Head of the Department  
Department of Mechatronics Engineering  
KPR Institute of Engineering and Technology  
Avinashi Road, Arasur, Coimbatore - 641407  
Tamilnadu, India

Surface bonding - Wire bonding - Sealing - Design considerations - Micro System Applications

#### UNIT IV INTRODUCTION AND OVERVIEW: NANOSCALE

9

Mendeleev's Periodic Table of Elements and Electronic Configurations - Nanoengineering and Nanoscience - Carbon Nanoelectronics: Carbon Nanotubes - Analysis of Carbon Nanotubes - Classification of Carbon Nanotubes

#### UNIT V MODELING OF NANO-ELECTROMECHANICAL SYSTEMS

9

Introduction to Modelling, Analysis, and Simulation of NEMS - Newtonian Mechanics - Functional Nano-Electro-mechanical Systems - Piezo actuators: Steady-state models and Characteristics.

#### Contact Periods:

Lecture: 45 Periods    Tutorial: – Periods    Practical: – Periods    Project – Periods  
Total 45 Periods

#### TEXTBOOKS:

1. Tai-Ran Hsu, "MEMS And Microsystems: Design and Manufacture", 1st Edition, McGraw-Hill Education Pvt. Ltd, New Delhi, 2017.
2. Lyshevski, S.E, "Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering", 2nd Edition, CRC Press, 2005.

#### REFERENCES:

1. Zhang, Dan, Wei, Bin, "Advanced Mechatronics and MEMS Devices II", 1st Edition, Springer International Publishing, 2017.
2. Takahata, K, "Advances in Micro/Nano Electromechanical Systems and Fabrication Technologies" 1st Edition, InTech Pvt. Ltd, 2013.

#### EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

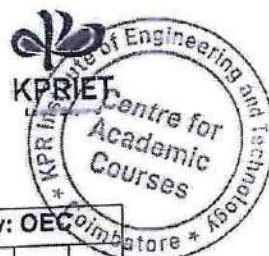
*[Signature]*  
22/5/23

Head of the Department  
Department of Mechatronics Engineering  
KPR Institute of Engineering and Technology  
Avinashi Road, Arasur, Coimbatore - 641407  
Tamilnadu, India

*[Stamp]*  
Head of the Department  
Department of Mechatronics Engineering  
KPR Institute of Engineering and Technology  
Avinashi Road, Arasur, Coimbatore - 641407  
Tamilnadu, India



**DEPARTMENT OF MECHATRONICS ENGINEERING**  
**SEMESTER V**



U21MIX04	ROBOTICS PROCESS AUTOMATION	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To provide insights on robotic process automation (RPA) technology and its value proposition
- To introduce different platforms for RPA
- To illustrate basic programming concepts and the underlying logic/structure related to RPA
- To describe the different types of variables, control flow and data manipulation techniques in a RPA platform
- To describe automation to email and various types of exceptions and strategies to handle

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1:** Gain insights into Robotic Process Automation Technology (Understand)  
**CO2:** Demonstrate the underlying logic/structure related to RPA (Understand)  
**CO3:** Classify several types of data inside a workflow and, gain skills in building workflows in a RPA platform (Understand)  
**CO4:** Comprehend different types of variables, pdf automation and data manipulation techniques (Understand)  
**CO5:** Design automation to Email and various types of Exceptions and strategies to handle (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	2		
CO2	3	3	3	3	2	-	-	-	-	-	-	2		
CO3	3	3	3	3	2	-	-	-	-	-	-	2		
CO4	3	3	3	3	2	-	-	-	-	-	-	2		
CO5	3	3	3	3	2	-	-	-	-	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INTRODUCTION TO RPA**

9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Future of RPA, Differentiating RPA from Automation, Defining Robotic Process Automation & its benefits, What RPA is Not, Types of Bots, Application areas of RPA, How Robotic Process Automation works, RPA development methodology and key considerations.

**UNIT II ROBOTIC PROCESS AUTOMATION PLATFORMS**

9

Components of RPA - RPA Platforms - Types of templates, user interfaces, domain in activities, variables, arguments, imports panel and user events - About Ui Path - The future of automation -

*[Signature]*  
 Head of the Department  
 Department of Mechatronics Engineering  
 KPR Institute of Engineering and Technology  
 Avinashi Road, Arasur, Coimbatore - 641407  
 Tamilnadu, India



Record and Play - Downloading and installing UiPath Studio - Learning Ui Path Studio - Task recorder - Step-by step examples using the recorder.

### UNIT III TAKING CONTROL OF THE CONTROLS

9

Finding and attaching windows - Finding the control - Techniques for waiting for a control - Act on controls - mouse and keyboard activities - Working with UIExplorer - Handling events - Revisit recorder - Screen Scraping - When to use OCR - Types of OCR available - How to use OCR - Avoiding typical failure points.

### UNIT IV DATA MANIPULATION AND PDF AUTOMATION

9

Data Manipulation, Automation of Virtual Machines, Introduction to Native Citrix Automation, Text and Image Automation, PDF Automation, Computer Vision.

### UNIT V EXCEPTION HANDLING, DEBUGGING AND LOGGING

9

Exception Handling, Debugging, and Logging - Exception handling - Common exceptions and ways to handle them - Logging and taking screenshots - Debugging techniques - Collecting crash dumps - Error reporting - Future of RPA.

#### Contact Periods:

Lecture: 45 Periods    Tutorial: – Periods    Practical: – Periods    Project – Periods  
Total 45 Periods

#### TEXTBOOKS:

1. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.
2. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, Mumbai, 2018.

#### REFERENCES:

1. A Gerardus Blokdyk, "Robotic Process Automation Rpa A Complete Guide ", 2020.
2. Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant", 1st Edition, Independently published, 2018.
3. Frank Casale, Rebecca Dilla, Heidi Jaynes and Lauren Livingston, "Introduction to Robotic Process Automation: A Primer".

#### EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

*(Signature)*  
22/5/22

Head of the Department

Department of Mechatronics Engineering  
KPR Institute of Engineering and Technology  
Avinashi Road, Arasur, Coimbatore - 641407  
Tamilnadu, India

Department of Mechatronics Engineering  
KPR Institute of Engineering and Technology  
Avinashi Road, Arasur, Coimbatore - 641407  
Tamilnadu, India



DEPARTMENT OF MATHEMATICS  
SEMESTER V

U21MAX01	MATHEMATICAL MODELING AND SIMULATION (Common to all)	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To understand the basic concepts of mathematical modeling
- To understand the applications using modeling and simulation
- To identify different optimization techniques

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

CO1: Apply the basics of mathematical tools using Sage Math (Apply)

CO2: Apply the structure of coding and error analysis (Apply)

CO3: Interpret modeling of techniques (Understand)

CO4: Implement optimization techniques to resolve problems (Understand)

CO5: Use the mathematical modeling to solve the engineering problems (Apply)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	2	-	-	-	-	-	-	1		
CO2	3	2	1	-	1	-	-	-	-	-	-	1		
CO3	3	2	1	-	1	-	-	-	-	-	-	1		
CO4	3	2	1	-	1	-	-	-	-	-	-	1		
CO5	3	2	1	-	1	-	-	-	1	-	-	1		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I MATHEMATICAL PROGRAMMING**

9

Math reckoner – Structuring data – Polynomial systems – Analysis – Graphics and computational domains using Sage Math

**UNIT II FUNCTIONS AND CODING BLOCKS**

9

Basic syntax in Matlab – Common functions – Basic graphics – Structure of coding – Program execution – Error analysis

**UNIT III SYSTEM MODELING AND SIMULATION**

9

Fundamentals of modeling using Matlab – Classification of models – Modeling techniques – Mathematical modeling of physical systems – Simulations: constructing, running and saving data in Matlab – Interpretation of results

**UNIT IV OPTIMIZATION TECHNIQUES**

9

Functions of linear and non-linear optimization – Optimization using numerical methods: solving equations – Optimization techniques using toolbox – Optimization using symbolic computation

**UNIT V APPLICATIONS**

9

Modeling in electric circuits – Car safety bumper – Water flow in a river – Heat conduction in a square plate using Matlab

**Contact Periods:**

Lecture: 45 Periods      Tutorial: – Periods      Practical: – Periods      Project – Periods  
 Total: 45 Periods

**TEXT BOOKS:**

1. Paul Zimmermann, "Computational Mathematics with Sage Math", 1<sup>st</sup> edition, SIAM Publications, 2019.
2. Devendra K Chaturvedi, "Modeling and simulation of systems using MATLAB and Simulink", CRC press, 1<sup>st</sup> edition, 2017.

**REFERENCES:**

1. Niket S Kaisare, "Computational Techniques for Process Simulation and Analysis Using MATLAB", CRC Press, 1<sup>st</sup> edition, 2017.
2. Cesar Lopez, "MATLAB optimization techniques", A press, 1<sup>st</sup> edition, 2014.
3. William J Paul, "MATLAB for engineering applications", Mc Graw Hill, 4<sup>th</sup> edition, 2018.
4. Steven I Gordon and Brian Guilfoos, "Introduction to Modeling and Simulation with MATLAB and Python", CRC Press, 1<sup>st</sup> edition, 2017.
5. Andrew Knight, "Basics of MATLAB and beyond", CRC press, 1<sup>st</sup> edition, 2019.

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

**Dr. K. KARTHIKEYAN** M.Sc., M.Phil., Ph.D.  
 Professor & Head  
 Department of Mathematics  
 KPR Institute of Engineering and Technology  
 Coimbatore - 641 407



B.E. – CE – R2021 – CBCS

CENTRE FOR INNOVATION, INCUBATION AND ENTREPRENEURSHIP DEVELOPMENT

SEMESTER V



U21CAX01	ENTREPRENEURSHIP DEVELOPMENT AND STARTUP	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- NIL

**COURSE OBJECTIVES:**

- To know the basic concepts in the area of entrepreneurship
- To identify entrepreneurial opportunities
- To create awareness on the new venture creation for startup.

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

CO1: Discuss the fundamentals of entrepreneurship (Understand)

CO2: Suggest different forms of new venture development (Understand)

CO3: Assess business plan, business pitch as an entrepreneurial tool (Understand)

CO4: Explain the methodology to start an enterprise in a systematic manner (Understand)

CO5: Make use of the different Government initiatives and support organizations for starting new venture (Understand)

**CO-PO MAPPING:**

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
COs														
CO1	-	-	-	-	-	2	2	-	-	1	2	2		
CO2	-	-	-	-	-	2	2	-	-	1	2	2		
CO3	-	-	-	-	-	2	2	-	-	1	2	2		
CO4	-	-	-	-	-	2	2	-	-	1	2	2		
CO5	-	-	-	-	-	2	2	-	-	1	2	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:**

**UNIT I ENTREPRENEURSHIP**

9

Concept of entrepreneurship – characteristics and Types of entrepreneurship – Factors affecting entrepreneurs – Entrepreneurship mindset – difference between inventors and entrepreneurs – companies vs startups – Entrepreneurial environment – Entrepreneurial growth – Role of entrepreneurship in economic development

**UNIT II CREATING ENTREPRENEURIAL VENTURE**

9

Creating and Starting the Venture: Sources of new Ideas – Methods of generating ideas – creating, problem solving – product planning and development process – Various forms of business organizations : Sole proprietorship – Partnership – Limited liability partnership firms – Corporation – Franchising – Setup process of small scale enterprise, procedures for Registration of small scale industry

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**UNIT III BUSINESS PLAN AND PITCH**

9

Nature of Business plan – Writing business plan – Evaluating business plan, implementing business plan – Marketing plan – Financial plan – Organizational plan – Business pitch –Preparing investor presentation – Element of the perfect investment pitch –delivering of investor pitch to panel of investors

**UNIT IV START-UP OPPORTUNITIES AND PROCESS**

9

Introduction to design thinking – Idea Generation with brainstorming – New industrial revolution – Business startup – Ideation – Venture choices – Startup policy – Startup opportunities, Registration and Legal process of startups – Startup Ecosystem – Business startups – Legal environment – Approval for new ventures – Taxes or duties payable for new ventures

**UNIT V GOVERNMENT INITIATIVES AND INSTITUTIONAL SUPPORT**

9

Role of Central Government and State Government in promoting entrepreneurship with various incentives, subsidies, grants, programs, schemes and challenges – Government initiatives and inclusive entrepreneurial Growth – Startup India Scheme – MSME Act – MEME policy in India – TN Startup schemes –Source of entrepreneurial finance – Commercial banks – Venture capital, angel investors – Funding startups with bootstrapping – Crowd funding – Strategic alliances

**Contact Periods:**

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods  
Total 45 Periods

**TEXT BOOKS:**

1. Khanna, S. S., "Entrepreneurial Development", S. Chand & Co. Ltd, New Delhi, 1999
2. Charantimath, P.M, "Entrepreneurship Development and Small Business Enterprises", 10<sup>th</sup> edition, Pearson Education, India, 2006

**REFERENCES:**

1. N.P.Srinivasan & G.P.Gupta, "Entrepreneurial Development ", Sultan chand and & Sons, India, 2020
2. Anil Kumar.S, "Entrepreneurship Development", New Age International (P) Ltd., 2003.
3. Aurangabadkar P, Singh S, "Startup and New Venture Management" 7<sup>th</sup> edition, Nirali Prakashan, 2018
4. Kathleen R Allen, "Launching New Ventures - An Entrepreneurial Approach", 7<sup>th</sup> edition, Cengage Learning, 2016

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60		
Total					200
					40
					60
					100

\*Roll Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.





**CENTRE FOR INNOVATION, INCUBATION AND ENTREPRENEURSHIP**  
**SEMESTER V**



U21CAX03	ENTREPRENEURSHIP DEVELOPMENT	Category: OEC				
		L	T	P	J	C
		2	0	2	0	3

**PRE-REQUISITES:**

- NIL

**COURSE OBJECTIVES:**

- Learn basic concepts in entrepreneurship, develop mind-set and skills necessary to explore entrepreneurship
- Apply process of problem - opportunity identification and validation through human centred approach to design thinking in building solutions as part of engineering projects
- Analyse market types, conduct market estimation, identify customers, create customer persona, develop the skills to create a compelling value proposition and build a Minimum Viable Product
- Explore business models, create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture ideas & solutions built with domain expertise
- Prepare and present an investible pitch deck of their practice venture to attract stakeholders

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1:** Develop an Entrepreneurial Mind-set and Understand the Entrepreneurial Ecosystem Components and Funding types (Understand)
- CO2:** Comprehend the process of opportunity identification through design thinking, identify market potential and customers (Understand)
- CO3:** Generate and develop creative ideas through ideation techniques (Apply)
- CO4:** Create prototypes to materialize design concepts and conduct testing to gather feedback and refine prototypes to build a validated MVP (Apply)
- CO5:** Analyse and refine business models to ensure sustainability and profitability Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders (Analysis)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	–	–	3	–	2	2	–	–	2	2	3	2		
CO2	–	2	3	2	–	2	–	–	2	2	2	2		
CO3	–	2	3	2	–	–	–	–	2	–	–	2		
CO4	2	2	3	3	2	–	–	–	2	2	2	2		
CO5	–	2	2	2	–	2	3	2	2	3	3	2		
Correlation levels:      1: Slight (Low)      2: Moderate (Medium)      3: Substantial (High)														

**SYLLABUS:****UNIT I      ENTREPRENEURIAL MINDSET****6+6**

Introduction to Entrepreneurship: Definition – Types of Entrepreneurs – Emerging Economics – Developing and Understanding an Entrepreneurial Mindset – Importance of Technology Entrepreneurship – Benefits to the Society.

Case Analysis: Study cases of successful & failed engineering entrepreneurs - Foster Creative Thinking: Engage in a series of Problem-Identification and Problem-Solving tasks

**UNIT II OPPORTUNITIES**

**6+6**

Problems and Opportunities – Ideas and Opportunities – Identifying problems in society – Creation of opportunities – Exploring Market Types – Estimating the Market Size, - Knowing the Customer and Consumer - Customer Segmentation - Identifying niche markets – Customer discovery and validation; Market research techniques, tools for validation of ideas and opportunities

Activity Session: Identify emerging sectors / potential opportunities in existing markets - Customer Interviews: Conduct preliminary interviews with potential customers for Opportunity Validation - Analyse feedback to refine the opportunity.

**UNIT III PROTOTYPING & ITERATION**

**6+6**

Prototyping – Importance in entrepreneurial process – Types of Prototypes - Different methods – Tools & Techniques.

Hands-on sessions on prototyping tools (3D printing, electronics, software), Develop a prototype based on identified opportunities; Receive feedback and iterate on the prototypes

**UNIT IV BUSINESS MODELS & PITCHING**

**6+6**

Business Model and Types - Lean Approach - 9 block Lean Canvas Model - Riskiest assumptions to Business Models – Using Business Model Canvas as a Tool – Pitching Techniques: Importance of pitching - Types of pitches - crafting a compelling pitch – pitch presentation skills - using storytelling to gain investor/customer attention.

Activity Session: Develop a business model canvas for the prototype; present and receive feedback from peers and mentors - Prepare and practice pitching the business ideas- Participate in a Pitching Competition and present to a panel of judges - receive & reflect feedback

**UNIT V ENTREPRENEURIAL ECOSYSTEM**

**6+6**

Understanding the Entrepreneurial Ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors. Financing models – equity, debt, crowdfunding, etc, Support from the government and corporates. Navigating Ecosystem Support: Searching & Identifying the Right Ecosystem Partner – Leveraging the Ecosystem - Building the right stakeholder network

Activity Session: Arrangement of Guest Speaker Sessions by successful entrepreneurs and entrepreneurial ecosystem leaders (incubation managers; angels; etc), Visit one or two entrepreneurial ecosystem players (Travel and visit a research park or incubator or makerspace or interact with startup founders).

**Contact Periods:**

Lecture:	30 Periods	Tutorial:	– Periods	Practical:	30 Periods	Project	– Periods
						Total	60 Periods

**REFERENCES:**

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business
3. Blank, S. G., & Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&S Ranch
4. Roy, R. (2017). Indian Entrepreneurship: Theory and Practice. New Delhi: Oxford University Press
5. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons



**EVALUATION PATTERN:**

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
Individual Assignment / Case Study/ Mini Project/ Seminar / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25			
50				50	
Total:100					

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided.

**Semester V**  
**General Engineering**



U21GEX03	INDIAN FOLKLORE, STAGE AND DRAMA	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- To know the historical evolution of Indian theatre, spanning classical, traditional, and modern periods
- To know the diverse folk theatre forms such as Bhand Pather, Tamasha, and Chhau, understanding their unique characteristics and regional variations
- To know how language and literature contribute to the richness and diversity of Indian dramatic expressions

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

- CO1:** Understand the historical evolution of Indian theatre, identifying key periods and transitions (Understand)
- CO2:** Understand the different folk theatre traditions, recognizing the cultural diversity within Indian theatre (Understand)
- CO3:** Understand the role of folklore and drama in shaping community identity and preserving cultural traditions (Understand)
- CO4:** Understand significance of language and literature in Indian drama, identifying key linguistic elements and literary contributions (Understand)
- CO5:** Understand the contributions of contemporary practitioners to the ongoing development and global recognition of Indian theatre (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	-	-	-	2		
CO2	-	-	-	-	-	3	-	-	-	-	-	2		
CO3	-	-	-	-	-	3	-	3	-	-	-	2		
CO4	-	-	-	-	-	2	-	-	-	-	-	2		
CO5	-	-	-	-	-	1	-	-	-	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I HISTORICAL EVOLUTION**

9

Historical periods of Indian theatre – classical period – traditional period – modern period – notable playwrights and performers – evolution of narrative traditions and folk theatre

N. Dey's

(Head/Ocean)



<b>UNIT II DIVERSE FORMS</b>	<b>9</b>
Exploration of diverse folk theatre forms – Bhand Pather – Tamasha – Chhau – regional variations – fusion of dance, drama, stylized speech, and spectacle	
<b>UNIT III SOCIAL AND CULTURAL CONTEXTS</b>	<b>9</b>
Socio-political realities reflected in folk theatre – role of folklore and drama in community identity – cultural preservation – impact of colonialism and post-colonialism	
<b>UNIT IV LANGUAGE, LITERATURE, AND PERFORMANCE</b>	<b>9</b>
Role of language and literature in Indian drama – analysis of scripts, narratives – performance traditions – significance of Sanskrit and regional languages.	
<b>UNIT V CONTEMPORARY RELEVANCE AND GLOBAL RECOGNITION</b>	<b>9</b>
Modern adaptations and innovations in Indian drama – global recognition of Indian performing arts – contemporary practitioners – contributions.	

**Contact Periods:**

Lecture:	45 Periods	Tutorial:	– Periods	Practical:	– Periods	Project	– Periods
						Total	45 Periods

**TEXT BOOKS:**

1. Julia C. Bignami, "Indian Folk Theatres", Routledge, 1<sup>st</sup> edition, 2014.
2. Varadpande, M.L., "History of Indian Theatre", Abhinav Publications, 2005.

**REFERENCES:**

1. Mahesh Elkunchwar, "Reflections on the Indian Stage", The Sruti Foundation, 2017.
2. Ananda Lal, "The Oxford Companion to Indian Theatre", Oxford University Press, 2004.
3. Farley P. Richmond, Darius L. Swann, and Phillip B. Zarrilli, "Indian Theatre: Traditions of Performance", Motilal Banarsidass Publishing House, 2007.

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60		
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

N. Day's  
(HEAD / OCEAN)

**Semester V**  
**General Engineering**



U21GEX04	INDIAN FOOD, AGRICULTURE AND ARCHITECTURE	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

**PRE-REQUISITES:**

- Nil

**COURSE OBJECTIVES:**

- Know the Indian food and regional cuisines of India
- Know the Indian agriculture and irrigation technology in ancient and medieval period
- Know the Indian architectural technology in ancient, medieval and modern India

**COURSE OUTCOMES:**

Upon completion of the course, the student will be able to

**CO1:** Understand the Comprehensive Knowledge and Practical Skills in Indian Culinary Arts (Understand)

**CO2:** Understand the Practical Expertise in Diverse Aspects of Indian Cuisine (Understand)

**CO3:** Understand the Historical Context of Indian Agriculture (Understand)

**CO4:** Understand and Analyze the Indian Architectural Heritage (Understand)

**CO5:** Understanding of Diverse Architectural Styles and Iconic South Indian Temples (Understand)

**CO-PO MAPPING:**

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	1	-	-	-	2		
CO2	-	-	-	-	-	-	2	-	-	-	-	2		
CO3	-	2	-	-	-	-	-	-	-	-	-	3		
CO4	3	-	-	-	-	-	-	-	-	-	-	2		
CO5	-	3	-	-	-	-	-	-	-	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

**SYLLABUS:****UNIT I INDIAN FOOD**

9

Historical development of Indian cuisine – Regional diversity in Indian food – Key ingredients and spices in Indian cooking – Traditional cooking methods in Indian cuisine – Essential kitchen tools and utensils – Safety and hygiene in Indian cooking

**UNIT II REGIONAL CUISINES OF INDIA**

9

North Indian cuisine: Dishes, flavors, and influences – South Indian cuisine: Specialties and ingredients – East, West, and Central Indian regional cuisines – Vegetarian staples: Dal, paneer, and

N. Dey's  
(Head / OCEAN)



more – Non-vegetarian delicacies: Chicken, lamb, and seafood – Dietary preferences and religious influences – Indian food's popularity worldwide, Fusion cuisine and contemporary adaptations, the future of Indian culinary trends

**UNIT III INDIAN AGRICULTURE**

9

The significance of agriculture and irrigation as emphasized in the Ramayana, Mahabharatha and other texts – Indian irrigation system – Seasonal crops – Agricultural technology in ancient and medieval periods

**UNIT IV INDIAN ARCHITECTURE**

9

The importance of Sthapatya-veda – The ancient cities of Indus-Saraswati region – Town planning and drainage system in Ramayana and Mahabharatha – Public opulence and private austerity in Indian architecture – Importance texts of architecture and sculpture

**UNIT V INDIAN ARCHITECTURE – MODERN INDIA**

9

Temples, palaces, forts and tombs – Architectural styles: Dravidian, Nagara, Mughal – South Indian temples: Bragatheshwara temple, Tharasuram, Gangaikondacholapuram, Meenachiamman temple, Sri Rangam temple and Ramanathaswamy temple

**Contact Periods:**

Lecture: 45 Periods    Tutorial: – Periods    Practical: – Periods    Project – Periods  
 Total 45 Periods

**TEXT BOOKS:**

1. Achaya, K.T., "Indian Food: A Historical Companion", Oxford University Press, 1997.
2. Saxena, R. C., and Choudhary, S. L., "Textbook on Ancient Indian agriculture", Munshiram Manoharlal Publishers, 2010.
3. Percy Brown, "Indian Architecture: Its Psychology, Structure, and History", D.B. Taraporevala Sons & Co., Publication, 1940.

**REFERENCES:**

1. Christopher Tadgell, "History of Architecture in India", Architecture Design and Technology Press, 1990.

**EVALUATION PATTERN:**

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60		
Total				40	60
				100	

\*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

N. D. Jais  
 (Head / OCEAN)



## KPR Institute of Engineering and Technology

Learn Beyond

(Autonomous, NAAC "A")

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0422 2635600, +91 75488 88444

[admission@kpriet.ac.in](mailto:admission@kpriet.ac.in)

Avinashi Road, Arasur, Coimbatore - 641407

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[kpriet.edu.in](http://kpriet.edu.in)      /KPRIETonline