



**KPR Institute of
Engineering and
Technology**

Learn Beyond (Autonomous, NAAC "A")

Avinashi Road, Arasur, Coimbatore.

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**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
DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE		
1.	U21ADX03	Artificial Intelligence: Principles and Techniques
2.	U21ADX04	Ethics and Data Science
DEPARTMENT OF BIOMEDICAL ENGINEERING		
1.	U21BMX03	Biomedical Visualization
2.	U21BMX04	Food as Medicine
DEPARTMENT OF CHEMICAL ENGINEERING		
1.	U21CHX03	Environmental Impact Assessment
2.	U21CHX04	Industrial Wastewater Treatment
DEPARTMENT OF CIVIL ENGINEERING		
1.	U21CEX03	Remote Sensing and GIS
2.	U21CEX04	Waste Management
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
1.	U21CSX03	Computational Thinking
2.	U21CSX04	Blockchain Fundamentals
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (AI&ML)		
1.	U21AMX02	AI fundamentals
2.	U21AMX03	Joy of Programming
DEPARTMENT OF COMPUTER SCIENCE AND BUSINESS SYSTEMS		
1.	U21CBX03	IT for Managers
2.	U21CBX04	Security Analysis and Portfolio Management
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING		
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.	U21ENX01	Effective Public Speaking and Presentation Skills
2.	U21ENX02	Emotional Intelligence
3.	U21MAX01	Mathematical Modelling and Simulation
4.	U21MAX02	Linear Programming Problems
5.	U21CYX05	Waste Management and Resource Recovery
6.	U21CYX06	Chemical Aspects of Food Adulteration
7.	U21CYX07	Food Engineering and Technology
8.	U21PHX04	Modern Physics for Engineering Applications
9.	U21PHX05	Semiconductor Processing and Nano Devices
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
3.	U21GEX07	Vertical Transportation Systems
FOREIGN LANGUAGE COURSES		
1.	U21FLX04	Advanced Japanese for Engineers
2.	U21FLX05	Advanced Hindi for Engineers
3.	U21FLX06	Advanced German for Engineers

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER V

U21ADX03	ARTIFICIAL INTELLIGENCE: PRINCIPLES AND TECHNIQUES	Category: OEC				
		L	T	P	Practical	Grading
		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:

COs \ POs	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: – Periods
 Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; 1st 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", 5th Edition, Springer, 2003.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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:

COs \ POs	POs													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	3	-	-	-	1		
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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** 9
 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** 9
 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** 9
 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:

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

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
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Total				40	60
				100	

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(Signature)

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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:

COs \ POs	POs													
	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 Slotte, "Computer Methods, Imaging and Visualization in Biomechanics and Biomedical Engineering II", Springer, 1st edition, 2022
2. Diego Gallo, Giuseppe Isu, Diana Massai (auth.), Rui Lima, Yohsuke Imai, Takuji Ishikawa, Mónica S. N. Oliveira, "Visualization and Simulation of Complex Flows in Biomedical Engineering", Springer, 1st 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, 1st edition, 2014

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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	

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 HNO - BIOMEDICAL ENGINEERING
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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:

COs \ POs	POs												PSOs	
	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

9

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

UNIT V FOOD AND THE BRAIN

9

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" 2nd 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:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.



HOD - BIOMEDICAL ENGINEERING
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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", 2nd edition, Wiley Blackwell, New Jersey, 2003
2. Anjaneyulu Y and Manickam V, "Environmental Impact Assessment Methodologies", 3rd edition, BS Publications, 2020


REFERENCES:

1. Henk A. Becker and Frank Vanclay, "The International Handbook of Social Impact Assessment", 2nd 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:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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SEMESTER V

U21CHX04	INDUSTRIAL WASTEWATER TREATMENT	Category: OEC				
		L	T	P	J	
		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:

COs \ POs	POs												PSOs	
	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:

UNIT I INTRODUCTION TO BIOCHEMICAL OPERATIONS	9
Classification of biochemical operations – Fundamentals of biochemical operations	
UNIT II TRADITIONAL BIOLOGICAL TREATMENT	9
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	
UNIT III APPLICATION OF TRADITIONAL BIOLOGICAL TREATMENT	9
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 – Tricking 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", 1st edition, CRC Press, 2016
2. Patwardhan A D, "Industrial Wastewater Treatment", 1st edition, PHI Learning Pvt. Ltd, 2017


REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
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				100	

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 Dr. S. Balasubramanian, M.Tech., Ph.D.
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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 9

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 9

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, 1st edition, 2015
2. Jensen, John R., "Remote Sensing of the Environment", An Earth Resource Perspective, 2nd edition, Prentice Hall, New Jersey, 2013


REFERENCES:

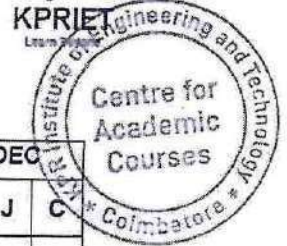
1. Prescott, Harley and Klein, "Microbiology", 10th edition, McGraw Hill, 2017

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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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:

COs \ POs	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", 2nd edition, McGraw Hill Education (India) Pvt Ltd., 2013
- Sincero A. P and Sincero G. A, "Environmental Engineering", 1st edition, A Design Approach by Prentice Hall of India, 2014


REFERENCES:

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

EVALUATION PATTERN:

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

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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", 1st Edition, Chapman & Hall/CRC, 2014
2. Karl Beecher, "Computational Thinking: A beginner's guide to problem solving and programming", 1st 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", 1st Edition, Springer, 2018
3. Jane Krauss, Kiki Prottzman, "Computational Thinking and Coding for Every Student: The Teacher's Getting-Started Guide" 1st Edition, SAGE Publications, 2016

EVALUATION PATTERN:

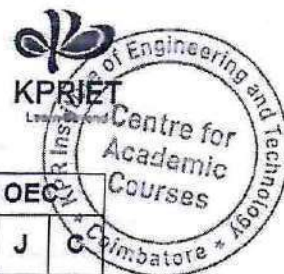
Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60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



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

9

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

9

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", 2nd Edition, Packt Publishinh Ltd, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, "Bitcoin and cryptocurrency technologies: a comprehensive introduction" 2nd Edition, Princeton University Press, 2016
3. Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", 1st 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. Antonopoulo, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 1st Edition, O'Reilly Media Inc, 2015

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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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:

COs \ POs	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

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Department of CSE(AI and ML)
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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", 1st edition, Packt publishing, 2017
2. Aurelien Geron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 1st edition, O'Reilly Media, 2019

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.



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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



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 Head of the Department

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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", 4th edition, Pearson, 2019
2. Kathy Sierra and Bert Bates, "Head First Java", 2nd edition, O'Reilly Media, 2021
3. Carlos Coronel, Steven Morris, and Peter Rob, "Database Systems: Design, Implementation, and Management", 12th edition, Cengage Learning, 2016


REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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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:

COs \ POs	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

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

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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", 4th Edition, IntechOpen, 2018
2. Ken J.Sousa, EfficOzz, "Management Information system", 7th Edition, Course Technology, 2014.

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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



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:

COs \ POs	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)

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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", 12th Edition, Cengage Learning, 2021.
2. Frank K. Reilly, Keith C. Brown, "Investment Analysis and Portfolio Management", 10th Edition, Cengage Learning, 2018.

REFERENCES:

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



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EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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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:

COs \ POs	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

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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", 2nd edition, Tata Mc Graw Hill, 2016
2. James A. Langbridge, "Arduino Sketches tools and techniques for programming" wizardry Wiley, 1st edition, 2015


REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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	

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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:

Cos \ POs	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


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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, Anwesa Borthakur, "Handbook of Electronic Waste Management" Butterworth-Heinemann: Elsevier, 1st edition, 2020
2. A.K.Hargi, "Waste Management: Research Advances to Convert Waste to Wealth", Nova Science Publishers, 1st edition, 2010


REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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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:

COs \ POs	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

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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", 2nd edition, PHI learning Pvt. Ltd., 2013
2. Khan B.H., "Non-Conventional Energy Resources", 2nd edition, Tata McGraw Hill Education, 2017


REFERENCES:

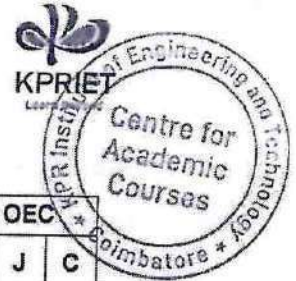
1. Sukhatme S.P. and Nayak J.K., "Solar Energy", 3rd edition, Tata McGraw Hill, 2017
2. Burton T., "Wind Energy Handbook", 2nd edition, John Wiley and Sons, 2011
3. Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", 2nd edition, John Wiley and Sons, 2011

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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

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:

COs \ POs	POs												PSOs	
	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


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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", 2nd edition, CRC Press, 2017
2. Simon Monk, "Programming Arduino Getting Started with Sketches", 2nd edition, McGraw-Hill Education, 2011
3. Dr. Umesh Dutta, Nilansh Khurana, Devdutt, "The Internet of Things Using NODEMCU", 1st edition, Blue Rose Publishers, 2021


REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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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

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UNIT III DATA-DRIVEN DECISION MAKING 9

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 9

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 9

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, 1st Edition, 2020
2. Pankaj Jalote, "Delivering Digital Transformation: A Manager's Guide to the Digital Revolution", De Gruyter Oldenbourg, 1st 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, 1st Edition, 2021

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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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:

COs \ POs	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

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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", 17th Edition, Pearson, 2021
2. PravinDurai, "Human Resource Management", 3rd Edition, Pearson, 2020


REFERENCES:

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

EVALUATION PATTERN:

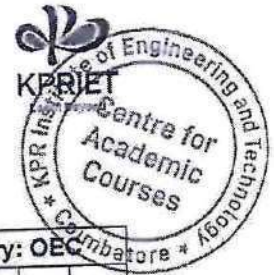
Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60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

COs \ POs	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


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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", 5th edition, AITB S Publishers, 2022
2. A.K. Gupta, "Industrial Safety Management", 1st edition, University Science Press, 2009

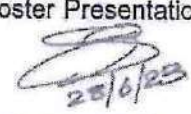
REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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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


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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", 3rd edition, World Scientific Publishers, 2010
2. Douglas Bryden, "CAD and Prototyping for Product Design", 2nd 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", 3rd edition CRC Press, 2012
2. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", 4th edition Springer, 2014
3. Gebhardt A., "Rapid prototyping", 4th edition, Hanser Gardener Publications, 2011
4. Hilton P.D. and Jacobs P.F., "Rapid Tooling: Technologies and Industrial Applications", 3rd edition CRC press, 2010

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.



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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:

COs \ POs	POs												PSOs	
	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 -

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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				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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	

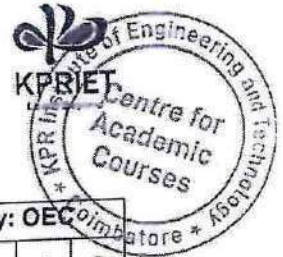
*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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 22/5/23

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 Tamilnadu, India

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DEPARTMENT OF MECHATRONICS ENGINEERING
SEMESTER V



U21MIX04	ROBOTICS PROCESS AUTOMATION	Category: OEC Coimbatore				
		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:

COs \ POs	POs												PSOs	
	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 -

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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 Tauli , "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.

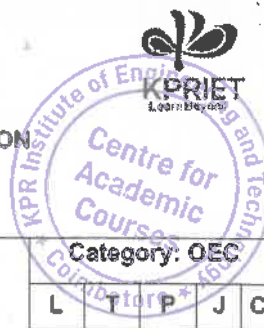
(Signature)
22/5/23

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DEPARTMENT OF LANGUAGE AND COMMUNICATION
SEMESTER V



U21ENX01	EFFECTIVE PUBLIC SPEAKING AND PRESENTATION SKILLS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop the ability to deliver impactful public speeches and presentations with clarity, confidence, and persuasion.
- To strengthen strategic communication skills for diverse academic, professional, and social contexts.
- To enhance students' critical thinking and audience engagement strategies during speeches and presentations.

COURSE OUTCOMES:

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

- CO1:** Demonstrate effective verbal and non-verbal communication in public speaking situations. (Apply)
CO2: Structure and deliver presentations tailored to specific purposes and audiences. (Apply)
CO3: Use effective presentation techniques to deliver messages clearly (Apply)
CO4: Design and deliver professional presentations using suitable visual aids and multimedia tools. (Analyze)
CO5: Understand the role of teamwork and confidence in real-life situations. (Understand)

CO-PO MAPPING:

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

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:**UNIT I FOUNDATIONS OF COMMUNICATION**

9

Introduction to public speaking – Types and purposes of speeches – The communication process – Audience analysis – Overcoming stage fright – Organizing the speech: introduction, body, conclusion – Crafting persuasive and informative content – Using storytelling and evidence effectively.

UNIT II MASTERING DELIVERY AND COMMUNICATION TECHNIQUES

9

Voice modulation, pitch, and pace – Effective body language – Use of gestures, eye contact, and posture – Role of silence and pauses – Designing impactful visual aids – Slide creation best practices – Integrating multimedia – Handling Q and A and feedback.

UNIT III PRACTICAL APPLICATION AND PERFORMANCE SKILLS 9

Speech delivery exercises – Peer and self-evaluation – Group presentations – Real-world public speaking scenarios – Storytelling for influence and engagement – Managing difficult audiences.

UNIT IV ADVANCED PRESENTATION AND PERSUASIVE SPEAKING SKILLS 9

Persuasive speaking strategies – Motivational and inspirational speeches – Professional and business presentations – Presentation for interviews and group discussions – Crisis and impromptu communication – Ethical communication and credibility building.

UNIT V DIGITAL AND PROFESSIONAL COMMUNICATION PRACTICES 9

Online presentation skills – Virtual meeting etiquette – Webinar and conference presentation techniques – Personal branding through communication – Use of AI and digital tools for presentation preparation – Intercultural communication in global contexts – Portfolio presentation and final speaking performance assessment.

Contact Periods:

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

TEXT BOOKS:

1. Stephen E. Lucas, The Art of Public Speaking, 13th Edition, McGraw - Hill Education, 2019.
2. Gallo, Carmine. Talk Like TED: The 9 Public-Speaking Secrets of the World's Top Minds. 1st Edition. St. Martin's Press, 2014.


REFERENCES:

1. Chris Anderson, "TED Talks: The Official TED Guide to Public Speaking", Houghton Mifflin Harcourt, 2016
2. Toastmasters International: <https://www.toastmasters.org>

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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DEPARTMENT OF LANGUAGE AND COMMUNICATION
SEMESTER V

U21ENX02	EMOTIONAL INTELLIGENCE	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop advanced emotional intelligence competencies for leadership and professional excellence.
- To enhance emotional adaptability, resilience, and strategic decision-making abilities.
- To apply emotional intelligence principles in organizational, social, and multicultural environments.

COURSE OUTCOMES:

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

- CO1:** Identify and manage emotions using emotional intelligence principles. (Apply)
CO2: Demonstrate empathy and effective interpersonal communication skills. (Apply)
CO3: Apply emotional intelligence in teamwork and collaboration. (Apply)
CO4: Utilize emotional intelligence for leadership and conflict resolution. (Analyze)
CO5: Examine the impact of emotional intelligence on professional growth and ethical decision making (Analyze)

CO-PO MAPPING:

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

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:**UNIT I FOUNDATIONS OF EMOTIONAL INTELLIGENCE 9**

Definition and components: self-awareness, self-regulation, motivation, empathy, social skills – Importance of EI in personal and professional life – Assessing personal EI through Tools Identifying – emotions and triggers – Techniques for emotional regulation – Stress management and resilience-building strategies.

UNIT II INTERPERSONAL COMPETENCE AND EMOTIONAL SKILLS 9

Active listening and nonverbal communication – Empathy in relationships and teamwork – Conflict resolution and negotiation techniques – Building rapport and trust – EI in leadership and team dynamics – Giving and receiving constructive feedback.

UNIT III EMOTIONAL INTELLIGENCE IN ACTION

9

EI in workplace scenarios and decision-making – Case studies and role-playing exercises – Developing a personal EI action plan – Emotional intelligence in difficult conversations – Case study on workplace and social conflicts.

UNIT IV CONFLICT MANAGEMENT, NEGOTIATION, AND ETHICAL PRACTICES

9

Psychology of conflicts and emotional reactions – Conflict transformation and mediation techniques – Emotional regulation during negotiation – Crisis communication and emotional stability – Ethical leadership and responsible emotional conduct.

UNIT V APPLIED EI AND PROFESSIONAL DEVELOPMENT

9

EI in entrepreneurship and innovation - AI, digital communication – Personal branding and professional presence – Reflective practices and emotional journaling – Designing a personal emotional growth framework – EI based problem-solving in real-life scenarios

Contact Periods:

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

TEXT BOOKS:

1. Marc Brackett, Permission to Feel: Unlocking the Power of Emotions to Help Our Kids, Ourselves, and Our Society Thrive, 1st Edition, Celadon Books, 2019.
2. Brené Brown, Atlas of the Heart: Mapping Meaningful Connection and the Language of Human Experience, 1st Edition, Random House Publishing Group, 2021.


REFERENCES:

1. Susan David, Emotional Agility: Get Unstuck, Embrace Change, and Thrive in Work and Life, 1st Edition, Avery Publishing Group, 2016.
2. Susan Cain, Bittersweet: How Sorrow and Longing Make Us Whole, 1st Edition, Crown Publishing Group, 2022.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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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 mathematical programming tools using Sage Math to analyze polynomials, data, and computational domains with correct syntax (Apply)
- CO2: Implement coding blocks in MATLAB to execute functions, generate graphics, and perform error analysis in simulations (Apply)
- CO3: Explain system modeling techniques using MATLAB to classify models and interpret simulation results for physical systems. (Understand)
- CO4: Describe optimization techniques for linear and nonlinear problems using numerical and symbolic methods in MATLAB (Understand)
- CO5: Apply mathematical modeling to engineering applications such as electric circuits, heat conduction, and fluid flow using MATLAB simulations (Apply)

CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	-	1		
CO2	3	2	1	-	3	-	-	-	-	-	-	1		
CO3	3	2	1	-	2	-	-	-	-	-	-	1		
CO4	3	2	1	-	2	-	-	-	-	-	-	1		
CO5	3	2	1	2	3	-	-	-	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", 1st edition, SIAM Publications, 2019
2. Devendra K Chaturvedi, "Modeling and simulation of systems using MATLAB and Simulink", 1st edition, CRC press, 2017

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	50
				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.



U21MAX02	LINEAR PROGRAMMING PROBLEMS (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 resource management techniques
- To solve problems in linear programming and Integer programming
- To familiar with CPM and PERT

COURSE OUTCOMES:

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

CO1:Solve linear programming problems using the simplex method and sensitivity analysis with correct tableau operations. (Apply)

CO2:Explain duality principles and apply transportation and assignment models to optimize network-based problems (Understand)

CO3:Apply integer programming techniques including cutting-plane and branch-and-bound methods to solve real-life optimization problems. (Apply)

CO4:Describe classical optimization methods including Newton–Raphson and Lagrangian approaches for constrained and unconstrained problems. (Understand)

CO5:Apply CPM and PERT techniques to schedule projects, identify critical paths, and level resources using network diagrams. (Apply)

CO-PO MAPPING:

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

SYLLABUS:**UNIT I LINEAR PROGRAMMING 9**

Principal components of decision problem – Modeling phases – LP formulation and graphic solution – Resource allocation problems – Simplex method – Sensitivity analysis

UNIT II DUALITY AND NETWORKS 9

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model - Shortest route problem

UNIT III	INTEGER PROGRAMMING	9
Cutting plan algorithm – Branch and bound methods, multistage (dynamic) programming		
UNIT IV	CLASSICAL OPTIMIZATION THEORY	9
Unconstrained external problems, Newton Raphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems		
UNIT V	OBJECT SCHEDULING	9
Network diagram representation – Critical path method – Time charts and resource levelling – PERT		

Contact Periods:

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

TEXT BOOKS:

1. Taha H A, "Operation Research", 10th edition, Pearson Education, 2019
2. Grewal B A, "Higher Engineering Mathematics", Khanna Publishers, 44th edition, 2017

REFERENCES:

1. Paneerselvam, "Operations Research", 2nd edition, Pearson Education, 2016
2. Anderson, "Quantitative Methods for Business", 8th edition, Thomson Learning, 2002
3. Winston, "Operation Research", 4th edition, Brooks, 2003
4. Vohra, "Quantitative Techniques in Management", 5th edition, Tata Mc Graw Hill, 2017

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
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.



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DEPARTMENT OF CHEMISTRY
SEMESTER V



U21CYX05	WASTE MANAGEMENT AND RESOURCE RECOVERY	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To provide fundamentals of solid waste collection, storage and management.
- To explain the solid waste processing, treatment technologies and integrated waste management.
- To summarize the principles of resource recovery and recycling.

COURSE OUTCOMES:

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

- CO1:** Explain the impact of solid waste on environment and its management frameworks. (Understand)
- CO2:** Solve the solid waste collection, transportation and storage issues through innovative approaches. (Apply)
- CO3:** Find the design and operation of various solid waste management technologies. (Apply)
- CO4:** Apply the principles of resource recovery and recycling for the sustainable management of waste. (Apply)
- CO5:** Summarize the importance of sanitary landfill and integrated waste management to ensure environmental safety. (Understand)

CO-PO MAPPING:

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

SYLLABUS:**UNIT I FUNDAMENTALS OF SOLID WASTE MANAGEMENT**

9

Introduction to solid waste – definition, types – municipal, industrial, biomedical, e-waste, hazardous – Sources and composition of solid wastes – Factors influencing waste generation and estimation – Impact of improper waste management on environment, health, and infrastructure – Sustainable waste management principles and hierarchy – Indian and international waste management regulations and frameworks (SWM Rules 2016, CPCB guidelines)

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UNIT II COLLECTION, TRANSPORTATION, AND STORAGE

Waste collection methods (door-to-door, community bin, curbside) and systems (primary, secondary, manual, mechanical, integration) – Design and operation of collection routes – Storage containers – types, sizing, and placement – Waste transportation – vehicles, logistics, and optimization – Transfer stations – design and function – Innovative waste collection technologies – smart bins, RFID tracking, IoT-enabled systems

UNIT III PROCESSING AND TREATMENT TECHNOLOGIES

9

Mechanical processing – shredding, screening, baling – Biological treatment – composting, vermicomposting, anaerobic digestion – design and operation – Thermal treatment – incineration, pyrolysis, gasification – working principles and emissions control – Chemical treatment – stabilization, neutralization, disinfection – Leachate and odour control mechanisms – Comparison of low- and high-cost tech treatment solutions

UNIT IV RESOURCE RECOVERY AND RECYCLING

9

Principles of 3R (Reduce, Reuse, Recycle) – Material recovery facilities (MRF) – types, design and function – Recovery of paper, plastic, glass, metals, and e-waste – Energy recovery from waste – RDF, biogas, and waste-to-energy plants – Life cycle assessment and economics of recycling systems – Material recovery technologies – optical sorting, eddy current – AI-based systems – Green products and circular economy concepts

UNIT V LANDFILLING AND INTEGRATED WASTE MANAGEMENT

9

Sanitary landfill – site selection, design, liner systems, gas and leachate collection – Post-closure care and environmental monitoring – Integrated Solid Waste Management (ISWM) – concept and planning – Public awareness and participation in waste management – Environmental impact assessment (EIA) for landfill projects – Case studies of successful waste management systems in India

Contact Periods:

Lecture:	45 hours	Tutorial:	- Hours	Practical:	- Hours	Project:	- Hours
						Total:	45 Hours

TEXT BOOKS:

1. G. Tchobanoglous, H. Theisen and S. A. Vigil, "Integrated Solid Waste Management: Engineering Principles and Management Issues", 1st Edition, McGraw Hill, 1993
2. M. Doble, K. Rollins, A. Kumar, "Green Chemistry and Engineering", 1st Edition, Academic Press, 2007
3. P. A. Vesilind, W. A. Worrell and D. R. Reinhart, "Solid Waste Engineering", 1st Edition, Cengage Learning, 2007
4. C. R. Rhyner, L. J. Schwartz, R. B. Wenger and M. G. Kohrell, "Waste Management and Resource Recovery", CRC Press, 1995

REFERENCES:

1. CPHEEO Manual on Municipal Solid Waste Management, Government of India.
2. Selected IS Codes, CPCB Guidelines and NGT Case Laws.

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EVALUATION PATTERN:

Continuous Internal Assessments					Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)				
*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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**DEPARTMENT OF CHEMISTRY
SEMESTER VII**



U21CYX06	CHEMICAL ASPECTS OF FOOD ADULTERATION	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To provide chemical characteristics of food nutrients and impact of processing on major nutrients and vitamin content of food.
- To discuss about common adulterants in different foods and detection of food adulterants.
- To create awareness on food borne diseases, food poisoning and aspects of food safety.

COURSE OUTCOMES:

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

- CO1:** Explain chemical characteristics of food nutrients and impact of processing on major nutrients. (Understand)
- CO2:** Describe various types of food adulterations and permissible food additives. (Understand)
- CO3:** Determine the common adulterants in food through different methods of analysis. (Apply)
- CO4:** Summarize the impact of microorganisms, contaminants and antibiotic residue leading to food poisoning. (Understand)
- CO5:** Explain the present regulations and procedures regarding food adulteration and consumer protection. (Understand)

CO-PO MAPPING:

Cos \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	CO1	2	2	2	-	1	2	2	-	1	-	-	1	
CO2	2	2	2	-	1	2	2	-	1	-	-	1		
CO3	3	2	2	-	2	2	2	-	1	-	-	1		
CO4	2	2	2	-	1	2	2	-	1	-	-	1		
CO5	2	2	2	-	1	2	2	-	1	-	-	1		

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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SYLLABUS:**UNIT I EFFECT OF PROCESSING ON MAJOR FOOD NUTRIENTS 9**

Chemical constituents, characteristics – nutritional role and metabolic aspects of water, carbohydrates, proteins, fats, fibre, vitamins and minerals – Anti-nutritional factors of natural origin –Effect of processing on major nutrients and vitamin content of food – Natural pigments – chlorophylls, anthocyanin, carotenoids and curcumin – their structural composition and application in food industry

UNIT II FOOD ADULTERATION 9

Food adulteration – definition, types – Types of adulterants – intentional and incidental adulterants –poisonous substances, foreign matter, cheap substitutes, spoiled parts – Adulteration through food additives – intentional and incidental
Common food Additives – Organic acids, esters, alcohol, wood smoke – Legal aspects

UNIT III DETECTION OF COMMON FOOD ADULTERANTS 9

Common adulterants in different foods and theoretical aspects of detection of common food adulterants in – spices, grains, coffee, tea, oil/fats, food colours and Milk
Seminars on related/current food related issues (not from the syllabus)

UNIT V FOOD BORNE DISEASES AND FOOD POISONING 9

Food hazard – definition, types, general impact on Human Health – Food poisoning – types, prevention and control – Food borne diseases due to Bacterial, Viruses, Rickettsia, Mycotoxins, Parasites – Contaminants – Pesticide, insecticide, herbicide, fungicide, rodenticide – Antibiotic residue – toxic meal residue hormonal residue

UNIT V ASPECTS OF FOOD SAFETY 9

Concept of sanitation and hygienic production of food – Highlights of Food Safety and Standards Act 2006 (FSSA) – Food Safety and Standards Authority of India – Rules and Procedures of Local Authorities – Requirements and benefits of food grades and standard – BIS, AGMARK, ISI, FPO, CAC and FDA – Consumer's rights and responsibilities; COPRA 2019 – offenses and penalties, procedures to complain, compensation to victims.

Contact Periods:

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

TEXT BOOKS:

1. W. W. Harvey, "Foods and Their Adulteration", 1st Edition, Book on Demand Ltd, 2013
2. E. M. Bruce, "Detection of the Common Food Adulterants", Alpha Edition, 2021
3. J. P. Battershall, "Food Adulteration and Its Detection", 1st Edition, Nabu Press, 2011
4. R. J. Marshall, "Food Safety: A Practical and Case Study Approach", 1st Editio, Springer-Verlag New York Inc., 2007
5. E. S. West, W. R. Todd, H. S. Mason, J. vanBruggen, "Textbook of Biochemistry", 4th Edition, Oxford and IBH Publishing Co. Pvt. Ltd,


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REFERENCES:

1. A. Y. Sathe, "A First Course in Food Analysis", 1st Edition, New Age International Pvt Ltd., 1999
2. N. J. Shyam, "Rapid Detection of Food Adulterants and Contaminants: Theory and Practice", 1st Edition, Academic Press Inc, 2016
3. Bare ACT, "Food Safety and Standards Act", 2006, 1st Edition, Commercial Law Publishers (India) Pvt. Ltd, 2021.
4. B. Sivasankar, "Food Processing and Preservation", 1st Edition, Prentice Hall India Learning Pvt Ltd., 2022
5. W. C. Frazier and D.C. Westhoff, "Food Microbiology", 5th Edition, Tata McGraw Hill Publishers, 2014
6. F. P. Antia, Clinical Dietetics and Nutrition, 4th Edition, Oxford university press, 1997.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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DEPARTMENT OF CHEMISTRY
SEMESTER V

U21CYX07	FOOD ENGINEERING AND TECHNOLOGY	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand nutrition, natural foods, and functional foods for health benefits
- To acquire knowledge on food processing, preservation and flavours used in the food industry
- To evaluate the impact of artificial ripening practices and modern food habits on human health

COURSE OUTCOMES:

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

- CO1:** Explain the importance of nutrients and food constituents in human health. (Understand)
- CO2:** Utilize the nutritional benefits of natural, traditional, and functional foods to meet specific dietary requirements. (Apply)
- CO3:** Implement the principles of food processing, preservation methods and food additives in industries (Apply)
- CO4:** Interpret the uses and health effects of sweeteners, food colours, and flavours (Apply)
- CO5:** Discuss the fruit ripening processes and the impact of modern food habits on health (Understand)

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	-	-	-	-	1		
CO2	3	2	1	1	-	-	2	-	-	-	-	1		
CO3	3	2	1	1	-	-	2	-	-	-	-	1		
CO4	3	2	1	1	-	-	2	-	-	-	-	1		
CO5	2	1	1	1	-	-	2	-	-	-	-	1		

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:**UNIT I FOOD, NUTRITION AND HEALTH**

9

Functions of food – Classification of nutrients – Balanced diet, Recommended Dietary Allowance (RDA) – Micro and macro nutrients, Calorific value of food. Carbohydrates – Classification and sources – Starch and dietary fiber – Starch gelatinization – Caramelization, Maillard reaction, Proteins – Essential and non-essential amino acids, denaturation, coagulation, Protein quality and Protein Efficiency Ratio (PER) – Lipids and Fats – Types of fats and oils, hydrogenation, rancidity, Vitamins and minerals, Deficiency and excess intake of major nutrients – Carbohydrates, Protein, Lipids and Fats, Vitamins and minerals

[Signature]
12/06/2026

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17/6/26

UNIT II NATURAL FOODS, TRADITIONAL DIETS AND FUNCTIONAL FOODS 9

Diary products and Natural beverages – composition and Nutritional importance, Seasonal Foods – Types, Phytochemical composition, Effect of harvest season, Natural pigments and their health benefits. Traditional diets – characteristics, Low-processed and high fibre foods Natural probiotics – sources and health benefits; Functional foods – concepts of probiotics, prebiotics, synbiotics, fortified foods and nutraceuticals

UNIT III FOOD PROCESSING, PRESERVATION AND FOOD ADDITIVES 9

Food Processing – Introduction, objectives, types and processing techniques, Food packaging and storage – functions, materials and storage methods, Food preservation – principles and methods including drying, dehydration, refrigeration, freezing, canning, pasteurization, fermentation and vacuum packaging; Food additives – definition, functions and classification, Food preservatives – benzoates and sorbates; Food antioxidants – BHA, BHT and their health implications, Emulsifying and stabilizing agents; Food hydrocolloids – carrageenan and xanthan gum and their industrial applications

UNIT IV SWEETENERS, FOOD COLOURS AND FLAVOURS 9

Artificial Sweeteners – importance and classification, Nutritive sweeteners, Non-nutritive sweeteners – Saccharin, Cyclamate, Aspartame – Metabolism, Uses and limitations. Food Colours – Role and importance of food colouring; Permitted food colours – Tartrazine, Sunset Yellow FCF and Carmoisine; Non-permitted food colours – Metanil Yellow and Rhodamine B, Health hazards and toxicological effects of illegal food colours. Flavours – significance of flavours, Types – esters and aldehydes, Monosodium glutamate (MSG) – mechanism, applications and safety considerations

UNIT V ARTIFICIAL RIPENING AND MODERN FOOD HABITS 9

Fruit Ripening – Types, artificial ripening agents – calcium carbide, ethephon and ethylene generators, associated health hazards. Modern Food Habits – Fast foods, processed foods and chemical additives, Health effects of modern dietary practices. Instant Foods – Manufacturing processes, nutritional implications and health concerns, Junk Foods – Characteristics, nutritional composition, obesity and metabolic disorders, Carbonated Beverages – Soft drinks and soda water; Carbonation chemistry, CO₂ dissolution and carbonic acid formation, Health implications. Chocolates – Cocoa chemistry, theobromine, fat bloom, nutritional aspects and health effects

Contact Periods:

Lecture:	45 hours	Tutorial:	- Hours	Practical:	- Hours	Project:	- Hours
						Total:	45 Hours

TEXT BOOKS:

1. Srilakshmi, B., "Food Science", 7th Edition, New Age International Publishers, New Delhi, 2018
2. Potter, N. N. and Hotchkiss, J. H., "Food Science", 5th Edition, CBS Publishers and Distributors, New Delhi, 2012
3. Mudambi, S. R. and Rajagopal, M. V., "Fundamentals of Foods, Nutrition and Diet Therapy", 7th Edition, New Age International Publishers, New Delhi, 2015

REFERENCES:

1. Belitz, H. D., Grosch, W. and Schieberle, P., "Food Chemistry", 4th Edition, Springer-Verlag Berlin Heidelberg, 2009
2. Fennema, O. R., Damodaran, S. and Parkin, K. L., "Fennema's Food Chemistry", 4th Edition, CRC Press, Boca Raton, 2008
3. Vaclavik, V. A. and Christian, E. W., "Essentials of Food Science", 4th Edition, Springer Science Business Media, New York, 2014
4. R. J. Marshall, "Food Safety: A Practical and Case Study Approach", 1st Edition, Springer-

Dr. M.S. KARTHIKEYAN

Professor & Head

Department of Chemistry

KPR Institute of Eng

D. Prakash
 17/06/2023

M.S.K.
 17/6/23

Verlag New York Inc., 2007

5. Shakuntalá Manay, N. and Shadaksharaswamy, M., "Foods: Facts and Principles", 3rd Edition, New Age International Publishers, New Delhi, 2017
6. Gibson, G. R. and Williams, C. M., "Functional Foods: Concept to Product", 2nd Edition, Woodhead Publishing Ltd., Cambridge, 2010

EVALUATION PATTERN:

Continuous Internal Assessments					Total Internal Assessments	End Semester Examinations	
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments			End Semester Examinations
*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. Pradeep
12/00/2026

Dr. M.S. KARTHIKEYAN*
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M.S.K.
17/6/26

**DEPARTMENT OF PHYSICS
SEMESTER V**



U21PHX04	MODERN PHYSICS FOR ENGINEERING APPLICATIONS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To provide knowledge of wave optics, photonic materials, smart materials, and semiconductor devices used in modern engineering applications
- To develop an understanding of quantum mechanical concepts, optoelectronic devices, and emerging technologies relevant to computing, communication, and sensing systems
- To enable students to apply the principles of advanced materials and photonic technologies for analyzing and solving real-world engineering problems

COURSE OUTCOMES:

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

- CO1:** Apply the properties of nonlinear optical materials and waveguides in photonic communication and sensing applications. (Apply)
- CO2:** Utilize and demonstrate the behavior of smart and functional materials in actuators, and transducers. (Apply)
- CO3:** Demonstrate the application of quantum mechanical principles in computing (Apply)
- CO4:** Use the principles of absorption, emission, and carrier recombination to evaluate optoelectronic devices and optical data storage technologies. (Apply)
- CO5:** Implement and demonstrate the role of semiconductor sensors and emerging technologies in industrial and real-time applications. (Apply)

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	1	1	-	-	-	-	-	-	-	-		
CO3	3	2	1	1	-	-	-	-	-	-	-	-		
CO4	3	2	1	1	-	-	-	-	-	-	-	-		
CO5	3	2	1	1	-	-	-	-	-	-	-	-		
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)					

SYLLABUS:**UNIT I WAVE OPTICS AND NONLINEAR PHOTONIC MATERIALS**

Wave equations for dielectrics – Light propagation in uniaxial crystals – NLO materials: properties and applications – Second harmonic generation of light – Optical waveguides –Types of optical waveguides

UNIT II SMART AND FUNCTIONAL MATERIALS**9**

Piezoelectric materials – Direct and Inverse piezoelectric effect – Shape memory alloys – Magnetostrictive materials – Dielectric materials – Ferroelectric materials – Actuators – Transducers – Capacitors

UNIT III QUANTUM COMPUTING**9**

Introduction to Quantum Computing – Moore's law and its limitations – Differences between Classical and Quantum computing – Concept of qubit and its properties – Representation of qubit by Bloch sphere – Single and Two qubits

UNIT IV OPTICAL MATERIALS AND DEVICES**9**

Classification of optical materials – Carrier Generation and recombination process – Absorption, emission and scattering of light in solids – Photodiode – Solar Cell – OLED – Optical data storage techniques – Blu Ray disc

UNIT V SENSORS AND OTHER EMERGING TECHNOLOGIES**9**

Semiconductor sensors – Temperature sensor – Pressure sensor – Gas sensor – Industrial Monitoring and Healthcare – Fabrication of MEMS and NEMS – Accelerometers – Smart Homes – Industrial automations.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project 0 Periods
 Total 45 Periods

TEXT BOOKS:

1. P. K. Palanisamy, Engineering Physics, 5th Edition, Scitech Publications (India) Pvt. Ltd., Chennai, 2023.
2. Safa O. Kasap, Principles of Electronic Materials and Devices, 4th Edition, McGraw-Hill Education, 2021.
3. Chris Bernhardt, Quantum Computing for Everyone, 2nd Edition, MIT Press, 2024.

REFERENCES:

1. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, 3rd Edition, Wiley, 2019.
2. Julian W. Gardner, Vijay K. Varadan and Osama O. Awadelkarim, Microsensors, MEMS and Smart Devices, Wiley, Reprint Edition, 2022
3. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information: 10th Anniversary Edition, Cambridge University Press, Reprint Edition, 2023.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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. E. RANJITH KUMAR Ph.D
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 Department of Physics
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 Coimbatore - 641 407



**DEPARTMENT OF PHYSICS
SEMESTER V**

U21PHX05	SEMICONDUCTOR PROCESSING AND NANO DEVICES	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To provide fundamental knowledge of semiconductor materials, fabrication processes, and electronic devices used in modern technology
- To familiarize students with nanomaterials, nanoelectronic devices, sensors, memory technologies, and their engineering applications
- To introduce emerging semiconductor and computing technologies that drive future intelligent systems

COURSE OUTCOMES:

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

- CO1:** Explain the properties of semiconductor materials and their role in modern electronic devices. (Understanding)
- CO2:** Describe semiconductor fabrication techniques and processing methods used in device manufacturing. (Understanding)
- CO3:** Apply the concepts of nanomaterials and nanoelectronic devices to identify suitable solutions for engineering applications. (Apply)
- CO4:** Apply the principles of sensors, MEMS/NEMS, and memory technologies in real-world engineering systems. (Apply)
- CO5:** Explain the significance of emerging technologies such as spintronics, photonic computing, quantum computing, and AI hardware accelerators (Understanding)

CO-PO MAPPING

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

SYLLABUS:**UNIT I SEMICONDUCTOR MATERIALS AND ELECTRONIC DEVICES****9**

Introduction to semiconductor technology – Silicon wafers and substrate materials – Conducting, semiconducting and insulating materials – High-k and low-k dielectric materials – Copper interconnects – Thin film materials – Properties and applications of electronic devices.

UNIT II THIN FILM AND FABRICATION TECHNIQUES 9

Thin film deposition techniques – Physical Vapour Deposition (PVD) – Chemical Vapour Deposition (CVD) – Oxidation techniques – Diffusion and ion implantation – Photolithography – Etching techniques – Plasma processing – Clean room technology.

UNIT III NANOELECTRONICS AND ADVANCED DEVICES 9

Introduction to nanoelectronics – Quantum confinement – Carbon nanotubes – Graphene – Quantum dots – Nanowires – Fin FET – SOI devices – Tunnel FET – Nanoelectronic devices and applications in single electron transistor.

UNIT IV SENSORS AND DATA STORAGE TECHNOLOGIES 9

Sensor materials and operating principles – Piezoelectric and magnetoresistive materials – MEMS and NEMS – SRAM, DRAM and Flash memory – Magnetic and optical data storage devices – Emerging memory technologies.

UNIT V EMERGING COMPUTING TECHNOLOGIES 9

Moore's law and scaling limitations – Neuromorphic computing – Spintronics – Quantum computing basics – Qubits and quantum gates – Quantum chips – Photonic computing – AI hardware accelerators – Future trends in emerging computing technology.

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Project: 0 Periods
 Total 45 Periods

TEXT BOOKS:

1. S. O. Kasap, Principles of Electronic Materials and Devices, 4th Edition, McGraw-Hill Education, 2018.
2. Donald A. Neamen, Semiconductor Physics and Devices: Basic Principles, 5th Edition, McGraw-Hill Education, 2020.
3. Nanoelectronics and Information Technology, Edited by Rainer Waser, 3rd Edition, Wiley-VCH Verlag GmbH & Co., Germany, 2012.

REFERENCES:

1. Ben G. Streetman and Sanjay Banerjee, Solid State Electronic Devices, 7th Edition, Pearson Education, 2016.
2. Stephen A. Campbell, Fabrication Engineering at the Micro and Nanoscale, 5th Edition, Oxford University Press, 2021.
3. Nanotechnology: Principles and Practices, Sulabha K. Kulkarni, 3rd Edition, Springer India, New Delhi, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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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 \ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

(Handwritten signature)

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", 10th 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" 7th edition, Nirali Prakashan, 2018
4. Kathleen R Allen, "Launching New Ventures - An Entrepreneurial Approach", 7th edition, Cengage Learning, 2016

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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	

*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.



B.E. – OE – R2021 - CBCS

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



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.

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		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:

COs \ POs	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)

UNIT II DIVERSE FORMS	9
Exploration of diverse folk theatre forms – Bhand Pather – Tamasha – Chhau – regional variations – fusion of dance, drama, stylized speech, and spectacle	
UNIT III SOCIAL AND CULTURAL CONTEXTS	9
Socio-political realities reflected in folk theatre – role of folklore and drama in community identity – cultural preservation – impact of colonialism and post-colonialism	
UNIT IV LANGUAGE, LITERATURE, AND PERFORMANCE	9
Role of language and literature in Indian drama – analysis of scripts, narratives – performance traditions – significance of Sanskrit and regional languages.	
UNIT V CONTEMPORARY RELEVANCE AND GLOBAL RECOGNITION	9
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, 1st 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				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
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.

N. Dayal
(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:

COs \ POs	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

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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				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
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.

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DEPARTMENT OF MECHANICAL ENGINEERING
SEMESTER V



U210EX07	VERTICAL TRANSPORTATION SYSTEMS	Category: ESC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the principles of mechanics applied to vertical transportation systems
- To understand the elevator operation and its control mechanism

COURSE OUTCOMES:

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

CO1: Explain the fundamentals of elevator systems, including terminology, types, layout, major components, and essential safety devices used in modern buildings (Understand)

CO2: Identify and describe the design features, components, and operational mechanisms of elevator hoisting ropes, car assemblies, and car-landing door systems (Understand)

CO3: Examine and interpret elevator electrical systems (Understand)

CO4: Analyze and integrate elevator signalization devices, sensors, and control interfaces (Understand)

CO5: Develop and implement basic embedded control logic using C++ to demonstrate elevator operation and intelligent controller functions (Apply)

CO-PO MAPPING:

COs \ POs	POs												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	1	-	-	-	-	-	-		
CO2	2	1	-	-	-	1	-	-	-	-	-	-		
CO3	2	1	-	-	-	1	-	-	-	-	-	-		
CO4	2	1	-	-	-	1	-	-	-	-	-	-		
CO5	3	2	1	-	2	1	-	-	-	-	-	-		

SYLLABUS:**UNIT I INTRODUCTION**

9

Elevator – Terminology – Types – Elevator Layout Drawing – Modern Elevator System – Regulations – Codes and Standards – Safety systems – Rescue – Ride Quality

UNIT II MECHANICAL ELEMENTS

9

Hoisting Ropes – Car – Classification, COP, floor, ceiling, lighting, ventilation – Door mechanism – Counterweight – Guiderails – Safety gears – Overspeed Governor – Buffers – Pit ladder – speed calculation in elevators – Brake

UNIT II ELECTRIFICATION AND CONTROL SYSTEMS

9

Hoist load – Motors – Drive – single speed, Variable speed (PWM, V3F) – Cabling – Shaft switches – Fuses – Relay and Contactors – Circuit Breaker – Earthing – Measurements and protection (Electrical Equipment, Load, Temperature) – Battery – UPS

UNIT IV SIGNALIZATION AND INTERFACING

9

Sensors – Door, Position, overload – Buttons - contact and contactless – Indicator: seven segments, LED, LCD, Matrix – Operating panel – Call Station – Controller – Monitoring system – Logic control and traffic management – Emergency landing

UNIT V EMBEDDED SYSTEM PROGRAMMING

9

Elevator Architecture – Intelligence Device – control system programs – Embedded Systems – Programming Evolution – Large-Scale Systems – C++ Programming

Contact Periods:

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

TEXT BOOKS:

1. Krishna Kant, "Microprocessors and Microcontrollers Architecture, Programming and System Design", 8th edition, Prentice Hall of India, 2011
2. Robert Bond Randall, "Vibration-Based Condition Monitoring, Industrial Aerospace and Automotive applications", 1st edition, John Wiley & Sons, 2011


REFERENCES:

1. P Kaliraj T Devi, "Higher Education for Industry 4.0 and Transformation to Education 5.0", 1st edition, CRC Press, 2021
2. Rashmi Agrawal, Marcin Paprzycki– Neha Gupta, "Big Data– IoT– and Machine Learning Tools and Applications", 1st edition, CRC Press, 2020

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.


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U21FLX04	ADVANCED JAPANESE FOR ENGINEERS	Category: OEC				
		L	T	P	J	C
		2	0	2	0	3

PRE-REQUISITES:

- U21FLX01- Essential Japanese for Engineers

COURSE OBJECTIVES:

- Develop intermediate proficiency in listening, speaking, reading, and writing - understanding conversations on familiar topics, engaging in routine interactions, reading medium-length texts, and writing coherent sentences.
- Build upon foundational knowledge of Japanese grammar, expanding the ability to express ideas more clearly and accurately.
- Gain deeper insights into Japanese culture, history, and social norms, enhancing contextual understanding for communication.

COURSE OUTCOMES:

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

- CO1:** Demonstrate an understanding of intermediate-level Japanese vocabulary and kanji characters (Understand)
- CO2:** Comprehend and engage in conversations on everyday topics, such as shopping, travel, and dining (Understand)
- CO3:** Produce coherent sentences and questions using appropriate verb forms, particles, and grammar structures (Apply)
- CO4:** Read and comprehend moderately complex texts, such as emails, short stories, and instructions (Apply)
- CO5:** Apply appropriate social expressions and cultural knowledge in various conversational contexts (Apply)

CO-PO MAPPING:

POS COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	2	-	-		
CO2	-	-	-	-	-	-	-	-	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	-	-	2	3	-	1		
CO5	-	-	-	-	-	-	-	2	-	3	-	1		

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

EVALUATION PATTERN:

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

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U21FLX05	ADVANCED HINDI FOR ENGINEERS	Category: OEC				
		L	T	P	J	C
		2	0	2	0	3

PRE-REQUISITES:

- U21FLX02 - Essential Hindi for Engineers

COURSE OBJECTIVES:

- Develop intermediate proficiency in listening, speaking, reading, and writing - understanding conversations on familiar topics, engaging in routine interactions, reading medium-length texts, and writing coherent sentences.
- Build upon foundational knowledge of Hindi grammar, expanding the ability to express ideas more clearly and accurately.
- Gain deeper insights into Indian culture, history, and social norms, enhancing contextual understanding for communication.

COURSE OUTCOMES:

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

- CO1:** Understand and recognize essential vocabulary related to everyday activities and basic Hindi grammar (Understand)
- CO2:** Comprehend and participate in simple conversations on topics such as greetings, food, family, and directions (Understand)
- CO3:** Construct simple sentences and ask questions using basic Hindi sentence structures, verbs, and pronouns (Apply)
- CO4:** Read and comprehend short, simple texts like announcements, advertisements, and basic instructions (Apply)
- CO5:** Use appropriate expressions for polite communication and cultural contexts in everyday conversations (Apply)

CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	2	-	-		
CO2	-	-	-	-	-	-	-	-	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	-	-	2	3	-	1		
CO5	-	-	-	-	-	-	-	2	-	3	-	1		

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I EXPRESSING ABSTRACT IDEAS AND COMPLEX EMOTIONS 9

Vocabulary: Describing abstract concepts such as justice, freedom, and tradition, Grammar: Complex sentence structures using conjunctions (क्योंकि, इसलिए, जब), Expressing emotions, inner thoughts, and personal perspectives in detail, Use of honorifics in different social contexts

UNIT II DISCUSSING CULTURAL AND SOCIAL ISSUES 9

Grammar: Conditional and hypothetical sentences (अगर... तो, यदि... तो), Vocabulary: Talking about social issues, politics, and current events, Discussions on gender roles, social changes, and contemporary challenges in India, Role of language in shaping societal norms and perceptions

UNIT III ADVANCED STORYTELLING AND NARRATIVE STRUCTURE 9

Grammar: Advanced use of tenses (future continuous, past perfect), Vocabulary: Using storytelling techniques, describing past events in detail, Grammar: Direct and indirect speech for storytelling, Creating complex sentences for storytelling and expressing cause-effect relationships

UNIT IV PROFESSIONAL AND FORMAL COMMUNICATION 9

Vocabulary: Workplace terms, discussing career, goals, and aspirations, Grammar: Use of passive voice, indirect speech, and formal expressions, Writing professional emails, formal letters, and reports, Making presentations and discussing professional topics with clarity and confidence

UNIT V POLITICS, HISTORY, AND CURRENT AFFAIRS DISCUSSIONS 9

Grammar: Use of subjunctive mood and indirect speech in discussions, Vocabulary: Talking about history, politics, and economics, Expressing opinions on current events and analyzing news articles, Debate and argumentation skills in Hindi

Lecture: 30 Periods Tutorial - Periods Practical: 15 Periods Project – Periods
Total :45 Periods

TEXTBOOKS:

1. Pavithra Publications, "Spoken Hindi: Through Tamil," 2nd Edition, Pavithra Publications, Chennai, 2015.
2. Dakshina Bharat Hindi Prachar Sabha, "Prathamik Text Book: New Syllabus," 1st Edition, Dakshina Bharat Hindi Prachar Sabha, Madras, 2023.

REFERENCES:

1. Ganga, K., & Ramesh, V., "Learn Hindi in 30 Days: A Beginner's Guide," 3rd Edition, Hindi Academy, 2019.
2. Vyas, S., "Spoken Hindi for Beginners," 1st Edition, Orient BlackSwan, 2018.

EVALUATION PATTERN:

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



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U21FLX06	ADVANCED GERMAN FOR ENGINEERS	Category: OEC				
		L	T	P	J	C
		2	0	2	0	3

PRE-REQUISITES:

- U21FLX03 - Essential German for Engineers

COURSE OBJECTIVES:

- Develop intermediate proficiency in listening, speaking, reading, and writing - understanding conversations on familiar topics, engaging in routine interactions, reading medium-length texts, and writing coherent sentences.
- Build upon foundational knowledge of German grammar, expanding the ability to express ideas more clearly and accurately.
- Gain deeper insights into German culture, history, and social norms, enhancing contextual understanding for communication.

COURSE OUTCOMES:

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

- CO1:** Demonstrate an understanding of basic German vocabulary and sentence structures (Understand)
- CO2:** Comprehend and engage in basic conversations on everyday topics such as greetings, travel, shopping, and ordering food (Understand)
- CO3:** Form simple sentences and questions using the correct verb conjugation, word order, and basic grammar structures (Apply)
- CO4:** Read and understand short and simple texts such as emails, advertisements, and signs (Apply)
- CO5:** Apply appropriate cultural expressions and polite language in formal and informal conversations (Apply)

CO-PO MAPPING:

POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	2	-	-		
CO2	-	-	-	-	-	-	-	-	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	-	-	2	3	-	1		
CO5	-	-	-	-	-	-	-	2	-	3	-	1		

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I FAMILIAR TOPICS AND DESCRIPTIONS 9

Vocabulary: Everyday activities, family, hobbies, Grammar: Present tense of regular and irregular verbs, conjugation with "sein" (to be) and "haben" (to have), Sentence structure: Word order in simple statements and questions, Pronouns: Personal pronouns (ich, du, er/sie/es, etc.), possessive pronouns (mein, dein)

UNIT II WORK AND STUDY 9

Vocabulary: Jobs, professions, workplace terms, Grammar: Use of articles (definite and indefinite), singular and plural forms, Question forms: Asking for and giving information about work and study, Verb conjugation: Modal verbs (können, wollen, müssen, etc.), Sentence structure: Expressing necessity, ability, and intention

UNIT III TRAVEL AND PLACES 9

Vocabulary: Places in the city, transportation, directions, Grammar: Prepositions of place (in, auf, neben, etc.), accusative and dative cases, Sentence structure: Asking for and giving directions, Verbs: Reisen (to travel), fahren (to go), suchen (to search), Cultural note: Transportation systems in Germany

UNIT IV SHOPPING AND CONSUMERISM 9

Vocabulary: Shopping, prices, stores, and food, Grammar: Comparative and superlative forms of adjectives, Sentence structure: Making purchases, ordering food and drinks, Verbs: Kaufen (to buy), bezahlen (to pay), möchten (would like), Cultural note: Typical shopping experiences in Germany

UNIT V FREE TIME AND LEISURE 9

Vocabulary: Sports, leisure activities, going out, Grammar: Accusative case for direct objects, Sentence structure: Talking about hobbies, preferences, and free-time activities, Verbs: Spielen (to play), gehen (to go), treffen (to meet), Cultural note: Freizeitmöglichkeiten in Germany (sports, cultural activities, etc.)

Contact Periods:

Lecture: 30 Periods	Tutorial - Periods	Practical: 15periods	Project – Periods
			Total:45 Periods

TEXTBOOKS:

1. Hueber Verlag, "Menschen A2: Deutsch als Fremdsprache," 1St Edition, Hueber Verlag, 2019
2. Schenker, E., & Köhler, H., "Beste Freunde A2: Deutsch als Fremdsprache," 2nd Edition, Langenscheidt, 2020.

REFERENCES:

1. Feller, P., "Fit fürs Goethe-Zertifikat A2: Übungsbuch mit Audio-CD," 2nd Edition, Comelsen Verlag, 2019.
2. Deller, S., & Price, C., "German for Beginners: A Practical Approach to Learning German," 1st Edition, Tuttle Publishing, 2021.

EVALUATION PATTERN:

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



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