Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electronics and Telecommunication Engineering

IMI3321: Fundamentals of Image

Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	ESE
Tutorials	--		ISE	50
Total Credits	02			

Prerequisite : Mathematics basics

Course Outcomes (CO): Students will be able to

CO1	Understand the image fundamentals
CO2	Study the Image perception
CO3	Explain different operations applied to Medical Images
CO4	Apply various image transformation procedures used inhealth care

	Course Contents	**CO**	**Hours**
Unit 1	**FUNDAMENTALS OF IMAGE :** Fundamentals of Image and Pictures, Analog image and Digital Image, Elements of Visual perception, Image sampling and quantization,	CO1	**4**
Unit 2	**DIFFERENT TYPES OF IMAGE** Image perception, Greyscale images, RGB Images, Indexed colour images, Medical Images.	CO1, CO2	**4**
Unit 3	**REPRESENTATION OF IMAGE:** Camera models , imaging geometry, Basics of image display, Data types and conversions	CO1, CO2	**4**
Unit 4	**IMAGE OPERATIONS:** Neighborhood pixel Relationships, Basic Image operations - Arithmetic, Geometric and Morphological	CO3	**4**
Unit 5	**TRANSFORMATION:** Image transform: 2D DFT- Discrete cosine, Sine , Haar Transform, Walsh Transform.	CO4	**4**
Unit 6	Case study 1. Medical Image Display using MATLAB /Python Case Study 2. Representation of Grey and RGB images using MATLAB /Python Case study 3. Different Operations on Images.	CO4	**4**

Text Books	Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, PearsonEducation, 2010.
	Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011An Introduction to Digital Image Processing with Matlab, Alasdair McAndrew
References	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing UsingMATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
	Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
	Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHILearning Pvt. Ltd., 2011.
Links	https://onlinecourses.nptel.ac.in/noc19_ee55/preview https://www.coursera.org/specializations/image-processing https://www.coursera.org/learn/introduction-image-processing

Mapping of COs and POs

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	20	10
Understand	10	10
Apply	10	10
Analyse	10	20
Evaluate	-	-
Create	-	-
Total	50	50

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electronics and Telecommunication Engineering

IMI3422: Basics of Image Processing for Healthcare

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	ESE
Tutorials	--		50	50
Total Credits	02			

Prerequisite : Digital Signal Processing basics

Course Outcomes (CO): Students will be able to

CO1	Study digital image fundamentals.
CO2	Explain image enhancement and restoration, compression, segmentation techniques

	Course Contents	CO	Hours
Unit 1	**FUNDAMENTALS OF IMAGE PROCESSING:** Digital Image Representation – Fundamental steps in Image Processing, Components of an Image Processing System.	CO1	4
Unit 2	**IMAGE ENHANCEMENT IN THE SPATIAL DOMAIN:** Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing spatial Filters, Sharpening spatial Filters.	CO1, CO2	4
Unit 3	**IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters, Homomorphic Filtering, Implementation.	CO2	4
Unit 3	**IMAGE RESTORATION:** A Model of the Image Degradation/Restoration Process, Linear, Position Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and Multi resolution Processing: Multi resolution Expansions, Wavelet Transforms in one Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions	CO2	4
Unit 4	**IMAGE COMPRESSION:** Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards.	CO2	4
Unit 5	**IMAGE SEGMENTATION:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.	CO2	4
Unit 6	**OBJECT REPRESENTATION AND DESCRIPTION:** Various schemes for representation, boundary descriptors, and regional descriptors	CO2	4

Text Books	Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.
References	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
	Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.
Links	https://onlinecourses.nptel.ac.in/noc19_ee55/preview https://www.coursera.org/learn/introduction-computer-vision-watson-opencv

Mapping of COs and POs

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	20	10
Understand	10	10
Apply	10	10
Analyse	10	20
Evaluate	-	-
Create	-	-
Total	50	50

Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Electronics and Telecommunication Engineering				
IMI3523: Particle Size Analysis using Image Processing				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		ISE	ESE
Tutorials	-		50	50
Total Credits	03			

Prerequisite :

Course Outcomes (CO): Students will be able to

CO1	Understanding of particle size analysis techniques and their applications in health care
CO2	Apply Methods of particle size Measurements by microscopic technique
CO3	Develop interpretation of particle size distribution data and analyzing particle morphology.

	Course Contents	CO	Hours
Unit 1	Principles of Particle Size Analysis	CO1	4
Unit 2	Techniques in Particle Size Measurement	CO1, CO2	4
Unit 3	Interpretation of Particle Size Distribution Data	CO3	4
Unit 4	Particle Morphology Analysis	CO3, CO4	4
Unit 5	Particle Size Analysis in health care medical system and Biomedical Samples	CO3	4
Unit 6	Introduction of MATLAB operations used for image processing,Image sampling and quantization, Study of DICOM standards. Histogram Processing and Basic Thresholding functions, Image Enhancement-Spatial filtering,	CO1, CO2	4

Text Books	G.R. Sinha, Bhagwaticharan patel, Medical Image Processing: Concepts and Applications, PHI Learning private limited.2014
	KayvanNajarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.
	E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012
References	Geoff Dougherty, Medical Image Processing: Techniques and Applications, Springer Science & Business Media, 25-Jul-2011
	Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, Science Direct,2nd Edition , 2009
	Deserno T M, “Biomedical Image Processing”, Springer, 2011.

Mapping of COs and POs

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	20	10
Understand	10	10
Apply	10	10
Analyse	10	20
Evaluate	-	-
Create	-	-
Total	50	50

Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Electronics and Telecommunication Engineering				
IMI3524: Particle Size Analysis using Image Processing Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	ESE
Tutorials	-		50	50
Total Credits	01			

Course Contents	
Course Outcomes (CO): Students will be able to	
CO1	Identify and describe the different tools and instruments used in particle characterization and formulation analysis.
CO2	Prepare and organize the laboratory environment, ensuring all equipment is correctly set up for experiments.
CO3	Execute particle characterization and morphological analysis procedures independently, demonstrating proficiency and accuracy.
Experiment 1	Principles of Particle Characterization in Formulations
Experiment 2	Techniques in Reverse Engineering of Formulations
Experiment 3	Classification Analysis of Formulated Products, Morphological Characterization of Formulations
Experiment 4	Microscopic Analysis of Formulated Products, Advanced Topics in Formulation Characterization

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	10	5
Understand	20	5
Apply	10	20
Analyse	10	20
Evaluate	-	-
Create	-	-
Total	50	50

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Electronics and Telecommunication Engineering				
IMI3625: Particle Characterization in Healthcare				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	ESE
Tutorials	-		50	50
Total Credits	02			

Prerequisite : Basics of Image processing

Course Outcomes (CO): Students will be able to

CO1	Understand of particle characterization techniques used in the health care sector .
CO2	Analyse the morphology, structure, and properties of particles.
CO3	Apply particle characterization techniques in health care medical research, formulation development, and quality control.

	Course Contents	CO	Hours
Unit 1	Fundamentals of Particle Characterization	CO1	**4**
Unit 2	Techniques in Particle Morphology Analysis	CO2	**4**
Unit 3	Analysis of API Particles	CO1,CO2	**4**
Unit 4	Microscopy Techniques for Characterization	CO3	**4**
Unit 5	Impurities Analysis and Detection	CO3,	**4**
Unit 6	Advanced Topics in Particle Characterization for health care applications.	CO3	**4**

Mapping of COs and POs

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	10	5
Understand	10	5
Apply	20	20
Analyse	10	20
Evaluate	-	-
Create	-	-
Total	50	50

Government College of Engineering, Karad				
Final Year (Sem – VII) B. Tech. Electronics and Telecommunication Engineering				
IMI3726: Particle Characterization in Formulation and Reverse Engineering				
Teaching Scheme			**Examination Scheme**	
Practical	2 Hrs/week		ISE	ESE
Tutorials	-		50	50
Total Credits	02			

Prerequisite : Basics of image processing

Course Outcomes (CO): Students will be able to

CO1	Explain the advanced knowledge and skills in particle characterization techniques applicable to health care image analysis.
CO2	Illustratethe reverse engineering methods for analysing complex formulations and identifying key components
CO3	Explain the techniques for microscopy image analytics for formulation characterization.
CO4	Apply the particle characterization techniques in formulation development, optimization, and quality control.

	Course Contents	**CO**	**Hours**
Unit 1	Principles of Particle Characterization in Formulations	CO1	**4**
Unit 2	Techniques in Reverse Engineering of Formulations	CO2	**4**
Unit 3	Classification Analysis of Formulated Products	CO2	**4**
Unit 4	Morphological Characterization of Formulations	CO3	**4**
Unit 5	Microscopic Analysis of Formulated Products	CO3	**4**
Unit 6	Advanced Topics in Formulation Characterization	CO4	**4**

Mapping of COs and POs

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	15	5
Apply	20	20
Analyse	10	20
Evaluate	-	-
Create	-	-
Total	50	50

Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Electronics and Telecommunication Engineering				
IMI3827:Project/Internship				
Teaching Scheme			**Examination Scheme**	
Practical	04 Hrs/week		ISE	ESE
Tutorials	-		50	50
Total Credits	02			

Prerequisite -

Course Outcomes (CO): Students will be able to

CO1	Carry out comprehensive reverse engineering of a formulation, utilizing multiple analytical techniques to deduce the composition and structure.
CO2	Modify standard procedures to troubleshoot and optimize techniques for specific formulations, demonstrating flexibility and problem-solving skills.
CO3	Design and implement novel analytical protocols to characterize new formulations, showcasing innovation and advanced technical skills.

	Course Contents	CO	Hours
	Project /Internship based on the completion of previous courses.	CO1,CO2,CO3	

Mapping of COs and POs

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

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

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	-	-
Understand	10	10
Apply	20	20
Analyse	20	20
Evaluate	-	-
Create	-	-
Total	50	50