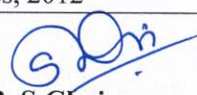


Government College of Engineering, Karad					
Third Year (Sem – V) MDM- Image Processing (Institute Level-Industrial)					
IMI3523: Particle Size Analysis using Image Processing					
Teaching Scheme			Examination Scheme		
Lectures	03 Hrs/week		MSE	20	
Tutorials	-		ISE	20	
Total Credits	03		ESE	60	
			Duration of ESE	02 Hrs 30 Min	
Prerequisite : Basics of Image Processing					
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: Particle size analysis, image segmentation, thresholding, edge detection, contour analysis, size distribution, automation, accuracy, reproducibility			CO1	(05)
Unit 2	Techniques in Particle Size Measurement:Image acquisition, preprocessing, thresholding, edge detection, contour analysis, morphological operations, segmentation, particle sizing, shape analysis, Feret’s diameter, equivalent diameter, circularity, convex hull, histogram analysis, statistical measurement			CO1, CO2	(07)
Unit 3	Interpretation of Particle Size Distribution Data:Size distribution, histogram, mean, median, mode, standard deviation, statistical analysis, graphical interpretation, accuracy assessment.			CO3	(07)
Unit 4	Particle Morphology Analysis:Particle shape, size, aspect ratio, circularity, roundness, convexity, solidity, surface texture, edge definition, fractal dimension, shape descriptors, contour analysis, morphology classification, structural properties, material characterization.			CO3, CO4	(07)
Unit 5	Particle Size Analysis in health care medical system and Biomedical Samples:Feature extraction, particle tracking, morphological operations, size distribution, shape analysis, fluorescence imaging, medical image processing, microscopy analysis.			CO3	(07)
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	(07)
Text Books					
1.	G.R. Sinha, Bhagwaticharan patel, Medical Image Processing: Concepts and Applications, PHI Learning private limited.2014				
2.	KayvanNajarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.				
3.	E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012				




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References	
1.	Geoff Dougherty, Medical Image Processing: Techniques and Applications, Springer Science & Business Media, 25-Jul-2011
2.	Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, Science Direct, 2nd Edition, 2009
3.	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	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	2	2	-	-	-	-	-	2	2	1
CO 2	2	3	-	2	3	-	-	-	-	-	-	1	2	1
CO 3	3	2	2	3	3	1	-	1	1	1	2	2	3	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60




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Third Year (Sem – V) MDM- Image Processing (Institute Level-Industrial)

IMI3524: Particle Size Analysis using Image Processing Lab

Teaching Scheme		Examination Scheme	
Lectures	02 Hrs/week	MSE	-
Tutorials	-	ISE	50
Total Credits	01	ESE	-

Course Contents

Prerequisite : Basics of Image Processing

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.

Course Contents

Experiment 1	Principles of Particle Characterization in Formulations: Image acquisition, preprocessing, thresholding, edge detection, contour analysis, size distribution, shape analysis, aspect ratio, circularity, Feret's diameter, equivalent diameter, texture analysis, feature extraction, statistical analysis.
Experiment 2	Techniques in Reverse Engineering of Formulations: Digital reconstruction, segmentation, pixel intensity analysis, structural analysis, feature mapping, algorithm development, computational modeling, spectral imaging, microscopy enhancement.
Experiment 3	Classification Analysis of Formulated Products, Morphological Characterization of Formulations : Based on different morphological parameters, pharmaceutical formulations, cosmetic formulations, biomedical applications.
Experiment 4	Microscopic Analysis of Formulated Products, Advanced Topics in Formulation Characterization: High-resolution imaging, digital image processing, particle morphology, spectral imaging, fluorescence microscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM), thresholding, edge detection, feature extraction, material characterization.



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

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)

Mapping of COs and POs

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Avg
Task I	15	15	15	15	15
Task II	5	5	5	5	5
Task III	5	5	5	5	5
ISE	25	25	25	25	25




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Government College of Engineering, Karad					
Third Year (Sem – VI) MDM- Image Processing (Institute Level-Industrial)					
IMI3625: Particle Characterization in Healthcare					
Teaching Scheme			Examination Scheme		
Lectures	02 Hrs/week		MSE	20	
Tutorials	-		ISE	20	
Total Credits	02		ESE	60	
			Duration of ESE	02 Hrs 30 Min	
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	(04)
Unit 2	Techniques in Particle Morphology Analysis			CO2	(04)
Unit 3	Analysis of API Particles			CO1, CO2	(04)
Unit 4	Microscopy Techniques for Characterization			CO3	(04)
Unit 5	Impurities Analysis and Detection			CO3,	(05)
Unit 6	Advanced Topics in Particle Characterization for health care applications.			CO3	(05)

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	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	2	2	-	-	-	-	2	-	2	1
CO 2	2	3	2	2	3	1	-	-	1	-	2	1	2	1
CO 3	3	3	3	3	3	2	1	1	2	2	3	1	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)




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Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60



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Government College of Engineering, Karad					
Final Year (Sem – VII) MDM- Image Processing (Institute Level-Industrial)					
IMI3726: Particle Characterization in Formulation and Reverse Engineering					
Teaching Scheme			Examination Scheme		
Practical	2 Hrs/week		MSE	20	
Tutorials	-		ISE	20	
Total Credits	02		ESE	60	
			Duration of ESE	02 Hrs 30 Min	
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	Illustrate the 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	(04)
Unit 2	Techniques in Reverse Engineering of Formulations			CO2	(04)
Unit 3	Classification Analysis of Formulated Products			CO2	(04)
Unit 4	Morphological Characterization of Formulations			CO3	(05)
Unit 5	Microscopic Analysis of Formulated Products			CO3	(05)
Unit 6	Advanced Topics in Formulation Characterization			CO4	(04)

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	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	3	2	-	-	1	-	2	-	2	2
CO 2	3	3	3	3	3	1	1	-	2	2	2	1	2	2
CO 3	2	2	2	2	3	-	-	-	1	1	2	1	2	2
CO 4	3	3	3	3	3	2	1	1	2	2	3	1	2	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)




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Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60



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Final Year (Sem – VIII) MDM- Image Processing (Institute Level-Industrial)

IMI3827: Project/Internship

Teaching Scheme		Examination Scheme	
Practical	04 Hrs/week	ISE	-
Tutorials	-	ESE	100
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
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	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	3	3	2	1	-	1	2	2	-	2	2
CO 2	3	3	3	3	3	1	1	2	2	2	3	1	2	2
CO 3	3	3	3	3	3	2	2	2	2	3	3	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
Understand	-	10
Apply	-	20
Analyse	-	20
Evaluate	-	20
Create	-	20
Total	-	100




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