Minor in Imaging Sciences and Machine Vision
Offered by Department of Networking and Communications
Networking and Communications

Category	Course Code	Course Title	L	T	P	C	Credits to be earned
Preparatory	21MNW001P	Fundamentals of Computer Science	3	0	0	3	
Foundation	21MNW009F	Introduction to Image Processing	3	0	2	3	4
	21MNW010F	Mathematics for Image processing	**3**	**0**	**0**	**3**	**3**
	21MNW011F	Introduction to Deep Learning for Computer Vision	2	1	0	3	3
	21MNW012F	Fundamentals of Image Coding Systems	2	1	0	3	3
Professional Electives I	21MNW012E	Medical Imaging	2	1	0	3	3
	21MNW013E	Remote sensing and Satellite Imaging	3	0	0	3	3
Professional Electives II	21MNW014E	3D and Colour image Processing	3	0	0	3	3
	21MNW015E	Steganography and Video Processing	3	0	0	3	3
Total credits							**19**

Minor in Imaging Sciences and Machine Vision will be offered only to Non School of Computing Students.
21MNWP001 - No End Semester exams will be conducted for preparatory courses and the credit will not be accounted for awarding certification.
* Any two of Four Elective courses should be carried out.

Course Code	\$21MNW001P	Course Name	Fundamentals of Computer Science	Course Category	P	Preparatory Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Networking and Communications*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1 :	*Understand the fundamentals of Computer*
CLR-2 :	*Gain knowledge about networking*
CLR-3 :	*Study about Operating System*
CLR-4 :	*Study about new processors of Computer System*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*
CO-1 :	*Gain knowledge about the Computer Science*
CO-2 :	*To present some of the flavor of the Computing Sciences*
CO-3 :	*Study about Operating System*
CO-4 :	*To involve you in the kind of thinking done in the Computing Sciences,*

Program Learning Outcomes (PO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Engineering Knowledge	Problem Analysis	Design/development of	Conduct investigations of complex problems	Modern Tool Usage	The engineer and society	Environment & Sustainability	Ethics	Individual &Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
-	-	-	*3*	-	-	-	-	-	-	-	-			
-	-	-	*3*	*2*	-	-	-	-	-	-	-			
-	-	-	*3*	-	-	-	-	-	-	-	-			
-	-	-	*3*	*1*	-	-	-	-	-	-	-			

Module – 1 ***Machine instructions and addressing modes*** ***9 Hour***

ALU, data-path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Module-2 ***Processes and Threads*** ***9 Hour***

Processes, threads, inter process communication, concurrency and synchronization. Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

Module-3 **Data Base Management** ***9 Hour***

ER model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Module-4 **Networking Fundamentals**	***9 Hour***
Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state).	
Module-5 Transport and Application Layer Fundamentals	***9 Hour***
TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.	

Learning Resources	1. *DATA COMMUNICATIONS AND NETWORKING (SIE) | 4th Edition Paperback – 1 July 2017,by Behrouz A. Forouzan*	2. *Operating System PrinciplesbySilberschatz , Galvin , Gagne*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*CLA-3 – (20%)*	
		Formative CLA-1 Average of unit test (20%)		*Life Long Learning CLA-2 – (60%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*20%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*25%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*25%*	-
Level 5	*Evaluate*	-	-	*10%*	-	*10%*	-
Level 6	*Create*	-	-	*5%*	-	*5%*	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

1. Dr. V. Joseph Raymond, SRMIST

2.Dr.M.B Mukesh Krishnan, SRMIST

Course Code	21MNW009F	Course Name	Introduction to Image Processing	Course Category	F	Foundation Course	L	T	P	C
							3	0	2	3

Pre-requisite Courses	*Nil*	*Co- requisite Courses*	*Nil*	*Progressive Courses*	*Nil*
Course Offering Department	*Networking and Communications*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*Understand the fundamentals steps in image processing*
CLR-2:	*familiarize on multiple image enhancement techniques*
CLR-3:	*Learn various discrete transforms*
CLR-4:	*Master various image restoration models*
CLR-5:	*learn the art of image segmentation*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/ development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual & Collaborative Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	*Gain knowledge on the fundamentals of image processing*	-	-	*2*	-	-	-	-	-	-	-	-			
CO-2:	*Apply image enhancement techniques*	-	-	*3*	-	-	-	-	-	-	-	-			
CO-3:	*Apply 2D discrete transforms*	-	-	*3*	-	-	-	-	-	-	-	-			
CO-4:	*Apply image restoration models*	-	-	-	*3*	-	-	-	-	-	-	-			
CO-5:	*Apply image segmentation techniques*	-	-	-	*3*	-	-	-	-	-	-	-			

Module -1 – Fundamentals in image processing	***9 Hour***
Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – ImageSampling and Quantization. Relationships between pixels - Color image models - RGB, HSI models	
Module-2 – Image Enhancements	***9 Hour***
Spatial Domain: Basic relationship between pixels- Basic Gray level Transformations – Histogram Processing – Smoothing spatial filters- Sharpening spatial filters. Frequency Domain: Smoothing	

frequency domain filters- sharpening frequency domain filters Homomorphic filtering.
Module-3 – Discrete Transforms ***9 Hour***
Two-dimensional mathematical preliminaries, 2D transforms -Introduction to Fourier Transform, DFT , FFT Properties of 2D Fourier, Separable Image Transforms –Walsh Hadamard Hadamard Transform, Haar Transform, Discrete Cosine Transform, Discrete Wavelet Transforms
Module-4 – Image Restoration ***9 Hour***
Introduction to Image Restoration- degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering
Module-5 - Image Segmentation ***9 Hour***
Feature extraction: Histogram based features - Intensity Features-Colour - Shape Features-Local Binary Patterns (LBP) - Texture descriptors- Grey Level Occurrence Matrix (GLCM) Fundamentals of Image Compression – water marking

Learning Resources	*1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, Third Edition, 2010.* *2. S. Sridhar, "Digital Image Processing", Second Edition, Oxford University, 2016.*	*3. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011. 3. Jayaraman S., Esaki Rajan S., T.Veera.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

1. *Dr G Suseela,SRMIST*
2. *Dr K Meenakshi ,SRMIST*

Course Code	21MNW010F	Course Name	Mathematics for Image processing	Course Category	F	Foundation Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Networking and Communications	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Understand gray tone and binary image processing
CLR-2:	learn how to represent and model images
CLR-3:	develop skills to apply spatial and tonal operations
CLR-4:	gain expertise in mathematical morphological processing
CLR-5:	explore probabilistic and Euclidean geometry in image processing

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/ development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual & Collaborative Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	apply gray tones and binary image processing	-	3	-	-	-	-	-	-	-	-	-			
CO-2:	implement image modelling and set theory	-	-	-	-	3	-	-	-	-	-	-			
CO-3:	Use spatial and tonal domain concepts.	-	-	3	-	-	-	-	-	-	-	-			
CO-4:	Apply morphological and convolutional systems in real-time image processing	-	-	-	-3	-	-	-	-	-	-	-			
CO-5:	Apply probabilistic functions and Euclidean geometry	-	-	3	-	-	-	-	-	-	-	-			

Module-1 – Gray Tone and Binary Image Processing	***9 Hour***
Intensity, pixels and Gray tones, intensity image formation models,.Gray Image Processing,Binary Image Processing,Dimensionality, continuity and discreteness ,Resolution, Scale,ranges and domains	
Module -2 – Mathematical Imaging Frame works	***9 Hour***
Imaging Paradigms ,frameworks,approaches,image representation and modelling,Basics of set theory , Sets and elements, mapping between set, injection, surjections, bijections	
Module -3 – Mathematical Notions spatial and tonal domain	***9 Hour***
Pixels-pixel setting in continuous and discrete, Point and cell discrete representation of pixels,Tonal domain- Vector space and algebra, linear operations-general operations ,homomorphic, ration,	

logarithmic operations.tonal affinity ,
Module-4 – Morphological framework and convolutional framework ***9 Hour***
Concepts and structures, morphology,dilation,opening,closing,Image Rank filtering, edge detection, softening, segmentation, convolution- Lebesgue-Bochner properties for convolution -image enhancement- image deconvolution-constrained deconvolution
Module-5 – Probabilistic functional framework and Euclidean geometry ***9 Hour***
Parametric Probability distribution, KL theorem,Kiener -khinchins theorem, Random gray tone functions,Gaussian gray tone functions,matrix, Euclidean dimension,determinants, eigen value, eigen vectors,Affine tansformation,Hyper planes, Poly tones

Learning Resources	*1. Pinoli, J. C. (2014). Mathematical Foundations of Image Processing and Analysis, Volume 2 (Vol. 1). John Wiley & Sons.*	*2. Pinoli, J. C. (2014). Mathematical Foundations of Image Processing and Analysis, Volume 2 (Vol. 2). John Wiley & Sons.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers
1. Dr. G Suseela, SRMIST
2.Dr. S. ATHITHAN, SRMIST

Course Code	21MNW011F	Course Name	Introduction to Deep Learning for Computer Vision	Course Category	F	*Foundation course*	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Networking and Communications*	Data Book / Codes / Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*Understand the visual features and features matching*
CLR-2:	*Explore the architecture of CNN model for object detection*
CLR-3:	*Implement and optimize deep learning models using industry-standard frameworks like TensorFlow and PyTorch*
CLR-4:	*Gain knowledge about image classification, object detection, and segmentation*
CLR-5:	*practical skills to leverage deep learning for solving real-world vision problems.*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	*Program Outcomes (PO)*											*Program Specific Outcomes*		
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*			
		Engineering Knowledge	*Problem Analysis*	*Design/development of solutions*	*Conduct investigations of complex problems*	*Engineering Tool Usage*	*The Engineer and The World*	*Ethics*	*Individual & Collaborative Team Work*	*Communication*	*Project Mgt. & Finance*	*Life Long Learning*	*PSO-1*	*PSO-2*	*PSO-3*
CO-1:	*To understand the visual features of image data*	*2*	-	-	-	-	-	-	-	-	-	-			
CO-2:	*Implement Convolutional Neural Networks (CNNs) and other architectures for image analysis.*	-	-	*3*	-	-	-	-	-	-	-	-			
CO-3:	*Apply techniques such as transfer learning, fine-tuning, and data augmentation.*	-	-	*3*	-	-	-	-	-	-	-	-			
CO-4:	*Understand the RNN,LSTM and GRU models for image captioning*	-	-	*3*	-	-	-	-	-	-	-	-			
CO-5:	*Understand the GAN models for image generation*	-	*3*	-	-	-	-	-	-	-	-	-			

Module-1 – Visual Features Engineering	***9 Hours***
Visual Features and Representations: *Edge Detection; From Edges to Blobs and Corners; Scale Space, Image Pyramids and Filter Bank; SIFT and Variants; Other Feature Spaces- Image Segmentation, Human Visual System -Visual Matching: Feature Matching; From Points to Images: Bag-of-Words and VLAD Representations; Image Descriptor Matching*	
Module -2 – Deep learning for object Detection	***9 Hours***
Neural Networks: A Review; Feedforward Neural Networks and Backpropagation; Gradient Descent and Variants; Regularization in Neural Networks; Improving Training of Neural Networks *Convolutional Neural Networks (CNNs): Convolutional Neural Networks: An Introduction; Backpropagation in CNNs; Evolution of CNN Architectures for Image Classification; Recent CNN Architectures; Finetuning in CNNs*	
Module-3 – Visualization and Understanding CNNs	***9 Hours***
Explaining CNNs: Visualization Methods; Early Methods (Visualization of Kernels; Backprop-to-image/Deconvolution Methods); CNNs for Recognition, Verification, Detection, Segmentation: CNNs for Object Detection; CNNs for Segmentation; CNNs for Human Understanding: Faces- CNNs for Human Understanding: Human Pose and Crowd	

Module-4 – Recurrent Neural Networks	***9 Hours***
Recurrent Neural Networks: Introduction; Backpropagation in RNNs; LSTMs and GRUs; Video Understanding using CNNs and RNNs -Attention Models: Attention in Vision Models:Image Captioning; Self-Attention and Transformers.	
Unit-5 - Deep Generative Models	***9 Hours***
Deep Generative Models: An Introduction; Generative Adversarial Networks; Variational Autoencoders; Combining VAEs and GANs Variants and Applications of Generative Models in Vision: GAN Improvements	

Learning Resources	1. *Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, 2016* 2. *Michael Nielsen, Neural Networks and Deep Learning, 2016* 3. *Yoshua Bengio, Learning Deep Architectures for AI, 2009* 4. *Richard Szeliski, Computer Vision: Algorithms and Applications, 2010.* 5. *Simon Prince, Computer Vision: Models, Learning, and Inference, 2012.* 6. *David Forsyth, Jean Ponce, Computer Vision: A Modern Approach, 2002.*	7. *Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.* 8. *Bishop, Christopher M. Pattern Recognition and Machine Learning. Springer, 2006. ISBN 978-0-387-31073-2* 9. *Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.* 10. *Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.* 11. *Richard Hartley, Andrew Zisserman, Multiple View Geometry in Computer Vision, 2004.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

1. *Dr K Meenakshi, SRMIST*
2. *Dr. Arul Valan, NIT, Nagaland*

Course Code	21MNW012F	Course Name	Fundamentals of Image Coding Systems	Course Category	F	Foundation Course	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	Co- requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Networking and Communications*	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*Understand the core foundations of image compression*
CLR-2:	*Learn about the fundamentals of JPEG*
CLR-3:	*Learn about the fundamentals of JPEG2000*
CLR-4:	*Gain a basic understanding of image encryption*
CLR-5:	*Learn about basic 2D chaos based encryption systems*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	*Program Outcomes (PO)*											*Program Specific Outcomes*		
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*			
		Engineering Knowledge	*Problem Analysis*	*Design/ development of solutions*	*Conduct investigations of complex problems*	*Engineering Tool Usage*	*The Engineer and The World*	*Ethics*	*Individual & Collaborative Team Work*	*Communication*	*Project Mgt. & Finance*	*Life Long Learning*	*PSO-1*	*PSO-2*	*PSO-3*
CO-1:	*Apply the underlying principles and techniques associated with image compression*	-	*3*	-	-	-	–	-	-	-	-	-			
CO-2:	*describe the DCT based image compression*	-	-	*3*	-	-	–	-	-	-	-	-			
CO-3:	*Compare the DCT and DWT based image compression Standards*	-	-	*3*	-	-	–	-	-	-	-	-			
CO-4:	*understand image encryption and its significance*	-	-	-	*3*	-	–	-	-	-	-	-			
CO-5:	*develop a practical understanding of the chaos based image encryption systems*	-	-	-	-	*3*	–	-	-	-	-	-			

Module-1 – Introduction to Image Coding	***9 Hour***
unit-1 – Types of compression- applications of compression – compression parameters, compression ratio, bitrate-MSE-PSNR,SSIM trade-off image quality vs compression ratio-Entropy coding-models –Huffman coding, Block truncation coding, Run length coding Error Free Compression – Variable Length Coding –Bit – Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding- Golomb Rice coding	
Module-2 – DCT based Image Compression	***9 Hour***
– Fundamentals of Image Compression -Basic image compression model -DCT based techniques-transform- quantization-Scalar vs vector quantization- coding -JPEG- Sequential Mode.Lossless Mode.	

Progressive Mode, Hierarchical Mode
Module-3 – DWT based Image Compression ***9 Hour***
Wavelet theory – 1D wavelet, 2D wavelet, DWT based image compression- EBCOT,Vector quantization, SPHIT, ROI CODING, JPEG2000
Module-4 - Fundamentals of Image Encryption ***9 Hour***
– Basic concepts of Image Encryption-Goals and Principles-Types of Encryption Algorithm-based on Encryption structure-keys-full-partial encryption- Crypt Analysis DES- double DES, triple DES,blowfish,RC5 ,AES
Module-5 – Chaos based Encryption systems ***9 Hour***
Chaos and cryptography, 2D Bakers map- Arnold cat map-Henon map- challenges in Chaotic encryption - Homomorphic Encryption system- Encryption evaluation metrics -Statiscal Analysis- Histogram Deviation, correlation coefficient -Key Space Analysis, Key Sensitivity Analysis, Shannon's Entropy, Differential Attack analysis- NPCR,UACI,Noise Immunity

Learning Resources	1. *Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, Third Edition, 2010* 2. *S. Sridhar, "Digital Image Processing", Second Edition, Oxford University, 2016.*	2. *Abd El-Samie, F. E., Ahmed, H. E. H., Elashry, I. F., Shahieen, M. H., Faragallah, O. S., El-Rabaie, E. S. M., & Alshebeili, S. A. (2013). Image encryption: a communication perspective. Crc Press.* 3. *Uhl, Andreas, and Andreas Pommer. Image and video encryption: from digital rights management to secured personal communication. Vol. 15. Springer Science & Business Media, 2004.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

1. *Dr G Suseela, SRMIST*
2. *Dr Y ASNATH VICTY PHAMILA, VIT,CHENNAI*

Course Code	21MNW012E	Course Name	Medical Imaging	Course Category	E	*Elective*	L	T	P	C
							2	1	0	3

Pre-requisite Courses	*Nil*	*Co- requisite Courses*	*Nil*	*Progressive Courses*	*Nil*
Course Offering Department	*Networking and Communications*	*Data Book / Codes / Standards*	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	*Understand the various imaging modalities such as CT, Ultrasound, X-Ray, MRI in the medical imaging field*
CLR-2:	*Able to apply basic mathematical tools such as transform techniques on the medical images*
CLR-3:	*Gain the knowledge of processing and reconstruction methods of medical images*
CLR-4:	*Understand the role of Neuro Fuzzy systems in medical imaging*
CLR-5:	*Explore the various software tools for visualization of medical images*

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	*Program Outcomes (PO)*											*Program Specific Outcomes*		
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*			
		Engineering Knowledge	*Problem Analysis*	*Design/development of solutions*	*Conduct investigations of complex problems*	*Engineering Tool Usage*	*The Engineer and The World*	*Ethics*	*Individual & Collaborative Team*	*Communication*	*Project Mgt. & Finance*	*Life Long Learning*	*PSO-1*	*PSO-2*	*PSO-3*
CO-1:	*Having a broad understanding of fundamentals of medical imaging modalities such as XRay, CT, Ultrasound and MRI.*	-	-	3	-	-	-	-	-	-	-	-			
CO-2:	*Able to apply basic mathematical tools such as transform techniques on the X ray images*	-	-	3	-	-	-	-	-	-	-	-			
CO-3:	*Understand the processing of PET, SPECT imaging*	-	-		3	-	-	-	-	-	-	-			
CO-4:	*Learn the image processing of ultra sound images*	-	-		3	-	-	-	-	-	-	-			
CO-5:	*Visualize medical data in an appropriate software*	-	-	3	-	-	-	-	-	-	-	-			

Module-1 – Basics of Medical imaging	***9 Hour***
Historical perspective -Generic Principles – modality – contrast – SNR – resolution – toxicity - Measurements and Modeling: Review of Linear Systems and Models – Basic Model for Tomography - Sampling - Fourier and Hankel transforms - k-space	
Module-2 – Xray -image processing	***9 Hour***
XRay projection radiography – Reconstruction in X-Ray Tomography - Computerized Tomography - acquisition and reconstruction methods - relaxation and contrast mechanisms – applications	
Module-3 – Nuclear medicine	***9 Hour***
Nuclear medicine - radio nuclides, PET, SPECT imaging – Applications of Probability : PET	
Module-4 – Ultrasound image processing	***9 Hour***
Ultrasound Imaging - echo equation - beam forming - Medical Image Processing - physics of Magnetic resonance imaging - MRI reconstruction, functional MRI.	

Module-5 – Role Fuzzy systems in medical imaging	***9 Hour***
Fuzzy and Neuro Fuzzy Systems: Medical Image Analysis and Processing – Wavelets and Fuzzy gated SPECT Images of Ventricles. Visualization of medical imaging data-segmentation applications.	

Learning Resources	1. Albert Macovski, Medical Imaging Systems, Prentice Hall, 1983. 2. Joseph Hornak, The Basics of MRI, Online at http://www.cis.rit.edu/htbooks/mri 3. Charles L. Epstein, Introduction to Mathematics of Medical Imaging, Pearson Education, Prentice Hall, NJ, 2003. 4. H.N. Teodorescu, L.C. Jain, Abraham Kandel, Fuzzy and Neuro Fuzzy Systems in Medicine, Computational Intelligence, CRC Press, 1999.	*1. . John L Semmlow, Biosignal and Biomedical Image Processing: MATLAB Based Applications, CRC Press.* *2. Kavyan Najarian, Biomedical Signal and Image Processing, CRC Press.* *3. Isaac Bankmem, Handbook of Medical Imaging: Processing and Analysis, Academic Press, 2000.* *4. Anil. K. Jain, Fundamentals of Digital Image Processing, Eastern economy ed., Prentice Hall of India, 1997*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	-	*15%*	-	*15%*	-
Level 2	*Understand*	*25%*	-	*20%*	-	*25%*	-
Level 3	*Apply*	*30%*	-	*25%*	-	*30%*	-
Level 4	*Analyze*	*30%*	-	*25%*	-	*30%*	-
Level 5	*Evaluate*	-	-	*10%*	-	-	-
Level 6	*Create*	-	-	*5%*	-	-	-
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

1. *Dr K Meenakshi, SRMIST*
2. *Dr. Arul Valan, NIT, Nagaland*

Course Code	21MNW015E	Course Name	Steganography and Video Processing	Course Category	E	Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Networking and Communications	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Understand steganography techniques, applications, and security implications in digital media.
CLR-2:	Understand various steganographic methods and their techniques for embedding hidden data.
CLR-3:	Explore steganalysis techniques for detecting hidden data using statistical, visual, and machine learning methods.
CLR-4:	Explore video steganography principles, image formation models, and signal processing techniques.
CLR-5:	Understand motion estimation techniques and their role in video coding and steganography applications.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual & Collaborative Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Analyze steganographic methods and assess their security risks across digital carriers.	-	3	-	-	-	-	-	-	-	-	-			
CO-2:	Apply and analyze different steganographic techniques used for covert data embedding.	3	-	-	-	3	-	-	-	-	-	-			
CO-3:	Analyze steganalysis systems and apply machine learning techniques for detecting steganography in digital media.	-	3	-	-	3	-	-	-	-	-	-			
CO-4:	Analyze video-based steganography methods and apply signal processing techniques for data embedding and detection.	3	-	-	-	3	-	-	-	-	-	-			
CO-5:	work with motion estimation methods for efficient video coding and analyze their implications in steganographic techniques	3	-	-	-	3	-	-	-	-	-	-			

Module-1 - Origins & Overview of Steganography	***9 Hour***
History of Use, Covert Messaging, Null Cipher Messages, Steganography vs. Encryption, Threats Posed by Steganography Use, Steganography in the Media, Availability & Production. Digital Carriers - Used to Exploit Human Weaknesses, Digital Images - Palette, True Color, Compressed Lossy, lossless, Formats: BMP, JPG, GIF, PNG, Digital Audio, Converters, Signal Processors, Wav files MP3, Dangers.	
Module-2 - Steganography Embedding Tools	***9 Hour***
Steganography Methods, Data Appending, Formatting Modification, Word Substitution, Color Palette Substitution, 24 Bit LSB Encoding, DCT Modification, PNS Modification, Covert Channels.	
Module-3 - Steganalysis	***9 Hour***

An Overview, The Statistical Properties of Images, The Visual Steganalytic System, IQM-Based Steganalytic System, Learning Strategies, Introduction of the Support Vector Machine, Neural Networks, Principle Component Analysis, Frequency-Domain Steganalytic System.
Module-4 - Basic Steps of Video Processing ***9 Hour***
Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations
Module-5 - 2D Motion Estimation ***9 Hour***
Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Learning Resources	*1. Information Hiding (Steganography and Watermarking - Attacks and Countermeasures), Johnson, Neil F./ Duric, Zoran/ Jajodia, Sushil , luwer Academic Pub, 2001* *2.Information Hiding Techniques for Steganography and Digital Watermarking, Katzenbeisser, Stefan (Edt)/ Petitcolas, Fabien, A.P. (Edt) , Artech House, 2000*	*3. . Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.* *4. Digital Video Processing – M. Tekalp, Prentice Hall International* *5. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier.*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	*-*	*15%*	*-*	*15%*	*-*
Level 2	*Understand*	*25%*	*-*	*20%*	*-*	*25%*	*-*
Level 3	*Apply*	*30%*	*-*	*25%*	*-*	*30%*	*-*
Level 4	*Analyze*	*30%*	*-*	*25%*	*-*	*30%*	*-*
Level 5	*Evaluate*	*-*	*-*	*10%*	*-*	*-*	*-*
Level 6	*Create*	*-*	*-*	*5%*	*-*	*-*	*-*
	Total	*100 %*		*100 %*		*100 %*	

Course Designers

1. *Dr. G. Saranya, SRMIST*
2. *Dr G Suseela, SRMIST*

Course Code	21MNW014E	Course Name	3D and colour image Processing	Course Category	E	Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Networking and Communications	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	Explore the basic concepts of 2D image and 3D images
CLR-2:	understand the fundamentals of 3D image acquisition, processing, and analysis.
CLR-3:	explore color models, color perception, and color image processing techniques.
CLR-4:	apply computational algorithms for 3D reconstruction, segmentation, and visualization.
CLR-5:	develop skills in implementing 3D and color image processing techniques using programming tools

Course Outcomes (CO):	At the end of this course, learners will be able to:	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/ development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual & Collaborative Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Understand the fundamentals of 3D imaging, color models, and their significance in image processing.	-	3	-	-	-	–	-	-	-	-	-			
CO-2:	Implement various 3D image processing techniques such as depth estimation, segmentation, and visualization.	-	-	3	-	-	–	-	-	-	-	-			
CO-3:	Understand the 3D image transformation and normalization	-	-	3	-	-	–	-	-	-	-	-			
CO-4:	Apply color image processing algorithms for enhancement, segmentation, and feature extraction.	-	-	-	3	-	–	-	-	-	-	-			
CO-5:	Work with real-world datasets and implement 3D and color image processing using Python/OpenCV	-	-	-	-	3	–	-	-	-	-	-			

Module-1 – Introduction to 3D Image Processing	***9 Hour***
Overview of 3D imaging and applications -3D image acquisition techniques (stereo imaging, structured light, time-of-flight) -Depth perception and disparity maps-Point cloud representation and processing-	
Module-2 – 3D Image Processing Techniques	***9 Hour***

3D image filtering and enhancement -3D segmentation and feature extraction- Surface reconstruction and texture mapping- Mesh processing and 3D model generation	
Module-3 – Color Image Processing Fundamentals	***9 Hour***
Color perception and human vision -Color spaces (RGB, HSV, YUV, LAB, CMYK) -Color transformation and normalization -Color image histogram processing	
Module-4 -Color Image Enhancement and Segmentation	***9 Hour***
Color balancing and correction- Color-based segmentation (K-means, Mean-Shift, Watershed)- Color edge detection and feature extraction -Applications in object detection and recognition	
Module-5 – Applications and Advanced Topics	***9 Hour***
3D object recognition and classification -3D visualization techniques -Augmented reality (AR) and Virtual reality (VR) applications -Deep learning for 3D and color image processing	

Learning Resources	*1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer* *2. D. Forsyth & J. Ponce, Computer Vision: A Modern Approach, Pearson*	*3. Mark S. Nixon, Feature Extraction & Image Processing for Computer Vision, Academic Press* *4. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	*-*	*15%*	*-*	*15%*	*-*
Level 2	*Understand*	*25%*	*-*	*20%*	*-*	*25%*	*-*
Level 3	*Apply*	*30%*	*-*	*25%*	*-*	*30%*	*-*
Level 4	*Analyze*	*30%*	*-*	*25%*	*-*	*30%*	*-*
Level 5	*Evaluate*	*-*	*-*	*10%*	*-*	*-*	*-*
Level 6	*Create*	*-*	*-*	*5%*	*-*	*-*	*-*
	Total	*100 %*		*100 %*		*100 %*	

Course Designers
1. Dr. K Meenakshi, SRMIST
2.Dr. G Suseela, SRMIST

Course Code	21MNW013E	Course Name	Remote sensing and Satellite Imaging	Course Category	E	Elective	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Networking and Communications*	Data Book / Codes / Standards	*Nil*		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*
CLR-1:	Study the basic concepts of remote sensing.
CLR-2:	Understand aerial photography and photogrammetry
CLR-3:	Understand satellite remote sensing principles
CLR-4:	Study different satellites and their applications.
CLR-5:	Explore Satellite Positioning Systems and GNSS applications.

Course Outcomes (CO):	*At the end of this course, learners will be able to:*	Program Outcomes (PO)											Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11			
		Engineering Knowledge	Problem Analysis	Design/ development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual & Collaborative Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO-1	PSO-2	PSO-3
CO-1:	Demonstrate an understanding of the basic principles and components of remote sensing.	*3*	-	-	-	-	-	-	-	-	-	-			
CO-2:	Apply knowledge of aerial photography and photogrammetry techniques for spatial data acquisition and analysis.	-	-	-	-	*3*	-	-	-	-	-	-			
CO-3:	Explain the principles of satellite remote sensing and their relevance in observing Earth's surface features.	*3*	-	-	-	-	-	-	-	-	-	-			
CO-4:	Identify various satellites, their capabilities, and applications in areas such as environmental monitoring, urban planning, and disaster management.	-	*3*	-	-	-	-	*3*	-	-	-	-			
CO-5:	Utilize Satellite Positioning Systems and Global Navigation Satellite Systems (GNSS) for accurate location-based analysis and decision-making.	-	-	*3*	-	*3*	-	-	-	-	-	-			

Module-1 - Fundamental of Remote Sensing	***9 Hour***
Introduction of Remote Sensing – Energy sources and Radiation principles, Energy equation, EMR and Spectrum, EMR interaction with Atmosphere- scattering, Absorption, EMR interaction with earth surface features- reflection, absorption, emission and transmission, Spectral response pattern, vegetation, soil, water bodies, Spectral reflectance.	

Module-2 - Aerial Photography and Photogrammetry	***9 Hour***
Introduction-Terrestrial and Aerial photographs - vertical and oblique photographs - height determination contouring - photographic interpretations - stereoscopy – parallax bar- Flight Planning- Photo Interpretation, Applications of aerial Photos-Photo theodolite.	
Module-3 - Satellite Remote Sensing Principles	***9 Hour***
Data acquisition –Procedure, Reflectance and Digital numbers- Intensity- Reference data, Ground truth, Analog to digital conversion, Detector mechanism-Spectroradiometer-Ideal remote sensing system – Characters of real and successful remote sensing system- Platforms and sensors- orbits- types – Resolution.	
Module-4 - Remote Sensing Satellites	***9 Hour***
Land observation satellites, characters and applications, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series, NOAA, GOES, NIMBUS Applications, Marine observation satellites OCEANSAT.	
Module-5 -Satellite Positioning System and GNSS Applications	***9 Hour***
. Introduction to Global Navigation Positioning System – Basic concepts, Pseudo Range Measurement, Phase difference Measurement, Differential Positioning Concept, Augmentation Systems (IRNSS, GAGAN, WAAS, LAAS, etc.), GNSS Applications.	

Learning Resources	1. *Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information Systems", BS Publications, Hyderabad. 2011. ISBN: 81-7800-112-8.* 2. *Chandra. A.M and Gosh .S.K, "Remote Sensing and GIS", Narosa Publishing Home, New Delhi 2009*	3. *Thomas M. Lilles and, Ralph W. Kiefer, Jonathan W. Chipman , "Remote Sensing and Image Interpretation", John Wiley & Sons, 2008* 4. *George Joseph, "Fundamentals of Remote Sensing" , Universities Press, Hyderabad 2005*

Learning Assessment

	Bloom's Level of Thinking	*Continuous Learning Assessment (CLA)*				*Summative Final Examination (40% weightage)*	
		Formative CLA-1 Average of unit test (50%)		*Life-Long Learning CLA-2 (10%)*			
		Theory	*Practice*	*Theory*	*Practice*	*Theory*	*Practice*
Level 1	*Remember*	*15%*	*-*	*15%*	*-*	*15%*	*-*
Level 2	*Understand*	*25%*	*-*	*20%*	*-*	*25%*	*-*
Level 3	*Apply*	*30%*	*-*	*25%*	*-*	*30%*	*-*
Level 4	*Analyze*	*30%*	*-*	*25%*	*-*	*30%*	*-*
Level 5	*Evaluate*	*-*	*-*	*10%*	*-*	*-*	*-*
Level 6	*Create*	*-*	*-*	*5%*	*-*	*-*	*-*
	Total	*100 %*		*100 %*		*100 %*	

Course Designers
1. Dr. G Saranya, SRMIST
2.Dr. G Suseela, SRMIST