|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LECTURE PLAN** | | | | | | | | | | | | | | | | | |
| **Institute/ Department:** | | | | **UIE/MTC** | | **Program:** | | | ME204 | | | | | | | | |
| **Master Subject Coordinator Name:** | | | | **Mr. Anurag** | | **Master Subject Coordinator E-Code:** | | | E5160 | | | | | | | | |
| **Course Name:** | | | | **Image Processing and Machine Vision** | | **Course Code:** | **MTB-401** | | **Course Credit:** | | 03 | | **Course Type:** | THEORY | **Contact Hours Per Week:** | 3 | |
|  | | | | | | | | | | | | | | | |
|
| **Vision of the Department** | | | To be recognized as a Center of Excellence for Research and Innovation in Mechatronics Engineering through modern as well as cutting-edge tools and technologies for serving the society at regional, national and global level. | | | | | | | | | | | | |
| **Mission of the Department** | | | MD1: Providing quality education to the students in core and allied fields through state of art infrastructure for meeting the international standards.  MD2: Enriching research and development culture among students through futuristic tools and technologies for providing solution to industrial as well as societal problems.  MD3: Transforming the student's perspective towards innovation and entrepreneurship through core and interdisciplinary technical skills.  MD4: Developing employability and leadership skills in students through hands on experiential learning and industrial collaboration for preparing industry ready professionals.  MD5: Inculcating professional and ethical values in young engineers by continuous learning and professional activities. | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
|
| **Program Educational Objectives (PEOs)** | | | PEO1 | Graduates will develop professional knowledge in Mechatronics Engineering and other interdisciplinary domains. | | | | | | | | | | | | |
| PEO2 | Graduates will have successful career in industries, academic institutions, government services and research & development organizations. | | | | | | | | | | | | |
| PEO3 | Graduates will have capability to adopt, transmit and maintain advanced engineering tools and technologies for providing solution to engineering problems. | | | | | | | | | | | | |
| PEO4 | Graduates will demonstrate the concern for society, environment and communicate effectively while leading the interdisciplinary diverse team under divergent circumstances. | | | | | | | | | | | | |
| PEO5 | Graduates will be effectively fit for higher education, research & development and entrepreneurship | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
|
| **Program outcomes** | | | | PO1 | **Engineering Knowledge:** Apply knowledge of mathematics, science and engineering fundamentals and Production and Industrial Engineering specialization to the solution of complex Production and Industrial Engineering problems. | | | | | | | | | | | | |
| PO2 | **Problem Analysis:** Identify, formulate, research literature and analyze complex Production and Industrial Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. | | | | | | | | | | | | |
| PO3 | **Design/ Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations. | | | | | | | | | | | | |
| PO4 | **Conduct investigations of complex Engineering problems**: Use research-based knowledge and research methods including analysis, interpretation of data and synthesis of information to provide valid conclusions. | | | | | | | | | | | | |
| PO5 | **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. | | | | | | | | | | | | |
| PO6 | **The Engineer and Society:** Apply contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. | | | | | | | | | | | | |
| PO7 | **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. | | | | | | | | | | | | |
| PO8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. | | | | | | | | | | | | |
| PO9 | **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings. | | | | | | | | | | | | |
| PO10 | **Communication:** Communicate effectively on complex Engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions. | | | | | | | | | | | | |
| PO11 | **Project Management and Finance:** Demonstrate knowledge and understanding of Engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. | | | | | | | | | | | | |
| PO12 | **Life Long learning:**Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
|
|  | | | | PSO1 | Apply the knowledge of sensors, data acquisition, robotics, PLC, control systems and modern software tools to solve mechanical and electronics related problems. | | | | | | | | | | | | |
| **Program Specific outcomes (Maximum Words for each point should be 25-30 words)** | | | | PSO2 | Design and develop various mechatronics systems by applying concepts of design, manufacturing, electronics and industrial automation required for current industrial needs. | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
|
|  | | | | 1 | Illustrate the fundamentals digital image processing and machine vision. | | | | | | | | | | | | |
| **Course outcomes (Min. 3 and Max. 6)** | | | | 2 | Apply gray level transformation techniques for quality enhancement of images. | | | | | | | | | | | | |
|  | |  |  | 3 | Compare numerous image enhancement techniques in spatial and frequency domain. | | | | | | | | | | | | |
|  | |  |  | 4 | Evaluate the methodologies for image compression and image segmentation. | | | | | | | | | | | | |
|  | |  |  | 5 | Design and implement various algorithms for digital image processing and machine vision. | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | |
| **Text Books** | | | |  | **Title of the Book** | | | **Name of the Author** | | | | **Volume/Edition** | | | **Publishing House** | **Year** | |
| T1 | Digital Image Processing | | | Gonzalez, R.C., and Woods, R.E., | | | | 3rd | | | Pearson Publication | 2009 | |
| T2 | Fundamentals of Digital Image Processing | | | A.K. Jain | | | | 1st | | |  | 2007 | |
|  | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | |  | **Title of the Book** | | **Name of the Author** | | | **Volume/Edition** | | | | | **Publishing House** | **Year** | |
| R1 | Digital Video Processing | | Tekalp A.M | | | 1st | | | | | Prentice Hall | 1995 | |
| R2 | Standard Codecs: Image Compression to Advanced Video Coding | | Ghanbari M | | | 1st | | | | | IET Press | 2003 | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Week Number** | **Lecture Number** | **Unit Number** | **Chapter Name** | **Topic/Sub-Topic** | **Text/ Reference Books** | **Pedagogical Tools\*\*** | **Mapped with CO Number(s)** |
| 1 | 1 | 1 | Introduction, digital image fundamentals | Introduction to Image Processing | T1, R1 | PPT & Video | 1 |
| 1 | 2 | 1 | Introduction, digital image fundamentals | Definition and Origin of Image Processing | T1 | PPT | 1 |
| 1 | 3 | 1 | Introduction, digital image fundamentals | Introduction to components of Image processing | T1 | PPT | 1 |
| 2 | 4 | 1 | Introduction, digital image fundamentals | Fundamental steps in Digital Image Processing | T1 | PPT | 1 |
| 2 | 5 | 1 | Introduction, digital image fundamentals | A Simple Image Model | T1 | PPT | 1 |
| 2 | 6 | 1 | Introduction, digital image fundamentals | Other Image colour models | T1, R1 | PPT | 1 |
| 3 | 7 | 1 | Introduction, digital image fundamentals | Image sensing | T1 | PPT | 1 |
| 3 | 8 | 1 | Introduction, digital image fundamentals | Image Acquisition | T1 | PPT | 1 |
| 3 | 9 | 1 | Introduction, digital image fundamentals | Sampling and Quantization | T1 | PPT | 2 |
| 4 | 10 | 1 | Introduction, digital image fundamentals | Relationship between Pixel | T1 | PPT | 2 |
| 4 | 11 | 1 | Introduction, digital image fundamentals | Image Formats | T1 | PPT | 2 |
| 4 | 12 | 1 | Introduction, digital image fundamentals | Image Transforms | T1, R1 | PPT | 2 |
| 5 | 13 | 1 | Introduction, digital image fundamentals | Gray-Level Transformations | T1 | PPT | 2 |
| 5 | 14 | 1 | Introduction, digital image fundamentals | Histogram processing | T1,R1 | PPT | 2 |
| 5 | 15 | 1 | Introduction, digital image fundamentals | Doubts and revision of unit-1 | T1, R1 | PPT | 2 |
| 6 | **MST-01** | | | | | | |
| 6 | 16 | 2 | Image Enhancement, image compression | Image subtraction, image averaging | T1 | PPT | 3 |
| 6 | 17 | 2 | Image Enhancement, image compression | Smoothing filters | T1 | PPT | 3 |
| 6 | 18 | 2 | Image Enhancement, image compression | Sharpening filters | T1 | PPT | 3 |
| 7 | 19 | 2 | Image Enhancement, image compression | Basic procedure in time study | T1 | PPT | 3 |
| 7 | 20 | 2 | Image Enhancement, image compression | Advantages and limitations of time study | T1 | PPT | 3 |
| 7 | 21 | 2 | Image Enhancement, image compression | Enhancement in frequency and spatial domain | T1 | PPT | 3 |
| 8 | 22 | 2 | Image Enhancement, image compression | Low pass filtering | T1 & R1 | PPT | 3 |
| 8 | 23 | 2 | Image Enhancement, image compression | High pass filtering | T1 & R1 | PPT | 3 |
| 8 | 24 | 2 | Image Enhancement, image compression | Fundamentals, Image Compression Models | T2 | PPT | 4 |
| 9 | 25 | 2 | Image Enhancement, image compression | Elements of Information Theory | T2 | PPT | 4 |
| 9 | 26 | 2 | Image Enhancement, image compression | Error-Free Compression | T2 | PPT | 4 |
| 9 | 27 | 2 | Image Enhancement, image compression | Lossy Compression | T2 | PPT | 4 |
| 10 | 28 | 2 | Image Enhancement, image compression | Image Compression Standards | T2 | PPT | 4 |
| 10 | 29 | 2 | Image Enhancement, image compression | Machine Vision | T2 | PPT | 4 |
| 10 | 30 | 2 | **Unit-2 Revision and Problems Discussion** | | | | |
| 11 | **MST-02** | | | | | | |
| 11 | 31 | 3 | Machine/computer vision | Introduction to machine vision | T2 & R2 | PPT | 4 |
| 11 | 32 | 3 | Machine/computer vision | Low and high level visions | T2 & R2 | PPT | 4 |
| 12 | 33 | 3 | Machine/computer vision | Image acquisition | T2 & R2 | PPT & Video | 4 |
| 12 | 34 | 3 | Machine/computer vision | Image digitization | T2 & R2 | PPT & Video | 4 |
| 12 | 35 | 3 | Machine/computer vision | Imaging: geometry | T2 & R2 | PPT & Video | 4 |
| 13 | 36 | 3 | Machine/computer vision | Coordinate transformation for image registration | T2 & R2 | PPT | 4 |
| 13 | 37 | 3 | Machine/computer vision | Geometric wrapping for image registration | T2 & R2 | PPT | 5 |
| 13 | 38 | 3 | Machine/computer vision | Hough transforms | T2, R1 | PPT | 5 |
| 14 | 39 | 3 | Machine/computer vision | Simple object recognition methods | T2, R1 | PPT | 5 |
| 14 | 40 | 3 | Machine/computer vision | Cameras, CCD, CID | T2 | PPT | 5 |
| 14 | 41 | 3 | Machine/computer vision | CPD models | T2, R2 | PPT | 5 |
| 15 | 42 | 3 | Machine/computer vision | Illumination and types | T2, R2 | PPT | 5 |
| 15 | 43 | 3 | Machine/computer vision | Image processing and analysis | T2, R2 | PPT | 5 |
| 15 | 44 | 3 | Machine/computer vision | Feature extraction | T2, R2 | PPT | 5 |
| 15 | 45 | 3 | Machine/computer vision | Applications, Revision | T2, R2 | PPT | 5 |

**CO PO Mapping**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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** |
| **CO 1** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO 2** | 3 | 3 | - | 3 | - | - | - | - | - | - | - | - | 3 | - |
| **CO3** | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 |
| **CO5** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | - | - | - | 2 | 3 |