TKR COLLEGE OF ENGINEERING & TECHNOLOGY
AN AUTONOMOUS INSTITUTION
Accredited by NBA and NAAC with A+ Grade.
(Sponsored by TKR Educational Society, Approved by AICTE, Affiliated to JNTU H)
Medbowli, Meerpet, Balapur, Hyderabad, Telangana – 500 097
Phone: 9100377790. email: info@tkrcet.ac.in. web site: www.tkrcet.ac.in

B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech III Semester(2024-25)
IMAGE ANALYSIS WITH HANDS ON TRAINING USING MATLAB

Course Objective:
The course will cover topics such as importing and exporting images, enhancing images, detecting edges and shapes, segmenting objects, and performing batch analysis.
Course Outcomes: After completion of this course, the candidate will be able to :

- Enhance images for analysis by using common preprocessing techniques such as contrast adjustment and noise filtering.
- Segment objects from an image based on color and texture. Use statistical measures to characterize texture features and measure texture similarity between images.
- Improve binary segmentation results by refining the segmentation mask. Use interactive and iterative techniques to segment image regions.

UNIT-I: Importing and Visualizing Images

Importing, inspecting, and displaying images, Converting between image types, Visualizing results of processing, Exporting images,

UNIT-II: Preprocessing Images

Adjusting contrast, Reducing noise with spatial filtering, Equalizing inhomogeneous background, Processing images in distinct blocks, Measuring image quality

UNIT-III: Color and Texture Segmentation

Transforming between image color spaces, Segmenting objects based on color attributes and color difference, Segmenting objects based on texture using nonlinear filters, Analyzing image texture using statistical measures like contrast and correlation

UNIT-IV: Improving Segmentation

Using morphological operations to refine segmentation masks, Segmenting images and refining results interactively, Using iterative techniques to evolve segmentation from a seed

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B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech IV Semester(2024-25)
C-based VLSI Design

Course Objective:
C-based VLSI Design include understanding the overall HLS flow, how C code is translated to hardware, writing C code for efficient hardware, and utilizing compiler optimizations to improve circuit performance.

Course Outcomes: After completion of this course, the candidate will be able to :

- Students will learn the process of automatically converting C code into RTL, a hardware description language.
- Students will learn how to write C code that is well-suited for efficient hardware implementation.
- Students will understand how compiler optimizations can be used to improve the performance of the generated hardware.

UNIT I Introduction to VLSI and C-Based Design

Overview of VLSI design flow**,** Need for high-level synthesis (HLS)**,** Comparison of RTL vs. C-based design**,** Basics of hardware description using C/C++

UNIT II High-Level Synthesis (HLS)

Introduction to HLS tools (e.g., Vivado HLS, Intel HLS Compiler)**,** C-to-RTL flow**,** Scheduling, allocation, and binding**,** Control-flow and dataflow handling in C

UNIT III C Programming Constructs for Hardware

Supported C subset for HLS**,** Loops, functions, pointers, and arrays in hardware**,** Bit-accurate data types (e.g., `ap_int`, `ac_int`)**,** Timing and concurrency

UNIT IV Interface Synthesis

Ports and interfaces**,** AXI, FIFO, and streaming interfaces**,** Memory-mapped IO

UNIT V Optimization Techniques

Loop unrolling and pipelining**,** Resource sharing**,** Performance vs. area trade-offs**,** Latency and throughput optimization

Reference Books

- *High-Level Synthesis: From Algorithm to Digital Circuit* by Michael Fingeroff
- *C to Verilog: A Practical Approach to Hardware Design with C-Based Languages* by David C. Black and Jack Donovan
- Tool documentation (e.g., Xilinx Vivado HLS user guide)

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B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech V Semester(2024-25)

Industrial Internet of Things (IIoT)

Course Objectives:

1. Understand the fundamental concepts, architecture, and applications of the Industrial Internet of Things.
2. Learn about various IIoT communication protocols and industrial data acquisition systems.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

- Design and develop basic IIoT applications using microcontrollers and cloud platforms.
- Apply analytics and machine learning techniques for industrial use cases such as predictive maintenance.
- Assess and propose security mechanisms for protecting IIoT systems.

Unit 1: Introduction to IIoT

Introduction to IoT and IIoT, Comparison of IT vs. OT systems, IIoT architecture and layered design, Applications of IIoT in various industrial sectors

Unit 2: Sensors, Actuators, and Embedded Systems

Types of industrial sensors and their characteristics, Microcontrollers and interfacing techniques, Edge computing and embedded platforms: Raspberry Pi, Arduino, ESP32, Real-time operating systems (RTOS) in IIoT

Unit 3: IIoT Communication Technologies

Overview of wired and wireless industrial networks, Protocols: MQTT, CoAP, OPC UA, Modbus, CAN, ZigBee, LoRa, NB-IoT, IIoT network architecture and time synchronization, Industrial Ethernet and Time-Sensitive Networking (TSN)

Unit 4: IIoT Platforms and Data Management

IIoT platforms: AWS IoT, Azure IoT Hub, IBM Watson IoT, ThingWorx, Cloud vs. edge analytics, Data acquisition, preprocessing, and storage, Interfacing with SCADA systems

Unit 5: Security and Privacy in IIoT

Security challenges in IIoT, IIoT security frameworks (e.g., NIST, IEC 62443), Secure communication: TLS, DTLS, Device authentication, access control, and firmware updates.

Textbooks and References:

1. I*ndustrial Internet of Things* by Sabina Jeschke, Christian Brecher, Houbing Song
2. *Internet of Things – A Hands-on Approach* by Arshdeep Bahga and Vijay Madisetti

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B.TECH – ELECTRONICS & COMMUNICATION ENGINEERING

B.Tech VI Semester(2024-25)

Image Pre-processing Techniques

Course Objectives:

1. Develop the ability to implement pre-processing steps that improve the performance of image-based AI models.
2. Enable students to evaluate and choose suitable pre-processing pipelines for real-world applications.

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

- Implement and evaluate noise removal and smoothing techniques.
- Transform images using geometric and color space transformations.
- Build pre-processing pipelines for applications like object detection, OCR, and medical imaging.

Unit 1: Introduction to Image Preprocessing

Overview of digital image processing**,** Importance of pre-processing in AI and CV pipelines**,** Types of images: grayscale, RGB, multispectral**,** Image representation and file formats

Unit 2: Image Enhancement in Spatial Domain

Contrast enhancement: Histogram equalization, CLAHE**,** Brightness and contrast adjustment**,** Gamma correction**,** Log and power-law transformations

Unit 3: Noise Removal and Filtering

Types of noise: Gaussian, salt & pepper, speckle**,** Linear filters: mean, Gaussian smoothing**,** Non-linear filters: median, bilateral filter**,** Edge-preserving filters

Unit 4: Geometric and Morphological Transformations

Scaling, rotation, translation, and affine transformations**,** Morphological operations: erosion, dilation, opening, closing**,** Border handling and interpolation techniques

Unit 5: Color Space Transformations

RGB, HSV, Lab, YCbCr, grayscale conversion**,** Applications of different color models**,** Color normalization and color constancy

Textbooks and References:

- *Digital Image Processing* by Rafael C. Gonzalez and Richard E. Woods
- *Computer Vision: Algorithms and Applications* by Richard Szeliski