VOCATIONAL ELECTIVES

COMPUTATIONAL PHOTOGRAPHY

EC28001
Credit: 0-0-2 1
Prerequisite: MA11001

Course Objective:

Computational photography (CP) is the fusion of computer graphics, computer vision, optics and imaging. The role of CP is to overcome the limitations of traditional cameras by combining imaging and computing to enable new and improved ways to capture, represent and interact with the physical world. The course provides and overview of elements photography, which includes digital image capturing mechanisms, lighting controls, effect of focal length and aperture and various lossy and lossless image storage mechanisms. Objective is to briefly explain computational methods used to enhance photographs.

Course Outcomes: Upon completion of this course, the students will be able to:

CO 1: appreciate concept of photography, and digital camera technology
CO 2: understand types of cameras and their mechanisms
CO 3: demonstrate computational image processing
CO 4: apply computational photography methods for photo composition and panoramic
CO 5: apply computational image processing for photography quality enhancement
CO 6: explain various image filtering techniques

Introduction to Computational Photography:
History of Photography and Computational Photography, Digital Representation of Images, Cameras, Difference between Full frame, APSC and Medium format sensors, scaling, crop sensor advantages/disadvantages

Digital photography:
Principle of Operation of DSLR camera, Aperture, ISO, Shutterspeed and Angle Control, Camera Calibration and Tethering, Computational Cameras, Image Storage formats: Compressed vs uncompressed formats, Basics of Lenses: Wide angle, Telephoto, Prime lenses, Macro lenses. Difference in angle, Depth of field control

Computational Techniques:
Concept of Color, color models, noise, its types, image histogram, Image Processing software: Licensed and Open Source

Training on Computational Photography:
Shooting with wide angle lenses, Shooting with Telephoto lens, zooming, changes in angle, Shooting with Prime lenses and constant aperture lenses, Shooting with Macro lenses, microscopic photography

Training on Digital Imaging-I:

Photography Genres, Scene Composition, Dynamic Range improvement, Portraits, Photographing scenes, crowd and people, Shooting Portraits, group photos and events

Training on Digital Imaging-II:

Long exposure, Brenizer's Method, Sports High Shutter speed, Burst, fisheye, architecture photography, Macro, Basics of Long exposures, using polarizing filters Shooting panorama, Brenizer's method and other photographing techniques Shooting sports, high shutter speed

Training on Digital Imaging-III:

Use of lights, soft box and flashes, guide number etc. , product photography, computational photography,E-commerce photography, Use of Lights, Flash, wireless flash, Basics of product photography, photography for e-commerce and computational photography

Training on Post Processing-I:

RAW image processing, Basic adjustments and correction, Lens Distortion and color correction using Adobe Photoshop, Monochrome image processing, color image processing batch processing using Light-room

Training on Post Processing-II:

Image enhancement operations, noise removal, Artistic filtering, cosmetic filtering, and other post processing methods. Post Processing III: Background removal, artificial coloring.

Training on Post Processing-III:

Open Source and free software for image post processing and computational photography, their usage and capabilities.

Photography Ethics:

Photography ethics: empathy, consent, integrity, ethical decision making, privacy

Text Book:

1. Computer Vision: Algorithms and Applications, 2nd ed by by Richard Szeliski

Reference Books:

1. Computational Imaging Book, by Ayush Bansai, Achuta Kadambi, and Ramesh Raskar.
2. Multiple View Geometry in Computer Vision, by Richard Hartley and Andrew Zisserman.
3. Computer Vision: A Modern Approach, by David Forsyth and Jean Ponce.
4. Foundations of 3D Computer Graphics, by Steven Gortler.
5. Digital Image Processing, by Rafael Gonzalez and Richard Woods.
6. Photography, by Barbara London and John Upton

SOUND ENGINEERING

EC28003
Credit :0-0-2 1
Prerequisite: Nil

Course Objective

It elaborately covers in various aspects of sound (physical and mechanical behavior), equipment used for recording/ reproducing and basic idea for the preparation of final sound track in film or television production.

Course Outcomes: At the end of the course, the students will be able to

CO1: Recognize, define, and explain the principles of sound engineering related to signal flow, microphones, recording, mixing, production, and mastering.
CO2: Demonstrate practical, imaginative understanding and fluency on sound engineering technologies and procedures.
CO3: Solve problems independently, imaginatively, and creatively in the field of sound engineering will be demonstrated by students.
CO4: Learn how to conduct research and have a critical comprehension of sound engineering and its related fields.
CO5: Understand the basic techniques of sound recording.
CO6: Understand the working of different types microphone and loudspeakers and their applications in industry.

Detailed syllabus:

- Introduction to technology of sound
- Analysis of prerecorded speech, music and effects
- Observation of the installation of PA System in a large auditorium
- Study and analysis of different microphones
- Study the feature of 2 channel digital sound recorder
- Study about the effect of loudness in relation with the distance from source to the listener
- Sound recording and reproduction practice by using recorder in PA system chain
- Study of sound in different environmental situation
- Study and analysis on Modulated Radio wave AM and FM in Live streaming radio stations
- Study the effect of Bass and Treble (Concept of Equalization)

Text Book:

1. Sound Recording and Reproduction – Glyn Alkin

Reference Book:

1. Sound Assistance – Michael Talbot Smith

SENSORS FOR AUTOMATION

EC28005
Credit: 0-0-2 1
Prerequisite: Nil

Course Objective:
Sensors and automation are revolutionizing the technology in the areas like consumer electronics, automotive industry, healthcare, and in other settings. The course will provide an opportunity for students to learn different sensors and its application in real world problems. It will empower the students to develop their knowledge regarding operation, application and integration of sensors to enable the design and realization a complete systems.

Course Outcomes: At the end of the course, the students will be able to :
CO1: Learn about the microcontroller, its hardware interfacing and programming
CO2: Understand the working principle and characteristics of different types of sensor
CO3: Interface various sensor interfacing with microcontroller and display devices
CO4: Understand the basic principles of analog to digital conversion and its application with different sensors
CO5: Gain knowledge about various types of automation system
CO6: Develop and implement sensor for final products in real time applications

Detailed syllabus:

1. Introduction to microcontroller, platform of operations with basic programming techniques
2. Interfacing of serial and parallel device with microcontroller
3. Interfacing of microcontroller with display devices
4. Use of ADC to interface various analog sensors with microcontroller
5. Introduction to sensor, measurement of physical parameters like temperature and humidity
6. Application of ultrasonic and proximity sensor
7. Application of gas and pressure sensor
8. Application of IR sensor and RFID
9. Interfacing actuators to drive DC motor (application of touch switch as actuators)
10. Implement sensor in final products for real time solution

Text Book:

1. T. Karvinen, and K. Karvinen, Getting started with sensors, Shroff Publishers, Kindle, Edition, 2014.

Reference Books:

1. J. S. Katre, Sensors in Automation, TechKnowledge Publications, 1st Edition, 2023
2. D. Patranabis, Sensors and Transducers, PHI Learning, 2nd Edition, 2003.

PCB DESIGN

EC28007
Credit: 0-0-2 1
Prerequisite: Basic Electronics EC10001

Course Objective:

Over the years, printed circuit board manufacturing has continued to grow in order to keep up with the increasing demands of newer, faster, and more complex electronic circuitry. This course will familiarize students to design, simulate electronics circuit and fabricate PCB for prototyping using CAD tool. This program is designed to provide a balanced foundation of theoretical knowledge and practical skills in printed circuit board design.

Course Outcomes: Upon completion of this course, the students will be able to:

CO1: understand and evaluate different electronics components.
CO2: create schematic and simulate the circuit using OrCAD or any other CAD tools.
CO3: understand single- and double-layer PCB.
CO3: create and fabricate PCB and analyze the PCB using screen printing method.
CO4: understand assembly of electronics component by soldering.
CO5: analyze and test the circuit for any error.

Detailed syllabus:

Description of different Electronics Component and their Identification:
Passive and active components, component identification, Color code for resistor and disc capacitors, Inductor and their types, simple air core and iron core inductor design.

Circuit Design and Simulation using CAD tool (OrCAD): Design of a simple electronics circuit using data sheet and circuit schematic and simulation.

Schematic to PCB transfer and routing:
Schematic to PCB transfer (assigning foot prints to various components, transfer to PCB), routing, DRC, ERC, EMC

Screen Printing Procedure:
Preparation of screen, mask transfer

PCB preparation and Checking of Routing:
transfer of layout to PCB using screen printing methods, etching, cleaning, error checking of routing, component mounting, soldering

Testing and Verification:
Testing the circuit with the help of multi-meter and CRO

Text Books:

1. Chris Robertson, Printed Circuit Board, PHI, 2003
2. Elaine Rhodes, Developing Printed Circuit Assemblies: From Specifications to Mass Production, 2008, ISBN: 978-1435718760.

Reference Books:

1. Douglas Brooks, Signal Integrity Issues and Printed Circuit Board Design, PHI, 2003.
2. Kraig Mitzner, Complete PCB Design Using OrCAD Capture and PCB Editor, Newnes, 2009
3. Open source EDA Tool KiCad Tutorial : http://kicad-pcb.org/help/tutorials/