

**CENTRAL UNIVERSITY OF PUNJAB,  
BATHINDA**



**Ph.D. in Computer Science and  
Technology**

**Session - 2019-21**

**Department of Computer Science &  
Technology**

## Course Structure of the Programme

### Semester-I

Course Code	Course Title	Course Type	Credit Hours		
			L	T	P
<b>CST.701</b>	Research Methodology	Core	4	0	0
<b>CST.702</b>	Research Methodology Lab		0	0	4
<b>CST.703</b>	Advance Image Processing	*Opt any one of the following courses along with the corresponding Lab	4	0	0
<b>CST.704</b>	Software Metrics and Measurements		4	0	0
<b>CST.705</b>	Advance Image Processing Lab		0	0	4
<b>CST.706</b>	Software Metrics and Measurements Lab		0	0	4
<b>Total Credits</b>			<b>12</b>	<b>0</b>	<b>12</b>

#### Evaluation Criteria for Theory Courses

- A. Continuous Assessment: [25 Marks]
  - i. Surprise Test (minimum three) - Based on Objective Type Tests (10 Marks)
  - ii. Term paper (10 Marks)
  - iii. Assignment(s) (5 Marks)
- B. Mid Semester Test-1: Based on Subjective Type Test [25 Marks]
- C. Mid Semester Test-2: Based on Subjective Type Test [25Marks]
- D. End-Term Exam: Based on Objective Type Tests [25 Marks]

**Course Code: CST.701**

**Course Title: Research Methodology**

L	T	P	Cr
4	0	0	4

**Total Lectures: 56**

#### Course Objectives:

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

- The course introduces basic concepts of Research Methods.
- To enable the student to prepare research plan, understand scientific literature, build hypothesis and test the results.
- To enable the student to effectively prepare the research papers and PhD thesis.
- To enable the student to use tools like SPSS, Latex and MS office for research work.

## Course Contents

### UNIT I

**Hours: 14**

**Research Aptitude:** Meaning of Research, Objectives of Research, and Motivation in Research, Types of Research, Research Approaches, and Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is done.

**Research Process:** Reviewing the literature, Formulation of research problem, Nature and type of variables, Hypothesis - meaning, types, and development of hypothesis and its testing, Meaning & functions of Research Design.

### UNIT II

**Hours: 14**

**Data Analysis:** Sources, acquisition and interpretation of data, Quantitative and qualitative data, Graphical representation and mapping of data, Sensitivity Analysis with Data Tables, Optimization with EXCEL Solver, Summarizing Data with Histograms and Descriptive Statistics, Pivot Tables, Summarizing Data with database statistical functions, using correlation, Multiple Regression, Using Sampling to Analyze Data.

### UNIT III

**Hours: 14**

**Scientific and Technical Writing:** Role and importance of communication, Effective oral and written communication, Scientific writing, Preparing Research papers for journals, Seminars and Conferences, Technical report writing, Making R&D proposals, Dissertation/Thesis writing, Oral and poster presentation in meetings, seminars, group discussions, Use of modern aids; Making technical presentations.

**Research and academic integrity:** Plagiarism, copyright issues, ethics in research, and case studies.

### UNIT IV

**Hours: 14**

**Use of Computers in Education and Research:** Data analysis tools, e-Library, Search engines related to research, Research paper editing tools like Latex.

#### **Transactional Modes:**

PPT

Video

e-content

google drive

**Suggested Readings:**

1. Sinha, P.K. Computer Fundamentals. BPB Publications.
2. Goel, A., Ray, S. K. 2012. Computers: Basics and Applications. Pearson Education India.
3. Microsoft Office Professional 2013 Step by Step  
<https://ptgmedia.pearsoncmg.com/images/9780735669413/samplepages/9780735669413.pdf>

**Course Code: CST.702**

L	T	P	Cr
0	0	4	2

**Course Title: Research Methodology - Lab**

The Laboratory assignments for this lab will include the assignments from the paper CST-701: Based on MS office, Latex and SPSS.

**Course Code: CST.703**

L	T	P	Cr
4	0	0	4

**Course Title: Advance Digital Image Processing****Credits Hours: 56****Course Objectives:**

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

- To expose students to advanced concepts of digital image processing
- To design, analyse and implement algorithms for advanced image analysis.
- To enable students to implements solutions for fuzzy image processing techniques.
- To enable students to implements solutions for complex image processing problems like image retrieval.

**Course Contents****UNIT I****Hours: 14**

**Recognition of image patterns:** introduction to pattern classification, supervised and unsupervised pattern classification, introduction to neural networks as pattern classifiers. Texture and shape analysis: primitives in textures, classification of textures, gray level co-occurrence matrix, texture spectrum.

**UNIT II****Hours: 14**

**Introduction to shape analysis** (landmark points, polygon as shape descriptor, dominant points in shape description, curvature and its role in shape determination, polygonal approximation for shape analysis), active

contour model, shape distortion and normalization, contour-based shape descriptor, region based shape descriptors.

### UNIT III

**Hours: 14**

**Fuzzy set theory in image processing:** introduction to fuzzy set theory (fuzzification, basic terms and operations, image as a fuzzy set, selection of the membership function), need for fuzzy image processing, fuzzy methods of contrast enhancement, fuzzy spatial filter for noise removal, smoothing algorithm.

### UNIT IV

**Hours: 14**

Fuzzy approaches to pixel classification (fuzzy c-means algorithm)

**Content based image retrieval:** introduction, fundamental steps in image retrieval, image features for retrieval, fuzzy similarity measure in an image retrieval System.

#### Transactional Modes:

PPT  
Video  
e-content  
google drive

#### Suggested Readings:

1. Acharya, T. and Ray A.K., Image processing principles and applications, 2005, Wiley Blackwell.
2. Gonzalez, R.C. and Woods, R.E. 2009. Digital Image Processing. 2<sup>nd</sup> ed. India: Person Education.

**Course Code: CST.704**

**Course Title: Software Metrics and Measurements**

L	T	P	Cr
4	0	0	4

**Total Lectures: 56**

#### Course Objectives:

This course offers a good understanding of Software Measurements and will prepare students to resolve various types of practical problems face by software engineers in the industry. This course helps to design various prediction models for good software quality.

#### Course Contents

### UNIT I

**Hours: 14**

**Overview of Software Metrics:** Measurement in Software Engineering, Scope of Software Metrics, Measurement and Models Meaningfulness in

measurement, Measurement quality, Measurement process, Scale, Measurement validation, Object-oriented measurements,

**Goal based framework for software measurement:** Software measure classification, Goal-Question-Metrics (GQM) and Goal-Question-Indicator-Metrics (GQIM), Applications of GQM and GQIM.

## **UNIT II**

**Hours: 14**

**Empirical Investigation:** Software engineering investigation, Investigation principles, Investigation techniques, Planning Formal experiments, Case Studies for Empirical investigations.

**Object-oriented metrics:** Object-Oriented measurement concepts, Basic metrics for OO systems, OO analysis and design metrics, Metrics for productivity measurement, Metrics for OO software quality.

## **UNIT III**

**Hours: 14**

**Measuring Internal Product attributes:** Software Size, Length, reuse, Functionality, Complexity, Software structural measurement, Control flow structure, Cyclomatic Complexity, Data flow and data structure attributes Architectural measurement.

**Measuring External Product attributes:** Software Quality Measurements, Aspects of Quality Measurements, Maintainability Measurements, Usability and Security Measurements.

## **UNIT IV**

**Hours: 14**

**Measuring software Reliability:** Concepts and definitions, Software reliability models and metrics, Fundamentals of software reliability engineering (SRE), Reliability management model.

### **Transactional Modes:**

PPT  
Video  
e-content  
google drive

### **Suggested Readings:**

1. Norman E. Fenton, S. L. P fleeger, "Software Metrics: A Rigorous and Practical Approach", published by International Thomson Computer Press, 2/e, 1998.
2. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Addison-Wesley Professional, 2/e, 2002.
3. Basu Anirban, "Software Quality Assurance, Testing and Metrics", Prentice Hall India Learning Private Limited, 2015
4. Robert B. Grady, "Practical Software Metrics for Project Management And Process Improvement", Prentice Hall, 1992.

5. Maxwell Katrina D., "Applied Statistics for Software Managers", Prentice Hall PTR, 2002

**Course Code: CST.705**

**Course Title: Advance Digital Image Processing Lab**

L	T	P	Cr
0	0	4	2

The Laboratory assignments for this lab will include the assignments from the paper CST-703: Based on Image feature extraction, fuzzy image processing, and image classification.

**Course Code: CST.706**

**Course Title: Advance Digital Image Processing Lab**

L	T	P	Cr
0	0	4	2

The Laboratory assignments for this lab will include the assignments from the paper CST-704