VI Semester

SOFTWARE ENGINEERING & PROJECT MANAGEMENT			
Course Code	**21CS61**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to Software Engineers.
CLO 2. Describe the process of requirement gathering, requirement classification, requirement specification and requirements validation.
CLO 3. Infer the fundamentals of object oriented concepts, differentiate system models, use UML diagrams and apply design patterns.5
CLO 4. Explain the role of DevOps in Agile Implementation.
CLO 5. Discuss various types of software testing practices and software evolution processes.
CLO 6. Recognize the importance Project Management with its methods and methodologies.
CLO 7. Identify software quality parameters and quantify software using measurements and metrics. List software quality standards and outline the practices involved

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: The evolving role of software, Software, The changing nature of software, Software engineering, A Process Framework, Process Patterns, Process Assessment, Personal and Team Process Models, Process Technology, Product and Process.

Textbook 1: Chapter 1: 1.1 to 1.3

Process Models: Prescriptive models, Waterfall model, Incremental process models, Evolutionary process models, Specialized process models.

Textbook 1: Chapter 2: 2.1, 2.2, 2.4 to 2.7

Requirements Engineering: Requirements Engineering Task, Initiating the Requirements Engineering process, Eliciting Requirements, Developing use cases, Building the analysis model, Negotiating Requirements, Validating Requirements, Software Requirement Document **(Sec 4.2)**

Textbook 1: Chapter 3: 3.1 to 3.6, Textbook 5: Chapter 4: 4.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Introduction, Modelling Concepts and Class Modelling: What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development; OO modelling history. Modelling as Design technique: Modelling, abstraction, The Three models. Class Modelling: Object and Class Concept, Link and associations concepts, Generalization and Inheritance, A sample class model, Navigation of class models, Introduction to RUP**(Textbook: 5 Sec 2.4)** and UML diagrams

Textbook 2: Chapter 1,2,3

Building the Analysis Models: Requirement Analysis, Analysis Model Approaches, Data modeling Concepts, Object Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, class Based Modeling, Creating a Behavioral Model.

Textbook 1: Chapter 8: 8.1 to 8.8

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Software Testing: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object -Oriented Software, Validation Testing, System Testing, The Art of Debugging.

Textbook 1: Chapter 13: 13.1 to 13.7

Agile Methodology & DevOps: Before Agile – Waterfall, Agile Development,

Self-Learning Section:
What is DevOps?, DevOps Importance and Benefits, DevOps Principles and Practices, 7 C's of DevOps Lifecycle for Business Agility, DevOps and Continuous Testing, How to Choose Right DevOps Tools?, Challenges with DevOps Implementation.

Textbook 4: Chapter 2: 2.1 to 2.9

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-4

Introduction to Project Management:
Introduction, Project and Importance of Project Management, Contract Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some ways of categorizing Software Projects, Stakeholders, Setting Objectives, Business Case, Project Success and Failure, Management and Management Control, Project Management life cycle, Traditional versus Modern Project Management Practices.

Textbook 3: Chapter 1: 1.1 to 1.17

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-5

Activity Planning:
Objectives of Activity Planning, When to Plan, Project Schedules, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass– Backward Pass, Identifying critical path, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

Textbook 3: Chapter 6: 6.1 to 6.16

Software Quality:
Introduction, The place of software quality in project planning, Importance of software quality, software quality models, ISO 9126, quality management systems, process capability models, techniques to enhance software quality, quality plans.

Textbook 3: Chapter 13: (13.1 to 13.6 , 13.9, 13.11, 13.14),

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand the activities involved in software engineering and analyze the role of various process models

CO 2. Explain the basics of object-oriented concepts and build a suitable class model using modelling techniques

CO 3. Describe various software testing methods and to understand the importance of agile methodology and DevOps

CO 4. Illustrate the role of project planning and quality management in software development

CO 5. Understand the importance of activity planning and different planning models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Roger S. Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill.
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.

3. Bob Hughes, Mike Cotterell, Rajib Mall: Software Project Management, 6th Edition, McGraw Hill Education, 2018.
4. Deepak Gaikwad, Viral Thakkar, DevOps Tools From Practitioner's Viewpoint, Wiley.
5. Ian Sommerville: Software Engineering, 9th Edition, Pearson Education, 2012.

Reference:

1. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India.

Weblinks and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview
2. https://www.youtube.com/watch?v=WxkP5KR_Emk&list=PLrjkTql3jnm9b5nr-ggx7Pt1G4UAHeFlJ
3. http://elearning.vtu.ac.in/econtent/CSE.php
4. http://elearning.vtu.ac.in/econtent/courses/video/CSE/15CS42.html
5. https://nptel.ac.in/courses/128/106/128106012/ (DevOps)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Case study, Field visit

VI Semester

FULLSTACK DEVELOPMENT			
Course Code	21CS62	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 T + 20 P	Total Marks	100
Credits	04	Exam Hours	03

Course Learning Objectives:

CLO 1. Explain the use of learning full stack web development.
CLO 2. Make use of rapid application development in the design of responsive web pages.
CLO 3. Illustrate Models, Views and Templates with their connectivity in Django for full stack web development.
CLO 4. Demonstrate the use of state management and admin interfaces automation in Django.
CLO 5. Design and implement Django apps containing dynamic pages with SQL databases.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1: MVC based Web Designing

Web framework, MVC Design Pattern, Django Evolution, Views, Mapping URL to Views, Working of Django URL Confs and Loose Coupling, Errors in Django, Wild Card patterns in URLS.

Textbook 1: Chapter 1 and Chapter 3

Laboratory Component:

1. Installation of Python, Django and Visual Studio code editors can be demonstrated.
2. Creation of virtual environment, Django project and App should be demonstrated
3. Develop a Django app that displays current date and time in server
4. Develop a Django app that displays date and time four hours ahead and four hours before as an offset of current date and time in server.

Teaching-Learning Process	1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples

Module-2: Django Templates and Models

Template System Basics, Using Django Template System, Basic Template Tags and Filters, MVT Development Pattern, Template Loading, Template Inheritance, MVT Development Pattern.

Configuring Databases, Defining and Implementing Models, Basic Data Access, Adding Model String Representations, Inserting/Updating data, Selecting and deleting objects, Schema Evolution

Textbook 1: Chapter 4 and Chapter 5

Laboratory Component:

1. Develop a simple Django app that displays an unordered list of fruits and ordered list of selected students for an event
2. Develop a layout.html with a suitable header (containing navigation menu) and footer with copyright and developer information. Inherit this layout.html and create 3 additional pages: contact us, About Us and Home page of any website.
3. Develop a Django app that performs student registration to a course. It should also display list of students registered for any selected course. Create students and course as models with enrolment as ManyToMany field.

Teaching-Learning Process	1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples 4. Case Study: Apply concepts learnt for an Online Ticket Booking System

Module-3: Django Admin Interfaces and Model Forms

Activating Admin Interfaces, Using Admin Interfaces, Customizing Admin Interfaces, Reasons to use Admin Interfaces.

Form Processing, Creating Feedback forms, Form submissions, custom validation, creating Model Forms, URLConf Ticks, Including Other URLConfs.

Textbook 1: Chapters 6, 7 and 8

Laboratory Component:

1. For student and course models created in Lab experiment for Module2, register admin interfaces, perform migrations and illustrate data entry through admin forms.
2. Develop a Model form for student that contains his topic chosen for project, languages used and duration with a model called project.

Teaching-Learning Process	1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples

Module-4: Generic Views and Django State Persistence

Using Generic Views, Generic Views of Objects, Extending Generic Views of objects, Extending Generic Views.

MIME Types, Generating Non-HTML contents like CSV and PDF, Syndication Feed Framework, Sitemap framework, Cookies, Sessions, Users and Authentication.

Textbook 1: Chapters 9, 11 and 12

Laboratory Component:

1. For students enrolment developed in Module 2, create a generic class view which displays list of students and detailview that displays student details for any selected student in the list.
2. Develop example Django app that performs CSV and PDF generation for any models created in previous laboratory component.

Teaching-Learning Process	1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns

	3. Live coding of all concepts with simple examples 4. Project Work: Implement all concepts learnt for Student Admission Management.

Module-5: jQuery and AJAX Integration in Django

Ajax Solution, Java Script, XHTMLHttpRequest and Response, HTML, CSS, JSON, iFrames, Settings of Java Script in Django, jQuery and Basic AJAX, jQuery AJAX Facilities, Using jQuery UI Autocomplete in Django

Textbook 2: Chapters 1, 2 and 7.

Laboratory Component:

1. Develop a registration page for student enrolment as done in Module 2 but without page refresh using AJAX.
2. Develop a search application in Django using AJAX that displays courses enrolled by a student being searched.

Teaching-Learning Process	1. Demonstration using Visual Studio Code 2. PPT/Prezi Presentation for Architecture and Design Patterns 3. Live coding of all concepts with simple examples 4. Case Study: Apply the use of AJAX and jQuery for development of EMI calculator.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO 1. Understand the working of MVT based full stack web development with Django.
CO 2. Designing of Models and Forms for rapid development of web pages.
CO 3. Analyze the role of Template Inheritance and Generic views for developing full stack web applications.
CO 4. Apply the Django framework libraries to render nonHTML contents like CSV and PDF.
CO 5. Perform jQuery based AJAX integration to Django Apps to build responsive full stack web applications,

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Practical Sessions need to be assessed by appropriate rubrics and viva-voce method. This will contribute to **20 marks**.

- Rubrics for each Experiment taken average for all Lab components – 15 Marks.
- Viva-Voce– 5 Marks (more emphasized on demonstration topics)

The sum of three tests, two assignments, and practical sessions will be out of 100 marks and will be **scaled down to 50 marks**
(to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG Publishers, 2009
2. Jonathan Hayward, Django Java Script Integration: AJAX and jQuery, First Edition, Pack Publishing, 2011

Reference Books

1. Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth Edition, Packt Publishing, 2020
2. William Vincent, Django for Beginners: Build websites with Python and Django, First Edition, Amazon Digital Services, 2018
3. Antonio Mele, Django3 by Example, 3rd Edition, Pack Publishers, 2020
4. Arun Ravindran, Django Design Patterns and Best Practices, 2nd Edition, Pack Publishers, 2020.
5. Julia Elman, Mark Lavin, Light weight Django, David A. Bell, 1st Edition, Oreily Publications, 2014

Weblinks and Video Lectures (e-Resources):

1. MVT architecture with Django: https://freevideolectures.com/course/3700/django-tutorials
2. Using Python in Django: https://www.youtube.com/watch?v=2BqoLiMT3Ao
3. Model Forms with Django: https://www.youtube.com/watch?v=gMM1rtTwKxE
4. Real time Interactions in Django: https://www.youtube.com/watch?v=3gHmfoeZ45k
5. AJAX with Django for beginners: https://www.youtube.com/watch?v=3VaKNyjlxAU

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Real world problem solving - applying the Django framework concepts and its integration with AJAX to develop any shopping website with admin and user dashboards.

Short Preamble on Full Stack Web Development:

Website development is a way to make people aware of the services and/or products they are offering, understand why the products are relevant and even necessary for them to buy or use, and highlight the striking qualities that set it apart from competitors. Other than commercial reasons, a website is also needed for quick and dynamic information delivery for any domain. Development of a well-designed, informative, responsive and dynamic website is need of the hour from any computer science and related engineering graduates. Hence, they need to be augmented with skills to use technology and framework which can help them to develop elegant websites. Full Stack developers are in need by many companies, who knows and can develop all pieces of web application (Front End, Back End and business logic). MVT based development with Django is the cutting-edge framework for Full Stack Web Development. Python has become an easier language to use for many applications. Django based framework in Python helps a web developer to utilize framework and develop rapidly responsive and secure web applications.

VI Semester

COMPUTER GRAPHICS AND FUNDAMENTALS OF IMAGE PROCESSING			
Course Code	**21CS63**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Objectives:

CLO 1. Overview of Computer Graphics along with its applications.
CLO 2. Exploring 2D and 3D graphics mathematics along with OpenGL API's.
CLO 3. Use of Computer graphics principles for animation and design of GUI's .
CLO 4. Introduction to Image processing and Open CV.
CLO 5. Image segmentation using Open CV.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
6. IntroduceTopicsin manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Overview: Computer Graphics hardware and software and OpenGL: Computer Graphics: Video Display Devices, Raster-Scan Systems Basics of computer graphics, Application of Computer Graphics. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions, Line drawing algorithms(DDA, Bresenham's).

Textbook 1: Chapter -1,2,3, 5(1 and 2 only)
Self-study topics : Input devices, hard copy devices, coordinate representation, graphics functions, fill area primitives, polygon fill areas, pixel arrays, Parallel Line algorithms

Teaching-Learning Process	Chalk & board, Active Learning Virtual Lab

Module-2

2D and 3D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function,

3D Geometric Transformations: Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions

Textbook 1: Chapter -6, 8
Self-study topics: Transformation between 2D coordinate system, OpenGL geometric-transformation, Transformation between 3D coordinate system.

Teaching-Learning Process	Chalk & board, Active Learning, Problem based learning Virtual Lab:

Module-3

Interactive Input Methods and Graphical User Interfaces: Graphical Input Data ,Logical Classification of Input Devices, Input Functions for Graphical Data , Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions , Designing a Graphical User Interface.

Computer Animation : Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures.

Textbook 1: Chapter -11, 18
Self-study topics: Raster methods for computer animation, Key frame systems, Motion specification.

Teaching-Learning Process	Chalk & board, MOOC, Active Learning

Module-4

Introduction to Image processing: overview, Nature of IP, IP and its related fields, Digital Image representation, types of images.

Digital Image Processing Operations: Basic relationships and distance metrics, Classification of Image processing Operations.
Text book 2: Chapter 3

(Below topics is for experiential learning only , No questions in SEE)
Computer vision and OpenCV*: What is computer vision, Evolution of computer vision, Application of Computer vision, Feature of OpenCV, OpenCV library modules, OpenCV environment, Reading, writing and storing images using OpenCV. OpenCV drawing Functions. OpenCV Geometric Transformations*.

(Note : Computer vision and OpenCV for experimental learning or Activity Based Learning using web sources, Preferred for assignments. No questions in SEE)
Web Source: https://www.tutorialspoint.com/opencv/

Teaching-Learning Process	Chalk& board, Problem based learning Lab practice for OpenCV for basic geometric objects and basic image operation

Module-5

Image Segmentation: Introduction, classification, detection of discontinuities, Edge detection (up to canny edge detection(included)).
Text Book 2: Chapter 9: 9.1 to 9.4.4.4

(Below topics is for experiential learning only , No questions in SEE)
Image processing with Open CV: *Resizing , Rotation/ Flipping, Blending, Creating region of Interest (ROI), Image Thresholding, Image Blurring and smoothing, Edge Detection, Image contours and Face Detection on images using OpenCV.*

(Note :Image Processing withOpenCV for experimental learning or Activity Based Learning using web sources, Preferred for assignments. No questions in SEE)

Web source: https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b

Teaching-Learning Process	Chalk & board, MOOC Lab practice on image processing. Virtual Lab:

Course Outcomes:

At the end of the course the student will be able to:

CO 1. Construct geometric objects using Computer Graphics principles and OpenGL APIs.
CO 2. Use OpenGL APIs and related mathematics for 2D and 3D geometric Operations on the objects.
CO 3. Design GUI with necessary techniques required to animate the created objects
CO 4. Apply OpenCV for developing Image processing applications.
CO 5. Apply Image segmentation techniques along with programming, using OpenCV, for developing simple applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(To have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

3. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
4. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Textbooks

1. Donald D Hearn, M Pauline Baker and WarrenCarithers: Computer Graphics with OpenGL 4th Edition, Pearson, 2014
2. S. Sridhar, Digital Image Processing, second edition, Oxford University press 2016.

Reference Books

1. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 2008
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

Web links and Video Lectures (e-Resources):

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102063/
3. https://nptel.ac.in/courses/106/103/106103224/
4. https://nptel.ac.in/courses/106/102/106102065/
5. https://www.tutorialspoint.com/opencv/ (Tutorial, Types of Images, Drawing Functions)

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

2. Mini project on computer graphics using Open GL/Python/Open CV.

VI Semester

AGILE TECHNOLOGIES			
Course Code	21CS641	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives:

CLO 1. To understand basics of agile technologies
CLO 2. To explain XP Lifecycle, XP Concepts and Adopting XP
CLO 3. To Evaluate on Pair Programming, Root-Cause Analysis, Retrospectives, Planning, Incremental Requirements and Customer Tests
CLO 4. To become Mastering in Agility
CLO 5. To provide well Deliver Value

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Why Agile? : Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor.

The Genesis of Agile, Introduction and background, Agile Manifesto, and Principles, Simple Design, User Stories, Agile Testing, Agile Tools

Textbook 1: Part I – Ch 1, Ch 2.

Textbook 2: Ch 1

Teaching-Learning Process	Chalk and board, Active Learning https://www.nptelvideos.com/video.php?id=904 https://www.youtube.com/watch?v=x90kIAFGYKE http://www.digimat.in/nptel/courses/video/110104073/L02.html https://onlinecourses.nptel.ac.in/noc19_mg30/preview

Module-2

Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility

Overview of Extreme Programming, The Practices of Extreme Programming, Conclusion, Bibliography, Planning Initial Exploration, Release Planning, Iteration Planning, Defining "Done", Task Planning Iterating, Tracking.

Textbook 1: Part I: Ch 3, Ch 4.

Textbook 3: Section 1: Ch 1

Teaching-Learning Process	Chalk and board, Active Learning https://www.nptelvideos.com/video.php?id=904 https://www.youtube.com/watch?v=x90kIAFGYKE http://www.digimat.in/nptel/courses/video/110104073/L02.html https://onlinecourses.nptel.ac.in/noc19_mg30/preview

Module-3

Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root Cause Analysis, Retrospectives,

Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting,

Releasing: "Done Done", No Bugs, Version Control, Ten-Minute Build, Continuous Integration, Collective Code Ownership, Documentation. Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating. Developing: Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization, Exploratory Testing

Textbook 1: Part II: Ch 5, Ch 6, Ch 7, Ch 8, Ch 9.

Teaching-Learning Process	Chalk and board, Demonstration https://www.nptelvideos.com/video.php?id=904 https://www.youtube.com/watch?v=x90kIAFGYKE http://www.digimat.in/nptel/courses/video/110104073/L02.html https://onlinecourses.nptel.ac.in/noc19_mg30/preview

Module-4

Mastering Agility : Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People :Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste :Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput

Textbook 1: Part III- Ch 10, Ch 11, Ch 12, Ch 13.

Teaching-Learning Process	Chalk and board https://www.nptelvideos.com/video.php?id=904 https://www.youtube.com/watch?v=x90kIAFGYKE http://www.digimat.in/nptel/courses/video/110104073/L02.html https://onlinecourses.nptel.ac.in/noc19_mg30/preview

Module-5

Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence: Software Doesn't Exist, Design Is for Understanding, Design

Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery

Textbook 1: Part IV- Ch 14, Ch 15.

Teaching-Learning Process	Chalk and board https://www.nptelvideos.com/video.php?id=904 https://www.youtube.com/watch?v=x90kIAFGYKE http://www.digimat.in/nptel/courses/video/110104073/L02.html https://onlinecourses.nptel.ac.in/noc19_mg30/preview

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO 1. Understand the fundamentals of agile technologies
CO 2. Explain XP Lifecycle, XP Concepts and Adopting XP
CO 3. Apply different techniques on Practicing XP, Collaborating and Releasing
CO 4. Analyze the Values and Principles of Mastering Agility
CO 5. Demonstrate the agility to deliver good values

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. James shore, Chromatic, O'Reilly, The Art of Agile Development, 2007

Reference Books

1. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum",Pearson, 2008
2. Agile-Principles-Patterns-and-Practices-in-C by Robert C Martin & Mic Martin.

Web links and Video Lectures (e-Resources):

Model wise mentioned

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of the project based on Agile technologies.

VI Semester

ADVANCED JAVA PROGRAMMING			
Course Code	21CS642	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Understanding the fundamental concepts of Enumerations and Annotations
CLO 2. Apply the concepts of Generic classes in Java programs
CLO 3. Demonstrate the fundamental concepts of String operations
CLO 4. Design and develop web applications using Java servlets and JSP
CLO 5. Apply database interaction through Java database Connectivity

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same program
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Enumerations, Autoboxing and Annotations:
Enumerations, Ednumeration fundamentals, the values() and valueOf() methods, Java enumerations are class types, enumerations inherits Enum, example, type wrappers, Autoboxing, Autoboxing methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of warning

Annotations, Annotation basics, specifying retention policy, obtaining annotations at run time by use of reflection, Annotated element interface, Using default values, Marker Annotations, Single member annotations, Built in annotations

Textbook 1: Chapter12

Teaching-Learning Process	Chalk and board, Online demonstration, Problem based learning

Module-2

Generics: What are Generics, A Simple Generics Example, A Generic Class with Two Type Parameters, The General Form of a Generic Class, Bounded Types, Using Wildcard Arguments, Bounded Wildcards, Creating a Generic Method, Generic Interfaces, Raw types and Legacy code, Generic Class Hierarchies, Erasure, Ambiguity errors, Some Generic Restrictions

Textbook 1: Chapter 14

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-3

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf(), Changing the case of characters within a String, String Buffer, String Builder

Textbook 1: Chapter 15

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-4

Background; The life cycle of a servlet; A simple servlet; the servlet API; The javax.servlet package Reading servlet parameter; the javax.servlet.http package; Handling HTTP Requests and Responses; using Cookies; Session Tracking, Java Server Pages (JSP); JSP tags, Variables and Objects, Methods, Control statements, Loops, Request String, Parsing other information, User sessions, Cookies, Session Objects

Textbook 1: Chapter 31
Textbook 2: Chapter 11

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-5

The concept of JDBC; JDBC Driver Types; JDBC packages; A brief overview of the JDBC Process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data Types; Exceptions.

Textbook 2: Chapter 6

Teaching-Learning Process	Chalk and board, Online Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understanding the fundamental concepts of Enumerations and Annotations
CO 2. Apply the concepts of Generic classes in Java programs
CO 3. Demonstrate the concepts of String operations in Java
CO 4. Develop web based applications using Java servlets and JSP
CO 5. Illustrate database interaction and transaction processing in Java

Assessment Details (both CIE and SEE)

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3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Herbert Schildt: JAVA the Complete Reference. 9th Edition, Tata McGraw-Hill
2. Jim Keogh, The Complete Reference J2EE, Tata McGraw-Hill

Reference Books:

1. Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/105/106105191/
2. https://nptel.ac.in/courses/106/105/106105225/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Programming exercises

VI Semester

ADVANCED COMPUTER ARCHITECTURE			
Course Code	21CS643	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Describe computer architecture.
CLO 2. Measure the performance of architectures in terms of right parameters.
CLO 3. Summarize parallel architecture and the software used for them

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

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2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same program
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI Models, Program and Network Properties, Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms, System Interconnect Architectures, Principles of Scalable Performance, Performance Metrics and Measures, Parallel Processing Applications, Speedup
Performance Laws. For all Algorithm or mechanism any one example is sufficient.

Chapter 1 (1.1to 1.4), Chapter 2(2.1 to 2.4) Chapter 3 (3.1 to 3.3)

Teaching-Learning Process	Chalk and board, Online demonstration, Problem based learning

Module-2

Hardware Technologies 1: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology. For all Algorithms or mechanisms any one example is sufficient.

Chapter 4 (4.1 to 4.4)

Teaching-Learning Process	Chalk and board, Online Demonstration

Module-3

Hardware Technologies 2: Bus Systems, Cache Memory Organizations, Shared Memory Organizations, Sequential and Weak Consistency Models, Pipelining and Superscalar Techniques, Linear Pipeline Processors, Nonlinear Pipeline Processors. For all Algorithms or mechanisms any one example is sufficient.

Chapter 5 (5.1 to 5.4) Chapter 6 (6.1 to 6.2)	
Teaching-Learning Process	Chalk and board, Online Demonstration
Module-4	
Parallel and Scalable Architectures: Multiprocessors and Multicomputers, Multiprocessor System Interconnects, Cache Coherence and Synchronization Mechanisms, Message-Passing Mechanisms, Multivector and SIMD Computers, Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, Scalable, Multithreaded, and Dataflow Architectures, Latency-Hiding Techniques, Principles of Multithreading, Fine- Grain Multicomputers. For all Algorithms or mechanisms any one example is sufficient. **Chapter 7 (7.1,7.2 and 7.4) Chapter 8(8.1 to 8.3) Chapter 9(9.1 to 9.3)**	
Teaching-Learning Process	Chalk and board, Online Demonstration
Module-5	
Software for parallel programming: Parallel Models, Languages, and Compilers ,Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays. Instruction and System Level Parallelism, Instruction Level Parallelism, Computer Architecture, Contents, Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism ,Operand Forwarding ,Reorder Buffer, Register Renaming ,Tomasulo's Algorithm. For all Algorithms or mechanisms any one example is sufficient. **Chapter 10(10.1 to 10.3) Chapter 12(12.1 to 12.9)**	
Teaching-Learning Process	Chalk and board, Online Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Explain the concepts of parallel computing
CO 2. Explain and identify the hardware technologies
CO 3. Compare and contrast the parallel architectures
CO 4. Illustrate parallel programming concepts

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

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2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks marks scored will be proportionately reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

Reference Books:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013

Weblinks and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

VI Semester

DATA SCIENCE AND VISUALIZATION			
Course Code	21CS644	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. To introduce data collection and pre-processing techniques for data science
CLO 2. Explore analytical methods for solving real life problems through data exploration techniques
CLO 3. Illustrate different types of data and its visualization
CLO 4. Find different data visualization techniques and tools
CLO 5. Design and map element of visualization well to perceive information

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Data Science

Introduction: What is Data Science? Big Data and Data Science hype – and getting past the hype, Why now? – Datafication, Current landscape of perspectives, Skill sets. Needed Statistical Inference: Populations and samples, Statistical modelling, probability distributions, fitting a model.

Textbook 1: Chapter 1

Teaching-Learning Process	1. PPT – Recognizing different types of data, Data science process 2. Demonstration of different steps, learning definition and relation with data science

Module-2

Exploratory Data Analysis and the Data Science Process

Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process, Case Study: Real Direct (online realestate firm). Three Basic Machine Learning Algorithms: Linear Regression, k-Nearest Neighbours (k- NN), k-means.

Textbook 1: Chapter 2, Chapter 3

Teaching-Learning Process	1. PPT –Plots, Graphs, Summary Statistics 2. Demonstration of Machine Learning Algorithms

Module-3

Feature Generation and Feature Selection

Extracting Meaning from Data: Motivating application: user (customer) retention. Feature Generation (brainstorming, role of domain expertise, and place for imagination), Feature Selection algorithms. Filters; Wrappers; Decision Trees; Random Forests. Recommendation Systems: Building a User-Facing Data Product, Algorithmic ingredients of a Recommendation Engine, Dimensionality Reduction, Singular Value Decomposition, Principal Component Analysis, Exercise: build your own recommendation system.

Textbook 1: Chapter 6

Teaching-Learning Process	1. PPT – Feature generation, selection 2. Demonstration recommendation engine

Module-4

Data Visualization and Data Exploration

Introduction: Data Visualization, Importance of Data Visualization, Data Wrangling, Tools and Libraries for Visualization

Comparison Plots: Line Chart, Bar Chart and Radar Chart; **Relation Plots:** Scatter Plot, Bubble Plot , Correlogram and Heatmap; **Composition Plots:** Pie Chart, Stacked Bar Chart, Stacked Area Chart, Venn Diagram; **Distribution Plots:** Histogram, Density Plot, Box Plot, Violin Plot; **Geo Plots:** Dot Map, Choropleth Map, Connection Map; What Makes a Good Visualization?

Textbook 2: Chapter 1, Chapter 2

Teaching-Learning Process	1. Demonstration of different data visualization tools.

Module-5

A Deep Dive into Matplotlib

Introduction, Overview of Plots in Matplotlib, **Pyplot Basics:** Creating Figures, Closing Figures, Format Strings, Plotting, Plotting Using pandas DataFrames, Displaying Figures**,** Saving Figures; **Basic Text and Legend Functions:** Labels, Titles, Text, Annotations, Legends**; Basic Plots:**Bar Chart, Pie Chart, Stacked Bar Chart, Stacked Area Chart, Histogram, Box Plot, Scatter Plot, Bubble Plot; **Layouts:** Subplots, Tight Layout, Radar Charts, GridSpec; **Images:** Basic Image Operations, Writing Mathematical Expressions

Textbook 2: Chapter 3

Teaching-Learning Process	1. PPT – Comparison of plots 2. Demonstration charts

Course Outcomes

At the end of the course the student will be able to:

CO 1. Understand the data in different forms
CO 2. Apply different techniques to Explore Data Analysis and the Data Science Process
CO 3. Analyze feature selection algorithms & design a recommender system.
CO 4. Evaluate data visualization tools and libraries and plot graphs.
CO 5. Develop different charts and include mathematical expressions.

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Doing Data Science, Cathy O'Neil and Rachel Schutt, O'Reilly Media, Inc O'Reilly Media, Inc, 2013
2. Data Visualization workshop, Tim Grobmann and Mario Dobler, Packt Publishing, ISBN 9781800568112

Reference:

1. Mining of Massive Datasets, Anand Rajaraman and Jeffrey D. Ullman, Cambridge University Press, 2010
2. Data Science from Scratch, Joel Grus, Shroff Publisher /O'Reilly Publisher Media
3. A handbook for data driven design by Andy krik

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/105/106105077/
2. https://www.oreilly.com/library/view/doing-data-science/9781449363871/toc01.html
3. http://book.visualisingdata.com/
4. https://matplotlib.org/
5. https://docs.python.org/3/tutorial/
6. https://www.tableau.com/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Demonstration using projects

VI Semester

INTRODUCTION TO DATA STRUCTURES			
Course Code	21CS651	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Introduce elementary data structures.
CLO 2. Analyze Linear Data Structures: Stack, Queues, Lists
CLO 3. Analyze Non Linear Data Structures: Trees
CLO 4. Assess appropriate data structure during program development/Problem Solving.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

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6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.

Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction:
Introduction to arrays: one-dimensional arrays, two dimensional arrays, initializing two dimensional arrays, Multidimensional arrays.
Introduction to Pointers: Pointer concepts, accessing variables through pointers, Dynamic memory allocation, pointers applications.
Introduction to structures and unions: Declaring structures, Giving values to members, structure initialization, arrays of structures, nested structure, unions, size of structures.

Textbook 1: Ch 8.3 to 8.15,Ch 12.3 to 12.19
Textbook 2:Ch 2.1 to2.13,2.51 ,2.80 to 2.98

Teaching-Learning Process	Chalk and board, Active Learning

Module-2

Linear Data Structures-Stacks and queues:
Introduction, Stack representation in Memory, Stack Operations, Stack Implementation, Applications of Stack. Introduction, Queues-Basic concept, Logical representation of Queues, Queue Operations and its types, Queue Implementation, Applications of Queue.

Textbook 2: Ch 6.1 to 6.14 ,Ch 8.1,8.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem Based Learning

Module-3

Linear Data Structures-Linked List:
Introduction, Linked list Basic concept, Logical representation of Linked list, Self-Referential structure, Singly-linked List Operations and Implementation, Circular Linked List, applications of Linked list.

Textbook 1: Ch 15.1 ,15.3,15.4,15.8 **Textbook 2: Ch 9.2.9.5**	
Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-4

Non Linear Data Structures – Trees

Introduction, Basic concept, Binary Tree and its types, Binary Tree Representation, Binary Tree Traversal, Binary Search tree, Expression Trees.

Textbook1: Ch 16.1,16.2
Textbook2:Ch 10.1,10.2,10.4,10.6.3

Teaching-Learning Process	Chalk& board, Active Learning, Problem based learning

Module-5

Sorting and Searching

Sorting: Introduction, Bubble sort, Selection sort, Insertion sort
Searching: Introduction, Linear search, Binary search.

Textbook1: Ch 17.1,17.2.2, 17.2.4, 17.3.1,17.3.2
Textbook2: Ch 11.1.,11.2,11.3,11.7,11.10.1,11.10.2

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Course Outcomes

At the end of the course the student will be able to:

CO 1. Express the fundamentals of static and dynamic data structure.
CO 2. Summarize the various types of data structure with their operations.
CO 3. Interpret various searching and sorting techniques.
CO 4. Choose appropriate data structure in problem solving.
CO 5. Develop all data structures in a high level language for problem solving.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. C Programming and data structures, E Balaguruswamy 4th Edition, 2007, McGraw Hill
2. Systematic approach to Data structures using C, A M Padma Reddy, 7thEdition 2007, Sri Nandi Publications.

References

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=DFpWCl_49i0
2. https://www.youtube.com/watch?v=x7t_-ULoAZM
3. https://www.youtube.com/watch?v=I37kGX-nZEI
4. https://www.youtube.com/watch?v=XuCbpw6Bj1U
5. https://www.youtube.com/watch?v=R9PTBwOzceo
6. https://www.youtube.com/watch?v=qH6yxkw0u78

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Demonstration of projects developed using Linear/Non-linear data structures

VI Semester

INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS			
Course Code	21CS652	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Understand the basic concepts and the applications of database systems.
CLO 2. Understand the relational database design principles.
CLO 3. Master the basics of SQL and construct queries using SQL.
CLO 4. Familiar with the basic issues of transaction processing and concurrency control.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain the functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develops design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema
architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams,Examples

Textbook 1: Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.7

Teaching-Learning Process	Chalk and board, Active Learning, Problem based learning

Module-2

Relational Model: Relational Model Concepts, Relational Model Constraints and relationaldatabase schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison**.** Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1:,ch5.1 to 5.3, 8.1 to 8.5, 9.1;

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

SQL:SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

Advances Queries: More complex SQL retrieval queries, Specifying constraints asassertions and action triggers, Views in SQL, Schema change statements in SQL.Database

Textbook 1: Ch 6.1 to 6.5, 7.1 to 7.4; Textbook 2: 6.1 to 6.6;

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Examples on normal forms.

Textbook 1: Ch 14.1 to -14.7, 15.1 to 15.6

Teaching-Learning Process	Chalk& board, Problem based learning

Module-5

Transaction management and Concurrency –Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.

Textbook 1: Ch 20.1 to 20.6, 21.1 to 21.7;

Teaching-Learning Process	Chalk and board, MOOC

Course Outcomes

At the end of the course the student will be able to:

CO 1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
CO 2. Use Structured Query Language (SQL) for database manipulation.
CO 3. Design and build simple database systems
CO 4. Develop application to interact with databases.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017,
   Pearson.
2. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=3EJlovevfcA
2. https://www.youtube.com/watch?v=9TwMRs3qTcU
3. https://www.youtube.com/watch?v=ZWl0Xow304I
4. https://www.youtube.com/watch?v=4YilEjkNPrQ
5. https://www.youtube.com/watch?v=CZTkgMoqVss
6. https://www.youtube.com/watch?v=Hl4NZB1XR9c
7. https://www.youtube.com/watch?v=EGEwkad_llA
8. https://www.youtube.com/watch?v=t5hsV9lC1rU

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Developing and demonstration of models / projects based on DBMS application

VI Semester

INTRODUCTION TO CYBER SECURITY			
Course Code	21CS653	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. To familiarize cybercrime terminologies and ACTs
CLO 2. Understanding cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention
CLO 3. Understand the motive and causes for cybercrime, cybercriminals, and investigators
CLO 4. Understanding criminal case and evidence, detection standing criminal case and evidence.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Cybercrime:

Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes,

Cybercrime: The Legal Perspectives,

Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000.

Textbook1:Ch1 (1.1 to 1.8).

Teaching-Learning Process	Chalk and board, Active Learning

Module-2

Cyber offenses:
How Criminals Plan Them: Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cybercafe and Cybercrimes.

Botnets: The Fuel for Cybercrime, Attack Vector

Textbook1: Ch2 (2.1 to 2.7).

Teaching-Learning Process	Chalk and board, Active Learning

Module-3

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors,

Steganography, DoS and DDoS Attacks, Attacks on Wireless Networks.

Textbook1: Ch4 (4.1 to 4.9, 4.12).

Teaching-Learning Process	Chalk and board, Case studies

Module-4

Understanding the people on the scene: Introduction, understanding cyber criminals, understanding cyber victims, understanding cyber investigators.

The Computer Investigation process: investigating computer crime.

Understanding Cybercrime Prevention: Understanding Network Security Concepts, Understanding Basic Cryptography Concepts, Making the Most of Hardware and Software Security

Textbook 2:Ch3,Ch 4, Ch 7.

Teaching-Learning Process	Chalk& board, Case studies

Module-5

Cybercrime Detection Techniques: Security Auditing and Log Firewall Logs, Reports, Alarms, and Alerts, Commercial Intrusion Detection Systems, Understanding E-Mail Headers Tracing a Domain Name or IP Address.

Collecting and preserving digital Evidence: Introduction, understanding the role of evidence in a criminal case, collecting digital evidence, preserving digital evidence, recovering digital evidence, documenting evidence.

TextBook 2:Ch 9, Ch 10.

Teaching-Learning Process	Chalk and board, Case studies

Course Outcomes

At the end of the course the student will be able to:

CO 1. Describe the cyber crime terminologies
CO 2. Analyze cybercrime in mobiles and wireless devices along with the tools for Cybercrime and prevention
CO 3. Analyze the motive and causes for cybercrime, cybercriminals, and investigators
CO 4. Apply the methods for understanding criminal case and evidence, detection standing criminal case and evidence.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

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Three Unit Tests each of **20 Marks (duration 01 hour**)

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Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. SunitBelapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2013
2. Debra Little John Shinder and Michael Cross, "Scene of the cybercrime", 2nd edition, Syngress publishing Inc, Elsevier Inc, 2008

Reference Books:

1. Robert M Slade, "Software Forensics", Tata McGraw Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, "Cybercrime", ABC – CLIO Inc, California, 2004.
3. Nelson Phillips and EnfingerSteuart, "Computer Forensics and Investigations", Cengage Learning, New Delhi, 2009.
4. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", Tata McGraw -Hill, New Delhi, 2006.

Weblinks and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=czDzUP1HclQ
2. https://www.youtube.com/watch?v=qS4VigjkC8
3. https://www.trendmicro.com/en_nz/ciso/21/h/cybercrime-today-and-the-future.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Demonstration of projects related to Cyber security.

VI Semester

PROGRAMMING IN JAVA			
Course Code	21CS654	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning Objectives

CLO 1. Learn fundamental features of object oriented language and JAVA.
CLO 2. To create, debug and run simple Java programs.
CLO 3. Learn object oriented concepts using programming examples.
CLO 4. Study the concepts of importing of packages and exception handling mechanism.
CLO 5. Discuss the String Handling examples with Object Oriented concepts.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries.

Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Textbook 1:Ch 2,Ch 3.

Teaching-Learning Process	Chalk and board, Problem based learning.

Module-2

Operators: Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses,

Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.

Textbook 1:Ch 4,Ch 5.

Teaching-Learning Process	Chalk and board, Active Learning, Demonstration

Module-3

Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class.

A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion, Introducing Access Control, Understanding static, Introducing final, Arrays Revisited. **Inheritance:** Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding.

Textbook 1: Ch 6, Ch 7.1-7.9,Ch 8.1-8.5

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Module-4

Packages and Interfaces: Packages, Access Protection, Importing Packages, Interfaces.

Exception Handling: Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses, Chained Exceptions, Using Exceptions

Textbook 1: Ch 9,Ch 10.

Teaching-Learning Process	Chalk& board, Problem based learning, Demonstration

Module-5

Enumerations :Enumerations, Type Wrappers.

String Handling: The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the Case of Characters Within a String , Additional String Methods, StringBuffer, StringBuilder.

Textbook 1: Ch 12.1,12.2,Ch 15.

Teaching-Learning Process	Chalk and board, Problem based learning, Demonstration

Course Outcomes

At the end of the course the student will be able to:

CO 1. Develop JAVA programs using OOP principles and proper program structuring.
CO 2. Develop JAVA program using packages, inheritance and interface.
CO 3. Develop JAVA programs to implement error handling techniques using exception handling
CO 4. Demonstrate string handling concepts using JAVA.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

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5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

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2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007. (Chapters 2, 3, 4, 5, 6,7, 8, 9,10, 12,15)

Reference Books:

1. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.
2. Rajkumar Buyya,SThamarasiselvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.
3. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
4. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017.

Weblinks and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving: Demonstration of projects developed using JAVA

VI Semester

<table>
<tr><th colspan="5">COMPUTER GRAPHICS AND IMAGE PROCESSING LABORATORY</th></tr>
<tr><td colspan="2">Course Code</td><td>21CSL66</td><td>CIE Marks</td><td>50</td></tr>
<tr><td colspan="2">Teaching Hours/Week (L:T:P: S)</td><td>0:0:2:0</td><td>SEE Marks</td><td>50</td></tr>
<tr><td colspan="2">Total Hours of Pedagogy</td><td>24</td><td>Total Marks</td><td>100</td></tr>
<tr><td colspan="2">Credits</td><td>1</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="5">Course Objectives:
CLO 1: Demonstrate the use of Open GL.
CLO 2: Demonstrate the different geometric object drawing using openGL
CLO 3: Demonstration of 2D/3D transformation on simple objects.
CLO 4: Demonstration of lighting effects on the created objects.
CLO 5: Demonstration of Image processing operations on image/s.</td></tr>
<tr><th>Sl. No.</th><th colspan="4">Practise Programs</th></tr>
<tr><td></td><td colspan="4">• Installation of OpenGL /OpenCV/ Python and required headers
• Simple programs using OpenGL (Drawing simple geometric object like line, circle, rectangle, square)
• Simple programs using OpenCV (operation on an image/s)</td></tr>
<tr><td></td><td colspan="4">PART A
List of problems for which student should develop program and execute in the Laboratory using openGL/openCV/ Python</td></tr>
<tr><td>1.</td><td colspan="4">Develop a program to draw a line using Bresenham’s line drawing technique</td></tr>
<tr><td>2.</td><td colspan="4">Develop a program to demonstrate basic geometric operations on the 2D object</td></tr>
<tr><td>3.</td><td colspan="4">Develop a program to demonstrate basic geometric operations on the 3D object</td></tr>
<tr><td>4.</td><td colspan="4">Develop a program to demonstrate 2D transformation on basic objects</td></tr>
<tr><td>5.</td><td colspan="4">Develop a program to demonstrate 3D transformation on 3D objects</td></tr>
<tr><td>6.</td><td colspan="4">Develop a program to demonstrate Animation effects on simple objects.</td></tr>
<tr><td>7.</td><td colspan="4">Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left.</td></tr>
<tr><td>8.</td><td colspan="4">Write a program to show rotation, scaling, and translation on an image.</td></tr>
<tr><td>9.</td><td colspan="4">Read an image and extract and display low-level features such as edges, textures using filtering techniques.</td></tr>
<tr><td>10.</td><td colspan="4">Write a program to blur and smoothing an image.</td></tr>
<tr><td>11.</td><td colspan="4">Write a program to contour an image.</td></tr>
<tr><td>12.</td><td colspan="4">Write a program to detect a face/s in an image.</td></tr>
<tr><td></td><td colspan="4">PART B
Practical Based Learning</td></tr>
<tr><td></td><td colspan="4">Student should develop a mini project and it should be demonstrate in the laboratory examination, Some of the projects are listed and it is not limited to:
➢ Recognition of License Plate through Image Processing
➢ Recognition of Face Emotion in Real-Time
➢ Detection of Drowsy Driver in Real-Time
➢ Recognition of Handwriting by Image Processing
➢ Detection of Kidney Stone
➢ Verification of Signature
➢ Compression of Color Image
➢ Classification of Image Category
➢ Detection of Skin Cancer
➢ Marking System of Attendance using Image Processing
➢ Detection of Liver Tumor
➢ IRIS Segmentation
➢ Detection of Skin Disease and / or Plant Disease
➢ Biometric Sensing System .
➢ Projects which helps to formers to understand the present developments in agriculture.</td></tr>
</table>

	➢ Projects which helps high school/college students to understand the scientific problems. ➢ Simulation projects which helps to understand innovations in science and technology

Course Outcome (Course Skill Set)

At the end of the course the student will be able to:

CO 1: Use openGL /OpenCV for the development of mini Projects.
CO 2: Analyze the necessity mathematics and design required to demonstrate basic geometric transformation techniques.
C0 3: Demonstrate the ability to design and develop input interactive techniques.
C0 4: Apply the concepts to Develop user friendly applications using Graphics and IP concepts.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).
  The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course is 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.
- General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)
- Students can pick one experiment from the questions lot of PART A with equal choice to all the students in a batch.
- **PART B :** Student should develop a mini project and it should be demonstrated in the laboratory examination (with report and presentation).
- Weightage of marks for **PART A is 60%** and for **PART B is 40%.** General rubrics suggested to be followed for part A and part B.
- Change of experiment is allowed only once (in part A) and marks allotted to the procedure part to be made zero.
- The duration of SEE is 03 hours.

Suggested Learning Resources:

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd/4th Edition, Pearson Education,2011
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson education

Weblinks and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102063/
3. https://nptel.ac.in/courses/106/103/106103224/
4. https://nptel.ac.in/courses/106/102/106102065/
5. https://www.tutorialspoint.com/opencv/
6. https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b