SOFTWARE ENGINEERING AND TESTING **Course Code : 315332**

Programme Name/s : Information Technology
Programme Code : IF
Semester : Fifth
Course Title : SOFTWARE ENGINEERING AND TESTING
Course Code : 315332

I. RATIONALE

Software engineering plays a pivotal role in addressing complex problems and improving efficiency to build software product. This course focuses on providing a structured framework by understanding and applying the working knowledge of the principles, techniques, and practices for estimation, designing, testing and quality management of software development projects. It enables students to blend the domain specific knowledge with the programming skills to get quality software products.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply software engineering principles to develop software product.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify relevant software process model for software development.
- CO2 - Use appropriate principles of software modeling to create data design.
- CO3 - Apply project management techniques in software development.
- CO4 - Apply different software testing types to ensure the quality of software product.
- CO5 - Identify defect to improve the overall quality of the software using automated testing tools.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315332	SOFTWARE ENGINEERING AND TESTING	SET	DSC	4	-	4	1	9	3	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain different types and characteristics of software. TLO 1.2 Describe software engineering layered technology and process framework. TLO 1.3 State software engineering principles for requirement engineering. TLO 1.4 Select software process model for the given problem statement. TLO 1.5 Apply agile development process with justification.	**Unit - I Basics of Software Engineering** 1.1 Software, software engineering as layered approach, characteristics of software, types of software 1.2 Software development framework: Software generic process framework activities and umbrella activities 1.3 Software engineering core principles, communication practices, planning practices, modelling practices, construction practices, software deployment practices 1.4 Prescriptive process models: Waterfall model, incremental model, RAD model, prototyping model, spiral model 1.5 Agile software development: Agile process, and its importance, extreme programming, scrum 1.6 Selection criteria for software process model	Presentations Chalk-Board Videos

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Determine requirement engineering tasks in the given problem. TLO 2.2 Prepare use case diagram for given scenario. TLO 2.3 Prepare SRS for the given problem. TLO 2.4 Convert analysis model into requirement model. TLO 2.5 Apply the specified design feature for requirements software modeling. TLO 2.6 Represent the specified problem in the given design notation.	**Unit - II Software Requirement, Modeling and Design** 2.1 Requirement engineering: Requirement engineering task, types of requirement, developing use-case 2.2 SRS (Software Requirements Specifications): Need of SRS, format and it's characteristics 2.3 Translating requirement model into design model 2.4 Design modelling: Fundamental design concepts - abstraction, information hiding, patterns, modularity, concurrency, verification, aesthetics 2.5 Design notations: Data flow diagram (DFD), structured flowcharts	Presentations Chalk-Board Problem Based Learning Video
3	TLO 3.1 Explain 4 P's of management spectrum. TLO 3.2 Estimate the size of the software product using the given method. TLO 3.3 Evaluate the cost of the given software using COCOMO model. TLO 3.4 Describe the RMMM strategy for the given problem. TLO 3.5 Use various scheduling techniques for the given project. TLO 3.6 Prepare the Timeline chart / Gantt chart to track progress of the given project.	**Unit - III Software Project Management** 3.1 The management spectrum- 4P's 3.2 Metrics for size estimation: Line of code (LoC), function points(FP) 3.3 Project cost estimation using COCOMO (Constructive Cost Model), COCOMO II 3.4 Define risk, types of risk, RMMM strategy 3.5 Project scheduling: Basic principle, scheduling techniques - CPM, PERT 3.6 Project tracking: Timeline charts, Gantt charts	Presentations Chalk-Board Problem Based Learning Video
4	TLO 4.1 State the importance of software testing. TLO 4.2 Identify errors and bugs in the program. TLO 4.3 Prepare test case for the application. TLO 4.4 Identify the entry and exit criteria for the given test application. TLO 4.5 Describe features of the given software quality evaluation standard. TLO 4.6 Explain V model for the given application. TLO 4.7 Describe features of the given testing method. TLO 4.8 Apply specified testing levels for the given application.	**Unit - IV Basics of Software Testing** 4.1 Software testing, objective of testing, software testing life cycle (STLC) 4.2 Failure, fault, error, defect, bug terminology 4.3 Test case, when to start and stop testing 4.4 Quality assurance, quality control and verification - validation, Quality evaluation standards: Six sigma, CMMI levels 4.5 Static and dynamic testing 4.6 The box approaches: Compare white box testing, black box testing 4.7 Levels of testing: Unit testing, integration testing, system testing, acceptance testing	Presentations Chalk-Board Videos

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Prepare test plan for the given application. TLO 5.2 Identify the resource requirement for test infrastructure management. TLO 5.3 Prepare test report of executed test cases for given application. TLO 5.4 Apply defect life cycle. TLO 5.5 Prepare defect report for identified defect for AUT. TLO 5.6 Compare automation and manual testing based on various parameters. TLO 5.7 Describe metrics and measurement for the given application.	**Unit - V Test and Defect Management** 5.1 Test planning: Preparing a test plan 5.2 Test management: Test infrastructure management 5.3 Test reporting: Executing test cases, preparing test summary report 5.4 Definition and types of defect, defect life cycle, defect template 5.5 Comparison of manual testing and automation testing 5.6 Metrics and measurement: Types of metrics - product metrics and process metrics	Presentations Chalk-Board Problem Based Learning Video

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use any software tool to Write problem statement and identify scope of the project.	1	*Problem statement to define the project title with bounded scope of the software project	2	CO1
LLO 2.1 Select relevant process model to define activities and related tasks set for assigned software project like Library Management System (Teacher can assign different projects in a group).	2	*Process model to define activities and related tasks set	2	CO1
LLO 3.1 Gather application specific requirements for assimilate into RE (Requirements engineering) model. LLO 3.2 Prepare SRS (Software Requirement Software) document.	3	*Software Requirement Specification (SRS)	2	CO2
LLO 4.1 Write use cases for different user scenarios. LLO 4.2 Draw use case diagram for different user scenarios using any tool.	4	*Use-case diagram	2	CO2
LLO 5.1 Draw the Activity diagram to represent the flow from one activity to another activity using any tool. LLO 5.2 Design Decision table using any tool.	5	Software Design tools : a) Activity diagram b) Decision table	2	CO2
LLO 6.1 Draw data flow diagram: DFD 0 Level, DFD 1 Level, DFD 2 Level for the software project using any tool.	6	*Data Flow Diagram	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Draw class diagram for the software project using any tool. LLO 7.2 Draw Sequence diagram for the software project using any tool. LLO 7.3 Draw Collaboration diagram for the software project using any tool.	7	UML Diagrams	2	CO2
LLO 8.1 Estimate size of the project using function point metric for the software project using any tool.	8	*Function point metric for size estimation	2	CO3
LLO 9.1 Estimate cost of the project using COCOMO (Constructive Cost Model)/COCOMO II approach for the software project using any tool.	9	*COCOMO (Constructive Cost Model) /COCOMO II for cost estimation	2	CO3
LLO 10.1 Identify risk involved in the project. LLO 10.2 Prepare RMMM(Risk Management, Mitigation and Monitoring) Plan.	10	RMMM (RMMM-Risk Management, Mitigation and Monitoring) plan	2	CO3
LLO 11.1 Use CPM (Critical Path Method) / PERT (Programme Evaluation and Review Technique) for software project scheduling.	11	CPM (Critical Path Method) / PERT (Programme Evaluation and Review Technique).	2	CO3
LLO 12.1 Prepare Timeline charts / Gantt charts to track the progress of the software project using any tool.	12	*Timeline charts / Gantt charts	2	CO3
LLO 13.1 Design test cases w.r.t. functional testing for the software project.	13	*Test cases for Functional Testing	2	CO4
LLO 14.1 Design test cases w.r.t. Control and decision making statement for the software project 1) For... Loop 2) Switch...case 3) Do... While 4) If...else	14	Test cases for Control and decision making statements	2	CO4
LLO 15.1 Design test cases for Web Page Testing for any Web Site.	15	Test cases for Web Application	2	CO4
LLO 16.1 Design test cases for e-commerce (Flipkart, Amazon) login form with respect to GUI testing.	16	*Test cases for GUI Testing	2	CO4
LLO 17.1 Prepare test plan for a standalone application.	17	*Test plan for a standalone application	2	CO5
LLO 18.1 Prepare test plan for web application like any Chatting Application.	18	Test plan for web Application	2	CO5
LLO 19.1 Prepare defect report after executing test cases for login functionality.	19	*Defect report	2	CO5
LLO 20.1 Execute test cases for e-commerce application (Flipkart, Amazon) login form using an Automation Tool.	20	Test cases for automation tool	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Visit any medical shop, gather information about purchasing and selling medicines, maintaining their inventory, generating sales invoices and generating reminders of expiry date about medicines. Write the Functional and non-functional requirements for the medical shop management system.
- Visit your Institute library, Collect the functional requirements for a Library Management System and estimate cost and size of the project.
- Visit any grocery shop, collect requirements from shop keeper and prepare SRS document.

Assignment

- Estimate size of software using any tool and risk involved in any food delivery system.
- Estimate cost of software using any tool and risk involved in the Hotel management system.
- Prepare test plan and defect report for calculator.

Other

- Use Infosys Springboard or any MOOC's platform to complete any one course related to Software Engineering and Testing.
- Discuss paper titled "Case Study Based Software Engineering Project Development: State of Art" reference link: https://arxiv.org/pdf/1306.2502.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Software Project Management Tools: open source Software such as Jira	1,2,3,10,17,18,19
2	Spreadsheet Package	13,14,15,16
3	Software Tools : SmartDraw / Draw.io / TINY TOOLS / STRS COCOMO / any other	4,5,6,7,8,9,11,12
4	Hardware: Personal computer, (i5-i7 preferable), RAM minimum 4 GB	All
5	Operating system: Windows 10/Windows 11/ Ubuntu or any other	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of Software Engineering	CO1	6	2	6	4	12

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
2	II	Software Requirement, Modeling and Design	CO2	10	4	4	8	16
3	III	Software Project Management	CO3	10	2	4	10	16
4	IV	Basics of Software Testing	CO4	8	2	4	8	14
5	V	Test and Defect Management	CO5	6	2	4	6	12
Grand Total				**40**	**12**	**22**	**36**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For theory two offline unit tests of 30 marks and average of two unit test marks will be considered for out of 30 marks.
- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment is of 70 marks.
- End semester examination if of 25 marks, lab performance, viva voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	2	2	2	1	-	1			
CO2	2	2	2	2	-	-	-			
CO3	1	2	2	3	-	2	1			
CO4	2	2	3	3	1	2	1			
CO5	2	2	3	3	1	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Roger S. Pressman & Bruce R. Maxim	Software Engineering: A practitioner's approach	McGraw Hill Higher Education, New Delhi, (Ninth Edition) ISBN 93-5532-504-5

Sr.No	Author	Title	Publisher with ISBN Number
2	Srinivasan Desikan, Gopalaswamy Ramesh	Software Testing: Principles and Practices	PEARSON Publisher: Pearson India 2007, ISBN: 978-81-7758-121-8,
3	Richard Fairly	Software Engineering Concepts	McGraw Hill Education New Delhi -2001, ISBN-13: 9780074631218
4	Deepak Jain	Software Engineering: Principles and practices	Oxford University Press, New Delhi ISBN 9780195694840
5	Ron Patton	Software Testing	Sams Publishing; 2nd edition, 2005 ISBN: 0672327988
6	M. G. Limaye	Software Testing: Principles, Techniques and Tools	Tata McGraw Hill Education, New Delhi., 2009 ISBN 13: 9780070139909
7	Naresh Chauhan	Software Testing: Principles and Practices	Oxford University Press Noida. ISBN: 9780198061847
8	Yogesh Singh	Software Testing	Cambridge University Press, Cambridge, 2021 ISBN: 9781107012967

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	www.tutorialspoint.com//software_engineering/	Software Engineering Tutorial
2	https://insights.sei.cmu.edu/library/	Software Engineering Institute Digital Library
3	https://nptel.ac.in/courses/106105087	NPTEL course on Introduction to Software Engineering
4	https://www.geeksforgeeks.org/software-testing-basics/	Software Testing Tutorial
5	https://www.youtube.com/watch?v=sO8eGL6SFsA&t=12304s	Video tutorial on Software testing by Edureka
6	https://www.youtube.com/@softwaretestingmentor	Video tutorial on Software testing by RCV Academy
7	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384297011411353628269_shared/overview	Software engineering and testing courses

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students