Birla Institute of Technology & Science, Pilani

**Program Title : Full Stack Engineering**

**Course No*.*** : CFSE ZG571

**Course Title : Capstone Project**

**Credit Unit : 4**

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**Lead Instructor : TBD**

**Team of Instructors : FSE Team**

**Course Description (list of topics, bulletin style):**

Full stack applications such as reservation systems, traffic monitoring systems, aggregator applications and social networking applications; Demonstrate UI, server and database components of an end to end multi-user application; Usage of one or more well-known development frameworks; Demonstration of scalability and reusability by applying design concepts such as microservices and container-based deployment on the cloud; Demonstration of compliance with principles of agile and CI/CD;

**Course Objective:**

* Apply the conceptual and hands-on knowledge in the field of full stack engineering for design and development of an end to end modern application
* Demonstrate Full stack application
  + consisting of frontend, server/backend, and database components
  + developed using of one or more well-known development frameworks
  + dealing with scalability and reusability by applying design concepts such as microservices and container-based deployment on the cloud
  + complying with the principles of agile and CI/CD thinking and process

**Project Methodology:**

During this 8-weeks tenure, the participants will get an experience of agile software development process aiming to deliver a working version of the application at short and regular intervals, in collaboration with people and tools. They will get an opportunity to work on the application domains to learn principles, practices and tools suitable for particular project categories.

The participants will collaborate with each other through the teams of size two or three to:

* examine the application requirements specification
* make decisions with respect to the architectural style and deployment options
* identify and design the necessary components required for end to end execution
* translate to a working software solution by adapting incremental development approach
* automate all facets of building, integrating, testing and deploying the software

While going through this journey, participants will identify and make use of various tools, frameworks and services required to:

* design, develop and deploy a minimal viable product
* reduce the amount of repetitive processes performed during the apps development

In an iterative manner, the teams has to consult BITS faculties to discuss the approach, demonstrate

the achievements and implement the feedback received. They will undergo a well-structured, rigorous

evaluation framework helping them to validate their learnings and receive feedback in timely manner.

**Learning Outcomes:**

Upon successful completion of this capstone project, learners will:

1. Understand the principles, practices and culture that defines the full stack engineering
2. Examine the requirements and translate it to a design that is modular, implementable, and scalable
3. Experience the end to end application development process involving complex components and communications, procedures and people
4. Automate all facets of building, integrating, testing and deploying the software
5. Gain working knowledge of cloud based services available for the development and deployment of application

**Application Domain Areas:**

|  |  |
| --- | --- |
| Application Domain | Project areas (but not limited to) |
| Cross Platform Apps | * Conventional “Layered” Web Apps * Cross Platform “Mobile Only” Apps * Cross Platform “Generic” Apps |
| Cloud-Native Apps | * Microservices design, development and deployments * Migrating Monoliths to Microservices |
| Serverless Apps | * Web Apps development and deployment over the cloud * Mobile Backend development (BaaS) * Data Intensive Applications |

**Text Book(s) /References:**

No prescribed text/reference books for this Capstone Project. Students are advised to refer content of earlier courses as well as white-papers, case-studies and research papers in FSE.

**Schedule/Duration:**

Though this Course (C7: FSE-Capstone Project) comes at the end of programme, students are advised to think through the application scenarios from the second immersion itself. Adequate guidance about the capstone project conduction and evaluation will be provided in the immersion programme. Full dedicated efforts of 8 Weeks are required from 15-August-22 to 8-October-22 (including one week of final evaluation and ending the program for the current batch).

**Evaluation:**

|  |  |  |  |
| --- | --- | --- | --- |
| Evaluation Component | Marks | Type | Week |
| EC1 – Inception | 10% | Online / Virtual | End of 1st Week |
| EC2 – Elaboration | 20% | Online / Virtual | End of 3rd Week |
| EC3 A – Construction & Deployment | 25% | Online / Virtual | End of 5th Week |
| EC3 B – Construction & Deployment | 25% | Online / Virtual | End of 7th Week |
| EC4 – Report, Demonstration & Viva | 20% | Online / Virtual | End of 8th Week |

**Evaluation Schedule:**

* EC-1- Inception (Problem Definition & Identification of Deliverables):

Identification of the core problem to be solved, Target customers& ROI, Understanding of the domain &  existing solutions based on literature review, Formulation of the requirements (Functional & Non Functional) of the system, Understanding of the major technological constraints, challenges, Identification of Key Metrics or Measures-of-Success,  Identification of inputs to your system and outputs generated by the system. Deliverables & Features supported in the deliverable, Process life cycle to be followed for execution.

Note: The requirements should match with what is expected from a product which can be deployed for the problem statement identified.

Expected Artifacts –

* Use cases
* Supplementary specification
* Domain model
* Risk list
* EC-2- Elaboration (Architectural Design and Risk Mitigation)

Knowledge of software architectures and design as applied in the current Project will be accessed. Identification of the frontend/backend/database/cloud technologies, complete system architecture, modular decomposition of the system, block diagram, design diagrams as required to explain the system. Choice of various components of the system with justifications will be evaluated. Role of each component should be clearly elaborated.

For major technological challenges, the solution /alternatives should have been identified. Risky areas/features should have been addressed through a quick and dirty prototyping.

Note: You may not be able to implement the ideal architecture identified at this stage due to the time constrains or other resource constraints. Attempt has to be made to implement the system as close as possible to the developed architecture. Wherever this is not possible due to time or resource constraints, highlight the changes proposed for the development of the prototype.

Expected Artifact –

* Revised use cases
* Revised domain model
* Proposed Logical Architecture
* Design model
* Data model
* Prototype I (Executable)
* EC-3: Construction & Deployment

Complete system implementation at a reduced scale, working prototype of the system with the frontend/backend/database/cloud technologies integrated.

Expected Artifact –

* Revised architecture
* Revised design model
* Revised data model and translation to Physical databases
* Deployment plan
* Prototype II (Executable)
* Prototype III (Executable)
* EC-4- Report, Live Demonstration and Viva

Final report needs to be submitted by the student groups based on the guidelines provided. Live Demonstration / Presentation followed by viva. (Overall scheme of presentation will be shared later). You are also expected to record a brief video of the system implementation.

Each team member will be graded separately for viva component. For all other components, the team members will be awarded the same mark.

Expected Artifact –

* Capstone final report
* Minimal Viable Product (MVP)

**Delivery Model:**

* There’s no specific video-lecture content tailored for this course. However, supplementary reference materials as and when required will be provided by the respective mentors.
* The students has to form the groups on their own from the programme participants, not more than 2-3 students per group.
* The capstone projects are mentored by the BITS Pilani faculties. For every group, there will be one faculty member allotted as mentor who will be tracking the progress of the project periodically through the scheduled evaluation components.
* There will be reviews/evaluations by faculty conducted four times the project phase. The evaluation scheme is detailed in the Evaluation section.
* The access to the artifacts, source code etc. should be made available by the groups to the evaluators, as and when required. Maintaining everything under a single GIT repository is advised.
* By default, all interactions and evaluation sessions with students happen in virtual mode—via Google Meet / Impartus etc.
* There will be a 1 hour interactive conference sessions as and when required (shall be announced upon commencement of the Capstone as per the convenience of the Faculty and Project groups) for the duration of the course to answer questions related to the project and generic questions on topics related to technology; however, for the benefit of all participating students, students are requested to limit their questions to few that would appeal to most participants, rather than specific issues related to your own unique HW/SW bugs or choices (which you can post on ‘Discussion Forums’ in the Canvas site and which will be answered off-line by faculty at frequent intervals).
* Apart from this, students can put up their queries/questions in the canvas (LMS) and these queries will also be answered with some lead time. This planned virtual interaction will be conducted via online ‘Discussion Forums’ and ‘Announcements’ on Canvas site by the faculty.

**Important Instructions:**

* All team members of the Project-Group must be present during all the above evaluation sessions. Absence of any team-member would entail losing of marks for the corresponding component. No makeup request will be entertained.
* Under any circumstance, all evaluations for all students shall be completed by 8th Oct 2022.

**Submission Format/Guidelines:**

* Ensure all Intellectual Property Rights (IPR—copyrights, trademarks, ideas/patents) of original contributors (individuals or organizations) are duly acknowledged wherever they are referenced in the report.
* Plagiarism of any kind will be treated as serious violation of academic code-of-conduct and the decision of examiners will be final.
* Ensure the content in your report is properly structured and readable by tech-savvy business decision makers.
* A short video (MPEG) file of your demonstration to be submitted in Canvas in advance of your scheduled evaluation (as a backup source in the event of network failure or poor online session).
* File-naming convention: all files submitted by student must be named as per the format

FSE-C7-<TEAM-NAME>-<EC\*>-<REPORT/DEMO>.PDF/DOC/MPEG

* Only one file is to be submitted for each Project-Group and for each of the components, and there should not be multiple versions/revisions once submissions are closed by the deadline.

**TBD**

**Annexure 1 – Capstone Project Calendar**

**Annexure 2 – Project Proposal Process Document**

**Annexure 3 – Project Report Guidelines**

**Annexure 4 - Capstone Project Evaluation Rubric**