E-LEARNING PLATFORM

A

MAJOR PROJECT-II REPORT

Submitted in partial fulfillment of the requirements

for the degree of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE & ENGINEERING

By

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June -2025

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CERTIFICATE

We hereby certify that the work which is being presented in the B.Tech. Major Project-II Report entitled **E-LEARNING PLATFORM,** in partial fulfillment of the requirements for the award of the degree of ***Bachelor of Technology,*** submitted to the Department of **Computer Science & Engineering**, Sagar Institute of Science & Technology (SISTec)**,** Bhopal (M.P.) is an authentic record of our own work carried out during the period from Jan-2025 to Jun-2025 under the supervision of **Prof. Bhavana Soni.**

The content presented in this project has not been submitted by me for the award of any other degree elsewhere.

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ACKNOWLEDGEMENT

We would like to express our sincere thanks to **Dr. D. K. Rajoriya**, **Principal, SISTec** and **Dr. Swati Saxena, Vice Principal SISTec** Gandhi Nagar, Bhopal for giving us an opportunity to undertake this project.

We also take this opportunity to express a deep sense of gratitude to **Dr. Amit Kumar Mishra, HOD, Department of Computer Science & Engineering** for his kindhearted support

We extend our sincere and heartfelt thanks to our guide, **Prof. Bhavana Soni**, for providing us with the right guidance and advice at crucial junctures and for showing us the right way.

I am thankful to the **Project Coordinator, Prof. Deepti Jain,** who devoted her precious time in giving us the information about various aspects and gave support and guidance at every point of time.

I would like to thank all those people who helped me directly or indirectly to complete my project whenever I found myself in any issue.

TABLE OF CONTENTS

TITLE	PAGE NO.
Abstract	i
List of Abbreviation	ii
List of Figures	iii
Chapter-1: Introduction	1
1.1 About Project	1
1.2 Project Objective	2
1.3 Functionality	3
1.4 Interface	4
1.5 Design and Implementation Constraints	5
1.6 Assumption and Dependencies	7
Chapter-2: Software and Hardware Requirements	9
2.1 Introduction	9
2.2 Software Requirement	9
2.3 Hardware Requirement	10
Chapter-3: Problem Description	12
3.1 Overview	12
3.2 Problems in the Existing System	12
3.3 Project Impact and Significance	13
Chapter-4: Literature Survey	15
4.1 Literature Survey	15
Chapter-5: Software Requirements Specification	18
5.1 Functional Requirements	18
5.2 Non-Functional Requirements	19
Chapter-6: Software Design	21
6.1 Use Case Diagram	21
6.2 ER Diagram	21
6.3 Data Flow Diagram	23
Chapter-7: Output Screens	25
7.1 Output Screens	25
Chapter-8: Deployment	36
8.1 Overview	36
8.2 Deployment Architecture	36
8.3 Deployment of Frontend	37

8.4 Deployment of Backend 37
8.5 Database Setup 37
8.6 Domain Configuration 38
8.7 Continuous Deployment 38
References
Project Summary
Appendix-1: Glossary of Terms

ABSTRACT

In the digital era, e-learning has emerged as a vital tool for providing flexible and accessible education across geographies. This project, EduVantage, is a comprehensive web-based e-learning platform developed using the MERN stack (MongoDB, Express.js, React.js, Node.js) to bridge the gap between students and educators. The platform facilitates seamless course creation by teachers, efficient content delivery, and course purchasing options for students through secure integration with Razorpay. It also features Cloudinary for optimized media storage and a built-in SQL IDE to support hands-on learning.

EduVantage follows a three-tier architecture and adopts the MVC2 design pattern, ensuring a clean separation between interface, logic, and data layers. It supports role-based access control for students, teachers, and admins, where the admin oversees all CRUD operations and manages course categories. Core functionalities are implemented using object-oriented programming concepts, enhancing modularity and scalability.

The documentation covers key software engineering aspects including problem definition, system analysis, software requirements, system design, database schema, user interface screens, and deployment strategy. The project also highlights the application of agile methodology, internal testing processes, and integration of modern development tools.

This platform not only aims to democratize learning but also provides a scalable, secure, and user-centric solution for online education, with future scope for enhancements like mobile app integration and real-time collaborative tools.

LIST OF ABBREVIATIONS

ACRONYM	FULL FORM
API	Application Programming Interface
CRUD	Create, Read, Update, Delete
DBMS	Database Management System
ERD	Entity-Relationship Diagram
GUI	Graphical User Interface
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
IDE	Integrated Development Environment
JSON	JavaScript Object Notation
JWT	JSON Web Token
MVC	Model-View-Controller
NoSQL	Not Only Structured Query Language
ODM	Object Data Modeling
OOP	Object-Oriented Programming
RAM	Random Access Memory
RBAC	Role-Based Access Control
REST	Representational State Transfer
SaaS	Software as a Service
SQL	Structured Query Language
SSL	Secure Sockets Layer
UI	User Interface
UX	User Experience
VM	Virtual Machine
VS Code	Visual Studio Code
VPN	Virtual Private Network

LIST OF FIGURES

FIG. NO.	TITLE	PAGE NO.
6.1.1	Use Case Diagram	21
6.2.1	ER Diagram	22
6.3.1	Level 0 Data Flow Diagram	23
6.3.2	Level 1 Data Flow Diagram	24
7.1.1	Home Page	25
7.1.2	About Us Page	25
7.1.3	Contact Us Page	26
7.1.4	Login Page	26
7.1.5	Sign Up Page	27
7.1.6	Teacher’s Dashboard	27
7.1.7	Student’s Dashboard	28
7.1.8	Admin’s Dashboard	28
7.1.9	Teacher’s Stats Page	29
7.1.10	Teacher’s My Course Page	29
7.1.11	Add Course Page	30
7.1.12	Update Profile Page	30
7.1.13	Update Password and Delete Account Page	31
7.1.14	Enrolled Course Page	31
7.1.15	Video Lecture Page	32
7.1.16	Buy Course Page	32
7.1.17	Give Review Page	33
7.1.18	IDE Page	33
7.1.19	Razorpay Interface Page	34
7.1.20	Manage Users Page	34
7.1.21	Manage Courses Page	35
7.1.22	Manage Categories Page	35

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PROJECT SUMMARY

About Project

Title of the project	E-Learning Platform
Semester	8th
Members	4
Team Leader	Shiv Kumar Sharma
Describe role of every member in the project	Abhishek Shukla: Work on Software Api Testing. Saurabh Agrawal: Work on Backend Development. Shiv Kumar Sharma: Work on Backend Development and Database Management. Sourabh Gour: Work on Frontend Development.
What is the motivation for selecting this project?	The motivation behind EduVantage is to bridge this gap by providing a cost-effective, user-friendly, and feature-rich e-learning solution.
Project Type (Desktop Application, Web Application, Mobile App, Web)	Web Application

Tools & Technologies

Programming language used	JavaScript vES15
IDE used (with version)	Visual Studio Code v1.98
Front End Technologies (With version, wherever Applicable)	ReactJS v19.0.0
Back End Technologies (With version, wherever applicable)	ExpressJS v5
Database used (with version)	MongoDB v8.0.4 Cloudinary v2.6.0 MySQL v9.2.0

Software/Hardware Design & Coding

Is prototype of the software/hardware developed?	Yes
SDLC model followed (Waterfall, Agile, Spiral etc.)	Agile
Why above SDLC model is followed?	Agile is a SDLC model that defines how software development needs to be done. It's not a single or specific method, and it is the collection of various methodologies and best practices that follow the value statement signed with the customer
Justify that the SDLC model mentioned above is followed in the project.	We used Agile model, so that we could make desired changes whenever needed.
Software Design approach followed (Functional or Object Oriented)	Object Oriented
Name the diagrams developed (According to the Design approach followed)	Use Case Diagram, Data Flow Diagram, ER Diagram
In case Object Oriented approach is followed, which of the OOPS principles are covered in design?	The project follows OOP concepts for better structure and maintainability. Encapsulation secures data using Mongoose models, while inheritance allows Student and Teacher to extend the User class. Polymorphism enables role-based behaviors, like different dashboards for users. Abstraction hides complex logic (e.g., payments), ensuring a clean and scalable codebase.
No. of Tiers (Example 3-tier)	3-Tier
Total no. of Frontend pages	13
Front end validations applied (Yes / No)	Yes
Session management done (in case of web applications)	Yes
Is application browser compatible (In case of web applications)	Yes
Exception handling done (Yes / No)	Yes
Commenting done in code (Yes / No)	Yes
Naming convention	Yes

followed (Yes / No)	
What difficulties faced during deployment of project?	During development, we faced challenges like handling real-time payments securely with Razorpay, ensuring scalable cloud storage with Cloudinary, and managing efficient database structuring in MongoDB. Debugging cross-origin issues (CORS) between frontend and backend and implementing role-based authentication were also complex tasks. However, these challenges were overcome through proper API integration, middleware handling, and database optimization.
Total no. of Use-case	8
Give titles of Use-cases	User Registration & Login, Course Creation by Teacher, Course Purchase by Student, Course Category Management by Admin, Course Progress Tracking, Payment Processing via Razorpay, Review & Rating System, Profile Management (User, Teacher, Admin)

Project Requirements

MVC architecture followed (Yes / No)	Yes
If yes, write the name of MVC architecture followed (MVC-1, MVC-2)	MVC-2
Design Pattern used (Yes / No)	Yes
If yes, write the name of Design Pattern used	MVC Pattern
Interface type (CLI / GUI)	GUI
No. of Actors	3
Name of Actors	Student, Teacher, Administrator
Total no. of Functional Requirements	10
List few important non-Functional Requirements	Scalability, Security, Performance, Availability

Testing

Which testing is performed? (Manual or Automation)	Manual
Is Beta testing done for this project?	No

Write project narrative covering above mentioned points

EduVantage is an E-learning platform designed to provide a seamless online education experience for students and teachers. The platform enables teachers to create and manage courses, while students can browse, purchase, and complete them at their own pace. An admin panel is available for managing courses, users, and categories. Built using the MERN stack, the platform integrates Razorpay for payments, Cloudinary for media storage, and an inbuilt SQL IDE for practical learning.

Our team is organized as follows:

- **Shiv Kumar Sharma** and **Saurabh Agrawal** are responsible for Backend Development and Database Management
- **Abhishek Shukla** and **Sourabh Gour** are responsible for Software API Testing and Frontend Development.

The project follows an **Agile methodology** to enable iterative development, ensuring flexibility and continuous feedback during the build process. EduVantage follows the MVC2 (Model-View-Controller 2) architecture, ensuring separation of concerns

We have two main user roles:

- **Admin:** Perform CRUD operations on users, courses, and categories.
- **Students:** Browse, purchase, and track course progress.
- **Teachers:** Upload and manage courses, track student engagement.

The aim of EduVantage is to provide a scalable and interactive e-learning platform where teachers can upload courses, students can purchase and learn at their own pace, and admins can efficiently manage the system. It ensures secure payments, real-time progress tracking, and seamless cloud storage, enhancing the digital education experience.

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Guide Signature
(Prof. Bhavana Soni)

APPENDIX-1 GLOSSARY OF TERMS

A

Admin — A user with the highest privileges who manages courses, categories, and user accounts.

API (Application Programming Interface) — A set of rules that allow the frontend and backend to communicate.

Authentication — The process of verifying user identity using JWT (JSON Web Token).

C

Cloudinary — A cloud-based service used for storing and managing course-related media files.

Course — A structured set of learning materials uploaded by teachers for students.

CRUD Operations — Create, Read, Update, and Delete functionalities, used for managing courses, users, and categories.

D

Database — MongoDB Atlas, a NoSQL database used to store user, course, and transaction data.

Deployment — The process of hosting the frontend on Vercel and backend on Render for public access

F

Frontend — The user interface, built with React.js, that students, teachers, and admins interact with

I

IDE (Integrated Development Environment) — A built-in SQL editor within the platform for running queries.

M

Middleware	Functions in Express.js that process API requests before reaching the controllers.
MongoDB	A NoSQL database used to store structured data like users, courses, and payments.
Mongoose	An ODM (Object Data Modeling) library that provides schema-based data management for MongoDB.
MVC2 (Model-View-Controller 2)	A design pattern used to separate the frontend (React.js), backend (Express.js), and database (MongoDB).

P

Payment Gateway	Razorpay, used for secure online transactions between students and the platform.

R

React.js	A JavaScript library used for building the frontend UI of EduVantage.
Render	A cloud hosting service where the backend (Express.js) is deployed.
Razorpay	A payment gateway integrated into EduVantage for handling course purchases securely.
RESTful API	A web service that enables communication between frontend and backend using HTTP methods like GET, POST, PUT, DELETE.
Role-Based Access Control (RBAC)	A system that assigns different permissions to students, teachers, and admins based on their roles.

S

Session Management	Maintaining user login sessions using JWT tokens stored in cookies.
SQL (Structured Query Language)	A programming language used in the built-in IDE for running database queries.
State Management	Managing application state using React hooks (useState, useContext) or Redux.
Student	A user who purchases and accesses courses on the platform.

T

Teacher	A user who creates and manages courses for students.

Testing	The process of debugging, unit testing, and manual testing to ensure system functionality.

U

UI/UX	The design and usability of the platform to enhance the learning experience.

V

Vercel	A cloud platform used for deploying the frontend (React.js) of EduVantage.

W

Webhooks	Automated callbacks used for handling payment status updates from Razorpay.
WebSocket	A protocol that enables real-time communication, useful for instant course progress updates.