



TestForge: Seamless Exam Conduction

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Abstract: The TestForge: MSBTE Exam Conduction Management System is a sophisticated web-based platform specifically designed to enhance the efficiency of end-semester exam processes at MSBTE exam centers. Utilizing cutting-edge technologies such as Next.js and FastAPI, this system automates key tasks including timetable retrieval, block allocation, seating chart creation, and inventory management. Additionally, it seamlessly integrates e-marksheets for streamlined record-keeping.

By facilitating efficient resource allocation, providing real-time updates, and automating report generation, the TestForge system significantly reduces the administrative burden on exam center staff. This paper delves into the implementation of TestForge, shedding light on its pivotal role in improving accuracy, minimizing manual labor, and optimizing exam center management.

Keywords: MSBTE Exam Conduction, Automated Reports

I. INTRODUCTION

Managing large-scale end-semester examinations efficiently is a crucial task for academic institutions. The Maharashtra State Board of Technical Education (MSBTE) oversees exams across multiple centers, requiring effective coordination of timetables, seating arrangements, invigilation, and record management. Traditional methods rely on manual processes, leading to errors, inefficiencies, and administrative burdens.

To address these challenges, TestForge: MSBTE Exam Conduction Management System has been developed as a web-based solution leveraging Next.js and FastAPI. It automates key tasks, including timetable retrieval, block allocation, seating chart generation, and inventory tracking, while integrating e-marksheets for streamlined data management.

Information Technology (IT) plays a vital role in modernizing educational processes, ensuring accuracy, efficiency, and real-time data handling. TestForge enhances exam center operations by reducing manual workload, improving resource allocation, and optimizing the overall examination process.

II. LITERATURE SURVEY FOR PROBLEM IDENTIFICATION AND SPECIFICATION

- [1] Kumar, R., and Sharma, A. (2020). 'Automated Exam Scheduling Using Optimization Algorithms', Journal of Educational Technology, Vol. 15, No. 3, pp. 45 - 58. Kumar and Sharma (2020) explored automated exam scheduling using optimization algorithms to reduce conflicts and improve resource utilization. Their study emphasizes the importance of efficiency and scalability, which aligns with TestForge's goal of streamlining scheduling for MSBTE examinations.
- [2] Zhang, Y., and Liu, H. (2019). 'Timetable Management System for Large-Scale Institutions', International Journal of Information Systems, Vol. 22, No. 4, pp.213-225. Zhang and Liu (2019) developed a timetable management system that centralizes scheduling tasks and minimizes manual input. Their findings support the need for centralized platforms like TestForge to enhance accuracy and reduce human errors.
- [3] Patel, S., and Desai, K. (2021). 'Role-Based Access Control in Educational Management Systems', International Conference on Advanced Computing, pp.198-205. Patel and Desai (2021) examined the implementation of role-based access control (RBAC) to secure sensitive data within educational management systems. Their research aligns with TestForge's use of RBAC to ensure that only authorized administrators can modify exam schedules.
- [4] Ahmed, M., and Khan, T. (2022). 'Generating Reports in Standardized Formats Using Automated Systems', Journal of Software Engineering, Vol. 30, No. 2, pp.125-138. Ahmed and Khan (2022) discussed the generation of reports in standardized formats, ensuring compliance with institutional requirements. This research supports TestForge's functionality of producing reports in MSBTE's official format.



[5] Lee, J., and Choi, S. (2020). 'Enhancing User Experience in Scheduling Applications', International Journal of Human-Computer Interaction, Vol. 36, No. 8, pp.765-779. Lee and Choi (2020) emphasized the importance of usability and intuitive design in scheduling applications. Their insights align with TestForge's focus on providing a user-friendly interface for efficient exam management.

[6] Spackos – Legacy Exam Management System for MSBTE.

Spackos is the current exam scheduling software used by multiple MSBTE examination centers, built on FoxPro, an outdated database management system. While it has been in use for years, Spackos suffers from slow performance, frequent crashes, and inefficiencies due to its manual processes and lack of automation. The system is not scalable and struggles to handle large datasets efficiently. Unlike modern exam management solutions, Spackos lacks real-time data processing and automated report generation, making it unsuitable for streamlined and secure exam scheduling.

III. PROBLEM STATEMENT

The exam management system currently utilized by MSBTE institutions is antiquated, ineffective, and susceptible to human errors. Disjointed procedures, absence of automation, and limited data visibility result in scheduling clashes and administrative complexities. Furthermore, data security and access control are pressing issues that need to be addressed.

In response to these obstacles, TestForge will offer a centralized, automated, and secure exam management platform. This solution will streamline scheduling, bolster security measures, facilitate scalability, produce standardized reports, and enhance user satisfaction, all while maintaining cost-efficiency.

IV. PROPOSED DETAILED METHODOLOGY OF SOLVING THE IDENTIFIED PROBLEM WITH ACTION PLAN

TestForge aims to transform the MSBTE exam process by streamlining administrative tasks, providing transparency, and enhancing operational efficiency. The platform integrates multiple modules customized to manage different aspects of exam management, ranging from pre-exam settings to post-exam reporting.

1. Configurations

This module provides administrators with the facility to configure critical exam-related settings.

- *Exam Center Management:* Manages registration and assignment of exam centers with appropriate capacity planning.
- *Timetable Management:* Automates timetabling to avoid clashes in subjects and timings.
- *Supervisors Management:* Assigns and manages supervisors for smooth invigilation.
- *Control Room Management:* Offers a virtual control center for real-time monitoring of exams and decision-making.
- *Seating Chart Configuration:* Produces optimized seating charts according to pre-defined rules.
- *E-Marksheet Management:* Online management of marksheets for safe access and verification.
- *Inventory Management:* Manages exam-related material, ensuring its proper allocation and availability.

2. Block Allocation

Ensures proper allocation of students in exam halls in a systematic manner.

- *Block Allocation:* Allocates students to a particular block as per their subject and roll numbers.
- *Session Clearance:* Ensures correct collection and verification of answer sheets after the exam.
- *Change Supervisor:* Helps in the reassignment of supervisors at the last minute in the event of emergencies.

3. Exam Day Edits

Offers live control to enable modifications on exam day.

- *QP Accounting:* Tracks the allocation and use of question papers to avoid leaks.
- *Absent Students:* Reflects the attendance records for students who have missed the exam.
- *Copy Case Students:* Enables reporting malpractice cases for subsequent disciplinary action.

4. Reports

Automatically generates reports for compliance and auditing.

- *Datewise Block Allocation:* Reports student placements within exam halls.
- *Datewise Attendance (Format 5&6):* Creates attendance reports of students and staff.
- *Supervision Report:* Maintains supervisory assignment and observation reports.
- *Absent Students:* Prints a total absentee list.
- *Packing Slip (Format 7):* Scales exam materials documentation to match official procedures.

**5. Additional Reports**

Provides supplementary oversight with niche reporting.

- *Blank Absent Report*: Permits filling a pre-set absent record with fewer manual keystrokes.

6. Format Specific Reports

Standard reporting format creation based on regulatory directives.

- *Format 1*: Instruction to the examiner.
- *Format 2*: Report of receiving the question paper.
- *Format 3 & 3A*: Question paper handover and verification of packet.
- *Format 8 & 9*: Receipt of the answer sheet.
- *Format 12*: Report of an external examiner.
- *Format 13*: Malpractice report cases.
- *Format 14*: Documentation for a police complaint.
- *Format 16*: Vigilance register.
- *Format 18*: Inventory of questions.
- *Format 19*: Spot demand of the inventory.
- *Format 20*: Receipt of inventory.
- *Format 21*: Inventory discrepancy report.
- *Format 22*: Panchnama report.

7. Premium Features

For sophisticated automation and optimization.

- *Generate Supervision Order*: Generates supervisor assignment letters automatically.
- *Generate Officer Incharge Order*: Generates duty orders for examination officers.
- *Print All Report (Pre-Exam)*: Summarizes and prints all pre-exam reports at high speed.

Implementation Strategy

TestForge will be implemented as a web-based application with role-based authentication to provide real-time monitoring, smooth communication, and increased security. The architecture of the system will enable scalability and adherence to MSBTE guidelines, finally streamlining the examination process and minimizing manual administrative tasks.

Key Features:

- Role-based, secure authentication
- Centralized dashboard for monitoring and analytics
- Standardized report formats as per MSBTE guidelines
- Fast and efficient report generation
- Quick processing for seamless exam management



Exam Management System Flowchart

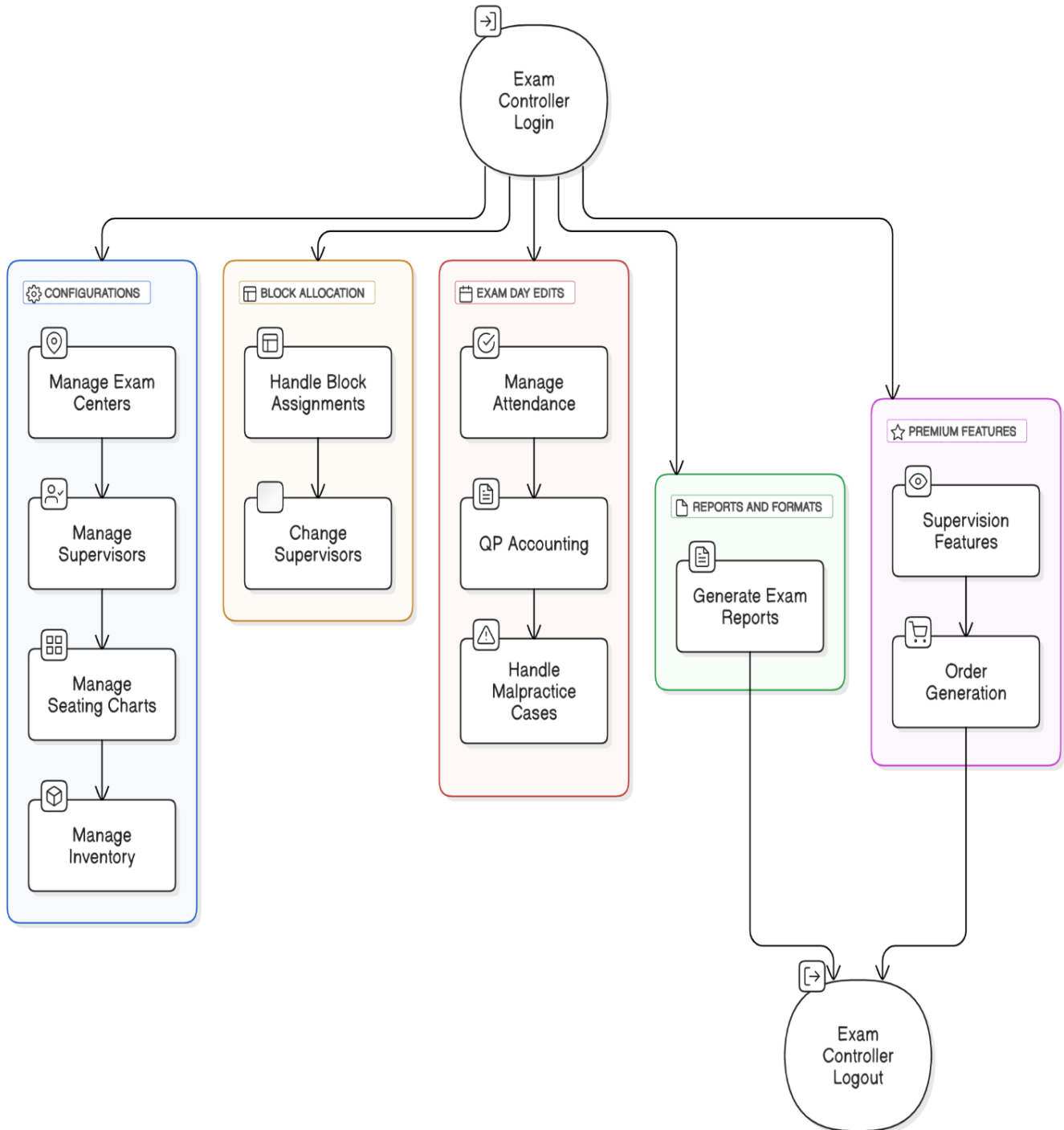


Fig. 4 A DFD level 1 Diagram



Made with Whimsical

Fig. 4B. Flow Diagram



[1]. USER BASE

USER/USER ID	DESCRIPTION	PRIVILEGE
INST_[EC_CODE]	EXAM CENTER (NON PREMIUM)	ALL MODULES (EXC. PREMIUM)
INST_[EC_CODE]	EXAM CENTER (PREMIUM)	ALL MODULES (INC. PREMIUM)

EVERY USER OF THE APPLICATION IS ASSIGNED A UNIQUE ID AND PASSWORD. THE APPLICATION WILL RESPOND TO THE PROVIDED ID AND AUTOMATICALLY NAVIGATE TO THE SPECIFIC MODULE CORRESPONDING TO THAT ID.

[1]. TECHNOLOGIES AND TOOLS USED TO DEVELOP APPLICATION

[2]. TECHNOLOGIES FOR BACKEND

SR. NO.	TITLE	DESCRIPTION/VERSION
1	FASTAPI	LATEST VERSION
2	PYTHON	3.11

[3]. TECHNOLOGIES FOR FRONTEND

SR. NO.	TITLE	DESCRIPTION/VERSION
3	NEXT.JS	14.0
4	REACT.JS	LATEST VERSION
5	TAILWIND CSS	LATEST VERSION

[4]. TECHNOLOGIES FOR DATABASE

SR. NO.	TITLE	DESCRIPTION/VERSION
1	MYSQL	8.1

[5]. TOOLS

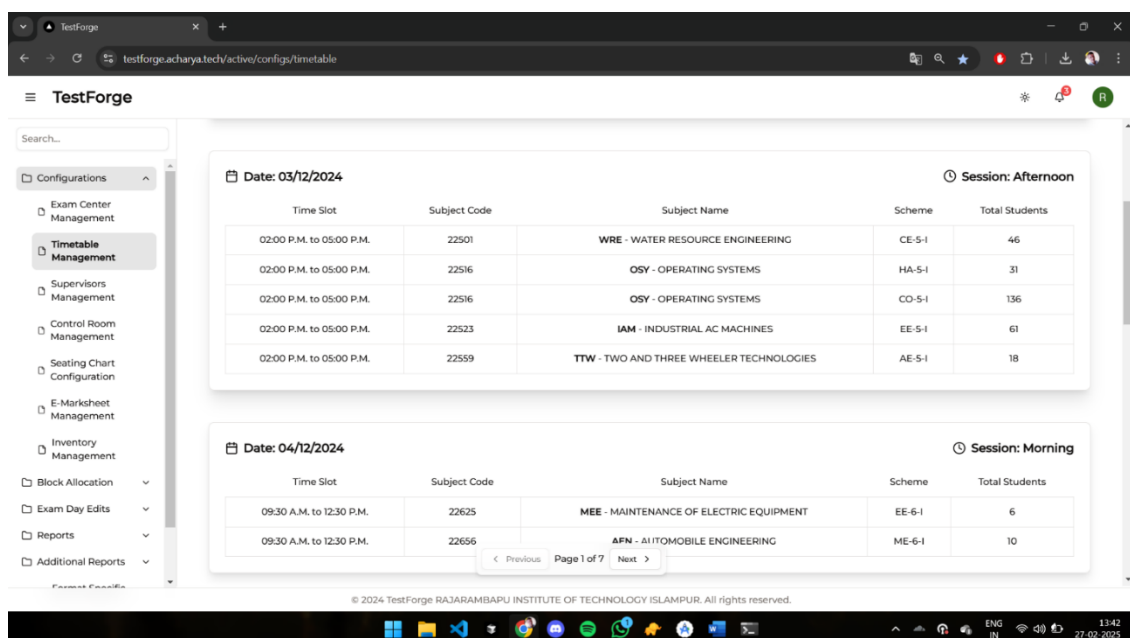
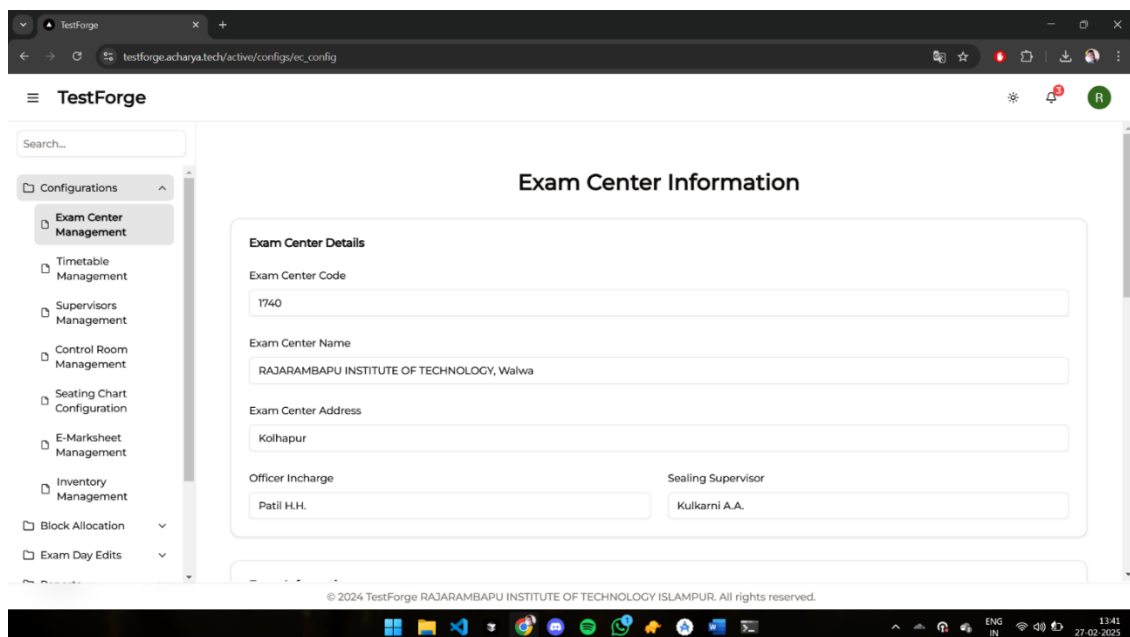
SR. NO.	TITLE	DESCRIPTION/VERSION
1	VISUAL STUDIO CODE	1.83.1
2	DOCKER	LATEST VERSION



[6]. REQUIREMENTS TO RUN APPLICATION

SR. NO.	TITLE	DESCRIPTION/VERSION
1	CPU/PROCESSOR	INTEL I3 OR ABOVE
2	RAM	4 GB
3	DISK SPACE	MIN. 100 GB
4	SOFTWARE REQUIREMENT - BROWSER	ANY BROWSER WITH LATEST VERSION
5	OPERATING SYSTEM - WINDOWS	WINDOWS 10 OR ABOVE

V. IMPLMENTED SYSTEM SCREENSHOTS





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National Level Conference – AITCON 2K25
Adarsh Institute of Technology & Research Centre, Vita, Maharashtra
Vol. 12, Special Issue 1, March 2025



TestForge

Search...

Configurations

- Exam Center Management
- Timetable Management
- Supervisors Management
- Control Room Management
- Seating Chart Configuration
- E-Marksheet Management**
- Inventory Management
- Block Allocation
- Exam Day Edits
- Reports
- Additional Reports

Upload E-Marksheet

Upload your E-Marksheet Excel file for processing

E-Marksheet Processed

The E-Marksheet has been successfully processed and stored in the database.

Current file: emarksheet_T740.xlsx

Download Delete Process File

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TestForge

Search...

Configurations

- Block Allocation
- Session Clearance
- Change Supervisor
- Exam Day Edits
- Reports
- Additional Reports
- Format Specific Reports
- Premium

Successfully allocated 39 students to 302

Name	301	302	303	305	306	307	401	402	403	404	406	407	DSH-1	DSH-2A	DSH-2B
Strength	39	39	39	40	37	39	17	31	30	30	30	40	36	23	27

Timetable Info

2024-12-14 Afternoon

Scheme	Subject Code	Remaining Students
CO-5-I	22520	58
HA-5-I	22520	31
EE-5-I	22525	64
AE-5-I	22561	19

Block Assignment

Total Candidates: 58 Scheme: CO-5-I

Block Details: Locatx

Supervisor: Choose supervisor

Candidates to Assign: 0

Clear Save

Block Distribution

Block Name	Scheme	Supervisor
301	CO-5-I 22520 (39)	E01100
302	CO-5-I 22520 (39)	E01101

Clear Update

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TestForge

Search...

Configurations

- Block Allocation
- Exam Day Edits
- QP Accounting
- Absent Students**
- Copy Case Students
- Reports
- Additional Reports
- Format Specific Reports
- Premium

Mark students as absent for a specific date, session, and block.

Date: 17-12-2024 Session: Morning

Fetch Blocks

Select Block: Block 1 - 301

Select Scheme: CE-4-I - TRANSPORTATION ENGINEERING

Seat Numbers

280975	280977	280978	280979
280983	280985	280986	280987
280988	280989	280991	280994
280996	281001	281002	

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MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

ATTENDANCE REPORT - EXAMINATION - SUMMER-2028

Exam Center: (1740) - RAJARAMBAPU INSTITUTE OF TECHNOLOGY, Wala
Institute Code: (1740) - KARGAON EDUCATION SOCIETY'S RAJARAMBAPU INSTITUTE OF TECHNOLOGY, Wala
Date: 17/12/2024
Time: 09:30 A.M. to 12:30 P.M.
Course Sem Master: CE-41
Block No.: [1]
Subject: TRANSPORTATION ENGINEERING (23403)
Name of Insigilator: MIRAJKAR D V
Code: 23403

Sl. No.	Examinee Seat No.	Sl. No. of Main Answer book	Sl. No. of Supplement Issued	Signature of the Candidate
1	280975			
2	280977			
3	280978			
4	280979			
5	280983			
6	280985			
7	280986			
8	280987			
9	280988			
10	280989			
11	280991			
12	280994			
13	280996			
14	281001			
15	281002			

Present: + Absent: - Total: 15
Total Main Ans. Books: Total Supp: Signature of Insigilator: (MIRAJKAR D V) Signature of Officer In-charge: (Pallu HEK)

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TestForge

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Generate Supervision Order

Generate Officer Incharge Order

Print All Report (Pre-exam)

RAJARAMBAPU INSTITUTE OF TECHNOLOGY

Islampur, Sangli, Maharashtra - 415 114
Tel: +91 2342 220329 Call: 09970700700
Email: director@rmitia.edu
Ref: RIT/DIP-W-24
Date: 27/02/25

OFFICE ORDER

To,
MIRAJKAR D.V
HEAD OF DEPT, Computer Engineering
Diploma
RAJARAMBAPU INSTITUTE OF TECHNOLOGY, Wala

Subject: Order of Block Supervisor for SUMMER Theory Exam - 2028
Reference: MSBTE/VKP/W-24

Sr. Masam,
You have to work as Insigilator (Block Supervisor) for MSBTE Theory Examination of SUMMER 2028 as per the following schedule. You have to make all the necessary arrangements for smooth conduct of the Examination.

Sl. No.	Date	Slot
1	09/12/2024	Morning
2	17/12/2024	Morning

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MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

Theory Examination: SUMMER-2028

PACKING SLIP

Examination Center Code: 1740
Date: 17/12/2024
Course: CE
Subject Code: 23403
Total Number of Answer Books in Bundle: 13
Marksheet No: 147867
Sealed on: 17/12/2024
Sealing Supervisor Signature

Institute Code: 1740
Time: 09:30 A.M. to 12:30 P.M.
Sem: 4
Subject Name: RAILWAY AND BRIDGE ENGINEERING[RBE]
Master: 1
Scaling Time: _____ AM/PM
Officer In-Charge Signature

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**VI. ADVANTAGES & LIMITATIONS****ADVANTAGES OF TESTFORGE**

SR. NO.	ADVANTAGE	DESCRIPTION
1	ROLE-BASED SECURE ACCESS	ENSURES SECURE AUTHENTICATION WITH DIFFERENT ACCESS LEVELS FOR EXAM CENTERS.
2	CENTRALIZED DASHBOARD	PROVIDES A UNIFIED DASHBOARD FOR MONITORING, ANALYTICS, AND QUICK ACCESS TO ESSENTIAL MODULES.
3	AUTOMATION OF EXAM PROCESSES	REDUCES MANUAL EFFORTS BY AUTOMATING EXAM SCHEDULING, STUDENT ASSESSMENTS, AND RESULT PROCESSING.
4	MULTI-PLATFORM SUPPORT	ACCESSIBLE VIA BOTH COMPUTER-BASED AND MOBILE-BASED APPLICATIONS.
5	DATA ACCURACY AND INTEGRITY	ELIMINATES HUMAN ERRORS IN EXAM MANAGEMENT BY ENSURING ACCURATE DATA STORAGE AND RETRIEVAL.
6	QUICK REPORT GENERATION	GENERATES DETAILED REPORTS ON STUDENT PERFORMANCE, FACULTY EVALUATIONS, AND EXAM RESULTS EFFICIENTLY.
7	USER-FRIENDLY INTERFACE	SIMPLE AND INTUITIVE DESIGN FOR EASY NAVIGATION AND MINIMAL TRAINING REQUIREMENTS.
8	EFFICIENT RESOURCE MANAGEMENT	OPTIMIZES ALLOCATION OF CLASSROOMS, FACULTY, AND EXAMINATION CENTERS, ENSURING SMOOTH OPERATIONS.

LIMITATIONS OF TESTFORGE

SR. NO.	LIMITATION	DESCRIPTION
1	HIGH INITIAL SETUP COSTS	REQUIRES INVESTMENT IN HARDWARE, SOFTWARE, AND TRAINING FOR SMOOTH IMPLEMENTATION.
2	INTERNET DEPENDENCY	CLOUD-BASED FUNCTIONALITIES REQUIRE STABLE INTERNET CONNECTIVITY FOR REAL-TIME OPERATIONS.
3	CUSTOMIZATION CONSTRAINTS	CUSTOMIZING SPECIFIC WORKFLOWS FOR DIFFERENT INSTITUTIONS MIGHT BE COMPLEX AND REQUIRE ADDITIONAL DEVELOPMENT.
4	USER ADAPTATION CHALLENGES	FACULTY AND STAFF MAY TAKE TIME TO ADAPT TO THE NEW SYSTEM, REQUIRING DEDICATED TRAINING SESSIONS.
5	POTENTIAL PERFORMANCE BOTTLENECKS	AS THE NUMBER OF USERS AND DATA VOLUME INCREASES, SYSTEM PERFORMANCE MAY BE AFFECTED IF NOT OPTIMIZED PROPERLY.
6	SECURITY CONCERNS	REQUIRES STRONG ENCRYPTION AND SECURITY MEASURES TO PREVENT DATA BREACHES OR UNAUTHORIZED ACCESS



VII. FUTURE SCOPE OF TESTFORGE

1. CLOUD-BASED DEPLOYMENT

THE PLATFORM WILL ENHANCE ITS CLOUD CAPABILITIES, ALLOWING EXAMINATION CENTERS TO SECURELY ACCESS TESTFORGE FROM ANYWHERE. CLOUD-BASED DEPLOYMENT ENSURES SCALABILITY, REAL-TIME DATA SYNCHRONIZATION, AND EASE OF MAINTENANCE.

2. BLOCKCHAIN FOR DATA SECURITY

BLOCKCHAIN TECHNOLOGY WILL BE EXPLORED FOR SECURING EXAM RECORDS, PREVENTING TAMPERING, AND ENSURING TRANSPARENCY IN RESULT GENERATION AND VERIFICATION.

3. AUTOMATED QUESTION PAPER GENERATION

AI-POWERED AUTOMATED QUESTION PAPER GENERATION WILL STREAMLINE EXAM CREATION BY SELECTING QUESTIONS BASED ON DIFFICULTY LEVELS, SUBJECT WEIGHTAGE, AND PAST PERFORMANCE TRENDS.

4. GLOBAL EXPANSION AND MULTI-LANGUAGE SUPPORT

TESTFORGE WILL EVOLVE TO SUPPORT MULTIPLE LANGUAGES AND ADAPT TO DIFFERENT EDUCATIONAL BOARD REQUIREMENTS, MAKING IT A GLOBALLY VIABLE EXAMINATION MANAGEMENT SOLUTION.

VIII. CONCLUSION

TestForge is a powerful examination management system that streamlines the entire exam process, from scheduling to evaluation. With role-based access control, it ensures secure operations, minimizing errors and unauthorized access. Its automation reduces manual effort by simplifying exam creation, candidate management, and result processing. Real-time analytics provide insights for better decision-making.

Built on a scalable and secure architecture, TestForge integrates seamlessly with existing systems while protecting sensitive exam data. With an intuitive interface and intelligent workflows, it enhances efficiency, security, and transparency in exam administration.

REFERENCES

1. Kumar, R., & Sharma, A. (2020). Automated Exam Scheduling Using Optimization Algorithms, *Journal of Educational Technology*, 15(3), 45-58.
2. Zhang, Y., & Liu, H. (2019). Timetable Management System for Large-Scale Institutions, *Int. Journal of Information Systems*, 22(4), 213-225.
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4. Ahmed, M., & Khan, T. (2022). Generating Reports in Standardized Formats Using Automated Systems, *Journal of Software Engineering*, 30(2), 125-138.
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6. Spackos – Legacy Exam Management System for MSBTE.